

Papers of 6th Canadian International Conference on Advances in Education, Teaching & Technology 2022

**June 25 – 26, 2022
Toronto, Canada**

PAPER PROCEEDINGS

**Unique Conferences Canada Publication
Toronto, Canada**



Published by Unique Conferences Canada

Unique Conferences Canada
Suite 2201, 250 Young Street,
ON M5B 2L7
Canada
info@uniqueca.com
www.uniqueca.com

Published Online in Canada
September 2022

ISBN 978-1-988652-51-1



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**6th Canadian International Conference on
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Reinforced Social Accountability: A Strategic Mechanism in Fostering Mental Health for Educators in The Division of Calapan City

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Abstract

This Descriptive-correlational study explored how the Division of Calapan City promotes mental health to educators through reinforced social accountability. It also analyzed the relationship between social accountability commitment principles consisting of leadership accountability, communication privacy, culture sensitivity, and care-group sincerity and main indicators in fostering mental health composed of emotional stability, psychological empathy, and social responsibility. The researcher utilized a quantitative research method using descriptive correlational design to answer the research questions. Questionnaires were distributed to the respondents using Google Form. Pearson's r product-moment correlation coefficient was employed for data analysis. The study revealed that the extent of predetermined social accountability practices of teachers in fostering mental health in the Division of Calapan City is high while the level of commitment of educators to social accountability principles and the level of social accountability commitment of educators based on the main indicators in fostering mental health are very satisfactory. It also revealed that there is a significant relationship between the social accountability principles and major indicators in fostering mental health resulting in the rejection of the null hypothesis. Based on the result of the study, it is recommended that the Schools Division is encouraged to support the implementation of Project SAVE (Social Accountability for a Vibrant Education) since it was proven as an effective strategic mechanism in fostering mental health for educators.

Key Words: *Reinforced Social Accountability, Mental Health, Educators, Project SAVE*

Introduction

Mental health is an integral part of sustainable development goals. Consequently, human resources with poor mental health and unfulfilled human potential pose major risks to the changes that are necessary for reaching Sustainable Development Goals (Izutsu, Tsutsumi, Minas, Thornicroft, Patel, et al., 2015). With the outbreak of the COVID-19 pandemic, all sectors are greatly affected resulting in the new normal system in every government agency.

As professional demands increase on the part of the teachers and the escalating learning difficulties encountered by learners in the new normal educational system, psychosocial and mental health become a crucial dilemma that requires immediate actions or strategic interventions so that both teachers and learners will be saved from any possible threatening consequences if this concern will not be addressed soon. Alarming numbers of suicides among teachers and students bombarded the daily news. From 2015 to 2020, the average number of deaths caused by suicide was 2,630 which is completely alarming (Rivas, 2021). These scenarios prompt calls for government action to take seriously the matter before it gets worse (Dela Cruz and Ciriaco, 2018).

As a result of these alarming realities, the researcher is determined to investigate the relationship between social accountability commitment principles consisting of leadership accountability and how the Division of Calapan City promotes mental health to educators through reinforced social accountability to be able to share best practices in addressing the threatening effects of mental health problems. This initiative

will empower teachers, learners, parents, and other stakeholders to join forces in overcoming mental health problems in times of pandemic while implementing the new normal educational system since the Division of Calapan City is not free from these challenges.

This study also aimed to propose a strategic platform or project that will uplift Social Accountability for Vibrant Education (Project SAVE) which can reach, help, and save the life of every teacher and learner against the life-threatening effects of mental health problems. Through this program, all are encouraged to become each brother's keepers.

Methods and Materials

Research Design

This quantitative research employed a descriptive correlational design. This study utilized more statistical tests to explain the nature, characteristics, relationships, and differences of variables. Concerning the study, descriptive research is designed to create a picture of the current thoughts, feelings, or behavior of individuals and how educators of the Division of Calapan City practice social accountability in fostering mental health to discover the relationship between existing variables.

Research Sampling

Stratified random sampling was used to gather quantitative data using the descriptive-correlational research design for the accomplishment of the study. From the population of one thousand four hundred eighty-nine (1489), Slovin's Formula was used to determine the sample of the study. Slovin's formula is written as $n = N / (1 + Ne^2)$ where: n = the number of samples N = the total population.

Ethical Issues

The researcher sought permission from the Schools Division Office (SDO) and the school heads, as well as assistance from fellow mentors for the distribution of questionnaires. Target respondents were informed about the nature and purpose of the study which involves an agreement to undergo activities like answering questionnaires as part of the conduct of the action research which includes office school heads, department heads, subject group heads, master teachers, and teachers since all have significant roles in fostering mental health with one another and with their clientele in all levels.

The researcher ensured that the data gathered were accurate through the validation of reliable experts in the Schools Division Office (SDO) of Calapan City. Further, he ensured that the data gathered from the respondents' survey questionnaire were kept with full confidentiality.

Research Instrument

A self-made questionnaire was used for the data collection of the study. The survey questionnaire was validated by SDO research experts upon sending a letter of validation request. Survey questionnaires were distributed to the School Principals, Department Heads, Subject-Group Heads, and teachers both from kindergarten, elementary, secondary, and senior high schools in the Division of Calapan City to determine the relationship between the level of commitment of teachers in the four social accountability principles and the three major social accountability indicators in fostering mental health in the Division of Calapan City.

Statistical Analysis

Both descriptive and inferential statistics were used in the study. Descriptive statistics such as mean and rank were employed to describe and discuss the data collected. These descriptive statistical tools answered questions 1, 2, and 3. Moreover, since the study requires analysis of the test of relationship researchers utilized Pearson product-moment correlation coefficient. It was employed to see the degree of relationship which was followed by linear regression for the association of variables. The analysis of what extent the variables affect each other was supported by the coefficient of determination.

Results and Discussion

This study investigated the variables leading to the following results how the Division of Calapan City promotes mental health to educators through reinforced social accountability.

Reinforced Social Accountability Practices of Teachers in Fostering Mental Health

Table 1
Mean Perception of the Extent of Social Accountability Practices of Teachers in Fostering Mental Health in the Division of Calapan City

Social Accountability Practices in Fostering Mental Health	Mean	Rank	Interpretation
Values the significance of mental health for everyone	4.47	1	High
Takes the initiative to communicate ideas and feelings to others	4.14	18	High
Improves adaptability skills to people, environment, and circumstances	4.16	13	High
Supports productive recreational activities and wellness programs	4.25	10	High
Joins care groups or support groups inside and outside the school	3.96	24	High
Participates in spiritual activities for moral and spiritual empowerment	4.15	14	High
Acknowledges colleagues' worth and significance as a person	4.41	4	High
Gives time and presence to workmates experiencing challenges	4.25	9	High
Opens to receiving feedback, advice, and guidance from others	4.44	2	High
Entertains and practices positive ideas from various sources	4.35	5	High
Practices love for nature, arts, and other outlets with others	4.34	6	High
Work-outs problems with teammates and experts' guidance	4.14	16	High
Ensures trusted confidants inside and outside the school	4.18	11	High
Maintains healthy eating habits at home and workplace	4.05	23	High
Encourages all to have enough rest and sleeping hours daily after work	4.12	19	High
Shares workloads collaboratively with others when necessary	4.16	12	High
Maintains balance with family, school, church, and community affairs	4.11	20	High
Accepts problems are a normal part of life that must be handled wisely	4.31	7	High
Sustains self-reflection and peer-evaluation for psychosocial red flags	4.06	22	High
Seeks opportunity to empower oneself and others holistically	4.10	21	High
Contributes to the solution of one's needs and problems	4.14	17	High
Believes in individual uniqueness to avoid comparison with others	4.44	3	High
Observes mutual accountability and responsibility in the workplace	4.28	8	High
Addresses physical health problems that may lead to mental stress	4.15	15	High
Models financial resourcefulness to avoid mental anxiousness	3.91	25	High
Overall	4.20		High

Legend: Very High (4.50 – 5.00) High (3.50 – 4.49) Moderate (2.50 – 3.49)
Low (1.50 – 2.49) Very Low (1.00 – 1.49)

Table 1 presented the extent of social accountability practices of teachers in fostering mental health in the Division of Calapan City. All or 100% of social accountability practices are of a high extent reflecting the healthy status of the teachers of the division in fostering mental health. The practice of valuing the significance of mental health for everyone with a mean of 4.47 dominate the rank while the practice of modeling financial resourcefulness to avoid mental anxiousness has the lowest mean of 3.91.

The overall mean of 4.20 which corresponds to a high extent showed that there are reinforced social accountability practices among teachers in the Division of Calapan City. It also revealed that the mental health of teachers is in very good condition and signifies that all teachers in the division are aware of the importance of mental health, accountable to each other in fostering mental health, and committed to observing these practices. Thus, it is evident that the deeper the social accountability present in an organization, the higher the opportunities to maximize the essence of professionalism and application of human resource technical abilities in dealing with problems and needs until solutions are materialized to sustain mental health in one another.

The Commitment of Educators in Social Accountability Principles

Table 2
The commitment of Educators in Social Accountability Principles

Social Accountability Principles	Mean	Rank	Interpretation
Leadership Accountability			
Practices accountability for quality performance with full responsibility	4.10	2	Very Satisfactory
Tackles tough issues and makes difficult decisions with transparency	3.95	5	Very Satisfactory
Communicates the strategies across the organization with sensitivity	3.97	4	Very Satisfactory
Expresses optimism about the institution and its future with empathy	4.11	1	Very Satisfactory
Displays external trends in the educational environment with clarity	3.98	3	Very Satisfactory
Overall	4.02		Very Satisfactory
Communication Privacy			
Respects the communication privacy of each employee based on the Data Privacy Act	4.41	1	Very Satisfactory
Follows mutually-held communication privacy rules inside the institution	4.30	3	Very Satisfactory
Upholds evidence-based and context-based communication content	4.13	4.5	Very Satisfactory
Ensures evaluation of risks and benefits of information disclosure	4.13	4.5	Very Satisfactory
Observes appropriate protocols in the flow of communication	4.30	2	Very Satisfactory
Overall	4.26		Very Satisfactory
Culture-Sensitivity			
Values cultural diversity among employees without discrimination	4.35	1	Very Satisfactory
Conducts cultural self-assessment annually among constituents	3.80	5	Very Satisfactory
Upholds understanding the dynamics of difference in an institution	4.00	3	Very Satisfactory
Institutionalizes cultural knowledge positivism and appreciation	4.00	3	Very Satisfactory
Practices cultural interdependence and competence	4.00	3	Very Satisfactory
Overall	4.03		Very Satisfactory
Care-group Sincerity			
Organizes social group with a clear vision, mission, goals, and objectives	3.77	5	Very Satisfactory
Perform members' duties and responsibilities while upholding privileges	4.05	4	Very Satisfactory
Promote holistic welfare of each member of the educational institution	4.09	3	Very Satisfactory
Recognize individual's strengths while mitigating weaknesses	4.12	2	Very Satisfactory
Practice honesty and transparency while valuing individual privacy	4.32	1	Very Satisfactory
Overall	4.07		Very Satisfactory
Grand Mean	4.095		Very Satisfactory

Legend: Excellent (4.50 – 5.00) Very Satisfactory (3.50 – 4.49)
Satisfactory (2.50 – 3.49) Fairly Satisfactory (1.00 – 1.49) Poor (1.50 – 2.49)

Table 2 revealed the educators' level of commitment to the social accountability principle in leadership accountability, communication privacy, culture sensitivity, and care-group sincerity. The data showed that in the four major principles, communication privacy topped the rank with a mean of 4.26 which is very satisfactory. The data exposed that the educators in the Division of Calapan City have a high sense of importance for the value of communication privacy within the organization and are conscientious of the disclosure of any information. It also signified that the majority are careful in handling information for the welfare of all with utmost professionalism.

On the other hand, even though leadership accountability is last in the rank, still it corresponds to a mean of 4.02 which is very satisfactory also. Hence, the overall mean of 4.095 is a good indicator of high-level commitment to the four major social accountability principles in fostering mental health. This simply means that the respondents are practicing reinforced social accountability with one another in fostering mental health for their fellow educators.

Level of Social Accountability Commitment of Educators

Table 3
Level of Social Accountability Commitment of Educators based on the Major Indicators

Main indicators	Mean	Rank	Interpretation
Emotional Sensitivity			
Practices prudence in evaluating others' emotions or feelings	4.18	5	Very Satisfactory
Gives room for the openness of one's emotions with an open mind, listening heart, and caring hands	4.31	2	Very Satisfactory
Acknowledges the person while paying attention to the content and context of the message shared	4.29	4	Very Satisfactory
Responses with pleasantness and courteousness with one's feelings	4.33	1	Very Satisfactory
Builds trust while acknowledging one's courage in expressing emotions	4.30	3	Very Satisfactory
Overall	4.28		Very Satisfactory
Psychological Empathy			
Understands the depth of the context of one's attitude and behavior	4.10	5	Very Satisfactory
Provides quality time in listening to someone's needs or problems	4.22	2	Very Satisfactory
Gives timely advice based on realities related to one's shared experience	4.14	3	Very Satisfactory
Observes balance in giving consolation to failure and praise to the success of one another without comparison	4.12	4	Very Satisfactory
Shows gestures or expressions of encouragement instead of judgments	4.23	1	Very Satisfactory
Overall	4.16		Very Satisfactory
Social Responsibility			
Offers quality commitment to a diverse workforce's needs and concerns	4.05	5	Very Satisfactory
Maintains open communication despite conflicts between parties	4.19	3	Very Satisfactory
Upholds relational wellness of each member through active engagement	4.09	4	Very Satisfactory
Gives equal opportunity for each member to be recognized in their fields	4.20	2	Very Satisfactory
Practices social security, gender equality, and community accountability	4.27	1	Very Satisfactory
Overall	4.16		Very Satisfactory
Grand Mean	4.2		Very Satisfactory

Legend: Excellent (4.50 – 5.00) Very Satisfactory (3.50 – 4.49)
Satisfactory (2.50 – 3.49) Fairly Satisfactory (1.00 – 1.49) Poor (1.50 – 2.49)

Table 3 highlighted the summary of the level of social accountability commitment of educators based on the main indicators in fostering mental health. Of the three main indicators in fostering mental health, emotional sensitivity got the highest mean of 4.28 and a very satisfactory level followed by psychological empathy (4.16) and social responsibility (4.16) both with equal rank and at a very satisfactory level.

With an over-all mean of 4.28, the respondents highly value emotional sensitivity to its positive degree as a strategic mechanism in fostering mental health. It also revealed their level of social accountability commitment as reflected in the manner in which they give respect to the emotions of others. The more sensitive they are to the emotions of others, the more careful they are in handling and responding to others' feelings resulting in more lasting and satisfying relationships which is a good indicator of good mental health status.

The data also gave an interpretation that educators in the division have the heart (emotional sensitivity), the will (psychological empathy), and the hands (social responsibility) to reach out to one another, help one another, restore one another, and commit to one another in fostering mental health.

Social Accountability Principles and Major Indicators in Fostering Mental Health

Table 4
Correlation between social accountability principles and major indicators in fostering mental health in the Division of Calapan City

	Leadership Accountability	Communication Privacy	Culture Sensitivity	Care Group Sincerity	Interpretation
Emotional Stability	.688	.713	.673	.687	positive, high, and significant
Psychological Empathy	.614	.667	.638	.641	positive, high, and significant
Social Responsibility	.693	.712	.717	.736	positive, high, and significant
df = 454, a = 5%, df = ± .092					
Social Accountability Principles and Major Indicators in Fostering Mental Health	R	r critical	Interpretation		
	.845	± .092	positive, high, and significant		

Table 4 revealed that all the social accountability commitment principles are positively, highly, and significantly related to the social accountability commitment indicators in fostering mental health for educators in the Division of Calapan City.

For leadership accountability and emotional sensitivity, since the absolute value of r computed is greater than the absolute value of r critical that is $|.688| > |.092|$ at a 5% level of significance with 454 degrees of freedom, the null hypothesis is rejected. The result showed a significant relationship. The higher the leadership accountability, the more leaders become aware of how to understand deeper and respect the feelings and emotions of others (Issah, 2018).

For leadership accountability and psychological empathy, since the absolute value of r computed is greater than the absolute value of r critical that is $|.614| > |.092|$ at a 5% level of significance with 454 degrees of freedom, the null hypothesis is rejected. The result gave a significant relationship. The higher the leadership accountability in an organization, the deeper the psychological empathy of each member and leader to one another (Rubini, 2017).

For leadership accountability and social responsibility, since the absolute value of r computed is greater than the absolute value of r critical that is $|.693| > |.092|$ at a 5% level of significance with 454 degrees of freedom, the null hypothesis is rejected. The result displayed a significant relationship. The higher the leadership accountability in an institution, the more committed its constituents are to assuming sociability responsibility in safeguarding the mental health of the organization's, members (Abbas and Asghar, 2010).

In the same way, for communication privacy and emotional sensitivity, since the absolute value of r computed is greater than the absolute value of r critical that is $|.713| > |.092|$ at a 5% level of significance with 454 degrees of freedom then the null hypothesis is rejected. The result exhibited a significant relationship. The higher communication privacy is observed and respected, the more an educator becomes emotionally sensitive to the feelings and needs of others (Krasnoff, 2016).

For communication privacy and psychological empathy, since the absolute value of r computed is greater than the absolute value of r critical that is $|.667| > |.092|$ at a 5% level of significance with 454 degrees of freedom, the null hypothesis is rejected. The result presented a significant relationship. The higher an individual values communication privacy, the better he empathizes with the psychological needs of others (McFarland, 2012).

For communication privacy and social responsibility, since the absolute value of r computed is greater than the absolute value of r critical that is $|.712| > |.092|$ at a 5% level of significance with 454 degrees of freedom, the null hypothesis is rejected. The result revealed a significant relationship. The higher communication privacy is practiced in an organization, the better socially responsibility is observed in information management and keeping of confidential matters for the common good of all, and the more respect is shared.

Moreover, for culture sensitivity and emotional sensitivity, since the absolute value of r computed is greater than the absolute value of r critical that is $|.673| > |.092|$ at a 5% level of significance with 454 degrees of freedom, the null hypothesis is rejected. The result presented a significant relationship. The higher culture sensitivity is valued in an institution, the more its members become emotionally sensitive in valuing interdependence out of diversity, thus, becoming more conscientious of the uniqueness of each individual's feelings and emotions.

For culture sensitivity and psychological empathy, since the absolute value of r computed is greater than the absolute value of r critical that is $|.638| > |.092|$ at a 5% level of significance with 454 degrees of freedom, the null hypothesis is rejected. The result displayed a significant relationship. The higher culture sensitivity is practiced in school, the more educators understand the context, depth, and degree of the needs, situations, and problems of its clientele.

For culture sensitivity and social responsibility, since the absolute value of r computed is greater than the absolute value of r critical that is $|.717| > |.092|$ at a 5% level of significance with 454 degrees of freedom, the null hypothesis is rejected. The result revealed a significant relationship. The higher culture sensitivity is practiced in school, the educators become more concerned with the psychological well-being of their colleagues and workmates, and the better they assumed responsibility for appreciating others' differences.

With the last social accountability principle, for care group sincerity and emotional sensitivity, since the absolute value of r computed is greater than the absolute value of r critical that is $|.687| > |.092|$ at a 5% level of significance with 454 degrees of freedom, the null hypothesis is rejected. The result showed a significant relationship. The higher care group sincerity is experienced in an organization, the more its members become emotionally open to express feelings like fears, anxiety, doubts, and struggles.

For care group sincerity and psychological empathy, since the absolute value of r computed is greater than the absolute value of r critical that is $|.641| > |.092|$ at a 5% level of significance with 454 degrees of freedom, the null hypothesis is rejected. The result presented a significant relationship. The higher care group sincerity is shared without discrimination, stereotyping, and judgment in an organization, the more its members become psychologically secure and satisfied with their workplace.

And for care group sincerity and social responsibility, since the absolute value of r computed is greater than the absolute value of r critical that is $|.736| > |.092|$ at a 5% level of significance with 454 degrees of freedom then, null hypothesis is rejected. The result displayed a significant relationship. The higher care group sincerity is practiced with consistency, the more vibrant the education system is, the more empowered the workers are, and the more satisfied the clientele.

Proposed Reinforced Social Accountability Project

Based on the findings of the study, it is proven that social accountability has a positive, high and significant relationship in fostering mental health for educators in the Division of Calapan City and serves as an effective strategic mechanism for its sustainable implementation, the researchers are determined to extend to all the platforms of Project SAVE (Social Accountability for Vibrant Education) and enlarge its scope by creating more functional Care Groups in the kindergarten school, elementary schools, and secondary schools not just in the division

Conclusions

The following are the conclusions drawn from the findings of the research:

1. The high extent of reinforced social accountability practices of teachers in fostering mental health in the Division of Calapan City is high. Various social accountability programs on fostering mental health from the Central Office, and Regional Office to every school of the Division of Calapan City contributed to this result.
2. The level of commitment of educators to social accountability principles in fostering mental health is very satisfactory with leadership accountability as the last on the rank. Hence, more reinforcement in the line of school heads is needed to raise the level of commitment of DepEd leaders.
3. The level of social accountability commitment of educators based on the main indicators in fostering mental health is very satisfactory. Therefore, educators in the Division of Calapan City valued highly the importance of emotional sensitivity, psychological empathy, and social responsibility in fostering mental health.
4. Since there is a significant relationship between the social accountability principles and major indicators in fostering mental health, the null hypothesis is rejected. Hence, reinforced social accountability is an effective strategic mechanism for fostering mental health for educators in the Division of Calapan City.
5. The indicators were all considered in the proposed Project SAVE to raise the level of social accountability in fostering mental health and are highly recommended for regional and country-wide implementation.

References

- Abbas, W. and Asghar, M. 2010. The role of leadership in organizational change: relating the successful organizational change to visionary and innovative leadership. Retrieved from <https://www.diva-portal.org/smash/get/diva2:326289/FULLTEXT01.pdf>
- Dela Cruz, J.M and Ciriaco, C. 2018. Suicide of teachers, children prompts call for govt action. Retrieved from <https://businessmirror.com.ph/2018/08/26/suicide-of-teachers-children-prompts-call-for-govt-action/>
- Issah, M. 2018. Change Leadership: The role of emotional intelligence. SAGE Open Journal. Retrieved from <https://journals.sagepub.com/doi/10.1177/2158244018800910>
- McFarland, M. S.J. 2012. Why we care about privacy? Retrieved from <https://www.scu.edu/ethics/focus-areas/internet-ethics/resources/why-we-care-about-privacy/>
- Krasnoff, B. 2016. Culturally responsive teaching. A Guide to Evidence-Based Practices for Teaching All Students Equitably. Region X Equity Assistance Center, Education Northwest. Retrieved from <https://educationnorthwest.org/sites/default/files/resources/culturally-responsive-teaching.pdf>
- Rivas, F. 2021. Suicide cases rise in PH as pandemic drags on. Retrieved from <https://www.rappler.com/nation/suicide-rises-philippines-pandemic-drags-on-2021>
- Rubini, Lea L., "Enhancing the Pace and Process of Change: Realizing Outcomes Through Leadership Empathy" 2017. Master of Science in Organizational Dynamics Theses. Retrieved from [87.https://repository.upenn.edu/od_theses_msod/87](https://repository.upenn.edu/od_theses_msod/87)

The Impact of Covid-19: Reflections and aspects of the school experience

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Cambridge International Research Hub, Cambridge University Press & Assessment, United Kingdom

Abstract

Education was affected by the pandemic and people working across nations in schools were heavily impacted by the onset of the Covid-19 pandemic across international contexts. During the first responses to the Covid-19 pandemic, schools were confronted with pressures and challenges of how to deliver their curricula and administer assessments in a remote, virtual and hybrid world. We worked with school leaders, coordinators and curriculum teams across some Cambridge International (9) schools in the Asian (South and Far East), European, North American and Sub-Saharan national contexts to explore what they perceived as effective teaching and learning during the Covid-19 pandemic period. We used a mixed methods approach (surveys, focus groups and semi-structured interviews) to capture 11 educational professionals' reflections on what were successful remote teaching and learning models in their context, and how educational institutions could respond effectively to the impact of Covid-19 or future disruptions to learning in terms of data monitoring and evidence-based practices. Participants were asked about teaching and learning approaches, challenges and how these were overcome, tracking, reporting and assessing students and reflections on what will stay in a post-pandemic world. Our findings suggest that a resilient education system that can cope with future disruption requires a greater emphasis on student agency and independence, the use of blended learning in preference to hybrid learning, assessment becoming an extension of learning, and increased levels of parental engagement and partnership with schools. Despite all the challenges that schools faced, teachers were shown to be adaptable, flexible, innovative and resilient. It is very important that teachers feel supported as they adjust their practices. Research has an important role in illuminating the challenges that teachers face so that they can be supported by school leaders, policy makers and others.

Keywords: Covid-19, Teaching and Learning

Introduction

On 31 December 2019, the Wuhan Municipal Health Commission, China, reported a cluster of cases of pneumonia in Wuhan, Hubei Province. A novel coronavirus was eventually identified. On 4 January 2020, the World Health Organisation (WHO) reported on social media that there was a cluster of pneumonia cases – with no deaths – in Wuhan, Hubei province. The WHO classified Covid-19 as a pandemic on 11 March 2020. As a result of this declaration many countries went into lockdown. Many industries were affected by the pandemic and were forced to react and change their methods of working.

This piece of research was a sub-project within a larger strand of work. The research project sought to understand through questionnaires, focus groups and interviews with teachers at all stages of their careers, what Cambridge International (from hereon, Cambridge) schools experienced during the pandemic; which interventions they implemented that they perceived worked well [in their context] and why. With particular emphasis on: Remote teaching and learning through evidence-based practices, and Data monitoring.

A review of current literature (15 journal articles) was carried out. The majority focused on university online learning, Massive Open Online courses (MOOCs). Medical journals (The Lancet) focused

on mental health (2) and learning loss (1); however, our focus was effective teaching and learning in a time of crisis and one study (Burgess and Sievertsen 2020) was relevant in this area.

Method and Materials

This study adopted a mixed methods approach and data was collected from four sources. Existing quantitative data collected through an online Omnibus survey and regular monthly online meetings were used as the foundation for qualitative data gathered from focus groups (2) and individual interviews (7).

The Omnibus survey carried out in July 2020 asked three questions relating to Covid-19 and the Teaching & Learning when schools reopen.

- What has surprised you most about your learners' response to the situation? (open question)
- What is your priority to focus on now? (selection of answers to choose from plus 'Other')
- How do you know actual learning has taken place? (open question)

There were almost 300 responses and the countries with the most schools that completed the survey were India, USA, Italy, Indonesia, Malaysia, UK and South Africa. The respondents who completed the survey were a combination of exams officers, teachers and senior leader, some with multiple roles.

Based on the data analysed from the Omnibus survey, schools were invited to participate in this research study via our social media channels and opt to put forward whoever they wanted to for the interviews. There were no specific subjects represented. The participants were school leaders (5), coordinators (5), researchers (1), and curriculum teams (1).

The research was guided by two questions:

What are the successful models of remote teaching and learning as experienced by our schools?

How can educational institutions effectively respond to the impact of Covid-19 or future virus outbreaks in terms of data monitoring and evidence-based practices?

Goldacre's (2013) definition of evidence-based practices was broadly used, he states, by collecting better evidence about what works best and establishing a culture where this evidence is used as a matter of routine, outcomes for children can improve, and professional independence can increase. Research can help find out which interventions will work best overall, and which strategies should be tried first, second or third, to help everyone achieve the best outcome. The caveat here is that not all interventions that schools tried were randomised control trials or possible during the pandemic.

Some schools opted to make presentations about their experiences as part of the focus groups. The schools that participated were all Cambridge schools (9) from across the globe in all our time zones. The countries that were represented were India, Brazil, Cuba, Zimbabwe, Oman, Malaysia, China, Italy, Spain and USA. A variety of education sectors that do Cambridge programmes were represented – private independent (4), large state schools (4) and US High schools (1).

In terms of research ethics, it was made clear from the outset that participation was for research purposes and anonymity would be maintained unless of course they gave permission to be identified in research outputs. Participants were informed that the semi-structured interviews would also be recorded to capture all comments and discussions in the interview and informed consent was established.

The one-hour interviews and focus groups (3 or 4 participants) were held between July 2020 and April 2021 and we asked participants about changes to their teaching and their lesson content, where they found challenges, how they overcame them and finally what of these on reflection they want retain.

Results and Discussion

Prior to each one-hour interview and focus group, it was agreed which researcher would lead the discussion. Both researchers made notes independently and the lead researcher documented the overall findings. Once all interviews were completed, the notes were reviewed, and the emergent themes were recorded and tabulated. The key emergent interview themes during the interviews and panel focus groups were: Teaching approaches – agency and independence, Lesson content – working smarter not harder, Challenges – the reality during the pandemic, Successful ways to overcome these challenges, Tracking and reporting progress – what, who and how? Assessing students – expectations and context, Reflections on what will stay in a post-pandemic world.

Teaching approaches – agency and independence

During the interviews it became apparent that participants perceived that the desire from their students was that they wanted more agency and independence. In order to accommodate this, more traditional teaching approaches needed to be modified. Blended learning was adopted in many schools using synchronous and asynchronous lessons. Synchronous lessons are run in real time, where the students and teacher, login and attend together from different locations, remotely/virtually, at a pre-determined time. They operate much like a traditional classroom, with set timetables and live discussions.

Asynchronous lessons are where the students access the class materials in their own time and can set their own pace and work independently. Teachers can post videos, audio files, notes, quizzes, exercises etc. Students can use discussion forums and learn socially.

Interestingly, schools told us that affordances of asynchronous lessons gave the students autonomy and agency to manage their learning at their own pace, because more content materials were shared online by the teachers during this period. It was also noted that hybrid teaching and learning was unsuccessful in the teaching environment as trying to maintain flow, student engagement and support, trying out new techniques and carrying out activities for more practical and creatives subjects was almost impossible, when there was a mixture of students in-person and remotely. Blended learning was much more successful in addressing these issues.

There was greater use of the flipped classroom model, where the traditional teaching method is ‘flipped’ or reversed, with the teacher's role becoming that of a learning coach and facilitator (Altemueller, Lindquist, 2017). This type of teaching approach has been around for many years although perhaps underutilised. The combination of asynchronous and synchronous lessons forced schools to incorporate this approach more. Participants agreed that they saw this model as more learner-centred rather than instructional, the outcome giving learners more autonomy and flexibility.

Participants indicated that older learners studying for high stakes examinations e.g. O Level, IGCSE and A Level wanted more personalised support and instruction. Learners requested drop in sessions where they could ask for individual help and guidance from their teachers on content or problems that they found particularly challenging.

Teachers recognised that with the inclusion of asynchronous lessons within the modified timetable, homework became an issue. One could ask oneself, what is the difference between homework and an asynchronous lesson? Teachers’ awareness and acknowledgement that learners use screens constantly for

a variety of reasons including socialising led to a reduction in homework and content heavy tasks which would take longer than an hour to enable learners to ‘get away from screens,’ at least for work.

Participants explained that the wellbeing of learners was of utmost concern and importance and just as flipped lessons were valuable in providing learners with agency and independence, more peer to peer teaching and learning was also incorporated into the lessons. This further encouraged student agency and independence. In addition peer to peer lessons ensured learners were working together for wellbeing reasons and fostered more collaboration. This type of lesson allowed more content coverage especially as there was a great deal of content to cover since because of the pandemic some lessons were missed. Another approach to ensure the wellbeing of the learner and social inclusion was compassionate questioning or ‘warm calling.’ This is where a teacher would contact a learner (particularly a quiet or shy student) the day before class and inform them that they would be calling upon them to answer a question and they would tell them exactly what question they were going to be asked. This way the student knew what was coming and could prepare their answer in advance, which reduces anxiety and allows for social inclusion.

Teaching approaches were focused on being learner-centred, however, there were other benefits for colleagues in terms of collaboration. Departments worked closely together to ensure that lessons had variety and engagement. Technology was used to enable learning not to hinder it. Colleagues who had expertise in the use of technology were able to cascade their knowledge to mentor and support those that were less confident.

Throughout the pandemic, schools needed to constantly adapt to the changing national and global guidelines and colleagues were expected to be flexible. It should be noted that whilst there was a need for flexibility there was also an awareness not to change too much too often as this resulted in increased amount of stress for teachers, learners and colleagues.

Lesson content – working smarter and harder

Within a syllabus whether the assessments are low or high stakes there is generally a great deal of content to cover. As indicated in the previous section teaching approaches were modified and it was imperative that when lesson planning, efficient use of time, particularly in the synchronous lessons, was implemented. Participants told us that the most important things to focus on when lesson planning were skills and key concepts that learners could use and apply across topics and subjects. The key was simplicity, focusing on skills rather than content, for example, providing learners with opportunities to learn how to use research skills or critical thinking. It was reiterated from several participants that the lesson outcomes were reinforced throughout the lesson (in the chat box for online delivery) so that there was absolute clarity for learners of what the expected lesson outcomes would be.

In addition effective use of technology was about exploiting the affordances it offers to enhance learning, not allowing it to restrict or to simply replace in person. For example, using video conferencing platforms such as Zoom, Microsoft Teams etc. for practical and creative subjects where teachers could carry out teacher demonstrations, show virtual labs and videos or for the musically minded, music recitals or even oral tests. Participants also shared the use of opportunities for learners to use materials in the home to find very creative ways to overcome the lack of laboratory or studio time. For example, experiments using household articles e.g. emulsification of lipids - oil, water, and detergent.

When planning remote/virtual synchronous lessons teachers were aware of how vulnerable students were to stress or isolation and that providing engaging lessons would impact positively on student wellbeing. They would try to conclude a lesson with something engaging, for example, a song or motivational video clip related to the lesson theme, or something meaningful that provided learners with something to consider after the lesson which allowed the learner to leave the lesson in a positive mood.

Challenges – the reality during the pandemic

There were differences in the approaches schools took across different countries. Some schools used blended learning; others tried hybrid learning, both with varying degrees of success. Materials are developed for a particular environment, so trying to make them work in two different environments is not successful, for example, playing an audio/video clip or writing answers on paper and swapping with another student to mark or check is a challenge. Although these can all be adapted, using one mode for two situations is problematic. The general consensus was that hybrid learning is not a successful experience for teachers and learners, to quote one participant:

“Hybrid learning means face to face and online at the same time. Honestly, I don’t think it works because either something is meant for online delivery or for face to face. Otherwise the interaction would be weird to carry out.”

The preferred method was blended learning approaches. The approaches taken were also determined by government guidance and restrictions. Overall, the approach taken depends more on individual school context with the exception of where government or local authority mandated a different approach. E.g. US schools graduation requirements.

One of the main challenges was the pace of the lessons were much slower due to the need for more attention and concentration. Examples of a combination of factors that attributed to the slower pace are checking in on learners, caring for learners and their wellbeing through more conversations and ice breakers, more warm up activities, it took longer to settle down, it took longer to try new materials, poor internet connections, struggling with the technology.

The challenge of not being able to ‘read the room’ in virtual lessons was significant when there were no verbal or visual cues if cameras were turned off and microphones on mute. It was difficult to sometimes assess learner engagement, and we heard creative examples of learners calling themselves ‘trying to connect...’ or ‘Reconnecting...’ instead of their name on the video conferencing platform screen when their camera was turned off. Primary and elementary school children were reported as broadly happy to have their cameras on because they enjoy participating in the lessons and seeing one another, however, older students are more self-conscious and prefer not to have cameras on because they do not like looking at themselves on screen or sharing their home space.

Participants explained that there appeared to be a conflict for learners between wanting autonomy and independence and the challenge they faced in wanting or needing guidance on time management between asynchronous and synchronous lessons. Learners sometimes felt ‘lost’ with asynchronous activities and preferred to do some of the activities with the teacher. However, this conflict appeared to be age-related or by year group related.

Successful ways to overcome these challenges

As mentioned in the previous section, the preferred approach for schools was blended learning and this overcame the challenges of hybrid learning. Schools tried many combinations of blended learning to find out what worked best for their context. One of the most successful combinations was two days in school, two days at home and one independent learning day.

To overcome the challenge of slower paced lessons, teachers compressed lessons by defining key concepts, using compassionate questioning or ‘warm calling’ for the quiet students considering their wellbeing. Participants told us their staff collaborated more and became closer during the pandemic, despite

only meeting remotely. When the technology worked well, there was easier access to shared documents, it was easier to observe lessons, and much more flexibility and opportunity to team teach.

Heads of Year/Home tutors investigated the apparent conflict that arose regarding time management and when older students were asked what they wanted, their response was that they just wanted more autonomy. In terms of asynchronous lessons, there was a realisation that learners do have a great deal of inner resources and if allowed to, they tap into this (sometimes with some teacher assistance), and learning starts to happen at a much deeper and more authentic level. Learners are able to self-reflect and work at their own pace and at times to suit their home situation, particularly, for example, if a learner needed to negotiate and share a device with siblings or where privacy was limited at certain times of the day. Where schools were able to provide this autonomy and personalisation easily everything became more harmonious.

Tracking and reporting progress – what, who and how?

The main findings indicate that the brand of the system being used is not the driver for tracking and reporting progress but more importantly whatever system that is used is done so by all stakeholders, i.e. leadership teams, teaching staff, learners and parents and that they all have the appropriate levels and rights of access, ensuring that the day-to-day essentials, are in place, such as recording attendance, progress, teacher-parent messaging system to communicate concerns or events etc. This means that teachers can upload assignments, PowerPoints, quizzes and tests etc., and learners are able to submit assignments through the system/portal, and/or have discussion forums allowing for flexibility within a programme. In addition the system should have the capability to send progress reports to parents/guardians.

All participating schools tracked online attendance but quickly realised this did not show the engagement of a learner in any meaningful way. They told us they evolved their systems to include the level of participation. Examples included 'do they contribute to the chat? Raise their hand and ask a question, answer a question and progress in lessons. 'Do they participate in the quiz? Do they submit their homework? Do they respond to feedback and corrections? Using simple visual system such as RAG (red, amber, green) reporting were preferred and worked well compared to over complex systems, as this allowed any issues to be identified at a glance. It was agreed that detailed information was not necessary at this stage.

Different schools in different countries had many different expectations from a cultural and social point of view and the answers were nuanced depending on their context. Schools took their time to get this right, for example, they asked themselves some of the following questions: Should students be made to have cameras on? Should students have to speak or type in the chat? At what ages? What should parents be informed of?

As mentioned previously, local authorities had different mandates in terms of approaches, and this included definitions of what an absence is or imposition of assignment deadlines and sometimes schools did not have or were not allowed to control what they were able to report.

Assessing students – expectations and context

With the combination of synchronous and asynchronous participants shared a variety of ways that were adopted in order to assess learners since it became apparent that conventional methods of testing were not appropriate in the new virtual classroom environment. It should be noted that methods used were dependent on expectations and school contexts particularly in terms of local government guidelines.

Assessment for Learning is characterised by the Assessment Reform Group as, “the process of seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in

their learning, where they need to go and how best to get there” (ARG, 2002). In the context of the pandemic this process could be enhanced by using simple technology such as polls, quizzes, surveys (e.g. Nearpod, Pear Deck), platform chat functions and breakout rooms to carry out discussion or group work. The data collected from these types of assessments were used to drive instruction.

Another popular method of assessing learners was the Collaborative Learning Network; here the emphasis was on rubrics for formative assessment and grading. Understanding why rubrics are important, the features of good rubrics and the different types and how to help learners read and understand them. Knowing the value of rubrics makes grading easier for teachers because this gives them an opportunity to think about the purpose, outcomes and skills, i.e. the underlying principles, and also the elements of the rubrics - the criteria and indicators.

Teachers also used creative ways to assess learners such as kitchen sink science by inviting learners to submit photos of their experiment and their results.

The uncertainty of how learners would perform in their exams, and that there would be fewer exams, and in some cases some subjects would be further behind than they would normally be, schools that ran exams needed to approach assessments differently. Many end of year exams were open book and ‘non Googleable’ questions were set so that answers couldn’t be looked up. In some cases, the exams set focused more on the application of knowledge and/or problem solving. This is where teaching key concepts and skills was imperative.

Some schools had departments working together to have students work on interdisciplinary projects, for example, Maths, History and Global Perspectives. This was a way of reimagining assessment as an extension of learning, producing more authentic assessments. More Project Based Learning (PBL) is something that is being considered in this arena.

Reflections on what will stay in a post-pandemic world

It is widely acknowledged that the pandemic posed many challenges for teaching and learning globally, however, it also provided many opportunities for enhancing teaching and learning. Participants reflected on what they learnt from their experiences and shared what had the greatest positive impact that their institutions would continue to incorporate and embed moving forward in a ‘living with Covid-19 world’.

More engagement and partnership between schools, learners and parents evolved during the pandemic. In-person parent consultation meetings and information evenings for transition between different key stages had to be delivered online, which afforded greater participation and engagement from both parents/guardians. The use of technology to track and report progress and share materials with learners and their parents also fostered this partnership.

Blended learning models worked well and there will be for some schools permanent changes to the timetable, where combinations of the synchronous and asynchronous lessons will continue remotely, in order to enhance student agency and independence. One school reported that they would continue with one or two days a week at home even when there is no pandemic as they do not ever want to be caught out with teachers or students becoming out of practice with the systems. There was a notable difference between schools who said they were proud, surprised and impressed by how much their students could actually do on their own, vs the ones who need constant handholding, even at the older age ranges. It is important to allow learners to have space to develop their skills in organisation, independent learning and time management.

The effective use of technology will continue in the form of flipped lessons, access to lesson plans, scores and materials across the school, more personalised structure, recording of lessons for those who miss them or need to rewatch and online parent consultation meetings, online teacher review meetings that would normally take place in the evenings. Part-time teachers and teachers who work in more than one school (common practice in many Cambridge markets) benefit from this as they avoid the need to return to school in the evening or move multiple times between schools.

Participants agreed that technology should be used as tool to enhance and not restrict learning, it was expressed that writing should stay as this is considered a life skill.

Conclusions

A resilient education system that can cope with future disruption, requires a greater emphasis on student agency and independence, the use of blended learning in preference to hybrid learning, assessment becoming an extension of learning, and increased levels of parental engagement and partnership with schools. Despite all the challenges that schools faced, teachers were shown to be adaptable, flexible, innovative and resilient. One of the biggest advancements due to the pandemic in international schools is teacher confidence in effective use of technology. The pandemic forced teachers into emergency remote instruction and the hugely challenging times helped reinforce the importance of the teacher, their skills and flexibility. Where they may previously have been reluctant to try technology, many now have a significantly reinforced willingness to make use of it where **they** feel it has value.

This works both ways too – as teachers have much higher expectations about the value of technology the teacher view and experience of it is now significantly enhanced. If technology, from their perspective, doesn't make significant impact, they rightly feel emboldened to demand more. It is very important that teachers feel supported by school leaders, policy makers and others as they adjust their practices.

Acknowledgements

Thank you to all the participants in this research study who were so open and honest with sharing their experiences. Thank you to my colleague Lynda Bramwell with whom it was a pleasure to work with on this research project and to Dr. Martin Johnson and Dr. Jude Brady for their very helpful and constructive feedback.

References

Altemueller, L. and Lindquist, C., 2017. Flipped classroom instruction for inclusive learning. *British Journal of Special Education*, 44(3), pp.341-358.

Burgess, S. and Sievertsen, H.H., 2020. Schools, skills, and learning: The impact of COVID-19 on education. *VoxEu.org*, 1(2).

Goldacre, B., 2013. Building evidence into education.

Shaw, S., Johnson, M. and Warwick, P. 2013 January. Assessment for Learning in International Contexts (ALIC): understanding values and practices across diverse contexts *Research Matters: A Cambridge Assessment publication*, 15, (pp17-28).

<https://www.who.int/news/item/27-04-2020-who-timeline---covid-19> (Accessed April 2021)

Emerging Trends in Imaginative Writing: A Post Pandemic Strategy for Enhancing the Teaching, Learning and Testing of Poetry in English in Nigeria Tertiary Education

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Abstract

Although the covid-19 pandemic adversely affected the mode of academic landscape of Nigerian tertiary education, the pandemic nonetheless has helped to introduce alternative modes of instruction, especially in the areas of teaching, learning and testing of creative writing. The aim of this study is to explore the impact of the pandemic on teaching and learning of creative writing in Crown-Hill University, and how the teacher and students have been able to adapt to the post-pandemic period. This study examined how the mode of instruction moved from the adopt phase to the adapt phase to the adept phase, and how the later two phases have radically spurred both teachers and students of creative writing to move from a largely traditional classroom mode of instruction to adapting to the on-line modes like the zoom and goggle-meet for teaching and learning, testing, group presentations and class discussions. There is also that conscious self-motivation from students to become adept in poetry writing. The study x-rayed the process of creative writing and the significance of literary devices in poetic construction and also considered how the on line and the classroom learning mode have helped to promote the socio-aesthetic imperatives in the art of poetry writing. This study adapts the formalist theory with specific focus on Roman Jakobson's and Viktor Shklovsky's interpretive approach that emphasizes literary form and the study of literary devices within the text, their attempt at objective analysis of the devices and techniques. Thanks to Polystratus' proposal of constructing a poem from a montage of words and pictures. Creative writing students are encouraged to experiment on Polystratus' idea to experiment and to construct their own unique poems. We deduced from our findings that the pandemic and the attendant post-Covid health precautions have helped to improve both teacher/student relations in their bid to find a common ground in finding solutions and improving on the common challenges as it relates to teaching and learning and testing of poetry. Learners also tapped into their dormant innate creative potentials and as teaching and learning becomes more interactive and their literary output expressive and unique.

Key Words: *Imaginative Writing, Post-Pandemic, Education.*

1.1. Introduction

“Children and lunatics cut the Gordian knot which the poet spends his life patiently trying to untie.” - Jean Cocteau –

This study explored the impact of the pandemic on teaching and learning of creative writing, in Crown-Hill University, during and after the lockdown. It examined how teacher and students were able to adapt to the post-pandemic period and how they sought for alternative teaching modes around the post-pandemic challenges; how the traditional classroom teaching/learning method was aligned with this emerging trend and how this trend was successfully interfaced with the on-line teaching, especially in the areas of teaching, learning and testing of creative writing. We examined how this mode of instruction transformed learners from the ‘adopt-learner’ to an ‘adept-writer’ and how the new teacher/student vertical interaction has helped to promote the socio-aesthetic imperatives in the learning capabilities of the students, and how learners applied the forms and techniques in poetry writing. The study explored how the teacher

took the students through a step by step process of writing, reading, creative writing models, exercises and textual examples with specific focus on the various genres of poetry, how students were tested on what is learnt through interactive sessions and exercises, with the teacher coordinating each session in order to access each students progress. We considered also learner's individual social and economic background and how it impacted on their learning, The impact of the Covid-19 was not uniform as it affected students differently, but despite the adverse impact of the Nigerian economic and class structure, the teacher and the learner in Nigerian institutions were able to find a way around this shortcomings: Through a combination of well-structured lesson and assignment compacts sent or delivered through text messages, WhatsApp and Virtual modes of instruction where applicable. Through these methods in question, we were able to appreciate the inevitability of change and the need to adapt to current mode of post-pandemic modes of instruction. In order to accommodate the new health code of conduct like social distancing, use of face mask and washing of hands, classroom space and sitting positions, the creative writing class that was originally meant for about 15-20 students now accommodates only 5-10 students. The post-covid-19 creative writing class saw a conscious effort, self-motivation as students explored their innate creative endowment to experiment on new mode of poetic forms and techniques.

2.1. Theoretical Framework and Review of Related Literature

We adapted the Formalism theory and interfaced this with the Expressive literary criticism

➤ Verbal/Visual arts and Surrealism

Formalism is an interpretive approach that emphasizes literary form and focuses on the literary devices used within the text.

- It places great importance on the literariness of texts, those qualities that distinguished the literary from other kinds of writing.
- Neither author nor context was essential for the Formalists. This theory assumed that there is a fundamental opposition between literary or poetical language and ordinary language because its laws produce the distinctive features of literariness,

The Expressive literary criticism defines poetry as an expression or utterance of feelings, or as product of the poet's imagination operating on his or her perceptions, thoughts and feeling"(Abram 2001); this criticism judges the work by its genuineness and adequacy to the poet's individual vision, state of mind and uniqueness. It looks in the work for evidences of the particular temperament and experiences of the author who has consciously or unconsciously, revealed himself to the reader through the text. We considered also the method of investigation of the relationship between verbal and visual arts proposed by Polystratus; who suggested to his painter-friend Lycinus, to merge written words and picture into a montage-literary form. Using this method, students are encouraged in creative writing class to adapt Polystratus idea of merging written poetry in pictorial form and by so doing test students ability to innovate into abstract and concrete forms. By this form, a montage of poetry in word-form and pictorial-form is constructed, thus a poem can be read in written form and pictorial form simultaneously. Through this method we adapted a number of writing models into new ones like word-visual, performance poetry and thus help to transform budding creative writers into adept writers. The expressionist criticism is author focused and thus, would be relevant in the areas where students express their writing skill with precision. Surrealism was a rebellion against all restraints on free artistic creativity, including logical reasoning, standard morality, social and artistic conventions and norms. It is a type of writing delivered entirely to the promptings of the unconscious mind; Surrealists have broken with conventional modes of artistic organization to experiment with free association, violated syntax, non-logical and non-chronological order and juxtaposed seemingly unrelated images (Abrams 2001). Our students in this study explored their poetic skill in surreal form as well.

3.1. Teaching: Theory and Practice of Poetry Writing The Process of Poetic Creativity from Inspiration to the Genre of Poetry

Creativity is a process of forming something out of nothing, to bring into being by force of imagination, to produce or to invest with a new form. In imaginative writing, one needs to be acquainted with the main aspects of poetic creativity. Inspiration is an external impression on the creative mind. It nudges and quickens the imagination, sets the dormant, innate creative nature in motion and gives the right words to thought. The imagination gives flesh to thought, in the mind's eye, and thus concretises creative thought with words in forms of concrete images and pictures. Peter Nivio Zarienga, personifies inspiration by these words: "I am imagination, I can see what the eyes cannot see, I can hear what the ears cannot hear, I can feel what the heart cannot feel." (Pritzker 1999). The third aspect of poetic creativity is experience: imagination works better when combined with experience, especially when the writing is mainstream focused. While imagination is the innate working of the mind that transforms thought process into ideas and concepts which is constructed with words, experience is a concept that comprises knowledge of, skill in, observation of something or event gained through involvement in and exposure to. Experience is what is registered in our subconscious mind, what we come in contact within our day to day living and which helps us to put our ideas in proper settings, in space and time. In all, creative writing skill requires patient apprenticeship, training and feedback. Creative writing must be learned and practiced. Though poetry is a subjective endeavor, it can take an objective form through performance. Expression of ideas or emotions in style that is concentrated, imaginative and powerful is the hallmark of good poetry. Inspiration is a largely external impression/suggestion in form of thought and words. We are inspired to think, to imagine thought form, picture in our minds eye. These words in abstract forms remain dormant in the realm of imagination until the innate experience nudges them into concrete forms. We write down these thought forms on paper as symbols thoughts concretised. The reader interprets our thought through concrete and symbolic forms. In writing poetry, except of course in surreal writings, a poem should have structural unity where words, sentences or stanzas are aligned with the central thought. A good poem emerges when lines and stanzas in the poem are arranged in a clear and logical order, and phrases are used to develop the controlling idea and these are close and distant relationships between the stanzas. In our classroom and on-line teachings, we considered a number of genres of poetry, their models, forms and the techniques of writing. Among the genres introduced to students include the African traditional forms like folk poetry and panegyric and performance poetry types, the Afghanistan traditional two lines poem, the three line Japanese haiku, the European sonnet, Odes, narrative, concrete, surreal forms and the written and picture form is another genre of poetry unique in the sense that it is a montage of words and picture and when a words-picture type is combined with performance, we have what we call 'total poetry' or 'tripod' type poem. To conclude by illustration: Inspiration (impressions (abstract/senses); Imagination (abstract thought forms, coupled with socio-aesthetic experiences); Medium/genre of poetry (describes/sets down what is imagined, seen or heard).



The Examples of Words-Picture taught in class:

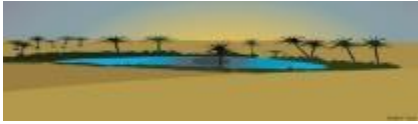
"The Cock Crows"



*The cock crows...
The sun steps out
In flowing rays.*

Oscar Wilde contends that “Art is all surface and symbols” (Wilde 1977).

“Oasis”



*Palm trees lined the edges of the oasis
like eye lashes
in the heart of the hot desert!*

*Encompassed by grains of sand,
the eye of the earth,
gazing into the horizon!*

Words-Picture poems can be appreciated through two levels: the surface/symbolic deep levels.

Testing and Exercises: Poetry-Writing through Exercises

After the teacher has taken the students through the creative writing reading and practice with examples in forms and techniques of imaginative writing on different genres of poetry and models, students are encouraged to construct their own poems choosing from any of genres of their choice. Class exercises also include collaborative group poetry writing.

Sample Questions: On-Line and In-Class Situations

1. Construct a poem of your own from any of the genres of poetry discussed in your creative writing class.
2. Write a poem of your own in any one of the genre of poetry below:
(a)Haiku, (b) Words-Visual type, (c) Surreal type.
3. Inspiration, imagination and experience; art and craft; surface and symbolic levels are creative tools of the imaginative writer. Explore this view with relevant illustration(s).

Students were encouraged to apply what they were taught on-line during the pandemic lockdown and post-pandemic classroom lectures. The overall result of the tests given was amazing; students combined their innate ingenuity with the model samples taught. Working in the confines of their homes, students adapted the class and on-line models, combined with their innate creativity; they constructed poems which is a profound proof of the adept ingenuity.

3.2. Creative Writing: Practice and Application in the Adept Mode

The following poems are randomly selected from the poems submitted by students

Student ‘A’ wrote:

“The Persistent Snail” (A four in one Haiku)
I have no knees,
So I cannot crawl,
But, I will get there anyway.

*I have no legs,
So I cannot run,
But, I will get there anyway.*

*I have no wings,
So I cannot fly,
But, I will get there anyway.*

*I have no body that thin and long,
So I cannot slither,
But, I will get there anyway.*

Student 'B' wrote a Words-Picture Haiku:

*"Soldiers also Care"
Soldiers also care ...
In the heat of battle,
A grain of sand in the booth.*

Student 'C' wrote:

*"Seizing the Horn by the Bull" (an Haiku-Surreal poem)
Do not seize the horn by the bull,
seize the bull by the horn,
Occupy the bull.*

*Do not seize the tusk by the elephant,
Seize the elephant by the tusk.
Occupy the elephant.*

*It is not enough to celebrate the tree and to look away
when the saw is set to the throat of the tree.
Occupy the tree.*

*It is not enough to celebrate the hills and to look away
when dynamites reduce the hills to gully of granites.
Occupy the hills.*

*It is not enough to celebrate the stream, and to look away
When fish are fed on arsenic urine.
Occupy the fish.*

Student 'D' wrote:

*"The Skin of the Sea" (A Word-Picture narrative poem)
The swimmer overwhelmed with kicking and vain punches;
sank his teeth into the watery flesh of the monster.
Drunk with salty punches: knockout.
He floats on the skin of the sea, helpless.
The Diver went head long into the skin of monster,
plucked the swimmer out of the watery jaw.
The swimmer stretched out on sandy canvas,*

*bleeding salt water: mouth, nose and ears. Limb.
The diver need not count but knelt down for a kiss.
The diver declared a technical knockout.*

Student “E” wrote “The Cow”:

“The cow”

*The day of the long knives: palates and stew of hides.
The night of the long-mares: dreams and fleet of horns
The cow is all horns and hides..*

*Daymare for the cow,
Nightmare for the eater:
Hoofs, flesh and blood,
fleet of horns and flying hides,
Mmuuuuhh! Mmuuuuhh!! Mmuuuuhh!!!*

Structurally, we can see from the poems of the students that poetry has a life of its own and thus, metaphorically, a poem can be likened to a living being – the body representing its form or genre, the message of the poem its content, and the style its spirit, which is innate.

3.3. Observations, Findings and Conclusion

The art of skillful placing of apt-words in the right environment are key to writing good poetry. Depth of thought and choice of words are fundamental to a great work. Since poetry is subjective, poetry should be organically constructed. Stanzas of a poem represent a community of words. Every word in a stanza has its own unique character and role to play. For aesthetic harmony and intrinsic beauty of the poem, every word should be alive, active and effective in the environment it is placed in order to give meaning, thus each word must be organically native to the environment it is planted. Writing poetry is not just speaking with the pen, it involves creative use of the language to express thought and idea. The art of writing comes through mastery of poetic order and structure, order in thought and language; structure in form and technique. From our findings, we discovered that the lock down of early 2020 to the current observing of Covid-19 health percussions in educational institutions have helped to improve both teacher/student relations as they explored a common ground in finding solution to challenges associated with the pandemic, consequently, making learners more emboldened to pro-actively explore their dormant innate capabilities. The experiences gained during the lockdown have helped learners to step out of the traditional mode of passive learning into a more participatory adept-mode of embracing new interactive mode of teaching and learning. The daunting situation of the pandemic has brought out in the learner the innate creativity and a firmer grasp of the art of writing. A good teacher/student relationship is imperative to the overall success in berthing a masterly writer. Despite the lockdown, teacher and students were still able to work together on line and off-line and the result was the making masters of learners of imaginative writing. Students are transformed from adopting creative writing models and from writing simple poems with surface literary devices to experimenting with more complex ones that involved combining surface and symbolic levels of literary devices.

References

- Abrams, M.H. 2001. "Symbols" *A Glossary of Literary Terms*. Sydney. Holt, Rinehart and Winston. (Fourth Edition), pp.37, 115, 161-167, 194.
- Bertens, Hans. 2001. "Early Formalism"; *Literary Criticism, The Basics*. London, Routledge. Pp.33-44. .
- Cowley, S. 2004. *Getting the Buggers to Write2*. New York. Continuum.
- Davies, Stephen J. 1998. "Creative Writing". *FORUM. A Journal for Teacher of English*. 32:4, October-December. Pp.25-26.
- Finch, G. J. 1980. *Wordsworth, Keats and the Language of the Senses*. *ARIEL. A Review of International English Literature*. Vol.11 No. 2.
- Greenberg, K. L. 1988. *Effective Writing*. America. Martin's Press.
- Myers, D. G. 2006, *The Elephants Teach: Creative Writing Since 1880*. Online. The University of Chicago Press.
- Oyeyemi, S.O; Adeyemo, E.A. 2006. *An Invitation to Sociology of Education (A Simplified Approach)*. Ibadan. Joytal Printing Press. Pp.34-36, 44.
- Pritzker, S.K; Runco, M. A. 1999. *Encyclopedia of Creativity*. London.Vol.1. pp.410-415.
- Rogers, P. 1996. "The Poetry Sausage Machine: Creative Writing As a Teaching Strategy". *English Teaching Forum*, pp.34, 3-4, 90-91.
- Weisstein, Ulrich.1982. "Literature and the Visual Arts". *Interrelations of Literature*. Edit: Gibaldi, Joseph; Barricelli, P.B. New York. pp.251-69.
- Wilde, Oscar. 1977. *The Picture of Dorian Gray*. London. Hunt Barnard Printing Ltd. P.5.

Tracking stress level using physiological data to enhance students' performance

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Abstract

Learning is one of the important aspects of human life since it passes knowledge and allows continuous progress. One of the methods for assessing learning is using a test which is designed by an instructor. Almost any test can increase stress level and can directly affect students' performance. Changes in stress levels can be different from one person to the other. Recently, wearable sensor technologies have been widely applied to monitor and track information related to physiological responses by analyzing physiological data using signal processing and machine learning techniques. This study aims to investigate the stress level of students during the standard Stroop color-word test with physiological signals and examine whether that's predictable and measurable. In this study we record Electroencephalogram (EEG) to assess brain activity during the standard Stroop test. At intervals throughout the test, subject will be prompted to perform faster to induce stress. The data is then analyzed to evaluate the effect of stress on EEG signal. Predictability of stress can help instructors to design a better test to evaluate students' performance in almost stress-free situations. In this paper the pattern in EEG waves for five volunteer students who were affected by stress was investigated by analyzing the alpha to beta power ratio where a significant decrease in ratio was observed in stress-induced states ($p < 0.01$).

Keywords: Learning enhancement, stress evaluation, Technology and education, Electroencephalogram

1-Introduction

With the development of computer networks, wearable sensor technologies have been widely applied in healthcare systems to track information on a real-time basis and also to provide feedback. Since wearable sensors have the advantages of low cost and fast data collection, educators have also applied sensor technologies to observe classroom activities and students' learning. Studies show that using sensor technologies can promote learning achievement, by measuring metrics such as concentration, stress level, and alertness (Khosravi et al., 2021, Wang et al., 2021, Liu et al., 2015). Evaluating students' mental state during exams helps instructors understand the learning status of the individual students and can be considered a key factor in the effectiveness of instructors' teaching and student evaluation strategies and enhancing learning outcomes. Students experience stress before and during exams, however, when it becomes excessive, it interferes with performance in exams, since cognitive symptoms of stress include memory problems and lack of concentration.

The alertness of a student can be revealed by facial expressions, eye and body movements, and from quantifiable physiological signals such as heart rate, blood volume pulse, and EEG. For example, when the blood oxygen level in the blood is low, the student is more easily fatigued. On the other hand, when a student focuses on reading materials, the heart rate variation is relatively low (Hsu et al., 2012, Yajima et al., 2016). A study also suggests that skin resistance decreases during tests, which needs higher concentration and increases during break or sleeping (Yajima et al., 2016). In (Pradhan et al., 2014) the stress status among the first-year medical students was measured by recording pulse rate, systolic and

diastolic blood pressure, and using a stress questionnaire, and its effect on cognitive function was evaluated by measuring reaction time. It was shown that excessive stress interferes with cognitive functions and may negatively affect students' performance on the test.

The stress and concentration levels can also be measured from EEG signals. Study of the brain through electroencephalography is a non-invasive method which was used for the first time by Hans Berger [ref]. Electroencephalogram (EEG) is still used today to monitor and diagnose seizures, sleep disorders, and more (Smith, 2005). However, in the analysis of stress, a pattern appears in the prefrontal cortex (PFC) where an increase in beta oscillations (12-25Hz) are observed in contrast to the decrease in power of alpha oscillations (8-12Hz) (Wen and Aris, 2020). Characteristically alpha waves are associated with relaxed consciousness, while beta waves denote higher levels of concentration (Nayak and Anilkumar, 2019).

In accordance with previous studies of this nature, the ratio of the slow wave to fast wave (alpha: beta) is being utilized to differentiate the neurological states of resting from stress-induced states (Nayak and Anilkumar, 2019). This study aims to utilize Electroencephalography (EEG) as a physiological indicator during a Stroop test. Two stimuli phases are applied to mimic a test situation, and suggests mental status evaluation of students in the teaching classroom to better understand and predict the student response to mental stress.

2-Method and Materials

Different physiological signals have been used to evaluate stress level (Wang et al., 2021, Pradhan et al., 2014), among them EEG has shown potential to be used as a measure of stress (Gedam and Paul, 2021). In this study, to investigate brain activity responses under stress situations, EEG signals were recorded using a headset when participants performed a Stroop test. To induce a higher stress level during the test, participants were asked twice to respond faster. The participant then completed a survey regarding the Stroop test to measure mental demand, temporal demand, performance, effort, and frustration that each participant experienced. Relative powers were extracted in alpha (8-12 Hz) and high beta (16-25 Hz) bands and the alpha to beta ratio was used as a metric to determine changes in stress level.

2-1-Data Collection and Experiment Setup

The study for investigating brain activity responses under stress situations was performed at the University of North Florida. An Institutional Review Board (IRB) protocol has also been approved [IRB#1743915-3] to allow data collection from human subjects. Five undergraduate and graduate students from the University of North Florida participated in this study. Participants were not under the influence of any drugs and were in healthy conditions. Experiments were held in an isolated room, to minimize distractions and to reduce inference from other electronic devices. EEG signals were recorded with the Emotiv Epoc X headset with a sampling frequency of 128 Hz. The headset has 16 saline-based electrodes covering AF3, F7, F3, FC5, T7, P7, O1, O2, P8, T8, FC6, F4, F8, AF4 locations and 2 reference electrodes located on mastoid bones (placement shown below in Figure 2b). The participants were instructed to take a baseline, followed by a Stroop test on the laptop in front of them. The baseline consists of 30 seconds period of EEG data collection, with the participants asked to keep their heads still to reduce artifacts and focus on a cross that appears on the screen. After recording the baseline, the test started. The test emulated the Stroop test, with a series of words on the screen that were colored either red, green, purple, or orange. The participants needed to press the keys on the keyboard 'R,' 'G,' 'O,' or 'P' to indicate which color the word was. Before starting the test, the participants were asked to familiarize themselves with the key placement and keep their fingers on these keys. The test took approximately 2 minutes to complete. Data was recorded and saved by the EmotivPRO application while performing an online Stroop test through the EmotivLab

website. Once the test was done, the participants completed the NASA Task Load Index (TLX) survey. Experiment setup is shown in Figure 1.

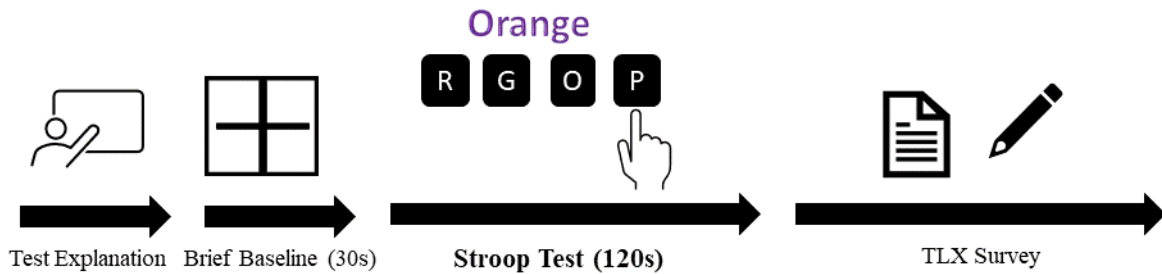


Figure1. Experiment steps including Test explanation, Baseline recording, Stroop test, and TLX survey

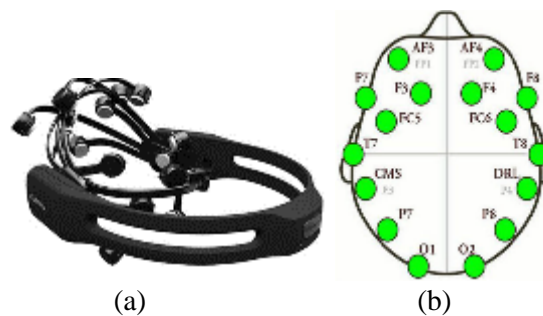


Figure 2. (a) Emotive EPOC-X (b) location for EEG channels (Emotiv)

2-2-EEG Data Analysis

To preprocess the EEG signals recorded from the scalp, DC offset was removed by subtracting the mean value from each channel. The average power in alpha (8-12 Hz) and beta (16-25 Hz) bands were evaluated from the magnitude of the Fast Fourier Transform (FFT) of the signal in each frequency band from each data segment. Data segmentation was performed using a window length of 256 samples and sliding the window by 16 samples. To reduce the effects of the leakage, a Hanning window was implemented before FFT. Average powers in alpha and beta bands were normalized to a length of one for each subject. Before calculating the average ratio across 5 subjects, they were normalized by subtracting the mean and dividing data by its standard deviation.

3-Results:

Printed TLX surveys were completed by participants after Stroop test to determine the mental demand, temporal demand, performance, effort, and frustration that each participant experienced (Hart et al., 1988, Noyes and Bruneau, 2007). Participants were answered to the following questions and ranked each between very low to very high (weight: range 0-100). Q1) Mental Demand: how much mental and perceptual activity was required? Q2) Physical Demand: how much physical activity was required? Q3) Temporal Demand: how much time pressure did you feel? Q4) Performance: how successful were you in accomplishing what you were asked to do? Q5) Effort: how hard did you have to work to accomplish your level of performance? Q6) Frustration: how insecure, discouraged, irritated, stressed, and annoyed were you?

There were also 15 possible pairwise comparisons of the mentioned six scales. Each pair was presented on a card. Students were instructed to circle the one which contributed more to the task workload in the pairwise comparison. The number of times that each factor was selected (Tally: range of 0 to 5) was multiplied by corresponding weight to calculate the adjusted weights. The adjusted weights were summed and divided by 15 to obtain the overall weighted workload score. The adjusted weights of each component factor were calculated for 5 subjects and the average was shown in Figure 3. Temporal and Mental demands had the highest scores which demonstrates Stroop test could be used to impose stress. Physical demand score was zero since the task did not demand any significant physical activities. The test has been completed with the average response time of 775 ± 220 ms, the average accuracy of $88.6 \pm 8.5\%$, and with average TLX score of 58.9 ± 16.8 . The response time was correlated with mental demand score ($r=0.75$). Moreover, frustration level which is related to stress is highly correlated with TLX score ($r=0.87$).

For recorded EEG data during Stroop test, normalized alpha to beta ratio was calculated for all channels for all subjects. The average of these ratios across subjects were shown in Figure 4 for 3 channels. During the test, subjects were asked to perform faster at two phases by displaying the words “Fast” and “Faster” on screen. Power ratios in channel F4, FC6, and T8 show statistically significant decreases ($p < 0.01$) between each stage; “baseline” (start of recording) to “go” (start of test), “go” to “fast”, and “fast” to “faster”. Based on the Stroop test, Fast and Faster stimuli are related to having more stress. Decrease in alpha to beta power ratio was observed from each stage compared to the previous stage. Higher power ratio changes were presented in the frontal lobe and the temporal-parietal lobe in the right hemisphere. As it was mentioned before, the Stroop test TLX score was correlated with stress and frustration and also high mental and temporal demands. As a result, this test is found to be reliable experiment to investigate the students’ stress during a test. However, observing measurable metrics calculated from physiological signals including EEG, in a real-time mode can be exploited to monitor student’s mental state.

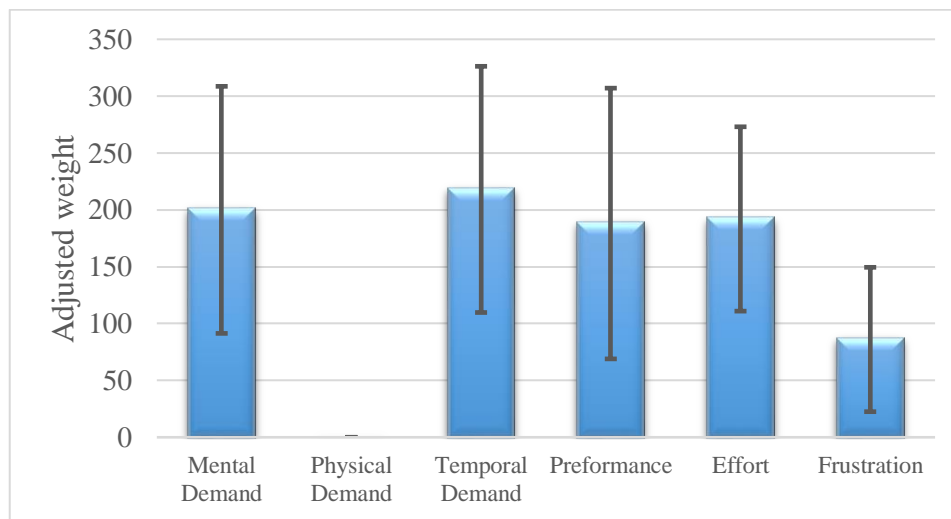


Figure 3. Workload score based on TLX survey. To calculate Adjusted weight, tally ratings are multiplied by weights that participants selected.

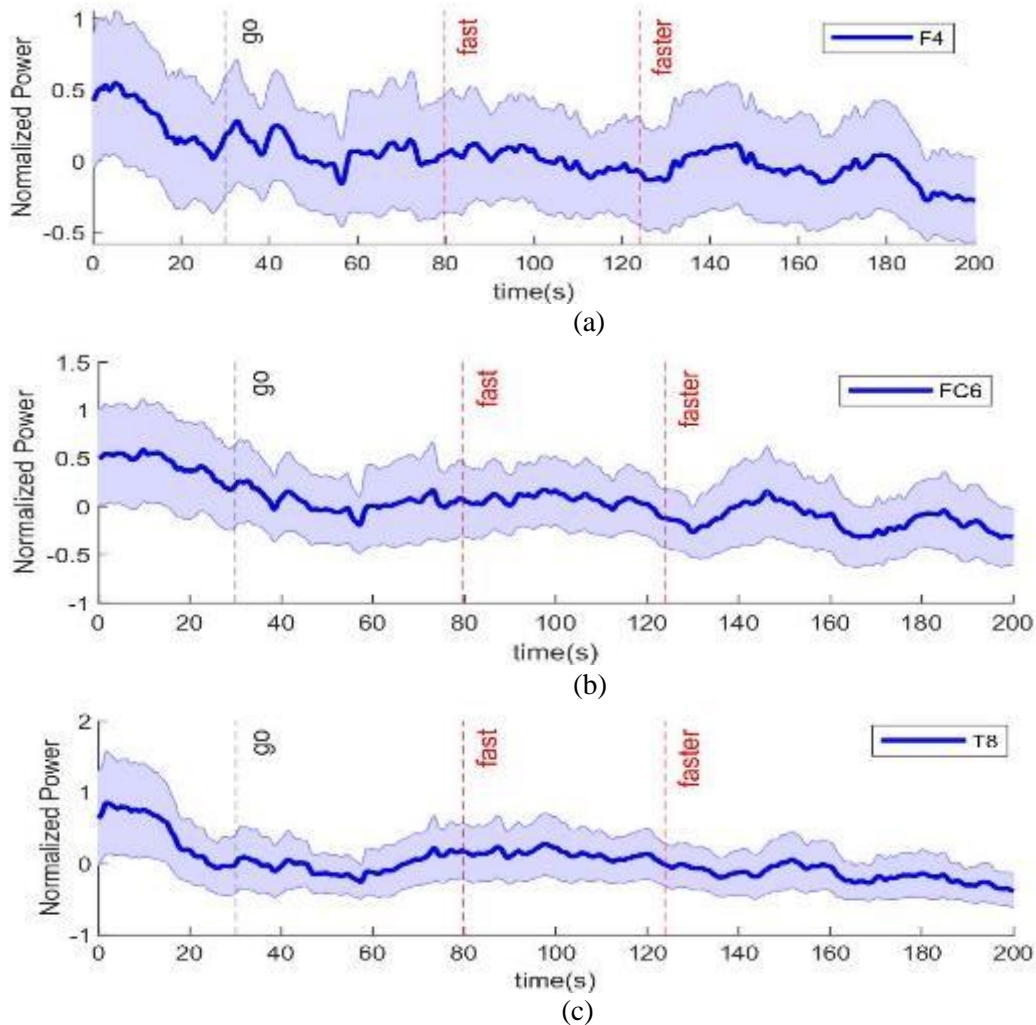


Figure 4. Normalized average alpha to beta ratio for 5 subjects in F4, FC6, and T8 is statistically different from “fast” to “go” and “faster” to “fast”. The ratio was significantly decreased by inducing stress on subjects. Dark blue line shows the average of alpha to beta ratio and standard error is shown as a shaded area.

4-Conclusion

Stress is a human body response and reaction to a challenge or stimulus that disturbs our physical or mental equilibrium. Researchers had developed techniques to measure stress in terms of questionnaires and the quantification of physiological signals. In this study we adapted physiological brain activity signals (EEG) to track stress. In order to measure relative stress levels, we have analyzed the ratio of alpha to beta power in EEG signal and found statistically significant reduction in the alpha-beta power ratio. Decrease in alpha power versus beta power during stress was also reported for auditory stress (Ehrhardt et al., 2021). Interestingly, all the channels that have significantly different average ratios are located in the right hemisphere. This result is in agreement with previous studies on brain functionality, showing stress mostly influences the right hemisphere and is handled by this part of the brain (Wittling, 1997). Additionally, the NASA task load index (NASA TLX) was used for measuring and conducting a subjective mental workload (MWL) assessment which shows mental demand, temporal demand, and frustration as well perceived performance level of each subject. Stress acts through the sympathetic nervous system and can also influence decision making and attention. Identifying the students who are at risk of excessive stress and anxiety will help the instructor and students’ guardians to work efficiently with those students at the earliest.

References

- EHRHARDT, N. M., FIETZ, J., KOPF-BECK, J., KAPPELMANN, N. & BREM, A. K. 2021. Separating EEG correlates of stress: Cognitive effort, time pressure, and social-evaluative threat. *European journal of neuroscience*.
- EMOTIV.
- GEDAM, S. & PAUL, S. 2021. A review on mental stress detection using wearable sensors and machine learning techniques. *IEEE Access*.
- HART, S. G., STAVELAND, L. E., HANCOCK, P. & MESHKATI, N. 1988. Human mental workload. Amsterdam: North-Holland.
- HSU, C.-C., CHEN, H.-C., SU, Y.-N., HUANG, K.-K. & HUANG, Y.-M. 2012. Developing a reading concentration monitoring system by applying an artificial bee colony algorithm to e-books in an intelligent classroom. *Sensors*, 12, 14158-14178.
- KHOSRAVI, S., BAILEY, S. G., PARVIZI, H. & GHANNAM, R. 2021. Learning Enhancement in Higher Education with Wearable Technology. *arXiv preprint arXiv:2111.07365*.
- LIU, M., LAI, C., SU, Y., HUANG, S., CHIEN, Y., HUANG, Y. & HWANG, J. 2015. Learning with great care: The adoption of the multi-sensor technology in education. *Sensing technology: Current status and future trends III*. Springer.
- NAYAK, C. S. & ANILKUMAR, A. C. 2019. Eeg normal waveforms.
- NOYES, J. M. & BRUNEAU, D. P. 2007. A self-analysis of the NASA-TLX workload measure. *Ergonomics*, 50, 514-519.
- PRADHAN, G., MENDINCA, N. L. & KAR, M. 2014. Evaluation of examination stress and its effect on cognitive function among first year medical students. *Journal of clinical and diagnostic research: JCDR*, 8, BC05.
- SMITH, S. J. 2005. EEG in the diagnosis, classification, and management of patients with epilepsy. *Journal of Neurology, Neurosurgery & Psychiatry*, 76, ii2-ii7.
- WANG, Y., LU, S. & HARTER, D. 2021. Multi-sensor eye-tracking systems and tools for capturing Student attention and understanding engagement in learning: A review. *IEEE Sensors Journal*.
- WEN, T. Y. & ARIS, S. M. 2020. Electroencephalogram (EEG) stress analysis on alpha/beta ratio and theta/beta ratio. *Indonesian Journal of electrical engineering and computer science*, 17, 175-182.
- WITTLING, W. 1997. The right hemisphere and the human stress response. *Acta physiologica scandinavica. Supplementum*, 640, 55-59.
- YAJIMA, K., IWATSUKI, R. & TAKAHASHI, S. 2016. Development of measurement of degree of concentration using BIO-information. *Procedia Computer Science*, 96, 1447-1453.

What do the Examination Items Used in Teacher Education Institutions in Jamaica Indicate about Primary School Teachers' Readiness for Teaching Mathematics?

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Abstract

Summative assessments used in teacher preparation are used to certify teachers into the profession. Therefore, it is imperative that these assessments provide evidence that those who successfully complete teacher education programmes possess the requisite knowledge and skills to be effective teachers. This is especially pertinent for teachers of mathematics where many students across the globe consistently underachieve. Research have shown that teachers with high levels of pedagogical content knowledge (PCK) and knowledge and understanding of mathematics concepts and skills achieve great success in the mathematics classroom. Despite the foregoing, the Jamaican literature consistently highlights that graduates of teachers preparation programmes lack adequate levels of PCK and knowledge of the mathematics concepts and skills they teach. It is against this backdrop that this study sought to evaluate the summative assessment items used in a teacher preparation programme, offered in five teachers' colleges in Jamaica, to determine the extent to which these core knowledge and skills for effective mathematics teaching are being assessed as part of the certification of teachers. Twenty-seven examination papers, totaling 1530 assessment items, were gathered for the content courses and 32 assessment items were collected for the methodology course. In addition, six teacher educators were interviewed. Four independent raters used Webb's Depth of Knowledge model to analyse the content of each examination item to determine the levels of conceptual knowledge and skills that were assessed. They also used Shulman's description of pedagogical content knowledge to determine the extent to which the assessment items used in the methodology course were designed to assess pedagogical content knowledge. The findings show that only 13.7% of the assessment items assessed pre-service teachers' knowledge of concepts and skills, and 1% assessed pedagogical content knowledge, making it highly possible for pre-service teachers to be certified to teach without being required to demonstrate mastery in PCK and CK. The findings imply that greater focus needs to be placed on ensuring that the examination items used in teacher preparation measures the types of knowledge and skills pre-service teachers need to achieve success in the mathematics classroom.

Keywords: *pedagogical content knowledge, conceptual knowledge and skills, examination items, and mathematics.*

Introduction

One of the primary roles of assessment in tertiary institutions is to certify professionals (Carless 2015). Therefore, successful completion of tertiary educational programmes, usually indicated by passes in examinations and coursework, signals to the student, institution, prospective employers, and the society that the student has the requisite knowledge and skills to function adequately in the profession. According to Samsujjaman (2017), teacher education programmes are designed to equip student-teachers with the requisite knowledge, attitudes, and skills to effectively perform their various roles and responsibilities in the classroom, school and wider community. Therefore, the certification students receive after successfully completing the programme communicates that the holder is adequately prepared to teach. However, in Jamaica and other Caribbean countries, teachers at the end of their preparation are not demonstrating expected competencies to effectively facilitate mathematics learning (Barret, 1981; Buddo, 2011 &

Benjamin,2013). It is with this in mind that we evaluated the summative examinations used in five teachers' colleges in Jamaica to determine the levels of content knowledge that are assessed as well as the extent to which PCK is assessed thereby supporting the interpretation that students who perform well on their examinations are adequately prepared to teach. Additionally, we sought to explain the factors that account for the outcome of the evaluation of the examination items. Evaluation of the assessment items used in Teachers' Colleges is an area that has remained silent within the body literature. The following research questions were designed to guide the inquiry:

1. What levels of mathematics content knowledge are assessed on the final examinations given in five teachers' colleges in Jamaica?
2. To what extent are the examination items used in five teachers' colleges in Jamaica designed to assess pre-service teachers pedagogical content knowledge?
3. How do teacher educators explain the outcome of the evaluation of the examination items used in the five teachers' colleges in Jamaica?

Conceptual Framework and Literature Review

It is well documented that, at all levels of the education system, teachers are required to teach mathematics in a way that allow students to do more than reproduce mathematics facts and procedures (National Council of Teachers of Mathematics [NCTM], 2014, National Mathematics Policy Guidelines, 2013). Teachers are expected to facilitate students' understanding of mathematics concepts and skills and aid in students' development of critical thinking skills. Therefore, teachers are expected to have conceptual knowledge of and skills in the mathematics content they will teach and to be able engage in critical thinking activities. Since teachers need to have different levels of content knowledge (such as procedural, conceptual, and critical thinking) of mathematics to effectively facilitate mathematics learning, it seems reasonable to expect that teachers are assessed for their mastery of such knowledge. Consequently, identifying a framework through which the examination items could be evaluated for their levels of mathematics content knowledge was critical to this research. After examining several models, Webb's Depth of knowledge framework (Webb, 1997) was selected. Webb's framework was developed for analysing the cognitive demand of assessment items (Webb, 1997) and is currently being used in Jamaica to support the New Standard based Curriculum that was implemented to improve students' development of conceptual knowledge and skills. The items were ranked on Webb's framework to determine the number of test items that falls under each of the levels. Webb's Framework has four levels:

Level 1 – Recall and reproduction, where learners are required to reproduce facts, procedures, and formulae. An assessment item that is focussed on having student-teacher reproduce

Level 2 – Concepts and Skills, at this level learners are required to have knowledge of the big idea/s that underpin specific mathematics topics and sub-topics, as well as to be able to complete skills such as measuring, evaluating, constructing and sketching diagrams.

Level 3 – Strategic thinking, this is where learners are expected to engage in critical thinking and the application of mathematics knowledge to complete task.

Level 4 – Extended Thinking, at this level learners are required to pull on a variety of mathematics ideas, theories and principles that will help them to provide solutions and decisions to complex mathematics problems.

Although Webb's framework was suitable for assessing the levels of mathematics content knowledge, it was inappropriate for assessing PCK since none of the levels of Webb's framework focussed on PCK. Consequently, Shulman's (1987) description of PCK was used to determine whether an assessment item assessed PCK. Shulman's (1987) describes PCK as knowledge of the most appropriate illustrations, analogies, useful forms representations, explanations and examples that can be used to best represent the contents of the subject for it to be readily understood by learners, as well as an understanding of what makes a topic/sub-topic difficult to learn. He also differentiated PCK from pedagogical knowledge (PK) because the two are easily confused. According to Shulman (1987), pedagogical knowledge is professional knowledge that focuses on knowledge of the strategies and principles for classroom management as well as general knowledge of teaching strategies such as collaborating groups and differentiated instruction, and behaviour management techniques. This distinction was important in this study since the pedagogical knowledge specific to the mathematics content (PCK) was the focus of this study. An examination item that aligned to Shulman's description of PCK, was classified as assessing PCK.

Methodology

This research utilized an explanatory sequential mixed methods design (Creswell, 2007). It began with a quantitative phase which assessed the test items. This quantitative phase was followed by a qualitative phase that sought to explain the quantitative results. Consequently, the methodology is described in two phases: The evaluation of the assessment items (quantitative phase) and the interviews (the qualitative phase)

The Quantitative Phase

Sampling

Yin (2014) postulates that a critical case is one that allows for analytical generalization since it provides the most information and/or the greatest opportunity for the development of new knowledge. Based on this description, the programme that prepares 70% of Jamaica's primary school teachers (teachers who teach children aged 6-12) was selected. Hence it was a critical case. The programme is offered in five (5) teachers' colleges. This program was updated in 2011 from diploma to degree granting to improve the quality of teachers that were available to students. All the examination papers from 2011 to 2016 (5 years) were collected for evaluation. It is customary for the examination items used over a five-year period, within the colleges, to become a part of a question bank where items are pulled for future examinations. Therefore, using the first five years of assessment items would provide insights into the quality of the items that will be used for future assessments.

Data collection

Twenty-seven final examination papers totalling 1530 assessment items were collected, from the Joint Board of Teacher Education (The accrediting body of teacher education in Jamaica), from the four content courses: Number Concept 1; Number Concept 2; Algebra and Problem Solving; Geometry and Measurement. These assessment items were used to measure levels of content knowledge and skills. Another 100 items were collected from the five examination papers from the one methodology course (The Teaching of Mathematics at the Primary level). These assessment items were used to measure PCK.

Data analysis

Four independent raters coded each test item of the content course as 1, 2, 3 or 4 which represented each level of Webb's DOK model. This was done to assess the levels of mathematical content knowledge that was assessed. The raters also coded each item on the methodology course examination items as 1 (if

the item reflects Shulman's description of PCK or 0 zero (if it does not). This was used to assess the extent to which the methodology examination items assessed PCK. Inter-rater reliability was calculated using Intraclass Correlation Coefficient (ICC) (Koo and Li, 2016) in Statistical Package for the Social Sciences (SPSS) 22.0. The percentage of each level of the DOK was determined using SPSS as well.

Validity

Validity was assured by ensuring that the raters were formally trained in order to increase the likelihood that they would have an accurate and shared interpretation of Webb's DOK model and Shulman's description of PCK. In addition, validity was assured by ensuring that raters had at least a first degree qualification in mathematics education and at least five years of experience teaching mathematics.

Koo & Li (2016) purport that a major step in the validation process is the establishment of a Gold standard to ensure that each rater was interpreting Webb's model and Shulman's description of PCK as intended. To accomplish this, a mathematics coach, who works with the Ministry of Education (the lead advisor on education in Jamaica) along with the primary researcher, discussed the levels of Webb's model and Shulman's description of PCK to ensure alignment in interpretation. Then, the primary researcher and the mathematics coach independently coded 332 examination items used in a teachers' college outside of the context of this research using the coding process described earlier. Interrater reliability (IRR) between the mathematics coach and researcher calculated using the Intraclass Correlation Coefficient and a two-way mixed effect model at a 95% confidence interval (Koo & Li, 2016) in Statistical Package for the Social Sciences (SPSS) 22.0 was 0.952. According to Koo and Li (2016) an ICC estimate with a 95% confidence interval, that has values less than 0.5, between 0.5 and 0.75, between 0.75 and 0.9, and greater than 0.90 are indicative of poor, moderate, good, and excellent reliability, respectively. Therefore, a reliability of 0.952 was interpreted as a high degree of agreement between the researcher and the mathematics coach. The assessment item for which there was no agreement were discussed until an agreement was reached. The ranking between the researcher and the Mathematics Coach became the standard that was used to determine whether each rater was interpreting Webb's model and Shulman's description of PCK as intended.

The next step in the validation process was to conduct a training section where the levels of Webb's models and Shulman's description of PCK were discussed. Further, examples of assessment items that reflected the levels of Webb's model and Shulman's description were cited by each rater. At the end of training, the raters were given the same 332 assessment items used to create the standard to assigned codes that reflect the levels of Webb's model or Shulman's description of PCK. The inter-rater reliability calculated for each rater against the standard at a 95% confidence interval, using SPSS was approximately .78 for all the raters. Using Koo and Li (2016) classification, the interrater reliability of each rater against the standard was good. The results confirmed that the raters were interpreting Webb's DOK model and Shulman's description of PCK as intended. Therefore, beginning the day after the training the raters used three consecutive days to code 1530 assessment items of the content course on Webb's model and the 100 assessment items against Shulman's description of PCK.

Qualitative Phase

The qualitative phase of the research sought to provide an explanation to the outcome of the quantitative phase. All teacher educators (N = 7), within the five colleges, who were instrumental in the design of the assessment items were invited to participate in this phase of the research. Six agreed to participate and were independently interviewed. The data from the interview scrips were read and reread, and assertions were drawn from the data.

Findings

The findings will be presented as responses to each research question. In response to the first research question: What levels of mathematics content knowledge are assessed on the final examinations given in five teachers' colleges in Jamaica, the findings show that of the 1530 assessment items that were designed to assess pre-service teachers' knowledge of the content, (1311) 85.7% of the item assessed preservice teachers' ability to recall and reproduce information, (209) 13.7% focused on conceptual knowledge and skills, and (10) 0.7% of the assessment items focused on assessing strategic thinking. NCTM (2014) advocates for procedural knowledge to be built upon knowledge of concepts. That is, teachers are required to teach all mathematics topics to develop conceptual knowledge. The inter-rater reliability for of the raters for the 1530 assessment items on the model is 0.922. Additionally, the topics that were assessed in the colleges addressed all the mathematics topics that are to be taught in the New Standard Based Curriculum that is being used in primary schools. Topics such as fractions, percentage, probability, decimals and ratio are examples of topics that are addressed in the colleges.

In response to research question 2: To what extent the assessment items used in five teachers' colleges in Jamaica designed to assess pre-service teachers pedagogical content knowledge the raters agreed (IRR – 100%) that of the 100 assessment items, one (1) assessment item (1%) aligned to Shulman's description of PCK. This suggests that pre-service teachers were very rarely assessed on their knowledge of best practices for teaching various mathematics topics.

The topics that were assessed, assessed pedagogical knowledge (Shulman 1986; 1987). The topics that were assessed included: teaching approaches, learning theorists, lesson/unit plans, use of technology, and types of knowledge.

In the qualitative phase, the participants explained the findings of the quantitative phase guided by research question 3. How do teacher educators explain the outcome of the evaluation of the examination items used in the five teachers' colleges in Jamaica?

During the interview, the teacher educators were asked about the circumstances that accounted for 13.7% of the assessment items focusing on assessing preservice teachers' knowledge of concepts and skills, while 85.7% focussed on assessment items focused on recall and reproduction of information. One teacher educator explained, "Well, we want our students to pass the exams and based on where they came in, and where they need to be, they just might not pass...." Mr. Manly, another teacher educator shared similar sentiments. He explained "The students are slow, so we cannot assess them at a high level because they might not pass."

Finally, Mrs. Brownie echoed the positions expressed earlier:

They (teacher educators) don't allow the difficult questions sometimes. Some lecturers think that some questions are too difficult to put on the exam. They fear that the failure rate will be high.

Based on the explanation given by the teacher educators, the low academic ability of the student-teachers and teacher educator's desire for their students to pass the examinations are the factors that are accounting for the high percentage of assessment items (85.7%) that assess recall and reproduction of knowledge and the low percentage of assessment items (13.7% and 0.7) that assess conceptual knowledge and skills, and strategic thinking. The teacher educators include items that they believe students with low academic ability will pass.

Teacher educators were also asked about the circumstances that would account for 1% of the assessment items used in the colleges to assess PCK. Two of the six teacher educators referred to pre-service teachers' participation in Practicum while the other teacher educators did not provide a reason.

Ms. Cherry explained:

They do micro teaching assessments in class, and they also go on Teaching Practice where they are assessed.

Mr. Richman:

When they go on Practicum they are graded for PCK, so it is not really necessary to assess them for PCK on examinations.

Based on the responses of the teacher educators, it would appear that pre-service teachers are primarily assessed for PCK on Teaching Practice. Therefore, the teacher educators felt it was unnecessary to assess them twice for PCK.

Discussion, Implications and Recommendations

The National Council of Teachers of Mathematics (NCTM) advocates for teachers to build procedural knowledge upon students' understanding of mathematics concepts (NCTM, 2014). NCTM's position is also represented in Jamaica's National Mathematics Policy (National Mathematics Policy Guidelines, 2013). Consequently, it would be reasonable to expect that teachers in preparation are heavily assessed on their understanding of mathematics concepts and skills. However, the findings demonstrated that 85.7% of the assessment items focused on assessing recall and reproduction of information. This makes it easy for pre-service teachers to score high marks on summative examinations by just reproducing facts and procedures, making it highly possible for them to exit teacher preparation without being required to demonstrate substantive knowledge of the concepts and skills they are expected to teach at the end of their preparation. Since the final examinations being used in the colleges contribute 60% of the students' overall grade for each course, and the overall grades are the basis for certification, this finding raises questions about the adequacy of the mathematics teachers preparation for teaching after leaving the teacher education programme.

Furthermore, the findings reveal that the content assessed in the colleges reflect the mathematics content the teachers are expected to teach in primary schools. This is outlined in the primary school curriculum (New Standard Based Curriculum). However, while the same content is covered, the requisite level of thinking or depth of knowledge is not being reflected in these summative examinations. For example, the primary school mathematics exit examination (school leaving exam) assesses primary school students' conceptual knowledge and skills, problem solving skills and their ability to engage in critical thinking (Ministry of Education, Youth and Information [MOEYI], 2019). Therefore, primary school teachers are required to develop these skills in their students to adequately prepare them for this exam.

However, since the teachers are predominantly assessed on their ability to recall and reproduce information, the findings provide a strong basis for implying that primary school teachers are inadequately prepared for their classroom responsibilities after successfully completing this teacher education programme. It could also be argued that if the primary school exit exam is consistent with its mandate, then primary school children (age 6-12) may be assessed, on the same content, at a higher levels compared to student-teachers.

Teacher educators' explanation as to why the assessment placed great focus on assessing student-teachers ability to reproduce facts and procedures instead of their knowledge of concepts and skills and their ability to engage in critical thinking was also instructive. Teacher educators explained that the content of the test is influenced by the student-teachers' weak mathematics ability, and the educators' fear that a high percentage of student-teachers will fail the examinations if more of the assessment items assessed knowledge of concepts and skills, and strategic thinking. These explanations reveal that greater attention must be placed on ensuring that teachers with the requisite knowledge and skills are entering into the profession for teacher education programmes to fulfil its mandate of adequately preparing teachers to teach. Accordingly, the findings provide insights on what needs to change in teacher preparation institutions to positively impact Mathematics achievement in Jamaica: the examinations used need to focus on the types of mathematics knowledge that are known to produce high quality mathematics instructions instead of the types of items that will allow students to pass examinations.

The research shows that 1% of the assessment items assessed PCK, and therefore there is no guarantee that a teacher at the end of their preparation understands why a particular strategy works over another in each context, why students might struggle with a particular topic, what analogies, examples, illustrations can be used to best illuminate the ideas within a particular mathematics topic. The explanation provided by teacher educators of the 1% of assessment items focusing on PCK, is preservice teachers are engaged in Practicum where their PCK is being assessed. This is a valid explanation and future studies could empirically investigate the accuracy of this explanation. However, the current structure of the practicum makes it possible for mathematics PCK not to be assessed to any large extent on the practicum as well. In Jamaica, practicum supervisors are required to grade three of student-teachers' teaching episodes. Importantly, only one of the three teaching episodes is required for mathematics. Therefore, it is highly likely that the student-teachers' overall grade will not reflect mathematics PCK to any large extent. One teaching episode may not adequately allow for the measurement of student-teachers' levels of PCK for a wide variety of mathematics topics they will teach at the end of their preparation. Given the limitations of the student-teachers Practicum requirements, it seems evident that student-teachers, in these five colleges, are not being adequately assessed for PCK. Therefore, moving forward it might be helpful to assess their PCK using pen and paper examinations along with the teaching episodes during their Practicum experience.

Conclusion

Examinations that are used for certification should reflect the knowledge and skills persons who are certified should possess to effectively perform their duties. This is critically important in Mathematics and in Jamaica where there is a chronic numeracy problem. The content of the final examinations used to train 70% of primary school teachers in five teachers' colleges in Jamaica show that teachers are highly likely to be inadequately prepared for their teaching responsibilities. Even with practicum, questions are raised about the level of the teachers PCK. Additionally, while summative assessments measure what has been learnt, they can also improve learning by requiring high levels of thinking from examinees. Because of the high stakes that are usually associated with these examinations, students are oftentimes propelled to rise to the expectation of the test. Therefore, teacher education institutions may benefit from increasing the validity of the interpretations of the results of their examinations and improving their students' learning by including more items that require PCK and deeper knowledge of the content they will teach at the end of their preparation.

Reference

- Barrett, E. (1981). Mathematics teaching: St. Lucia, Grenada, Jamaica. *Assignment report: Development of national infrastructure and strategies for science and technological education*. Paris: UNESCO. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000044210>
- Benjamin, T. (2013). *Shedding light: Evaluating the impact of initial teacher education on the mathematics attitude and competences of Jamaican primary teacher trainees* (Unpublished doctoral thesis). University of Sheffield, United Kingdom
- Buddo, C. (2011). *An evaluation of classroom practices of grade four mathematics teachers in selected primary schools in Jamaica* (Unpublished doctoral dissertation). University of the West Indies, Mona, Jamaica.
- Carless, D. (2015). *Excellence in university assessment: Learning from award-winning teaching*. Abington: Routledge.
- Creswell, J. W., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage.
- Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intra class correlation coefficients for reliability research. *Journal of Chiropractic Medicine*, 15(2), 155-163, doi: <https://doi.org/10.1016/j.jcm.2016.02.012>
- McCarthy-Curvin, A. (2020). An evaluation of the instructional system for primary mathematics teachers in selected teachers' colleges in Jamaica. In: The University of the West Indies.
- Ministry of Education, Youth and Information. (2019). Primary Exit Profile National Report. <https://japarliament.gov.jm/attachments/article/2128/The%20Primary%20Exit%20Profile%202019%20-%20National%20Report.pdf>
- National Council of Teachers of Mathematics (NCTM). (2014). *Principles to action: Ensuring mathematical success for all*. Washington, DC: The National Council of Teachers of Mathematics.
- National Mathematics Policy Guidelines. (2013). *National mathematics policy guidelines*. Retrieved from [http://moe.gov.jm/sites/default/files/National Mathematics Policy Guidelines \(2013\).pdf](http://moe.gov.jm/sites/default/files/National%20Mathematics%20Policy%20Guidelines%20(2013).pdf)
- Samsujjaman. (2017). Principle and Significance of Teacher Education. *International Journal of Engineering Development and Research* 5(2), 1995-1999.
- Shulman, L.S. (1986). Those who understand: Knowledge growth in teaching. *American Educational Research Association*, 15(2), 4-14.
- Shulman, L.S. (1987). Knowledge and teaching: Foundations of the new reform. *Harv. Educ. Rev.* 1987, 57, 1–23.
- Webb, N. (1997). *Criteria for alignment of expectations and assessments in mathematics and science education research* [Monograph 6]. Washington, DC: Council of Chief State School Officers.
- Yin, R. (2014). *Case study research design and methodology* (5th ed.). Los Angeles, CA: Sage.

Digital Education in Portugal and Brazil –an analysis of the Trends and Challenges Encountered in Higher Education Institutions in the Face of its Implementation

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Abstract

The objective of this research is to promote an analysis of the trends and challenges encountered in higher education institutions of Portugal and Brazil, when the implementation of Digital Education during the remote emergency education in the isolation imposed by the pandemic of the new corona virus.

It is believed that the exchange of experiences in terms of methodological proposals, as well as the different ways of coping with the challenges to which these institutions were and are being subjected, tends to provide valuable cooperation between them, mainly because Digital Education is considered as an ally to promote Digital Citizenship.

In Portugal and Brazil, Digital Education was adopted very early, in some disciplines of some courses. Currently it is perceived as a strong trend, allowing greater access to higher education, before, for many, something unthinkable.

The challenges are numerous and need to be overcome. Because we are not in a controlled situation, neither in relation to the virus nor in relation to technological, behavioral and psychological conditions. What institutions require, a greater dimensioning of their efforts, favoring the necessary cooperations to obtain a legacy of this unprecedented situation.

Further strengthening the (United Nations) UN's 2030 Agenda, on Inclusive Education as a relevant factor for a better world.

Digital Education can go "beyond the classrooms", improving teaching-learning processes, promoting an integral development of the individual.

Keywords: *Digital Education, Higher Education, Trends and Challenges.*

Introduction

Digital Education has been considered a strong trend for Higher Education Institutions (HEIs) in several countries to promote a more inclusive Education. This certainly reinforces the UN's 2030 Agenda, the United Nations, which highlights in its SDGs – Sustainable Development Goals the need to have a better world for all. Where education plays a big part.

It is necessary to highlight that, both in Portugal and in Brazil, Digital Education was adopted in a very beginner way. That is, it was used only in some disciplines of certain courses. Currently, however,

through Digital Education, one can offer a more inclusive Education, being considered a factor of access to Higher Education to individuals who previously, would never dare to dream.

However, to be implemented, Digital Education requires efforts and involves many challenges, but as it was in the context of the isolation imposed by the pandemic of the new corona virus.

This research was carried out during the postdoctoral internship at IE – Institute of Education of UL - University of Lisbon, where studies and interviews were conducted in the field of "Digital Education (Digital Transformation) in the context of Higher Education Institutions in Portugal and Brazil, and their challenges in the face of its implementation, when the need for remote emergency education on the occasion of the social isolation imposed by the pandemic.

In this way, Digital Education is believed as an inclusive practice in higher education, fulfilling increasingly its role of promoting a more inclusive, fair and ethical society.

From the year 2020, more precisely in March of that year, more precisely, on a Friday March 13 to a Monday, March 16, Higher Education will have many stories to tell. Mainly due to the urgent change that needed to make to provide the remote classes, in digital format, to meet the orientation of social isolation, imposed on the occasion of the pandemic of the New Corona Virus – Covid 19.

Thus, in addition to the obligation to close Higher Education Institutions, they had to promote distance learning and teaching, increasing the challenges previously existing in many Portuguese-speaking countries and regions, such as Portugal and Brazil, more specifically demonstrated here.

This quarantine situation in this pandemic further increased the challenges encountered in these countries, because, regardless of the social-academic-economic structure of each of them, both suffered some consequence in relation to this adaptation, mainly due to the novelty of the situation.

According to the report of several teachers interviewed, as the phase of remote emergency education passes, many HEIs have already declared their intention to adopt hybrid education, that is, teaching that allows combining face-to-face education with digital education. Being considered by many of these interviewees, as an asset, a true legacy, left as an experience of the period lived in the respective institutions.

With this emergency situation, it was evidenced the need, already perceived previously, to have a teaching that could meet, remotely and in person, a B-learning format, where active methodologies could be applied in order to expand the teaching-learning process, thus promoting its own process of Digital Transformation through a Pedagogical Innovation.

Brazil, for example, until the urgency imposed by social isolation, in digital format, practiced more the well-known Distance Education in Higher Education, E-Learning, hybrid or totally distance. Although the prospects were for an expansion in the adopted model, it was necessary this emergency situation for the processes to be streamlined, in relation to the implementation and development of New Technologies, Active Methodologies and Digital Tools that facilitated the care of students so that they could maintain their academic calendar.

Therefore, the search for active methodologies that favor the participation of teachers and students, in the current context, promotes and causes a change in the role of both, even valuing the experiences of these "actors". Current protagonists in a process that seeks the intervention of active methodologies in hybrid teaching. (Macedo; Petti, i.E.; PASSOS, 2007; Moran, 2018).

Also in Moran (2018), we observed that such active methodologies evidence this role, especially in the context of student participation and their autonomy in the learning process, under the guidance of the teacher. Where, such Active Methodologies, through their hybrid models, can favor the current scenario of Higher Education, it is independent of which format will be adopted.

Certainly, the solutions found by Higher Education institutions in Portugal and Brazil present distinctions among themselves, also evidenced also in the public and private sectors of Education.

Carvalho (2005) shows us the fundamental role of change, where "they present themselves in the various means of knowledge acquisition, such as information and communication technologies", which is in line with an inclusive Digital Education through a Pedagogical Innovation, with active methodologies, which can go beyond the need for emergency, content delivery, for instance.

In this Post-Doctoral Internship, we sought to address some topics that involved and still involve Digital Education, the Digital Transformation necessary, not only for the delivery of remote classes in emergency periods, but, an asset from all that Higher Education has lived in recent years.

Which, from what we have observed, converges with a previously demonstrated need, of a transformation in the methodologies themselves in classrooms, whether remote or face-to-face. And, through the analysis of the challenges of Digital Education in Higher Education in the countries surveyed, namely Portugal and Brazil, it is believed in the possibility of true sharing, so that one can have an added value, in the face of all the wear and suffering, experienced by the tireless actors of this context. Namely, teachers and students, true protagonists.

Objective

The main objective of this research was to conduct a study, an analysis of the trends and challenges encountered in the HEIs researched. Therefore, it is believed that, through a better understanding of these trends and challenges, Digital Education can be considered as an asset for a long-awaited Digital Transformation.

The choice of the theme was due to this urgent need for reflection and analysis, especially in order to find possible paths to be followed through greater cooperation between schools, universities, institutions and countries, in order to cross, in the best possible way, this moment, having, in the "baggage", more and better conditions, technological tools, reflections, that favor education itself,, as well as the most varied teaching-learning processes that people, companies and society so badly need.

It is believed that, from these exchanges of experiences, countries such as Portugal and Brazil can, each in their own way, indicate future paths so that we can have a more inclusive Digital Education, "not allowing anyone to be left behind!", living up to "a school for all".

Methodology

This research was possible through structured interviews with higher education teachers in these two countries. Ten interviews have been conducted. Five in Portugal and five in Brazil. With professors from private universities, public and polytechnic institutes of these countries. To whom I thank you very much for your valuable contribution.

It is believed that, from this study, both the exchange of experiences in terms of methodological proposals vis-à-vis Digital Education, as well as the different ways of facing the various challenges to which both educational institutions were and are being submitted, can be considered as an asset in terms of future cooperation, especially among the countries involved. In addition, of course, the Portuguese-speaking countries and regions.

In Portugal, in addition to the interviews, face-to-face visits were also made in the different HEIs, such as universities and polytechnic institutes. This allowed a renewal of professional-academic ties, fostering interest for future partnerships and co-operations.

In Brazil, one can observe the different realities reported by the professors surveyed. Teachers from public and private institutions, who reported how digital education was implemented in their IESs, in the aforementioned context of the pandemic.

Results of Interview Analyses

From the interviews conducted, it can be seen that the implementation of Digital Education was already awaited by many. For in many institutions, digital education was already being practiced, in the format of The Distance Education.

A factor of great relevance observed in the interviews was in relation to the appropriation of New Information and Communication Technologies, methods and tools, by teachers, enabling the expansion of their knowledge. This fact also occurred with the students, who, despite demonstrating great difficulties in the beginning, understood the added value of these tools, both in their professional and academic careers.

In the interviews, despite the differences between the HEIs, it was observed that the implementation of Digital Education, that is, remote emergency education, was very similar, occurring gradually, according to the advancement of needs and always with the support of Information Technology - IT staff, as well as their computer laboratories.

In all interviews, training was evidenced, the training sums that were made available to students and teachers. That initially went on the teams platform and zoom, and later the meet platform.

In some institutions, many teachers were already familiar with remote education, adding more value to the institution. In many, many reported helping their classmates and students, so that remote classes could take place.

For most respondents, the greatest difficulty was in relation to the cameras. Because many students generally did not open their cameras, making better communication difficult. Having even reported that they seemed to "be teaching classes to no one", which became a great discomfort.

Many of the interviewees considered the fact that the students did not open their cameras as something both in relation to the need for a better appropriation of the use of digital tools and in relation to some embarrassment because they were in a family environment. What demands, according to most interviewees, the creation of clear institutional rules regarding their use. So that, in fact, there can be more interaction between all, within the classroom environment. Because, in this way, remote-digital teaching can be more inclusive, with more and better interactions, mediated by teachers who respect and feel respected by their students. A true teaching-learning environment, with dynamic classes, that promote the development of all.

In all the interviews, it was clear that the experience of remote emergency education was considered as a premissa of a Digital Education in fact, although all revealed to be aware of the great challenges that will face, in addition to the demands of human and technological resources, better equipment, good internet, so that one can meet the demand generated from now on.

Although most of the interviewees reported such experiences as positive for Digital Education, mainly because they believed in an evolution of education itself, through Digital Education, with new processes, including pedagogical, for example, one of the interviewees, reported as negative their experience.

This, according to this interviewee, was due to the nature of their disciplines. He even declared that it was almost unfeasible for his classes to be taught by remote education. For, such disciplines required a follow-up of the screens, and these subjects required monitoring of the screens/écrans of their students. This has become unfeasible in the context of remote teaching. Although I believe that, in the near future, from more resources, such difficulties can be minimized.

All interviewees stated the need for better monitoring of the agents involved in Digital Education. So that, through institutional actions, there can be a full use of the necessary resources. So that Digital Education can fulfill its role in the context of a better and more attractive Inclusive Education, a true Pedagogical Innovation.

Conclusions

From the analysis of the interviews conducted, we realized the opportunity and need to implement a Digital Education that is not only emergency, even if, at the time of isolation, it was the best choice, so that the school year could be fulfilled, for example. However, from the face of the challenges and the clarity of this trend of digital transformation, it is believed that, from now on, Digital Education can be installed, in fact, in the educational environment. Being considered as a new perspective that meets the needs of each country, of each Higher Education Institution, that makes possible the advancement of Education.

It was also clearly observed great efforts and strong interest on the part of the teachers interviewed, in getting involved with a Digital Education capable of reaching more and better, individuals who, in the very near future, dared not even imagine attending higher education. But that, from a Digital Education of greater and better reach, they will be able to realize their dreams of an academic, professional career.

In addition to being able to appropriate the New Information and Communication Technologies, because they are more inserted in this Innovation and Pedagogical Transformation. This will certainly improve the quality of these individuals, professionals, in an integral way. Even as citizens more inserted in the current digital context of a globalized world.

References

- CARVALHO, Ana Maria. Liderança Autêntica, Capital Psicológico Positivo e Criatividade dos Gestores Empresariais das Cidades do Rio de Janeiro e São Paulo. Tese de Doutorado apresentada à Universidade de Trás-os-Montes e Alto D' Ouro – Vila Real, Portugal, 2014.
- CARVALHO, Ana Maria. Resiliência e Liderança – Administrando diante da adversidade. Ed. Publit, Rio de Janeiro, 2007.
- CARVALHO, Ana Maria. Mudanças na Prática Docente face à implementação do laboratório de informática. Dissertação de Mestrado apresentada à Universidade Estácio de Sá. Rio de Janeiro, 2005.
- COLL, C. Psicologia e currículo: uma aproximação psicopedagógica à elaboração do currículo escolar. São Paulo: Ática; 2000.
- KENSKI, Vani. Tecnologia educacional: uma nova cultura de ensino e aprendizagem na universidade. In: SPELLER, P., ROBL, F.; MENEGHEL, S. M. (Org.). Desafios e perspectivas da educação superior brasileira para próxima década. 2011-2020. Brasília: UNESCO / CNE-MEC, 2012.
- MACEDO, L.; PETTY, A. L. S.; PASSOS, N. C. Os jogos e o lúdico na aprendizagem escolar. Porto Alegre: Artmed, 2007.
- MORAN, J. Metodologias ativas para uma aprendizagem mais profunda. In: BACICH, L.; MORAN, J. Metodologias ativas para uma educação inovadora: uma abordagem teórico-prática. Porto Alegre: Penso, 2018.
- ROSADO, L. A. S.; FERREIRA, G. M. S.; CARVALHO, J. S. Educação e Tecnologia na literatura acadêmica online em português. In: FERREIRA, G. M. S.; ROSADO, L. S.; CARVALHO, J. S. (Org.) Educação e Tecnologia: abordagens críticas. Rio de Janeiro: SESES/UNESA, 2017.
- VALENTE, J. A. Blended learning e as mudanças no ensino superior: a proposta da sala de aula invertida. In: Educar em Revista, ed. especial, n. 4, p. 79-97, 2014.

Academic achievement critical factors and the bias and variance decomposition: evidence from high school students' grades

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Abstract

This study is centered on the sources of machine learning bias in the prediction of students' grades. The dataset comprises 29,788 Portuguese high school teacher final grades corresponding to 10,364 public high school students' academic paths (from the 10th to the 11th grades). We use an artificial neural network to perform the tasks. In the experimental phase, we undertake a bias and variance decomposition when predicting the 11th year students' grades. Two different implementations are used, a critical implementation that comprises only academic achievement critical factors and a lagged implementation where the preceding teacher grade is appended. The critical implementation has a higher machine learning bias, notwithstanding the higher critical factors' contribution. The lagged implementation, on the other hand, has a smaller bias, but a smaller critical factors' contribution. It is possible for a machine learning model to have a reduced bias and simultaneously a little critical factors' contribution, simply by accessing information about the historical value of the target variable. The education stakeholders should therefore be aware of the critical quality of the model in use. In defining policies and choosing the variables to influence, predictive models with low biases and built upon the critical factors information are indispensable. A machine learning model based on the critical factors produces more consistent estimates of their effects on AA. They are therefore suitable models to assist in policymaking. On the other hand, if the goal is to obtain a simple set of predictions, the use of target variable historical values is appropriate.

Keywords: *Bias and variance decomposition, education policy, academic achievement*

1 Introduction

Given the augmented predictive accuracy of machine learning algorithms, their extensive use in the prediction of students' academic achievement (AA) was just a matter of opportunity. However, some risks are emerging. The main motivation of this study is to analyze the sources of machine learning bias that can appear when predicting students' grades. Without contributing to any underestimation of the ethical implications of an algorithm affecting a person's life (Rességuier and Rodrigues, 2020), the failure of some recent implementations purposely developed to assign student grades highlights its prevailing relevance. We can point the 2020 final exam of the International Baccalaureate, an international educational institution with headquarters in Geneva, a revealing case (Broussard, 2020). As the SARS-Cov-2 pandemic unfolded, the institution decided to cancel out the final exam and to use a predictive model instead to evaluate the students' AA. Despite the implementation being based on historical learning assignments and on the teacher's opinion about the likely grade, the algorithm ended up disappointing by far. Thus, we decided to undertake a thorough analysis of the machine learning bias and variance decomposition latent in any implementation that aims at anticipating student grades and highlight any hypothetical particularity it conveys. We used an artificial neural network (ANN) and focused on predicting the final teacher grades of the 11th Portuguese high school grade year. The conclusions are drawn from the simultaneous analysis of two different implementations, a critical implementation that comprises only AA critical factors predictive variables and a lagged implementation where the preceding grade is appended to the input space.

2 Bias and variance decomposition

We closely follow Mehta et al. (Mehta et al., 2019) bias and variance decomposition. Consider the following mathematical expression:

$$\mathbf{y} = \mathbf{F}(\mathbf{X}; \boldsymbol{\theta}) + \boldsymbol{\varepsilon} \quad (1)$$

Where the function \mathbf{F} has a vector of parameters $\boldsymbol{\theta}$ and transforms, with a stochastic perturbation $\boldsymbol{\varepsilon}$, the vector \mathbf{X} of independent variables into the continuous target variable \mathbf{y} .

Moreover, let us consider a statistical learning model to search for \mathbf{F} whose cost function is the square error. Given a random dataset $\mathbf{D}^N = (\mathbf{X}, \mathbf{y})$, where N represents its cardinality, retrieved from the population, the cost function \mathbf{C} and the optimization problem come respectively as:

$$\mathbf{C}(\mathbf{y}, \mathbf{F}(\mathbf{X}; \boldsymbol{\theta})) = \sum_i (\mathbf{y}_i - \mathbf{F}(\mathbf{X}_i; \boldsymbol{\theta}))^2 \quad (2)$$

$$\hat{\boldsymbol{\theta}}_{\mathbf{D}^N} = \mathit{argmin}[\boldsymbol{\theta}, \mathbf{C}(\mathbf{y}, \mathbf{F}(\mathbf{X}; \boldsymbol{\theta}))] \quad (3)$$

The cost function value and the $\hat{\boldsymbol{\theta}}_{\mathbf{D}^N}$ vector depends on the actual training dataset $\mathbf{D}_j^N = (\mathbf{y}_j, \mathbf{X}_j)$. If we draw n different datasets from the population, we learn n different $\hat{\boldsymbol{\theta}}_{\mathbf{D}^N}$ vectors and the cost function expected value of predicting unseen data can be decomposed as follows:

$$\begin{aligned} & E_{\mathbf{D}, \boldsymbol{\varepsilon}} \left\{ \mathbf{C}(\mathbf{y}, \mathbf{F}(\mathbf{X}; \hat{\boldsymbol{\theta}}_{\mathbf{D}^N})) \right\} \\ &= \sum_i \left(\mathbf{F}(\mathbf{X}_i; \boldsymbol{\theta}) - E_{\mathbf{D}} \{ \mathbf{F}(\mathbf{X}_i; \hat{\boldsymbol{\theta}}_{\mathbf{D}^N}) \} \right)^2 + \sum_i E_{\mathbf{D}} \left\{ \left(\mathbf{F}(\mathbf{X}_i; \hat{\boldsymbol{\theta}}_{\mathbf{D}^N}) - E_{\mathbf{D}} \{ \mathbf{F}(\mathbf{X}_i; \hat{\boldsymbol{\theta}}_{\mathbf{D}^N}) \} \right)^2 \right\} \\ &+ \sum_i E_{\boldsymbol{\varepsilon}} \left\{ (\mathbf{y}_i - \mathbf{F}(\mathbf{X}_i; \boldsymbol{\theta}))^2 \right\} \quad (4) \end{aligned}$$

$$E_{\mathbf{D}, \boldsymbol{\varepsilon}} \left\{ \mathbf{C}(\mathbf{y}, \mathbf{F}(\mathbf{X}; \hat{\boldsymbol{\theta}}_{\mathbf{D}^N})) \right\} = \mathit{Bias}^2 + \mathit{Variance} + N \cdot \sigma_{\boldsymbol{\varepsilon}}^2 \quad (5)$$

The expected value of the cost function $E_{\mathbf{D}, \boldsymbol{\varepsilon}} \left\{ \mathbf{C}(\mathbf{y}, \mathbf{F}(\mathbf{X}; \hat{\boldsymbol{\theta}}_{\mathbf{D}^N})) \right\}$ depends on the dataset that is drawn (\mathbf{D}) and on the irreducible variance ($\boldsymbol{\varepsilon}$). The model expected value $E_{\mathbf{D}} \{ \mathbf{F}(\mathbf{X}_i; \hat{\boldsymbol{\theta}}_{\mathbf{D}^N}) \}$ depends on the dataset that is drawn. Finally, the expected value of the error term, $E_{\boldsymbol{\varepsilon}} \{ \mathbf{y}_i - \mathbf{F}(\mathbf{X}_i; \boldsymbol{\theta}) \}$, depends only on the irreducible variance.

The bias and the irreducible variance, respectively the first term and the third term of the equations (4) and (5), are not empirically separable as the true function $\mathbf{F}(\mathbf{X}_i; \boldsymbol{\theta})$ is unknown.

In the literature, there is a multitude of methods for computing the bias and variance decomposition. Normally, they follow similar steps. First, k training datasets of size m are drawn from a source dataset D , and a test dataset of size t is put aside. Second, for each training dataset, a model is learned and the prediction of the test dataset is produced. Finally, the bias and variance decomposition is computed from the test dataset estimates' matrix whose dimension is $(t \times k)$. The distinction between them resides in how each step is undertaken. Kong and Dietterich (1995) put aside a large test dataset whose samples were located on blurred regions in terms of classification and drew the training datasets uniformly with replacement. Kohavi and Wolpert (1996) decided to randomly select the test dataset and apply to the remaining half of the samples a bootstrap (Efron and Tibshirani, 1993) to generate the training datasets. Domingos (2000) followed a similar approach, but he decided to assign only one-third of the samples to the test dataset. Bauer and Kohavi (1999) applied the methodology of Domingos (2000) three times and compute the bias and

variance from the three prediction rounds. Unlike Kohavi and Wolpert (1996) and Domingos (2000) that assumed a null irreducible variance, James (2003) gathered the three closest input vectors in subsets, took their most common class, and computed the irreducible variance as the within set variability. Next, he applied a bootstrap to generate 50 training datasets, fitted the models to each of them, and calculated the most common class per sample. Subsequently, he carried out a five-fold cross-validation procedure and predicted each test dataset.

Finally, these predictions, the estimated irreducible variance, and the most common class per sample estimates were used to decompose the generalization error into bias, variance, and noise. For synthetic data, Valentini and Dietterich (2002) assigned 10.000 samples to test and generated a large number of training datasets with 100 samples each. For real data, they assigned half of the samples to test and, from the remaining, they generate 200 training datasets with 100 samples each that were drawn uniformly with replacement. In another study, the same Valentini and Dietterich (2003) used a bootstrap to generate 200 training datasets and the hold-out samples of each drawing were used as test datasets. Webb (2000) ran a three-fold cross-validation procedure ten times. He gathered the ten test predictions produced for each sample and computed from there the bias and variance decomposition. He presupposed that the irreducible variance was null. Bouckaert (2008) studied a set of different experimental methodologies for the bias and variance decomposition. In the final, he argued for the ten-fold version of the cross-validation sampling method, a threshold of 100 samples for each fold, and a threshold of 2.000 samples for the test dataset.

In our study, we closely followed the methodology proposed by Kohavi and Wolpert (1996). We believe this methodology represents a reasonable option taking-into-account the dimensionality of the dataset considered in this study.

3 Methodology

In the variable selection phase, the multilinear Lasso regression model (Tibshirani, 1997) was applied to set aside the variables with null $\widehat{\beta}_j$, considered to be of little significance for the explanation and prediction of the Portuguese language grades. In this procedure, the regularization term (\mathbf{t}) was optimized through a four-fold cross-validation grid search (Hastie et al., 2008; Mohri et al., 2018). The chosen (\mathbf{t}) corresponds to the MAE immediately below the minimum MAE plus its standard deviation. The 10th grade dataset and the baseline implementation were used for this purpose. The learning algorithm employed to predict the students' grades was an artificial neural network (Haykin, 2009). The tuning phase of the architecture and hyperparameters of the neural network was based on a four-fold cross validation (Hastie et al., 2008; Mohri et al., 2018) random grid search (Bergstra et al., 2011; Bergstra and Bengio, 2012) from a purpose-built search space. The topology and hyperparameters chosen corresponded to the lowest MSE found. This phase was also based on the 10th grade dataset and the baseline implementation.

The dataset used in the bias and variance decomposition corresponds to the Portuguese language 11th grade and was divided into 70% for learning and 30% for testing. The training set was standardized, and the same transformation was applied to the test dataset. The decomposition of the MSE into bias and variance was achieved through a bootstrap (Efron and Tibshirani, 1993) for each implementation. It consisted of 200 samples and models generating 200 predictions of the test set. The model variance estimate coincides with the variance of the predictions, and the bias estimate is equal to the difference between the total MSE and the model variance.

$$MSE = \text{mean}\{Bias^2 + N \cdot \sigma_\varepsilon^2\} + \text{mean}\{Variance\} \quad (6)$$

The importance of each AA critical factor was assessed from both the number of significant variables associated with each critical factor and their permutation feature importance (Altmann et al.,

2010). To select the relevant variables, we used the Lasso regression as in the variable selection phase. In the permutation feature importance, we had 20 rounds and aggregated the results of each variable by critical factor.

The fact that the selection of variables and the hyperparameters tuning were performed on the 10th grade dataset enhances the robustness of the bias and variance decompositions.

The topology of the neural network comprises 8 hidden layers with 10 neurons each. The hidden layers activation is the Relu function. The output layer has no activation. You use the Adam optimizer and the MSE loss function. The learning phase has 25 epochs and a batch size of 32. The total number of parameters to train is 1,281. The implementations were developed in Python and Keras.

4 Data

The dataset comprises 29,788 Portuguese high school teacher's final grades, corresponding to 10,364 students' high school academic paths. The models are based on two sub-datasets corresponding each to the 10th and 11th year grades, with 15,112 and 14,676 samples respectively. The data was extracted from the main database of the Directorate-General for Statistics of Education and Science of the Portuguese Ministry of Education information system and from Statistics Portugal.

We have 40 AA critical factors features in the dataset (see Table 3). After transforming the categorical variables, we end with 120 predictive variables ready to take part in the feature selection step. An adequate AA critical factors literature review can be found in Costa-Mendes et al. (2021) and Cruz-Jesus et al. (2020).

Feature	Critical factor	Feature	Critical factor	Feature	Critical factor
Subjects	n.a.	Mother job situation	SES ¹	School size	School size
Retentions	Cognitive ability	Responsible educational level	SES	Class size	Class size
Enrolments	Cognitive ability	Father educational level	SES	Teacher professional category	Lecturing quality
Gender	Gender	Mother educational level	SES	Teacher educational level	Lecturing quality
Father nationality	Ethnicity	Scholarship	SES	Teacher career step	Lecturing quality
Computer	Computer usage	Parish	SES	Teacher gender	Lecturing quality
Internet	Internet usage	County	SES	Temporary replacement	Lecturing quality

¹ Socioeconomic status

Job situation	SES	Family non-classical dwellings	SES	Educative support	Lecturing quality
Education responsible	SES	Collective dwellings	SES	Teacher age	Lecturing quality
Responsible job educational level	SES	Illiteracy rate	SES	Lecturing time	Lecturing quality
Father job educational level	SES	Post-secondary schooling rate	SES	Non-lecturing time	Lecturing quality
Mother job educational level	SES	Primary sector importance	SES	Educative support time	Lecturing quality
Responsible job situation	SES	Secondary sector importance	SES	Teacher grade	Target variable
Father job situation	SES	Unemployment rate	SES		

Table 3 – Dataset variables and associated critical factor

5 Results

5.1 Bias and variance decomposition

The bias and the irreducible variance cannot be empirically separated. However, the irreducible variance of the target concept is not meant to vary along with the implementations. So, we opted to call the composite of bias and irreducible variance just bias.

When we compare the critical with the lagged implementation, we can perceive a deep decline in the MSE in favour of the latter. The MSE drops 62.92%, the bias 63.72% and the variance 56.60%. (Table 4).

The improvement in bias explains the bulk of the decrease in the MSE. In fact, 89.89% of the MSE improvement is explained by the bias behaviour, only 10.11% is due to the variance.

	MSE	Bias	Variance
Critical	5.85	5.19	0.66
Lagged	2.17	1.88	0.29
Difference	3.68	3.31	0.37

Table 4 – Bias and variance decomposition

5.2 Critical factors role

In the critical implementation, 21 critical factor predictive variables have Lasso coefficients different from zero, contrasting with the lagged implementation where only 2 variables are as relevant (table 5). When using the lagged teacher grade as an input variable, the Lasso filter put aside a higher number of AA critical factor variables, curtailing their global participation in the prediction.

The most important critical factors are the SES and the cognitive ability. In the critical implementation, their permutation feature importance is 43.20% and 26.50% respectively. In the lagged implementation however, as the permutation feature importance for the lagged teacher grade is 95.5%, the global importance of any AA critical factor is negligible.

We conclude that the critical factors' role changes from decisive in the critical implementation to negligible in the lagged implementation. There is a fundamental difference between the two implementations.

Literature AA critical factor	# variables after Lasso procedure		Permutation feature importance	
	Critical	Lagged	Critical	Lagged
Cognitive ability	2	1	0.265	0.004
Gender	1	1	0.216	0.002
Ethnicity	0	0	-0.007	0.000
Computer usage	0	0	0.000	0.000
Internet usage	0	0	0.000	0.000
SES	17	0	0.432	0.036
School size	1	0	0.033	0.001
Class size	0	0	0.009	0.000
Lecturing quality	0	0	0.052	0.001
(lagged teacher mark)				0.955
	21	2	1.000	1.000

Table 5 – Variables after Lasso selection and normalized permutation feature importance both aggregated per critical factor

6 Discussion and conclusions

The machine learning performance depends on the accurateness of both the problem representation space and the approximation procedures embedded in the algorithm's heuristics. Any factor that interferes either in the problem representation or in the algorithmic approximation procedures and misleads the learning process creates bias (Gordon and Desjardins, 1995).

An algorithm chooses a specific method to approximate the problem and to reach a solution among a set of hypothetical alternatives introducing algorithm bias into the learning process. For instance, the structural bias is a type of algorithm bias that happens when the evolutionary algorithms focus their search on some

parts of the solution space in detriment of the other parts (Caraffini and Kononova, 2019). The representational bias occurs when the search space does not represent appropriately the problem to be solved (Li and Vasconcelos, 2019).

The critical factors contributions to the lagged implementation search space are minor. Its bias satisfactory results are due to the use of the preceding year grade as an input variable. The critical implementation search space includes only the variables related to AA critical factors. Yet, the bias results are poor as the dataset lacks rigor and latitude. In fact, the dataset does not include student intelligence quotient data, their motivations, parental engagement, family size and income, school layout and building features and teachers lecturing abilities. In addition, a major proportion of the variables are proxies and do not measure the critical factors directly.

A search space where the problem is correctly projected is essential for ensuring low representational bias. Thus, a necessary condition for a good student grade predictive model is either a differed observation of the target variable or a precise dataset conveying every critical factor.

The education systems should develop information systems that collect detailed information on the AA critical factors. In this way, it would be possible to develop machine learning predictive models to help the educational actors in the policy design and in the decision-making process. When we look at our results regarding the role of the critical factors, the implementations relative position changes. The critical implementation has a higher machine learning bias, notwithstanding the higher critical factors' contribution. The lagged implementation, on the other hand, has a smaller bias, but a smaller critical factors' contribution. It is possible for a machine learning model to have a reduced bias and simultaneously a little critical factors' contribution, simply by accessing information about the historical value of the target variable.

In defining policies and choosing the variables to influence, predictive models with low biases and built upon the critical factors information are indispensable. A machine learning model based on the critical factors produces more consistent estimates of their effects on AA. They are therefore suitable models to assist in policymaking. On the other hand, if the goal is to obtain a simple set of predictions, the use of target variable historical values is appropriate. In social sciences, knowledge of the critical factors is less decisive, and phenomena tend to drag on over time. That is why the classification of machine learning models based on the preponderance of critical factors is more important in the social sciences than in other domains. For instance, in an engineering system, low machine learning bias is ever associated with a large awareness of the target determinants. The critical factors are known and thoroughly perceived, and the target concept behaviour varies rapidly and often in a decisive way: we know how to drive a car, the critical factors, and in a nanosecond, we switch from the accelerator to the brake.

References

- Altmann A, Toloşi L, Sander O, et al. (2010) Permutation importance: A corrected feature importance measure. *Bioinformatics* 26(10): 1340–1347.
- Bauer E and Kohavi R (1999) Empirical comparison of voting classification algorithms: bagging, boosting, and variants. *Machine Learning* 36: 105–139.
- Bergstra J and Bengio Y (2012) Random Search For Hyper-Parameter Optimization. *Journal of Machine Learning Research* 13: 281–305.
- Bergstra J, Bardenet R, Bengio Y, et al. (2011) Algorithms for Hyper-Parameter Optimization. In: *Advances in Neural Information Processing Systems*, 2011, pp. 2546–2554.
- Bouckaert RR (2008) Practical bias variance decomposition. In: *AI 2008, Lecture Notes in Artificial Intelligence*, 2008, pp. 247–257.
- Broussard M (2020) When Algorithms Give Real Students Imaginary Grades. *The New York Times*, 8 September. New York. Available at: <https://www.nytimes.com/2020/09/08/opinion/international-baccalaureate-algorithm-grades.html?searchResultPosition=1>.
- Caraffini F and Kononova A V. (2019) Structural bias in differential evolution: A preliminary study. In: *AIP Conference Proceedings*, 2019, p. 020005. DOI: 10.1063/1.5089972.
- Costa-Mendes R, Oliveira T, Castelli M, et al. (2021) A machine learning approximation of the 2015 Portuguese high school student grades: A hybrid approach. *Education and Information Technologies* 26(2). Education and Information Technologies: 1527–1547. DOI: 10.1007/s10639-020-10316-y.
- Cruz-Jesus F, Castelli M, Oliveira T, et al. (2020) Using artificial intelligence methods to assess academic achievement in public high schools of a European Union country. *Heliyon* 6(6). Elsevier Ltd: e04081. DOI: 10.1016/j.heliyon.2020.e04081.
- Domingos P (2000) A Unified Bias-Variance Decomposition. *Aaai/Iaai*: 564–569.
- Efron B and Tibshirani RJ (1993) *An Introduction to the Bootstrap*. New York: Chapman and Hall.
- Gordon DF and Desjardins M (1995) Evaluation and Selection of Biases in Machine Learning. *Machine Learning* 20(1): 5–22. DOI: <https://doi.org/10.1023/A:1022630017346>.
- Hastie T, Tibshirani R and Friedman J (2008) *The Elements of Statistical Learning: Data Mining, Inference, and Prediction Second Edition*. Springer.
- Haykin S (2009) *Neural Networks and Learning Machines Third Edition*. Pearson.
- James GM (2003) Variance and bias for general loss functions. *Machine Learning* 51: 115–135.
- Kohavi R and Wolpert DH (1996) Bias plus variance decomposition for zero-one loss functions. *Proceedings of the 13th International Conference on Machine Learning (ICML96)* (September): 275–283.

- Kong EB and Dietterich TG (1995) Error-Correcting Output Coding Corrects Bias and Variance Eun. In: *Proceedings of the 12th International Conference on Machine Learning*, San Francisco, 1995. Morgan Kaufmann.
- Li Y and Vasconcelos N (2019) REPAIR: Removing Representation Bias by Dataset Resampling. In: *2019 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, June 2019, pp. 9564–9573. IEEE. DOI: 10.1109/CVPR.2019.00980.
- Mehta P, Bukov M, Wang C-H, et al. (2019) A high-bias, low-variance introduction to Machine Learning for physicists. *Physics Reports* 810. Elsevier B.V.: 1–124. DOI: 10.1016/j.physrep.2019.03.001.
- Mohri M, Rostamizadeh A and Talwalkar A (2018) *Foundations of Machine Learning Second Edition* (F Bached.). MIT Press.
- Rességuier A and Rodrigues R (2020) AI ethics should not remain toothless! A call to bring back the teeth of ethics. *Big Data & Society* 7(2): 205395172094254. DOI: 10.1177/2053951720942541.
- Tibshirani R (1997) The Lasso Method for Variable Selection in the Cox Model. *Statistics in Medicine* 16(4): 385–395. DOI: 10.1002/(SICI)1097-0258(19970228)16:4<385::AID-SIM380>3.0.CO;2-3.
- Valentini G and Dietterich TG (2002) Bias—Variance Analysis and Ensembles of SVM. In: F. R and J. K (eds) *Multiple Classifier Systems MCS 2002, Lecture Notes in Computer Science*. Springer-Verlag Berlin Heidelberg, pp. 222–231.
- Valentini G and Dietterich TG (2003) Low Bias Bagged Support Vector Machines. *Proceedings Twentieth International Conference on Machine Learning (ICML-2003)*: 752–759.
- Webb GI (2000) MultiBoosting: a technique for combining boosting and wagging. *Machine Learning* 40: 159–196.

Synchronous e-Learning Technology Skills of Preservice Primary School Teachers

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Abstract

The covid-19 pandemic necessitated the need for rapid adoption of synchronous e-learning by school and universities. In developing countries where the use of synchronous e-learning is very low, students online learning needs remain largely unmet due to the dearth of synchronous e-learning facilities, skills, economics and political factors. In this study, the researcher aims to examine synchronous e-learning technology skills of pre-service primary school teachers. The research approach adopted is the interpretative phenomenological research paradigm. A total of 5 primary school teachers enrolled in the pre-service training programme participated in this study. The extent of their e-learning technology skills was accessed using qualitative measures (structured interview). Thematic analysis of the pre-service teachers' view indicates several unmet e-learning need across four key themes. The policy implication of the finding of this research and future direction were highlighted.

Keywords: *preservice teachers, synchronous, e-learning skills, technology, primary school pupils*

Introduction

The outbreak of Covid-19 pandemic led to a closure of classrooms in almost the whole world thereby forcing 1.5 billion pupils and 63 million teachers to suddenly embrace alternative means of teaching and learning (World Bank Education and Covid-19 in Valverde-Berrocso, 2020). This condition exposed the strengths and weaknesses of some of the education systems concerning the challenge of digitalization. The Nigerian Government shut down all schools in order to curtail the spread of the virus and directed all students in primary and secondary school to engage with public media channels such as radio and television stations for their learning programmes due to lack of skills of personnel and facilities to migrate to virtual learning platforms.

This situation has led to changes in teaching and learning conditions at primary education at post-covid-19 era. E-learning is state-of-the art internet system based on technologies and other kinds of educational resources that its main objective is to provide pupils with a personalized, learner-centered, open, and interactive teaching and learning environment that is supportive and enhances the learning processes (Rodrigues et al. 2019). This denotes that e-learning technology is the application of technopedagogical state-of-art such as the internet or intranet computer to enhance teaching and learning processes. Many modes of e-learning technology abound such as blogs, wikis, synchronous, asynchronous, animation among others.

However, this study adopted synchronous e-learning technology which is conceptualized as a teaching and learning environment that enables teachers and pupils to meet on a specific online platform for instructional activities (Amiti,2020).

A lot of synchronous e-learning technology have been highlighted by researchers like Rahman, Jalil, and Ghani (2021) who revealed that there are some available options for teachers to host their class through e-learning technology which include but not limited to online management systems (Google

Classroom, Edmodo, and Classdojo), online video conferencing such as Zoom, Google Meet and Skype) and massive open online courses which include (Udemy, Open learning and Coursera). Despite the limitations of synchronous e-learning technology, Schulman (2020) reported that it can turn into long one-sided teaching, thereby making it difficult for primary school pupils to participate and leaving them exhausted. However, Hrastinski (2008) reported that many teachers preferred synchronous learning over asynchronous since assumed to provide enough chances for pupils to concurrently ask and answer questions. Synchronous e-learning is a closest alternative to a conventional classroom since it involves video and audio conferencing that enable primary school pupils to engage in real interaction with their peers and teachers.

Therefore, for preservice primary school teachers to effectively use these synchronous e-learning technology for instructional delivery, they must possess some skills that are essential for utilization of these synchronous e-learning platforms. Arias-Masa et. al (2014) revealed that some technical skills such as accessibility of the e-learning interface, preparation of learning sessions, control of students access to class, use of text, sound and image during instructions, preparation of students' sessions and creation of scenes, structuring of appropriate and organized virtual classroom, use of online help system, Organization and functionality of the elements offered, Recording and printing of contents, usability of platform to ensure best cognitive performance. These are the expected technical skills of that pr-service primary school teacher should possess for effective utilization of synchronous e-learning technology for optimal instructional delivery. Therefore, there is need to explore the preservice primary school teacher's skills for efficient utilization of synchronous e-learning technology platforms.

Literature Review

Several studies have been conducted on the effectiveness of synchronous e-learning technology in instructional delivery as well as the competency required for optimal utilization of synchronous teaching and learning platforms. A study conducted by Moser and Smith (2015) outlined the best practice of effective utilization of synchronous e-learning instruction platforms as follows; teacher displaying of welcome message on the platform 15 minutes before the starting time, check your equipment and notify class of your presences, ease the method to connect to virtual classroom, record proceeding of class, curtail unnecessary use of video online sharing by students, integrate other software to augment virtual classroom experiences. All these contents outline is within the category of technical skills. Coman et al (2020) maintained that technical issues are the major hindrance of optimal utilization of e-learning classroom for effective instructional delivery, followed by lack of technical skills as well as their improper teaching style adapted for the online platforms.

Additionally, Al-Hayani, Bardesi, and Hassanien (2020) listed some of these skills for effective engagement of pupils in the e-learning platform which include effective communication in an electronic platform, utilization of technology in e-learning, skills in designing e-courses, optimal engagement of pupils in the educational process in e-learning, and assessing pupils' level in e-learning. Salmon (2003) highlighted the competence of pre-service teachers and grouped them into five groups which includes. Comprehending online processes, technical skills, online communication skills, content expertise, and personal characteristics. Similarly, Dubins and Graham (2009) disclosed eight skill categories which include "content management system (CMS) skills, technical skills, instructional design, social processes and presence, managing assessment, orienting students, institutional knowledge, and pedagogy and andragogy".

Other researchers like (Abdous, 2011; Alman & Tomer, 2012; Bailie, 2011; Bailey & Card, 2009; Bawane & Spector, 2009; Munoz-Carril et al., 2013) reported that online teachers must acquire some of these technological literacy skills to be able to do the following: to retrieve several technological resources

and tools such as video chat applications (zoom, skype), internet browsers, email and productivity applications, comprehend the teaching and learning potentials of the tools, knowledge of the procedure used to create, link e-contents like e-books and video tutorial, always alert for latest updates and renovations of instructional e-learning technology and software.

Methodology

The study adopted an interpretative phenomenological research paradigm. According to Lester (1999) phenomenological research design is based on a paradigm of personal evidence and subjectivity, and highlights the significance of personal viewpoint and interpretation. This research design is appropriate for this study because it aimed at comprehending the subjective experience of primary school pre-service teachers with respect to their skills in utilization of synchronous e-learning technology.

This study adopted purposeful sampling technique to sample primary school preservice teachers and a convenient sampling procedure to select five primary school preservice teachers (made up of 2 males and 3 females) from two universities in South East Nigeria. This type of sampling allows the researcher to interview the number of respondents that are accessible, (Nworgu, 2015). Convenience sampling procedure was used because participants were interviewed at their own convenient.

Six open ended questions were utilised to collect data from the primary school preservice teachers during the data collection processes. Preliminary questions were first administered to the participants which include. 1) Are you aware of synchronous e-learning technology, if yes, could you tell your experiences? 2) How friendly is the interface of synchronous e-learning technology? 3) Is it easy to prepare and create scenes in the platform? 4) Are you in control of your pupils' access to the classroom? 5) Do you make use of image, test, audio, and video during instruction? 6) Do you find it easy to provide responses to pupils' feedback instantly? 7) Can you record and print class proceedings. The interviewer asks follow-up questions to get better understanding of the situation. These interview questions were extracted from the existing literature which led to adoption of open-ended questions in order to comprehend the concept behind research variables under study.

Data collected were subjected to thematic content analysis. The researcher clustered codes and form consistent by identifying patterns across the codes and reflected the underlying meaning from the personal interviews. This was done to ensure that most critical matters, likenesses, and variations among participants. In line with Nowel, Norris, and Moules (2017) procedure and prescription for establishing trustworthiness were followed for thematic data analysis, all data were presented and analysed. These research phases include; Phase 1: researchers get familiarised with data; 2 initial codes are generated; 3 finding themes; theme review; 5 theme definition and assigning of names; 6 generating reports. These are the major phases as stipulated by (Nowell et al., 2017) which made the researcher go through the dataset thoroughly, reviewing the group's data, generate code, search for themes, review the themes, define, name themes, and produce the report.

Ethical Considerations

The ethical approval for this study was received by the researcher from the faculty of Education, university of Nigeria Nsukka. Consent forms were given to the sampled participants before the commencement of the interview. The consent form contained information with respect to the purpose of the study, method and advantages to selected with assurance of protecting their privacy and confidentiality of their responses.

Findings

Four themes are presented to address the synchronous e-learning technology skills of preservice primary school teachers in South East Nigeria. The general perception is that synchronous interfaces are complex, hence they cannot prepare and create a scene in synchronous interface independently. Also, participants highlighted that they are in charge of students' access to the class. Still, it was revealed that participants possessed the skills for content sharing during instruction, which is quite useful. The fraction of respondents affirmed that they can provide instant feedback delivery to pupils via a synchronous platform and record the proceeding of the class.

The general perception of preservice primary school teachers is that they do not have sufficient skill to optimally manipulate a synchronous interface.

Interviewing 5 preservice primary schools (2 male and 3 female) in this study revealed recent potential of respondents. Concerning the skill to manipulate the synchronous interface without any IT specialist support, the respondents revealed that they manipulate the interface to an extent but always need some assistance from the ICT experts to achieve their individual objectives. For instance, one respondent said that: *"I can successfully create an account with some of the synchronous applications or websites such as zoom and skype but I always call on ICT expert to assist me setting the interface"* (P3). Some of the participants revealed that they always call on the ICT experts to create an account for them especially when it comes to video conferencing. *"I cannot manipulate the interface single handedly. I always call my son to assist me or I go to ICT centre where an expert can assist me. But I am learning it gradually, because I can mute and unmute my speaker each time I want to speak"* (P5). *"I can confidently manipulate the video conference software to large extent but little problem is network glitches which leads to braking of sound and video"* (P4).

With respect to other synchronous platforms that do not require video conferencing but depend heavenly on live chat. The participant shared their experience on the extent they can manipulate the interface on the website or application. *"I normally use Google Classroom during my teaching practice and it was helpful, however, my daughter always helps me to assign class exercises to pupils during covid-19 era"* (P2). *"Yes... I can create my class in google classroom application, send information to pupils, start discussion with them, distribute and collect task among other. I prefer using google classroom because is very easy for to manipulate the interface."* (P1).

Similarly, participant expressed difficulty in preparing and creating a scene in synchronous classroom. Majority of the participants reported that preparing and creating is a big task for them in a synchronous classroom as they always seek for assistant in this regard. The female respondents expressed more disappointment with respect to preparing and creating a scene. This could be attributed to their lack of skills required for effective manipulation of synchronous interface. Some participants expressed difficulty in creating scenes in a chat-based synchronous classroom. *".....sometimes these software or application updates after some period which either lead to deleting, adding and replacing some of the features. When this happens, i encounter challenges with respect to preparing and creating scene for my pupils (P1)."* *"Yes...preparing and creating scenes is not my concern in utilizing synchronous classroom, but when I noticed some new features, I called upon the ICT expert to explain those features"* (p4). ... *"preparing and creating a scene has been one of the challenges that limit my utilization of synchronous classroom because my daughter always assists me when she is around. Hence, I cannot do it when she is not around"* (P2).

With respect to video-based synchronous classrooms, some of the participants did not find it difficult in preparing and creating scenes. *"I do not have issues preparing and creating scene in zoom and skype because the interface is not complex for me, however, when it comes to other live chat based of*

synchronous classroom, I need little assistance” (p4). “...with regard to preparing and creating scenes, it depends on what is want to discuss with pupils. For instance, if it some that require more contents, I will call for assistance for optimal delivery using a synchronous platform.” (P3). The expression of these participants indicated that they are not finding some of the interface of synchronous platforms friendly. Hence, they seek assistance to achieve their objective during teaching practice training.

Participants highlighted that they are in charge of pupils’ access to the synchronous classroom.

Synchronous classroom requires participants to have passwords to enter the class online and these access passwords are created by the host (the teacher). Majority of the participants confidently revealed that they grant access for pupils to enter the classroom. *“..eh, granting students access to the online classroom has never been a problem for me, since it requires sharing the password and time for the class to them.” (P3).* *“...for is not a problem because I write the password and username on pieces of paper and share to my pupils before dismissal time.” (P5).* *“... what I do personally is that I write the password and username and indicate the synchronous software to be used. I always tell them to submit the note to their caretakers when they get home. This will enable the caretaker to know the time of the online I used test the user’s name and password including the particular synchronous platform to be used to the caregiver or parents of my pupils” (P1).* *“...I used to have a WhatsApp group made up of the parents or caregiver of pupils in my class. When I want to have a class online, I send the username and password indicating the platform we shall use and time” (P2).*

From the responses of the participants, it is clear that they do not find it difficult inviting pupils in synchronous classroom. However, the participants' responses showed that there are several means of inviting primary school pupils into synchronous classrooms which lead to active participation of pupils.

Participants possessed the skill for contents sharing during instruction in Synchronous classroom

Content sharing during synchronous classroom is very essential in both video conferencing and live chat base. These contents sharing include sharing documents, audio, and video to participants in order to illustrate major points. The host can also share his screen to pupils if the host is making references to online contents which is normally applicable in video conferencing. These sampled participants expressed their skills in content sharing in a synchronous classroom as follows. *“yes, ...I can share some of the note during online class like google class that am familiar with. What I normally do is that I upload the notes prior to class so that during instruction, I can easily make reference to it” (P1).* *“Sharing content like screen and sometimes audio message is very easy for me in synchronous platform, it does not stress me unless there are network glitches” (P4).* *“I prefer to share more of pictures to my pupils using synchronous class because I feel that it engages them more irrespective of the platform” (p3).* *“.... uploading instructional contents for synchronous classroom has never been an issue for me because the interface of the application (Google classroom) which I use is quietly easy to understand” (p5).* *“...there some platform of synchronous classroom that I can update instructional contents independents, but some that have to do with sharing of screen for video conferencing, I seek for assistance (P2).*

Therefore, based on the responses of the participants, sharing instructional contents using synchronous classroom is not a problem per se. However, some of them express concern that some synchronous application interfaces are very easy to share contents while some are complex.

Participant possessed the skill to provide instant feedback and record proceeding of class

Feedback plays a significant role in the instructional processes irrespective of offline and online modes. All the synchronous platforms are designed for two-way flow of feedback between the instructor and the pupils. Pre-service participants have expressed their skills in providing instant feedback as well as

the potential in recording the proceeding of the instruction via a synchronous platform. *“I ensure that replied to all the questions my pupils ask during online instruction especially on Google Classroom to enable the students to make reference to it.” (P2). “I like using Google Meet because it permits both oral and feedback and written feedback. Therefore, I make two use of them in responding to some of the issues that come up during instructional processes” (P3). ...“answering pupils’ questions in both video conferences and live chat based has never been a problem in a synchronous classroom”(P5).*

Concerning the recording of classroom proceeding during instructional process which is essential future of some video conferencing in the synchronous classroom. The participant demonstrated their skills in recording the proceeding of their synchronous class for some of the students who missed the class and other references purposes. *“Eh, I record all the proceeding of my class because, sometimes, not all pupils participate in the online class. Hence, I take note of the absentees and forward the recorded class to them for their peruse under the guidance of their caregiver or parents.” (P1). “...I activated my record button at the beginning of the class and ensured that I replied to all the questions raised in the class. The reason for recording the class is that some pupils may not have good networks at that of instruction, hence, I forward the recorded class for their personal use.” (P4).* Based on these responses from the participants it can be deduced that preservice primary school teachers have possessed the required skills for providing feedback and recording the proceeding of the classroom.

Discussion

There is a dearth of studies on the synchronous e-learning technology skills of preservice primary school teachers especially in southeast Nigeria. The current study investigated the synchronous e-learning technological skills of preservice primary school teachers. From the interview conducted on the sampled participants, the expression disclosed that they are lagging behind in some technical skills while in some they are well equipped with the required skills to manipulate the synchronous classroom. With respect to the interface of the synchronous classroom, the general perception of preservice primary school teachers is that they do not have sufficient skill to optimally manipulate the synchronous interface. The skill to manipulate these interfaces is necessary for pre-service teachers of primary school to enable them to utilize them from the comfort of their home and other convenient places. The expressions of their lack of skill for manipulation of these applications could be attributed could be attributed their seldom use of these synchronous web sites and applications. The finding of the study expatiated the finding of previous researchers such as (Al-Hayani, Bardesi, & Hassanien, 2020; Salmon, 2003) that revealed that ability to manipulate the interface of the synchronous website is one of the technical skills that are essential for optimal utilization of synchronous applications. Manipulation of the synchronous interface equally entails preparation and creation of scenes, which this study revealed most the participant expressed difficulty in preparing and creating Scene in Synchronous Classroom. This implies that pre-service primary school teachers lack behind in term maximum utilization of synchronous e-learning technology.

The finding of this study equally revealed that participants highlighted that they are in charge of pupils’ access to synchronous classrooms. This denotes that preservice primary school teachers have the skill to grant primary pupils access to synchronous classrooms and monitor their individual engagement. This also means that a pre-service teacher can manage a synchronous classroom once all the setting and configuration have been done by an ICT expert. The potential of preservice teachers being in control of a synchronous classroom have been highlighted by previous studies. For instance, Cooper, Warren, Hogan-Chapman, and Mills, (2020) revealed that pre-service teachers have the skills to teach online, coordinate disrupting behaviour of students online, get through most difficult students, and provide feedback to students’ questions via online. Controlling primary school pupils online is one the major tasks in synchronous classrooms because some of these pupils are in different environments which could influence their behaviours, thereby may lead to disruption of classroom activities. This finding is also in agreement

with the finding of Al-Hayani, Bardesi, and Hassanien (2020) who revealed that optimal engagement of pupils in educational process in e-learning is one the required skill for effective instructional delivery.

Furthermore, this study found that participants possessed the skill for content sharing during instruction in a synchronous classroom. Content sharing is very important skills for maximum use of the synchronous classroom because it enriches the lesson and makes the e-learning more engaging as well as interesting for participants. This finding of this study is in affirmation with the finding of Dubins and Graham (2009) that disclosed content management and sharing is one of the most significant skills in eight skills of online instruction. The finding of this study is in affirmation with the finding of (Bawane & Spector, 2009; Munoz-Carril et al., 2013) which revealed that knowledge of the procedure to create, link e-contents like e-books and video tutorials is essential for synchronous e-learning.

This study also identified that participants possessed the skill to provide instant feedback and record the proceeding of class. Provision of feedback is important features of a synchronous classroom, since it enables the participant to ask questions. The preservice teacher has established that they have the skill to use these features for optimal instructional delivery. The finding of this aligned with the report of Cooper, Warren, Hogan-Chapman, and Mills, (2020) which revealed that pre-service teachers have the skills to provide feedback to pupils' questions via online. Feedback from the online instructor makes the instruction lively and engaging for the participant because it makes them active and deeply involved in the instructional processes.

Educational implications and recommendation

This study revealed that the general perception of preservice primary school teachers is that they do not have sufficient skill to optimally manipulate synchronous interfaces. This implies that pre-service sufficient equipped with the requisite skills for effective utilization of synchronous e-learning technology, hence, they still seek assistance when they want to use these synchronous educational services. This study also found that pre-service teachers can manage these synchronous e-learning with respect to granting pupils' access, controlling their activities online, providing efficient feedback and recording the online class. This implies that despite their shortcomings, they have the skills to manage the activities of primary school pupils, respond to their individual questions, give them class work and monitor the progress in a synchronous class.

Based on the findings and implications of this study, the researcher recommends that training should be organized for pre-service primary school teachers on how to use the interface some of the synchronous applications and web sites. Seminar should also be organized for these preservice primary school teachers important of utilization of synchronous e-learning to engage primary school pupils' children at home. Parents of these primary school children should also be sensitized on the importance of engaging their children in an online classroom.

Conclusion

This study has revealed the skills of preservice primary school teachers on synchronous e-learning technology. Through a qualitative lens, this study has revealed that preservice teachers of primary education do not have sufficient skills to manipulate the interface of synchronous classroom independently. This indicates that they need some assistance in one way or the other to optimally utilize the synchronous e-learning. This study equally revealed that preservice teachers can use some aspect of synchronous e-learning efficiently, such as providing feedback, assigning students to online classes, providing feedback and recording classroom activities.

References

- Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International journal of qualitative methods*, 16 (1), 1609406917733847
- Nworgu, B. G. (2015). Educational research: Basic issues and methodology. *Nsukka: University trust publishers*, 135-136
- Lester, S. (1999). An introduction to phenomenological research. Taunton UK, Stan Lester Developments.
- Abdous, M. H. (2011). A process-oriented framework for acquiring online teaching competencies. *Journal of Computing in Higher Education*, 23(1), 60-77.
- Albrahim, F. A. (2020). Online teaching skills and competencies. *Turkish Online Journal of Educational Technology-TOJET*, 19(1), 9-20.
- Al-Hayani, A. A., Bardesi, H. J. & Hassanien, M. A. (2020). The Five Competencies of E-Learning. English language - Study and teaching.
- Alman, S. W., & Tomer, C. (2012). Designing online learning: A primer for librarians. ABC- CLIO.
- Amiti, F. (2020). Synchronous and asynchronous E-learning. *European Journal of Open Education and E-Learning Studies*, 5(2).
- Arias-Masa, J., Alonso-Díaz, L., Cubo-Delgado, S., Gutiérrez-Esteban, P., & Yuste-Tosina, R. (2014). Assessment of the use of synchronous virtual classrooms in higher education. *New Educational Review*, 38(4), 223-237.
- Bailey, C. J., & Card, K. A. (2009). Effective pedagogical practices for online teaching: Perception of experienced instructors. *The Internet and Higher Education*, 12(3), 152- 155.
- Bailie, J. L. (2011). Effective online instructional competencies as perceived by online university faculty and students: A sequel study. *Journal of Online Learning and Teaching*, 7(1), 82- 89.
- Bawane, J., & Spector, J. M. (2009). Prioritization of online instructor roles: Implications for competency-based teacher education programs. *Distance Education*, 30(3), 383-397
- Coman, C., Țîru, L. G., Meseșan-Schmitz, L., Stanciu, C., & Bularca, M. C. (2020). Online teaching and learning in higher education during the coronavirus pandemic: Students' perspective. *Sustainability*, 12(24), 1-24.
- Cooper, R., Warren, L., Hogan-Chapman, A., & Mills, L. (2020). Pre-service teachers and their self-efficacy toward online teaching. *SRATE Journal*, 29(2), n2.
- Hrastinski, S. (2008). Asynchronous and Synchronous E-Learning. *Educause Quarterly*, 31(4), 51–55.
- Moser, S., & Smith, P. (2015). Benefits of Synchronous Online Courses. *ASCUE Proceedings*, (pp. 43-48).
- Munoz Carril, P. C., Gonzalez Sanmamed, M., & Hernandez Selles, N. (2013). Pedagogical roles and competencies of university teachers practicing in the elearning environment. *The International Review of Research in Open and Distance Learning*, 14(3), 462-487.

- Rahman, M. S. A., Jalil, M. J., & Ghani, M. T. A. (2021). Teaching and Learning Calculus through Google Meet Platform During the Covid-19 Pandemic: Implementation and Evaluation. *International Journal of Academic Research in Progressive Education and Development*, 10(2), 548–555
- Rodrigues, H., Almeida, F., Figueiredo, V., & Lopes, S. L. (2019). Tracking e-learning through published papers: A systematic review. *Computers & Education*, 136, 87-98.
- Schulman, C. (2020, April 9). used to shut my windows to New York’s noise. Now I long for a honking horn. *Washington Post*. <https://www.washingtonpost.com/outlook/2020/04/09/new-york-silent-coronavirus/>
- Valverde-Berrocso, J., Garrido-Arroyo, M. D. C., Burgos-Videla, C., & Morales-Cevallos, M. B. (2020). Trends in educational research about e-learning: A systematic literature review (2009–2018). *Sustainability*, 12(12), 5153.

Guidance Counsellors' Perceived Sense of Preparedness for the Job

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Abstract

Guidance and Counselling in schools is a high stakes job. The Guidance Counsellor is responsible for providing guidance and support to students in critical areas such as: academic preparation and planning, mental health issues, interpersonal relations, social adjustment and career preparation for the workforce. The nature and responsibilities of Guidance Counsellors make it important for a country to ensure that well prepared Guidance Counsellors are available in all schools. Any shortcomings in their ability to carry out their responsibilities will have detrimental effects on some of the most vulnerable groups of school children. Accordingly, this research sought to investigate the levels of preparedness of Guidance Counsellors to carry out their responsibilities in three Caribbean countries (Jamaica, St. Vincent and the Grenadines, and St. Lucia). A cross sectional survey design was used, and data was collected, using quota sampling, from 97 Guidance Counsellors. The findings show that Guidance Counsellors perceived their preparation positively ($M = 42$, $SD = 4.754$), scores ranging from 24 to 50. This finding was supported by the strong positive significant correlation that was found between their preparedness for the profession and requirements (job description) for the task of guidance and counselling ($r = .720$, $p < .01$). Investigation into the extent to which Guidance Counsellors' perceived their sense of preparedness for their profession prepared them to meet the requirements for the job, revealed a significant influence ($R^2 = .519$, $F(1,95) = 102.34$, $p < .01$) which explained 51.9% of the variance. The challenges that Guidance Counsellors report facing: that of being overwhelmed and at times being ineffective on the job might be explained by workload and not a lack of preparedness. Consequently, more Guidance Counsellors might be needed in some schools to address the challenges being faced by the counsellors as well as to better meet the needs of students.

Key words: Guidance counselling, Guidance Counsellors, preparedness, Caribbean

Background

Guidance Counsellors are uniquely positioned to provide support in encouraging the social and emotional wellbeing of the students. They play a critical role in the education and psycho emotional wellbeing of students. They work in schools to promote and advocate for students' social, emotional and cognitive needs.

In the Caribbean, the role of Guidance Counsellors is crucial because they create “services and programmes for the personal/social, educational, and career development of all students” (Maynard, 2014). Guidance Counsellors are expected to assist with the shaping of behaviours and encouraging positive values and attitudes among students and providing psychosocial interventions for students as necessary (Yuksel-Sahin, 2012). Guidance Counsellors are expected to provide guidance to students who are vulnerable and/or at risk (Maynard, 2014; Yuksel-Sahin, 2012). Children need help/support with mental health issues (Caribbean Policy Research Institute CAPRI, 2021), which requires Guidance Counsellors who are

prepared and equipped to provide support to students. Their preparedness also significantly impacts their sense of wellbeing, their pedagogy and students' outcome.

Highly trained Guidance Counsellors are needed who will advocate for a high-quality education for all children in schools and nurture the holistic development of every student's academic competence, and emotional, social and spiritual well-being (Maynard, 2014, p. 8). Guidance Counsellors are under tremendous pressure dealing with mental health issues since the resumption of face-to-face classes (Radio Jamaica News, April 10, 2022). They are required to assist with the design of interventions to respond to learning gaps. They are sometimes overwhelmed as a result of the demands of their job, some of which require on the job training.

The impact of the Covid 19 pandemic has increased the demands of Guidance Counsellors. There have been several reports of Guidance Counsellors being overwhelmed, which caused one to question whether they are fully prepared for the nuances of their job requirements. Covid 19 brought on psychosocial challenges for students and teachers. For students there were issues of isolation, absenteeism from online classes, abuse, poverty and limited supervision. Counsellors are required to address all these issues and meet the needs of students, some of which they may not feel prepared. Therefore, this research sought to examine Guidance Counsellors' perceived sense of their preparedness to work in Caribbean schools based on the requirement for the job and the support system provided by their schools and respective education ministry of education.

Research Questions

1. What are Guidance Counsellors' perceived sense of preparedness for the job?
2. To what extent are Guidance Counsellors satisfied with the support systems required to do their job?
3. To what extent is there a relationship between Guidance Counsellors' perceived sense of preparedness and the requirements for the job?

Review of Literature

The 21st century requirements for guidance and counselling involve competence in executing their roles, which take into account their level of preparedness based on the job requirements and the level of support received. This review highlights three key prerequisites (roles and job requirements, preparedness/training and social support) for Guidance Counsellors to successfully execute their roles. In addition, their sense of preparedness to carry out their roles and responsibilities are predicated on the efficacy of accomplishing their tasks.

Roles and Job Requirement of Guidance Counsellors

The roles and responsibilities of Guidance Counsellors are sometimes misunderstood as a result of the multiple roles they are required to play. Guidance Counsellors play multiple roles (Maynard, 2014) and are task with the responsibilities of developing, implementing and assessing the counselling programme in their schools to improve students' outcomes (American School Counsellors Association, n. d, p. 2).

Guidance Counsellors are required to be involved in administrative, preventive, interventive, supportive roles and enhance their skills through personal and professional development (Ministry of Education, Professional Development Unit, 2008). Some of the responsibilities include programme management and coordination, group guidance, career counselling, group and individual counselling with

students, conducting home visits, interpret assessment scores to be able make the best decisions for students' development, relevant referrals to external agencies for students and collaborate with the community (Ministry of Education, Professional Development Unit, 2008). As a result of the multiplicity of roles and requirement of Guidance Counsellors working in the Caribbean schools, they may struggle with implementation of programmes and interventions (Griffin & Bryan, 2021).

Preparedness of Guidance Counsellors

The training of Guidance Counsellors is critical in providing the necessary support to vulnerably population (Camp, Foxx & Flowers, 2019). School counsellors are the ones more likely to see students who are at "risk for suicide than other mental health professional ... many school counselors lack appropriate crisis intervention and suicide assessment training" (Becnel, et al. 2021 p. 327). Springer et al. (2020) review of studies found that Guidance Counsellors feel that they are ill-prepared to handle crisis situation (example suicide) experienced by the population they serve. Maynard (2014) research in Barbados also highlight that some counsellors have limited awareness and understanding on how to address social-emotional and career development needs of students. For Betser et al (2018) there is also training gaps between course delivered in training institutions and what is required in the school setting. Griffin and Bryan (2021) research conducted in Barbados concludes that the education programme for counsellors should prepare them to work in international contexts and "ensure that local knowledge and practices are centered in teaching counseling approaches which inevitable have a western, Eurocentric lens" (p. 14).

Social Support for Guidance Counsellors

The support from administrators and staff is critical to the Guidance Counsellors in undertaking their roles. According to McConnel et al (2020) Guidance Counsellors are more satisfied with their jobs, perform effectively, less likely to leave their jobs when they are supported by their principal. Counsellors who receive social support are less likely to experience burn-out. Because the job demands of Guidance Counsellors are likely to lead to burn-out (Mohamed, Johari & Mahmud, 2020). Therefore the social support from different sources "supervision, peer support, and support from family and friends" (Manning-Jones, Terte & Stephens, 2016, p. 21) is critical for them to carry out their jobs.

According to Lowery et al. (2018), principals and administrators need to be trained on the roles and responsibilities of Guidance Counsellors and the support and resources they need to carry out their duties and enhance their professional development. As such, not only should there be support for their professional development, but efforts should also be made for their wellness including adequate time-off and pastoral care.

Theoretical Framework - Self-Efficacy

Guided by the self-efficacy theory that describes Counsellors' capabilities and confidence in themselves to successfully complete a task or execute actions required for an outcome (Bandura, 1994; Brown, et. al, 2013) Guidance Counsellors who are trained to meet the job requirements are likely to believe that they can successfully achieve desired results. According to Bandura (1994) individuals who have a strong sense of self-efficacy are likely to accomplish set goals. It is perceived that the extent of the preparedness of Guidance Counsellors will influence their sense of efficacy when carrying out their functions and roles. Mitcham –Smith (2005) found that school counsellors who had a higher sense of self-efficacy were likely to have positive perception about their roles and were likely to be involved in actual practice.

From the perspectives of Kebongo and Mwangi (2020) Guidance Counsellors who do not have formal training in Guidance and Counselling and limited professional development are likely to have low

efficacy in dealing with issues such as sexuality, substance and alcohol use and abuse and in providing psychosocial support. Issues of sexuality, substance and alcohol use and abuse are aspects of socialization and pervade the society and can impact students' psychosocial wellbeing. Consequently, all Guidance Counsellors should be knowledgeable and be prepared in how to work with students who are impacted. Although self-efficacy does not directly lead to an individual being good at a task, it influences decisions to engage in a task, how much effort will be put in completing the task and how failure is dealt with (Mathwasa & Sibanda, 2020).

Method and Materials

A cross sectional survey design was employed to address the purpose of the research.

Quota sampling was used to collect data from 97 Guidance Counsellors across three Caribbean countries (76 Jamaica, 4 St. Vincent and the Grenadines and 17 St Lucia). Of the sample 50 of the counsellors are employed at the primary level, 41 at the secondary level and six at the tertiary level. Twenty six of the schools are located in urban areas while 71 in rural areas. The data collection was done using an online survey. The questionnaire was designed bearing in mind the competencies, job descriptions and the appraisal instruments being used by the Ministries (Forbes 2018; Professional Development Unit 2008) and guided by literature reviewed on Guidance Counsellor's preparedness, their role, responsibilities and the support required to do their job (Kelly 2003; McCarthy 2011; Ockerman, Patrikakou & Feiker Hollenbeck 2015). The questionnaire was validated using exploratory factor analysis and Cronbach Alpha Reliability. The data was analysed using descriptive and inferential statistics using the Statistical Package for the Social Sciences (SPSS version 25). The research received ethical approval from the University of the West Indies, Mona ethical review board.

Results and Discussion

Guidance Counsellors (N=97) perceive their preparation for the job of guidance and counselling positively (M=42, SD = 4.754), with scores ranging from 24 to 50. Most of the Counsellors reported that they are very satisfied with their preparedness for the job (see figure 1). A similar degree of positive perception was found in their satisfaction with the requirement for their job as Guidance Counsellors across all educational level (see figure 2).

In the Caribbean, Guidance Counsellors perceive that they are adequately prepared for their job as Guidance Counsellors, which suggests that they receive the necessary professional training that will make them competent in carrying out their job. The findings across all educational level suggest that teachers are confident in their competence/preparedness in carrying out their roles. Therefore, in the training programmes offered in training institutions there is some alignment of training with the needs of students. This is unlike Maynard (2014) and Springer et al. (2020) studies that found that Guidance Counsellors are not sufficiently prepared to meet the needs of their students.

In addition, they perceive that a satisfactory degree of support is provided to them (M=31.30, SD = 5.878) scores ranging from 17 to 34. Approximately 88% of the Guidance Counsellors reported that they are provided with adequate support, while 11% are provided with some support. The responses ranged from satisfactory to very satisfactory. More tertiary level Guidance Counsellors reported satisfactory than very satisfactory.

Guidance Counsellors perceived sense of support is satisfactory, which suggest there could be improvement in the level of support provided by the school and their respective education ministry. For

example Counsellors who work in large schools may feel burnt out because of the different responsibilities that they may have. In addition, some Counsellors are asked to substitute in classes and engage in other unrelated activities could influence their level of satisfaction. In addition, the school leadership may not understand the roles and responsibilities of Counsellor to provide the necessary support required by the Guidance Counsellor. Therefore equal attention should be focused on improving training providing support within the region. Providing the support will enhance their sense of wellbeing in the job and their level of satisfaction (McConnel et al., 2020). The challenges Guidance Counsellors face may be external to them. Therefore providing appropriate support and resources can strengthen their programme delivery and reduce the stress of the workload. In addition, efforts should be made to improve policies and practice that support Guidance Counsellors.

There is a strong positive correlation between guidance counsellors 'sense of preparedness for the job and the (requirements) job description for guidance and counselling ($r = .720$, $p < .01$). This suggests that the more prepared Guidance Counsellors are the more likely they are to perform on their jobs. Unlike the results of Becnel, Range and Remley, (2021) and Springer et al. (2020) this research found a strong positive correlation between Guidance Counsellors' sense of preparedness and the requirement for the job suggest that they are capable of carrying out their functions, notwithstanding the diversity and challenges that may exist. This finding could suggest that Guidance Counsellors working in the Caribbean schools are likely to be higher in their self-efficacy. Counsellors with high levels of self-efficacy are more likely transfer the relevant skills learned into practice. In addition, individuals high in self-efficacy are likely to be more resilient as they navigate the varied challenges of working with students, provide the relevant support, advocate for students wellbeing (Bray-Clarke & Bates, 2003; Mitcham-Smith, 2005).

Conclusion

Guidance Counsellors are adequately prepared to meet the demands of their job and the challenges that they face should not be attributed to their professional competence. However, they would benefit from greater social support in carrying out their roles.

Recommendations

The findings suggest that Counsellors require targeted social support in carrying out their responsibilities and reducing burn-out. Support from the Ministry of Education through the provision of resources to the schools and employing more Counsellors based on the needs of the schools. In addition, Counsellors should engage in on-going professional and personal development sessions to equip them to meet the challenges of their students and schools. Scientists theorize that happy cows produce more milk in the same way Guidance Counsellors who feel appreciated by being adequately remunerated and given appropriate work environment will enhance their level of satisfaction. Guidance Counsellors are required to provide academic, personal and career advice to students thus they should be kept current with universal trends and best practices. In addition, some principals are not au fait with the roles and responsibilities of the guidance counsellor, therefore the Ministry of Education should ensure that workshops are done with principals to get them current with what is expected of their Guidance Counsellors.

References

- American School Counsellors Association, n.d. The role of the school counsellor. Retrieved from <https://www.schoolcounselor.org/getmedia/ee8b2e1b-d021-4575-982c-c84402cb2cd2/Role-Statement.pdf>
- Bandura, A. 1994. Self-efficacy. In V. S. Ramachaudran (Ed.), *Encyclopedia of human behavior* (Vol. 4, pp. 71-81). New York: Academic Press. (Reprinted in H. Friedman [Ed.], *Encyclopedia of mental health*. San Diego: Academic Press, 1998). <https://www.uky.edu/~eushe2/Bandura/Bandura1994EHB.pdf>
- Becnel, A. T., Range, L., & Remley, T. P. 2021. School counselors' exposure to student suicide, suicide assessment self-efficacy, and workplace anxiety: Implications for training, practice, and research. *The Professional Counselor*, 11(3), 327-339.
- Belser, C. T., Wheeler, N. J., Bierbrauer, S. L., Solomon, C. S., & Harris, S. 2018. The experiences of counselors-in-training in a school-based counseling practicum. *The Journal of Counselor Preparation and Supervision*, 11(2), Article 8.
- Brown, L. J., Malouff, J. M. & Schutte, N.S. 2013. Self-efficacy theory. Retrieved from <http://samples.jbpub.com/9781449689742/chapter2.pdf>
- Caribbean Policy Research Institute (CAPRI) .2021. Mind the Gap: The inadequacy of mental health services for children. Retrieved from mind_the_gap_the_inadequacy_of_mental_health_services_for_children_revised_october_2021.pdf
- Forbes, A. 2018. Critical counseling competencies for the English-speaking Caribbean. Theses and Dissertations. 2212. <https://commons.und.edu/theses/2212>
- Griffin, D. M. & Bryan, J. 2021. A qualitative Study of school counseling in Barbados: A focused ethnography. *International Journal for the Advancement of Counselling* <https://doi.org/10.1007/s10447-021-09445-x>
- Kebongo, S.N. & Mwangi, B, N. 2020. An assessment of guidance and counseling teachers' preparedness in offering effective services in public primary schools in Kikuyu Sub County, Kenya. *African Research Journal of Education and Social Sciences*, 7(1), 73-92
- Kelly, G. A. 2003. *A comprehensive guidance counseling program for Jamaican schools: A needs assessment*. Dissertation Andrews University. Retrieved April 10, 2021 from <https://digitalcommons.andrews.edu/cgi/viewcontent.cgi?article=1484&context=dissertations>
- Lowery, K., Quick, M., Boyland, L., Geesa, R. L., & Mayes, R. D. 2018. "It wasn't mentioned and should have been": Principals' preparation to support comprehensive school counselling. *Journal of Organizational & Educational Leadership*, 3(2): Article 3. https://digitalcommons.gardner-webb.edu/joel/vol3/iss2/3/?utm_source=digitalcommons.gardner-webb.edu%2Fjoel%2Fvol3%2Fiss2%2F3&utm_medium=PDF&utm_campaign=PDFCoverPages

- Manning-Jones, S., de Terte, I., & Stephens, C. 2016. Secondary traumatic stress, vicarious posttraumatic growth, and coping among health professionals: A comparison study. *New Zealand Journal of Psychology*, 45(1), 20-29.
- Mathwasa, J. & Sibanda, L. 2020. Enhancing students' self-efficacy: Implication for high school guidance and counselling educators. *Counseling and Therapy*. (1-20). DOI: <http://dx.doi.org/10.5772/intechopen.90555>
- Maynard, D. B. 2014. Guidance and counselling in Barbados. *GCSCORED Chronicle*.
- McCarthy, J. 2001. The skills, training and qualifications of guidance workers. A paper prepared for an OECD review of policies for information, guidance and counselling services Commissioned jointly by the European Commission and the OECD.
- McConnell, K. R., Geesa, R. L., Mayes, R. D., & Elam, N. P. 2020. Improving school counselor efficacy through principal-counselor collaboration: A comprehensive literature review. *Mid-Western Educational Researcher*, 32(2), 133-155.
- Ministry of Education, Professional Development Unit. 2008. Guidance counsellor performance appraisal policy & procedure. Retrieved from <https://moey.gov.jm/wp-content/uploads/2015/01/Guidance-Appraisal-Manual.pdf>
- Mitcham-Smith, M. A. 2005. *Relationships among school counselor self-efficacy, perceived school counselor role, and actual practice*. Doctoral thesis, University of Central Florida. Retrieved from <https://stars.library.ucf.edu/cgi/viewcontent.cgi?article=1359&context=etd>
- Mahomed, N. J. B., Johari, K. S. K., & Mahmud, M. I. 2020. *International Journal of Psychosocial Rehabilitation*, 24(6), 2353-2360.
- Ockerman, M. S., Patrikakou, E., & Feiker Hollenbeck, A. 2015. Preparation of school counselors and response to intervention: A profession at the crossroads. *The Journal of Counselor Preparation and Supervision*, 7(3). <http://dx.doi.org/10.7729/73.1106>
- Springer, S., Hennigan Paone, C., Colucci, J., & Moss, L. J. 2020. Addressing Suicidality: Examining preservice school counselors' perceptions of their training experiences. *Journal of Child and Adolescent Counseling*, 6(1), 18-36. DOI: 10.1080/23727810.2018.1556990
- Yuksel-Sahin, F. 2012. School counselors' assessment of the psychological counseling and guidance services they offer at their schools. *Procedia – Social and Behavioral Sciences*, 47, 327-339.

Appendix

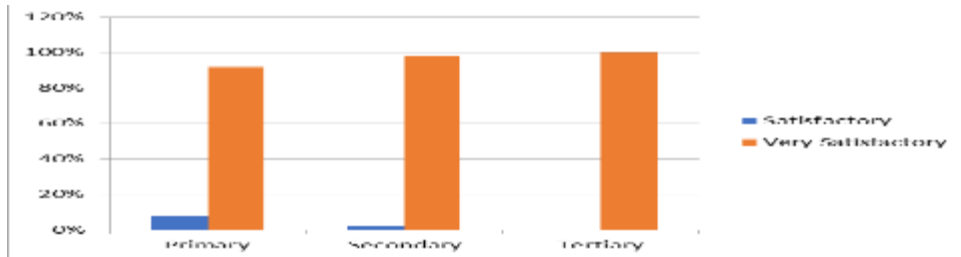


Figure 1: Satisfaction with their perceived sense of preparedness for the job

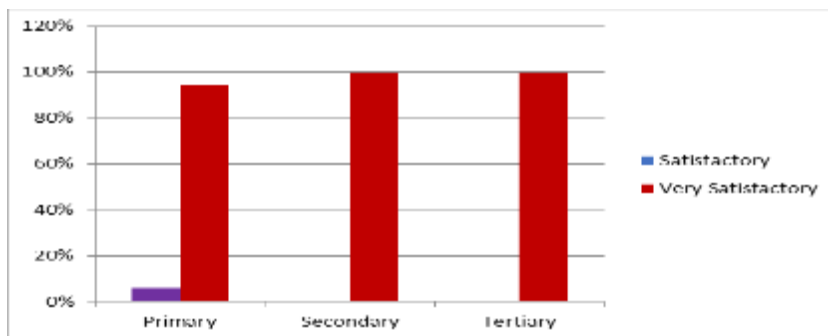


Figure 2: Satisfaction with the requirements for the job

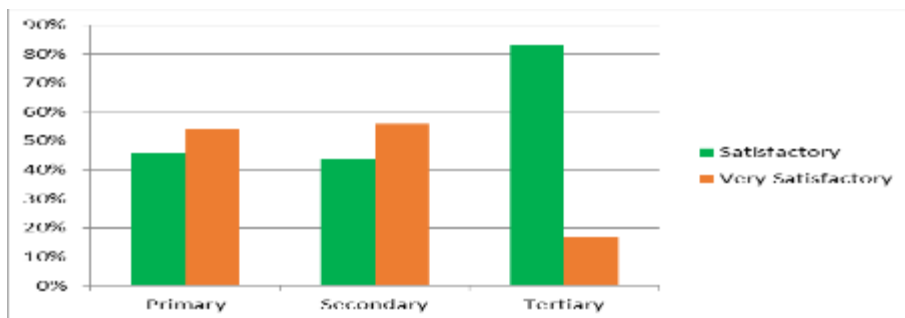


Figure 3: Satisfaction with the support systems required to do the job

Using Social Network Sites in English Language Learning: Voices from Indonesian Higher Education Students

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Abstract

The purpose of this qualitative study was to investigate the Indonesian EFL students' practices on using Social Networking Sites (SNS) and understand their experiences with SNSs as a tool for English language learning. The study used a qualitative case study. Forty-four participants were purposefully recruited and interviewed during the qualitative phase of data gatherings in order to further explain the qualitative results, develop a richly descriptive picture of their lived experiences utilizing social networking to enhance their English language learning, and identify the benefits of using SNSs. The report claims that students prefer to learn English through social networking sites. According to the interview, the majority of participants felt comfortable using YouTube, Instagram, and Facebook for English language acquisition. However, the participants found disadvantages of using the SNSs. Furthermore, they were more interested in viewing other people's items than in having participated in a discussion or producing linguistic output. The findings also revealed that learners' practices or behaviours in the SNS environment varied depending on variables such as situation, community, and the students' interests and needs.

Keywords: EFL students, English learning, Indonesia, social networking sites

Introduction

As forums for language-learning development, social networking sites have quickly gained significance. Different social networking platforms emphasize different sorts of learning. They are *Busuu*, whose websites facilitate intercultural contact among their users. Using autoethnographic records and multimodal semiotic analysis of the website, Alvarez-Valencia (2016), in analysing the social networking sites for language learning (SNSLL) *Busuu*, demonstrates that its contents and learning activities are informed by different views of language (structural, interactional, and ecological) and learning (behavioural, cognitive, and constructivist) In formal education, there are common interest networking sites such as Live Mocha. According to Brick's (2011) research, SNSLLs provide benefits such as the chance to practice oral skills with native speakers of various languages and to receive immediate feedback. Due to its heavy emphasis on vocabulary and the unfavourable interactional dynamics generated by cyber-flirting behaviours within the online community, Live mocha's learning materials were nevertheless limited.

The hegemony of these trimming technology in society is altering our way of life. The most popular emerging technology is Web 2.0. Blogs, wikis, media sharing (*YouTube, Flickr, etc.*), bookmarking services, and social networks are examples of these technologies. Because adults, particularly students, have integrated this technology into their daily lives, educators worldwide are paying attention to it (Kale & Goh, 2014). Social networking sites (SNS), which are defined as sites that build and maintain relationships with other people, are one of the most popular Web 2.0 tools. Students and teachers use these websites widely worldwide. Although social networking sites are primarily used for social interaction, their structure and various features allow them to be used for various other purposes, including education.

To incorporate social networks into the teaching-learning process, it is crucial to understand the current use of SNS, as well as the experiences and attitudes of students regarding its instructional use. In the Indonesian context, such information has not been documented in the literature. Consequently, the current study evaluates the experiences and attitudes of Indonesian higher education students using specialized SNS for collaborative learning activities outside the classroom. This finding of this study will assist designers, researchers, and educators in comprehending the present use and acceptance rate of SNSs among students, hence facilitating the development of action plans for the use of such technologies in educational contexts.

Method

The study was participated by 29 female students and 17 male students, ageing from 18-20 years old. A synchronous web-based written interview study was used for this study to investigate a detailed and in-depth analysis of the use of social networking sites in English language learning by students of the English Study Program in Indonesia. Because it was impossible to meet for face-to-face interviews with research participants during the pandemic, an online interview was conducted using Google Docs (Opara, Spangsdorf, & Ryan, 2021). It also allows access to 'hard to reach' groups and individuals due to geography (Madge and O'Connor, 2002), as the participants were drawn from five Indonesian universities. This current study included 46 volunteers from the fourth semester of the English Study Program.

The student participants visited the social networking sites on average seven days a week. When they visited the website, they stayed on the site for approximately more than one hour. The average time of visiting the SNS was 5 to 10 times a day, and the student participants visited the SNS almost every day, seven days a week.

This current study adopted a qualitative study to interpret and refine data. Integrating both types of data could provide a deeper understanding of the research problem and answer the research question: "How do Social Network Sites/SNS(s) practices affect English language learning experiences of Indonesian higher education students?"

The qualitative data were collected through in-depth interviews with 46 undergraduate EFL learners. They were identified by *STD 1, STD 2, STD 3, STD 4, STD 5, STD 6, STD 7, STD 8, STD 9, STD 10, STD 11, STD 12, STD 13, STD 14, STD 15, STD 16, STD 17, STD 18, STD 19, STD 20, STD 21, STD 22, STD 23, STD 24, STD 25, STD 26, STD 27, STD 28, STD 29, STD 30, STD 31, STD 32, STD 33, STD 34, STD 35, STD 36, STD 37, STD 38, STD 39, STD 40, STD 41, STD 42, STD 43, STD 44, STD 45, STD 46*. The analysis of the open-ended questionnaire transcripts identified four main themes:

- SNS(s) provide convenience and comfort
- SNS(s) provide easiness to learn English language;
- SNS(s) supports social interaction and collaboration among EFL learners
- SNS(s) is helpful and useful to learn English language

Findings and Discussions

Findings from the analysis are detailed into four themes: 1) SNS(s) provide convenience and comfort, 2) SNS(s) provide easiness to learn English language, 3) SNS(s) supports social interaction and collaboration among EFL learners, and 4) SNS(s) are helpful and useful to learn English language.

SNS(s) provide convenience and comfort

The participants shared that they encountered convenience and comfort in enacting SNS(s) for learning English. It is depicted in the interview with STD 14 and STD 10:

SNS(s) give us much more affordable freedom, and the ability to find the right online English course for you without the expense of travel and accommodation. Studying online also saves you from having to take time out of your busy life to commit to a class timetable (STD 14, Male, May 25th, 2022).

I can learn through social network sites anytime and anywhere depending on that I want (STD 10, Male, May 24th, 2022).

SNS(s) provide easiness to learn English language

All 46 students indicated that SNS(s) give them easiness to learn English language. This idea is seen in the interview with STD 19 and STD 9:

It's easier to find knowledge about it (STD 19, Male, May 24th, 2022).

I like to learn English through social networking sites because it really interesting thing and easy for me to understand with the entertainment and fun tools (STD 9, May 24th, 2022)

SNS(s) supports social interaction and collaboration among EFL learners

In light of other findings, in this case, the participants contend that they experienced interactions and collaboration with other EFL learners when using SNS(s). It is depicted in the interview:

We can learn English through social network sites, which is very useful and we can get friend with a stranger and make relationships as a friend (STD 17, Female, May 24th, 2022)

SNS(s) are helpful and useful to learn English language

In the interview with STD 44, SNS(s) was said to be useful and helpful in terms of developing participants' English skill. This is shared in the interview as follows:

I really like to learn English through social network sites because they are easily accessed, and I can learn from various platforms. Those social networking sites such as Facebook, Instagram, YouTube, and others really helped in developing my English skills, which I am capable of learning how to easily pronounce English words from English accents. Various idioms and up-to-date English words are provided on those social network sites because most people are super creative to create English learning activities through videos well. Therefore, social networking sites are useful for all English learners to expand their own English knowledge, which the learning process is fun and easily caught up (STD 44, Male, May 30th, 2022)

Conclusions

According to the Harpercollins website (2010), 375 million people worldwide aspire to study a language, and the market is currently projected to be worth more than \$80 billion. Given this enormous demand, it is probable that SNSs for language learning will expand in size and number in the near future, as well as spread onto new platforms as smartphones become more advanced.

Regarding the data and discussion of this study, it can be argued that Instagram, YouTube, and Facebook are often used by students for English language learning. Instagram is the social network most frequently utilized by students learning English. In Indonesian colleges, students use social networking sites to learn English when they have free time at home or when their professors permit it, particularly for group discussions. Students' English skills are enhanced by the site's material, which is more diverse and thus stimulates their use of social network sites for language learning.

In addition, the positive effects of social media on the English language acquisition of students should be recognized. In the context of English as a foreign language (EFL) university student, the integration of social media must be considered in order to improve the students' language skills through the use of relevant social media in English language teaching and learning.

Acknowledgments

The authors would like to thank Indonesian Ministry of Education and Culture for financial support on this current study.

References

- Alvarez-Valencia, J. A. 2016. Language views on social networking sites for language learning: The case of Busuu. *Computer Assisted Language Learning*, 29(5), 853–867. <https://doi.org/10.1080/09588221.2015.1069361>
- Brick, B. 2011. How effective are web 2.0 language learning sites in facilitating language learning? *Compass. Journal of Learning and Teaching*, 2(3), 57–63. <https://doi.org/10.21100/compass.v2i3.48>
- Kale, U., & Goh, D. 2014. Teaching style, ICT experience and teachers' attitudes toward teaching with Web 2.0. *Education and Information Technologies*, 19(1), 41–60. <https://doi.org/10.1007/s10639-012-9210-3>
- Madge, C., & O'Connor, H. 2002. Online with e-mums: exploring the Internet as a medium for research. *Area*, 34(1), 92–102. <https://www.jstor.org/stable/20004209>
- Opara, V., Spangsdorf, S., & Ryan, M. K. 2021. Reflecting on the use of Google Docs for online interviews: Innovation in qualitative data collection. *Qualitative Research*. <https://doi.org/10.1177%2F14687941211045192>

Mental Health and Psychological Wellbeing in the Hungarian Higher Education in Economy

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Abstract

In our study we focus on the mental health of first-year students in higher education in economics, which is a relevant topic worldwide and also in Hungary. University is the gateway to a new world for the 18-20-year-old students: many of them consider the successful admission and the start of their university studies as one of the most important moments in their lives. Young people leaving secondary school enter a new phase in their lives. It is also an important stage in the journey to adulthood, which is not experienced in the same way by all young people. The process of becoming independent from the family will accelerate and an independent self-image will emerge. The familiar friends and peers from secondary school no longer provide security: new relationships and alliances are formed in a new, unfamiliar environment, and a new way of life becomes dominant.

In our study, we present the situation of Hungarian higher education in the field of economics, and then based on literature sources we identify the most important characteristics of the age group under study.

Having university websites analysed, we explore the network of mental health, life management and psychological counselling services in Hungarian higher education institutions and also introduce the programmes they offer to support students' mental health.

Keywords: *Mental health, Hungarian higher education in economy, Life management and psychological counselling services, Emerging adulthood*

1. Introduction

University years can be extremely busy and demanding for students in general. They spend almost half of their waking hours studying and preparing. In addition, the most motivated students participate in scientific student conferences, national and international competitions and extend their professional experience.

Therefore, the time spent at university has an impact not only on the students' knowledge and competences, but it also has a significant one on their self-esteem and self-image. From a different perspective, this influences their life satisfaction and happiness which, in turn, can have a great influence on how their lives develop later.

In 2019 The COVID-19 epidemic turned life upside down in all walks of life including education. Online and then hybrid education started, making universities face a new challenge. This study though does not examine the effects of the COVID-19 epidemic in detail due to space limitations, but only draws some conclusions about the mental health counselling provided by universities.

This paper presents the preliminary results of a comprehensive study at higher educational institutions which offer business education.

2. Literature Review

2.1. Presentation of students at higher education institutions of economics

In order to get a full picture of whom universities provide mental health and life skills counselling to, it is important to briefly describe the current generation of university students, the so-called Generation Z. In public discourse, it is if often heard: ‘The youth of today...’ or ‘Back in my time...’ This might lead us to think that the generation of university students is a very problematic age group. But this is not a new perception among older generations. Socrates wrote as early as the fifth century BC (quoted in Thuma 2016): ‘Our youth [...] is ill-bred, disdainful of authority and shows no respect for the elderly. Nowadays our sons [...] do not stand up when an elderly person enters the room, they talk back to their parents and chatter instead of working. They're just insufferable.’

Researchers define the different generations by the date of birth. Generations change every 15-20 years. People belonging to the same generation own the very same characteristics: they are at a similar stage in life; they have been exposed to the same events and have developed a different set of values from other generations. (Mannheim, 1969, Tari, 2010, Tari, 2011, Thuma, 2016, Szabó-Szentgróti et al., 2019)

Generation Z is the most relevant generation for this study and will be discussed more detailed below. As we are already used to it, researchers are at the forefront of using new concepts. Some call them the net generation (Oblinger and Oblinger, 2005), others the Facebook generation or digital natives (Prensky, 2001).

Generation Z is also discussed by several authors (Pais, 2013, Thuma, 2016, Tari, 2011). Their most prominent findings are as follows:

- Personal freedom is very important to them.
- Their social life is constantly shared with the public.
- Their social life is constantly shared with their peers.
- They live at a much faster pace than their predecessors.
- They are not afraid of change because they are used to it, they are born into it.
- They are less loyal consumers.
- They trust themselves rather than the world around them.
- They are clever rather than wise.
- Less willing to follow rules.
- They live their lives mainly on Google, Facebook, YouTube, Wikipedia.
- Compared to previous generations, they live in families where:
 - the parents are rather old,
 - divorce rates are the highest,
 - the fewest siblings are.

After a general overview of the characteristics of Generation Z, let us briefly look at the most important features of university students’ new life situations.

For first-year students, university is the gateway to a new world: many of them see the successful admission and the start of their university studies as one of the most defining moments of their lives. Young

people leaving secondary school enter a new phase in their lives. This is also an important stage in the journey to adulthood, which is not experienced in the same way by all young people. As with all life transitions, the period after leaving secondary school can be a time of crisis (Peter Pan syndrome, also known as the quarter-life crisis).

Generally speaking, the process of becoming independent from the family is accelerated and an independent self-image is formed. Friends and peers from secondary school no longer provide security: new relationships and alliances are formed in a new, unfamiliar environment, and a new way of life becomes dominant (Tari, 2011, Nagyné Kricsfalussy, 2017, Leist Balogh and Jámbori, 2016).

Some people become anxious in unfamiliar surroundings, unable to cope with the seemingly limitless freedom. They feel lost in the vast organisation. The transparent and manageable classroom community is replaced by immense classes.

University lecturers no longer know the students personally, teaching becomes impersonal and difficult to bear. During a semester a lecturer meets hundreds, sometimes thousands of students, so the time spent on a student is reduced to a minimum.

During lectures, exams and at student services, students are no longer registered by name but by their Neptun code. They become a tiny screw in the vast university machine (Vasa et al., 2014, Kárpáti-Daróczi and Karlovitz, 2020).

For higher education in business, the number of state-funded places has fallen remarkably, so a significant proportion of students have to find the resources to support themselves while studying. Consequently, there will be new entrants to higher education and to the labour market at the same time, so these students will have to perform well in both areas simultaneously. This could again create a serious crisis for young people. I have already mentioned above the gate-opening crisis, which can start at this stage of life causing a serious crisis for students. The many changes, the need to fit into many places at the same time, the start of independent life all coinciding, can cause considerable amount of anxiety for young people, who mostly start their independent lives at this point.

It's often heard from students: will my life always be like this from now on? Study, work and work again?

The realisation can come as a huge shock to a young person. It can be compounded by a failure to perform at the level expected of themselves at university and in the world of work. This can be a strait path to youth burnout.

If it happens, young people will not find their place either at university or at work. In such cases, for example, students may leave university and completely change their lives, often to the dismay of those around them. Some students flee abroad to start a 'new and better life', others try their luck in a completely different field.

For some young people another mental burden is that university life is accompanied by an infinite sense of freedom. Unlike in secondary education there are no strict obligations during the academic year. There are no assignments, and lectures are not obligatory. This can be an intoxicating experience for them at first with the added lack of parental control and the ecstasy of endless parties.

In this case, a new problem, the question of addictions may arise: alcohol and drugs to relax and pills to get through the day or prepare for exams. The majority of students successfully complete university and a well-established mental health and life skills counselling system can effectively support this (Vágány, 2021).

3. Methods

The Hungarian Government Decree No 51/2007 (26.III.) defines the student allowances provided by the state budget. This includes mental health and guidance counselling (Article 10(6)(a)). The Regulation therefore requires universities to provide some level of guidance, mental health or psychological counselling.

Before conducting the research, nine support professionals (psychologists, mental health professionals) from higher education institutions in the field of business education were interviewed. We concluded that higher education institutions differ greatly how their mental health and life coaching is supported on their premises.

Based on the interviews, we found that there are institutions where a complete network of support for students and staff was established. Other institutions provided only the mandatory minimum service for their students.

Following the interviews, the websites of seventeen higher education institutions in the field of business education were studied to find out what information was available regarding life coaching, mental health or psychological counselling activities offered by the institutions.

First, we listed the higher education institutions offering business education from the homepage of felvi.hu.

Subsequently, a targeted search and content analysis was carried out on the websites of the selected institutions. We examined the information available under the headings 'life guidance', 'psychological counselling' and 'mental health counselling'. Where information was not readily available on the website, a Google search was conducted to see if there were any results for the higher education institution and the three terms.

The results and the information obtained were summarized in an excel sheet to provide information on available options concerning solutions to students' mental health problems or improve their mental health, according to the information on the institutions' websites. The first research was carried out between 1 February and 31 March 2020 and the second one between 1 February and 31 March 2022. In addition, the mental health professionals or psychologists listed on the websites of the same seventeen universities were asked nine written questions about specific activities at those institution (these questions were answered during the first research period). The results of these surveys are presented in this study.

According to the latest Hungarian statistics higher education in business is the most popular among applicants. For the academic year starting in September 2022 the most popular fields of study by choice are: economics (22%), humanities (12%), engineering (11%), teacher training (9%), medicine and health (9%), computer science (8%). (felvi.hu, 2022)

4. Results

The selected institutions differ in size, their training offered, location or the number of students, but they all have training in economic.

It was assumed that the historic universities of sciences, which have a varied and multidisciplinary training structure and also offer training in 'humanities' (teacher training, psychology, etc.), would pay particular attention to life coaching, mental health or psychological counselling. We hypothesized, that the above would be also highlighted on their websites.

Content analysis was carried out during the research. The data was collected in an Excel spreadsheet. A substantial extract of this spreadsheet is presented in text form below. Results regarding the two research phases are presented jointly.

4.1. Departments providing life coaching, mental health and psychological counselling

The majority of the higher educational institutions surveyed provide counselling services within the framework of Career Offices, Student Counselling Centres, Student Services or Life Skills Counselling Centres.

4.2. Number of helpers or advisers listed on the website

University websites listed the names of 1-4 counsellors (mainly psychologists). However, some refreshing exceptions were noted. In cases where psychological, mental health or life guidance counselling was provided by the Student Counselling Centres, the names of peer student counsellors were also listed on the website.

Based on the interviews with the helpers and the responses from the professionals who answered the written questions sent to the addresses on the websites, it can be concluded that the student counsellors are extremely overworked. There is a significant demand from students for support and life coaching. Thus, the number of students per advisor is high. The average session time per student is 45-50 minutes.

Some universities also offer training for psychologists. In these cases, psychology students are also involved in counselling, taking a significant burden off an overloaded care system and the obvious differences are well-reflected on their websites.

4.3. Tasks completed, problems addressed, and skills developed

The most significant difference between universities is in the activities and services provided. Let us look at some good examples.

- Free psychological and mental health counselling for university staff as well as for students
- Free group sessions in Hungarian and English for students and staff: e.g. 10 and 12 weeks of autogenic training
- Development of self-awareness or other social skills in small groups of 8-15 people. Some universities work with larger groups up to 25 people.
- Self-help modules: students can get feedback on their current situation and possible difficulties after completing a symptom-assessment questionnaire on a specific topic. In addition, they can also read various life coaching tips regarding each topic which will help them in skills and self-awareness.
- Online counselling and Skype consultations when meetings in person are not possible, for example when students study abroad.
- Since January 2018 one of the universities in Budapest, counselling has been provided via consultation system of six sessions. This is considered to be the most appropriate in the given context, taking the high level of interest into account. For the client this consultation means a commitment of about one and a half month. However, it is pointed out that cancellations can set the consultation process back and slows down the management of waiting lists, causing other students in need of help to get later appointments. Therefore, they urge everyone to apply for counselling only if they can commit to attending weekly consultations!
- This consultation system is in practice at several universities.

Generally speaking, the information on the websites suggests that individual preferences (a one-to-one or group situation) should be taken into account.

Individual counselling is generally recommended when a problem needs to be explored in greater depth (e.g. dealing with a loss).

Group counselling is useful if students rather wished get feedback from peers or observe peers' behaviour to help them solve their own problem (e.g. developing assertiveness).

Several universities point out that life coaching is not therapy.

4.4. Problem solving, life coaching

Problem-solving and life coaching at universities focus mainly on the following areas:

- Doubts about their chosen career
- Adjustment difficulties
- Difficulties in fitting in
- Illness
- Family and relationship problems
- Depression
- Decision-making difficulties
- Blockages
- Life planning issues
- Difficulties with emotions and emotion regulation
- Unresolved events
- ‘Strange habits’ that cannot be broken,
- Mood disorders
- Homesickness
- Identity problem
- Relationship formation problems
- Gate-opening panic
- Coping with critical life situations
- Dealing with mental, personal or university-related problems
- Coping problems
- Lack of motivation
- Conflicts at work
- Superficial relationships due to language difficulties
- Self-esteem problems
- Suicidal thoughts
- Fear of something that is indifferent to others,
- Substance abuse issues
- Anxiety problems
- Persistent depression
- Dealing with loss
- Behavioural disorders (eating, sleeping or sexuality)
- Loneliness
- Crises
- Grief
- Quarantine lifestyle
- Cyber relationships
- Emotional and physical abuse
- Zoom fatigue²

4.5. Organised programmes

Universities organise varied programmes for their students. They offer a wide range of programmes, including skills trainings, group activities and educational lectures. Here are some of the programmes offered by universities.

² The term refers to the exhaustion caused by spending excessive amount of time in front of a screen participating in online meetings. According to the authors (Peper, et al., 2021), the lack of facial expressions and physical feedback is also a major contributor to Zoom fatigue.

4.5.1. Skills development trainings

- Assertiveness training
- Emotional intelligence training
- Time management training
- Communication development workshops
- MBTI based self-awareness training
- Self-awareness issues in career planning
- Self-awareness training along behavioural types
- Presentation workshops
- Resilience training
- Stress management training
- Learning support training
- Leadership skills training

4.5.2. Group sessions

- Identity and ConnAct board games
- Relationship focus group
- Self-awareness, social skills group
- Psychodrama group
- Loss and Grief Support Group
- Studying during an epidemic
- Quarantine lifestyle advice

4.5.3. Educational lectures

- ‘Am I using you or are you using me?’ - lecture on mobile addiction
- Financial awareness in everyday life
- ‘Can I get my mother to be climate conscious? - The family slip-ups of a lifestyle change’
- Environmental awareness - dilemmas in environmental psychology

4.5.4. Other programmes

- Mental Health Film Club
- Mental Health Café

4.5.5. Book recommendations

Books on problem solving and life skills regarding the topics listed in chapter 4.4.

5. Conclusions

Universities are advised to pay increasing attention to students' mental health in the future. A large body of research shows that high performance is associated with high mental health indicators not only in sport, but also in learning and at work (Reinhardt et al, 2019).

The research findings demonstrate that universities have very distinct mental health and life skills advisory networks and treat the issue of mental health of students and faculty members very differently. It is certainly fortunate that general well-being and raising awareness are in focus (Boda, 2021). Increasing competition in higher education and the changing environment make it clear that the mental health protection and the psychological well-being of students and staff will be essential to ensuring long-term satisfaction.

Acknowledgments

The authors would like to thank the National Research, Development and Innovation Office (Hungary) for their support (MEC_R 141087).

Reference List

- 51/2007. (III. 26.) Korm. rendelet a felsőoktatásban részt vevő hallgatók juttatásairól és az általuk fizetendő egyes térítésekről
- Boda T. 2021. Szemléletváltás a felsőoktatásban: az általános jólét vizsgálata a Neumann János Egyetem Pedagógusképző Kar hallgatói körében. *Gradus*. 58-64, <https://doi.org/10.47833/2021.1.ART.002>
- Budavári-Takács I. 2011. Karriertervezés, Digitális tankönyvtár, https://regi.tankonyvtar.hu/hu/tartalom/tamop412A/2010-0019_Karriertervezes/ch06.html Accessed 21 February 2022.
- felvi.hu, 2022. Csaknem százezren jelentkeztek a felsőoktatásba. https://www.felvi.hu/felveteli/ponthatarok_statistikak/jelentkezo_es_felvettek/22A_jelentkezo
- Kárpáti-Daróczi, J. and Karlovitz, J. T. 2020. Vállalkozói kompetenciák komparatív vizsgálata albán és magyar közgazdász hallgatók között. *Multidiszciplináris kihívások, sokszínű válaszok - Gazdálkodás- és Szervezéstudományi folyóirat*, (1), 45-60. <https://doi.org/10.33565/MKSV.2020.01.04>
- Kiss I. 2009. Életvezetési kompetencia - Észlelt életvezetési én-hatékonyság mintázat elemzése tanácsadási szolgáltatásokat igénybe vevő felsőoktatási hallgatók mintáján, PhD Dissertation, https://ppk.elte.hu/file/kissistvn_tf_h.pdf Accessed 2 March 2022.
- Leist Balogh B. and Jámboři Sz. 2016. A kapunyitási pánik vizsgálata a megküzdési módok és a szorongásfüggvényében. *Alkalmazott Pszichológia* 2016, 16(2) 69–90. http://ap.elte.hu/wp-content/uploads/2016/10/AP_2016_2_Leist-Balogh_Jambori.pdf
- Mannheim, K. 1969. A nemzedéki probléma. *Ifjúságszociológia*. Budapest
- Maramba D. C. and Kodama C.M. ed. 2017. *Brigding Research and Practice to Support Asian American Students*, Wiley Periodical, <https://tinyurl.hu/ezuR/> Accessed: 17 January 2020.
- Nagyné Kricsfalussy A. 2017. Pán Péterek? – avagy létezik-e a kapunyitási pánik a szakképzésből kikerülő fiataloknál? *Különleges Bánásmód*. (3) 2017/2. 39-62.
- Oblinger D. and Oblinger J. 2005. Is It Age or IT: First Steps Toward Understanding the Net Generation In: Oblinger D. – Oblinger J. (ed.): *Educating the Net Generation*, Washington D.C.: EDUCAUSE <https://www.educause.edu/ir/library/PDF/pub7101.PDF> Accessed 25 April 2022.
- Pais E. R. 2013. Alapvetések a Z generáció tudománykommunikációjához. Tanulmány. Pécsi Tudományegyetem. https://ktk.pte.hu/sites/ktk.pte.hu/files/images/szervezet/intezetek/mti/pais_alapvetesek_a_z_generacio_tudomany-kommunikaciojahoz_-_tanulmany_2013.pdf Accessed 21 January 2020.
- Peper, E. & Wilson, V. & Martin, M. & Rosegard, E. & Harvey, R., 2021. Avoid Zoom fatigue, be present and learn. *NeuroRegulation*. [e-folyóirat] 8(1), pp. 47–56. <https://doi.org/10.15540/nr.8.1.47>
- Prensky M. 2001. *Digital Natives, Digital Immigrants*. MCB University Press, 2001/ 5. szám. <https://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf> Accessed 12 March 2020.

- Reinhardt M., Tóth L. and Rice K. R. 2019. Perfekcionista csoportok pozitív mentális egészsége – A perfekcionizmus, az érzelmszabályozás és a szubjektív jóllét mintázódása fiatal élsportolók körében. *Magyar Pszichológiai Szemle*, 2019, 74.3/3. 301–325, <https://doi.org/10.1556/0016.2019.74.3.3>
- Szabó-Szentgróti G., Gelencsér M., Szabó-Szentgróti E. and Berke Sz. 2019. Generációs hatás a munkahelyi konfliktusokban. *Vezetéstudomány*, 2019/4. szám 77-88 <https://doi.org/10.14267/VEZTUD.2019.04.08>
- Tari A. 2010. Y generáció: Klinikai pszichológiai jelenségek és társadalomlélektani összefüggések az információs korban. Budapest: Jaffa Kiadó.
- Tari A. 2011. Z generáció. Budapest: Tercium Kiadó.
- Thuma O. 2016. Generációs különbségek a munka és az iskola világában. In: Fenyvesi É. – Vágány J. (ed): *Korkép*. Budapest: BGE 213-232 <https://tinyurl.hu/Nlgh/> Accessed 23 May 2022.
- Vágány J. B. 2021. Gazdasági felsőoktatási intézményekben tanuló hallgatók pszichológiai jóllétének vizsgálata egy kérdőíves kutatás tükrében. *Multidiszciplináris kihívások, sokszínű válaszok - Gazdálkodás- és Szervezéstudományi folyóirat* (1), 135-162. <https://doi.org/10.33565/MKSV.2021.01.06>
- Vágány J. B. 2021. Pillanatkép a gazdasági felsőoktatás intézményi mentálhigiénés támogatórendszeréről, *GRADUS*, 8 (2). pp. 94-101. <https://doi.org/10.47833/2021.2.ART.002>
- Vasa, L., Spaller, E. and Tömböly, T. 2014. Felsőoktatási innovációs kihívások, In: Tompos, Anikó; Ablonczyné, Mihályka Livia (szerk.): *A tudomány és a gyakorlat találkozása: Kautz Gyula Emlékkonferencia 2014. június 17.*
- Wang V. C. X. (2015) *Handbook of Research on Learning Outcomes and Opportunities in the Digital Age*, IGI Global, <https://tinyurl.hu/6vyi/> Accessed 1 March 2022.

Efficiency of Secondary Level Schools by ICT Intervention in Bangladesh: An Estimation using Stochastic Frontier Analysis

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Abstract

The main objective is to develop an appropriate stochastic frontier secondary schools efficiency model by ICT Intervention and to analyze the effect of ICT challenges on secondary schools efficiency of Dhaka division in Bangladesh using stochastic frontier analysis. Translog stochastic frontier model was found an appropriate than Cobb-Douglas model in secondary schools' efficiency by ICT Intervention. From the results of Cobb-Douglas model, the coefficient of the number of teachers, the number of students and teaching ability of the teachers were found positive and straight causal factor to change the level of efficiency. The online class in school played significant role in increasing the school efficiency. In Translog model, the coefficient of classrooms has positive and significant effect in the secondary school efficiency. The coefficient of the interaction effects of the number of students and teaching ability of the teachers were observed positively significant and this has positive impact to increase the secondary school efficiency. The coefficients of teacher's preference ICT tool like multimedia projector used always, often, sometimes, rarely and never in teaching and learning were found negative and significant which indicated that multimedia projector played significantly contributor role in decreasing the secondary school inefficiency. The average secondary school efficiency of Dhaka division for Cobb-Douglas model was 0.9350 while it was found 0.9337 for Translog model. It is expected that the developed model for secondary schools efficiency and the deficiency of knowledge regarding teaching-learning method with the ICT integration would be useful in Bangladesh.

Keywords: *Efficiency, Secondary Schools, ICT, Stochastic Frontier Analysis, Tobit regression.*

Introduction

Education is the mainstay of a state and it is a crucial component to guarantee the improvement of a state (Katitia, 2015). The value of prime education at the secondary level is an indispensable implement for the expedited economical improvement of Bangladesh. How to guarantee comprehensive and prime education for all and advance acquisition has been enclosed in the Sustainable Development Goals (SDGs-4), 2030. Schools are expected to gear up students to live in "a knowledge society" essential to see Information Communication Technology (ICT) consolidation in their course of study (Ghavifekr & Rosdy, 2015). In concurrence with gear up students for the actual digital era, teachers are the persons in their everyday classrooms through ICT. This is to guarantee that subjective teachers are well entree to ICT instrument whenever required (Hennessy, Ruthven, & Brindley, 2005). Want of capable ICT instrumentation and internet entree is the main difficulty that schools generally are lining now in rural areas. Former researchers established that usage of ICT in teaching heightened the basic cognitive process and upgrades the students' quality in progressive learning (Jamieson-Procter et al., 2013). Hermans, Tondeur, Van-Braak, & Valcke (2008) and traced three principal phases for ICT to be extremely valuable and respected by the teachers: group action, improvement and additive. Start out with policy, followed by the

ICT hardware and software facilities, the teachers should have preparedness and accomplishment to incorporate it into pedagogical procedure (Agbatogun, 2012). This is a motive to analyze the role of ICT in boost an synergistic acquisition situation. However, there is considerably less research which centered the role of ICT and boost a more synergistic learning situation, as portion of teaching and learning.

The technical efficiency of schools studies have been conducted by many researchers. The study by Sengupta & Sfeir (1986) made an fascinating opening constituent for the study of efficiency measuring in education and in the following year he ended that this method seemed to be more steady than non-frontier methods. The increasing involvement in measuring the efficiency level of students' acquisition, of the accomplishment acquired and of the power to usage of ICT in everyday life and in the work (Hanushek and Woessmann, 2010). Chakraborty (2009) deliberated the efficiency of public education using a SFA and he estimated both the educational production and the inefficiency effect related to the socio-economic and environmental components. Scippacerola & D'ambra (2014) adopted SFA in Campania to measure the school relative and the factors affecting efficiency by adopting both SFA and Tobit regression. The studies of the impact of ICT and it's barriers in education of Bangladesh is not very common (for example, Ali, 2015; Khan, Hassan, & Clement, 2012; Khan, Hadi, & Ashraf, 2013; Most, 2015; Rahman, 2015) and the efficiency studies of both urban and rural secondary schools are very rare. Following this literature, it is intended to develop an appropriate stochastic frontier secondary school's efficiency model by ICT Intervention and to find the responsible factors for secondary school inefficiency in Dhaka division that could be a substance of information for the policymaker of Bangladesh. Any unsolved problem in ICT integration may result in current gap between teachers and students; this will make a deep economical and social difference for the country. So, it is important to examine the impact of ICT and measure how teachers perceive ICT innovation and its effectiveness in teaching-learning process.

Method and Materials

The quantitative data were collected from both urban and rural secondary schools of Dhaka division in Bangladesh through questionnaire on the use of ICT and preference, teachers' qualification, teachers' knowledge of ICT by gender, experience regarding the ICT application etc. The study sites is the Dhaka division, the working capital city of Bangladesh. It has a boundary line with every other division except Rangpur Division. It is delimited by Mymensingh Division to the north, Barisal Division to the south, Chittagong Division to the east and south-east, Sylhet Division to the north-east, and Rajshahi Division to the west and Khulna Divisions to the south-west. Dhaka district whose area is 1497.17 sq km, placed in between 23°53' and 24°06' north latitudes and in between 90°01' and 90°37' east longitudes.

Sampling Design: Three districts namely Dhaka, Gazipur and Narayanganj were selected randomly from thirteen districts of Dhaka division in Bangladesh. Both urban and rural secondary schools (12) were selected from the selected districts of Dhaka division. The questionnaire in size of 240 were distributed to different stakeholders like non-trained teachers, trained teachers, head teachers and students over the 12 secondary schools. The secondary schools were selected based on both urban and rural context, and the questionnaires apportioned are not tantamount in numbers where teachers from urban secondary schools influence the total population rather than the teachers from rural secondary schools.

Empirical Translog Stochastic Frontier Secondary School Model

The formulation of Translog stochastic frontier secondary school model for Dhaka division is given by

$$\begin{aligned} \ln(Y_i) = & \beta_0 + \beta_1 \ln(X_{1i}) + \beta_2 \ln(X_{2i}) + \beta_3 \ln(X_{3i}) + \beta_4 \ln(X_{4i}) \\ & + \frac{1}{2} [\beta_{11} \ln(X_{1i}^2) + \beta_{22} \ln(X_{2i}^2) + \beta_{33} \ln(X_{3i}^2) + \beta_{44} \ln(X_{4i}^2)] \\ & + \beta_{12} \ln(X_{1i}) * \ln(X_{2i}) + \beta_{13} \ln(X_{1i}) * \ln(X_{3i}) + \beta_{14} \ln(X_{1i}) * \ln(X_{4i}) \\ & + \beta_{23} \ln(X_{2i}) * \ln(X_{3i}) + \beta_{24} \ln(X_{2i}) * \ln(X_{4i}) + \beta_{34} \ln(X_{3i}) * \ln(X_{4i}) + V_i - U_i \quad (1) \end{aligned}$$

where, \ln = Natural logarithm; Y_i = the percentage of the students passed in SSC in i-th secondary school; X_{1i} = the number of teachers in i-th secondary school; X_{2i} = the number of students in i-th secondary school; X_{3i} = the number of class rooms in i-th secondary school; X_{4i} = teaching ability of the teachers in i-th secondary school; β_i = The unknown parameters ($i=1,2,3,4$) to be estimated. The error factor V_i , which is assumptive to be independently and identically distributed as $V_i \sim NID(0, \sigma_v^2)$ independent of U_i which measure the technical efficiency related to stochastic term.

Empirical Technical Inefficiency Effect Model for Dhaka Division

The formulation of the technical inefficiency effects model U_i for Dhaka division is defined as

$$U_i = \delta_0 + \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \delta_4 Z_{4i} + \delta_5 Z_{5i} + \delta_6 Z_{6i} + \delta_7 Z_{7i} + W_i \quad (2)$$

where U_i 's are non-negative and inefficiency terms, assumed to be independently truncated normally distributed with mean zero and variance, σ_i^2 such that Z_{1i} is the ICT lab; Z_{2i} is the online class; Z_{3i} is the multimedia project used always i-th secondary school; Z_{4i} is the multimedia project used often; Z_{5i} is the multimedia project used sometimes; Z_{6i} is the multimedia project used rarely; Z_{7i} is the multimedia project used never, $\delta_0, \delta_1, \delta_2, \delta_3, \delta_4, \delta_5, \delta_6$, and δ_7 are the parameters to be estimated. W_i is the disturbance terms, assumed to be truncated normally and independently distributed with mean zero and variance, σ_i^2 . The variance parameters are uttered in terms of $\sigma^2 = \sigma_v^2 + \sigma_u^2$, $\gamma = \frac{\sigma_u^2}{\sigma^2}$, γ is the ratio of variance of education outcome specific efficiency to the total variance of output and the value is bounded [0, 1].

Likelihood Ratio Test for an Appropriate Model for Dhaka Division

The likelihood ratio test assist to find out whether Cobb-Douglas or Translog model is better or not. It is measured as follows:

$$\lambda = -2\{\ln[L(H_0)] - \ln[L(H_1)]\} = -2\{\ln[L(H_0)] - \ln[L(H_1)]\}. \quad (3)$$

where $L(H_0)$ and $L(H_1)$ are the functions of the likelihood under the null and alternative hypothesis and the Likelihood-Ratio test statistic is followed by the mixed chi-square distribution. The null hypothesis is rejected when $\lambda_{LR} > \chi_c^2$.

Empirical Tobit Regression Model

The specification of the Tobit regression model for Dhaka division is defined as

$$E_i = \phi_0 + \phi_1 TSR_i + \phi_2 TE(2-5)_i + \phi_3 TE(5-10)_i + \phi_4 TE(10+)_i + \phi_5 STNG_i + \phi_6 STMPO_i + \phi_7 SLR_i + \phi_8 PTMC_i + \phi_9 ICTTAM_i + \phi_{10} ICTTAH_i + \xi_i. \quad (4)$$

where E_i is the efficiencies based on Stochastic frontier Cobb-douglas, Translog with Battese and Coelli (1992, 1995) in i -th secondary schools; TSR_i is the teacher-student ratio; TE_i is the teaching experience (0-2 years, 2-5 years, 5-10 years, and 10 years above); ST_i is the school type (government, non-government, MPO); SL_i is the school location (semi-urban, rural); PTM_i is the preference of teaching methods (modern, conventional); $ICT-TA_i$ is the ICT teaching ability (low, medium, high). ξ_i is the error term.

Results and Discussion

Results of Secondary School Efficiency for Dhaka Division with Translog (Battese & Coelli, 1992)

The estimates of Maximum Likelihood Estimates (MLE) parameters of Translog frontier model in the case of secondary school efficiency for Dhaka division are presented in Table 1. The coefficients of the number of students, the classrooms and teaching ability input variables were found to be positive values and the class rooms was recorded significant. The square effects of the teaching ability was found positive and has significant effect in secondary school efficiency of Dhaka division in Bangladesh. The interaction effects of the number of teachers and the number of students, and the classrooms and teaching ability were registered with the positive impacts and significant effects to increase on secondary school efficiency of Dhaka division. The value of σ -square is (0.0122) was found significant and indicate a good fit. The value of γ (0.9985) was positive and significant and can be stated that 99.5% of variation around in secondary school outcomes due to inefficiency.

Results of Secondary School for Dhaka Division with Translog Inefficiency Effects Model based on Battese & Coelli (1995)

The MLE of the parameters in case of secondary school efficiency of Dhaka division followed by Battese & Coelli (1995) Translog model are presented in Table 2. The coefficient of classrooms input variable was found positive and significant while the coefficient of teaching ability of the teachers was found significant with negative value. The square effects of the number of classrooms was found statistically significant with the negative while the squared effect of the number of teachers was found positive and significant. The coefficient of the interaction effects of the number of students and teaching ability of the teachers was observed positive and significant impact to increase the secondary school efficiency. In the inefficiency effects model, a coefficient of positive value enhanced the grade of inefficiency and vice-versa. The coefficients of teacher's preference ICT tool like multimedia projector used always, often, sometimes, rarely and never in teaching and learning were found negative and significant which indicated that multimedia projector does play significantly contributor role in decreasing the secondary school inefficiency. The value of γ was calculated at positive (0.9999) and significant, 99.9% of random variation that exist in secondary school through inefficiency. The estimate of sigma-square was found significant and was perfectly fitted to this model.

Table 1: Maximum-Likelihood Estimates of Translog Stochastic Frontier Secondary School Model based on Battese & Coelli (1992) for Dhaka Division

Variables	Parameters	Estimate	Std. Error	Z value	Pr(> z)
Intercept	β_0	4.439948	0.381747	11.6306	< 2.2e-16 ***
X ₁	β_1	-0.077882	0.108469	-0.7180	0.47275
X ₂	β_2	0.000617	0.071220	0.0087	0.99308
X ₃	β_3	0.135565	0.030610	4.4287	9.481e-06 ***
X ₄	β_4	0.108357	0.672659	0.1611	0.87202
X ₁ ²	β_1^2	-0.002713	0.025092	-0.1081	0.91389
X ₂ ²	β_2^2	0.001291	0.009185	0.1406	0.88822
X ₃ ²	β_3^2	-0.006550	0.011184	-0.5857	0.55806
X ₄ ²	β_4^2	0.372715	0.221219	1.6848	0.09202
X ₁ X ₂	$\beta_1\beta_2$	0.023430	0.013265	1.7663	0.07734
X ₁ X ₃	$\beta_1\beta_3$	-0.007790	0.014813	-0.5259	0.59895
X ₁ X ₄	$\beta_1\beta_4$	-0.070026	0.120327	-0.5820	0.56059
X ₂ X ₃	$\beta_2\beta_3$	-0.014596	0.009781	-1.4922	0.13564
X ₂ X ₄	$\beta_2\beta_4$	-0.042404	0.068212	-0.6217	0.53417
X ₃ X ₄	$\beta_3\beta_4$	0.035803	0.018713	1.9132	0.05572
Variance Parameters					
sigmaSq	σ^2	0.0122422	0.002203	5.5559	2.763e-08 ***
gamma	γ	0.9985394	0.005644	176.912	< 2.2e-16 ***
Log likelihood function: 95.5036; Mean Efficiency: 0.92327;					

*, **, *** Significance level at 1, 5, and 10%, respectively, @ indicates insignificant.

Results on the Choice of Appropriate Model for Dhaka Division with Battese and Coelli (1992, 1995)

The results of likelihood ratio test for an appropriate model for Dhaka division with Battese and Coelli (1992, 1995) is represented in Table 3. The likelihood values of Translog model and Cobb-Douglas model are found 95.504 and 90.786 respectively. The chi-square value is recorded 9.4354 and found to be insignificant. The likelihood values of Translog model and Cobb-Douglas model are found 119.122 and 96.915 respectively. The chi-square value is recorded 44.413 and found to be highly significant. Based on the likelihood values, Translog model is an appropriate more than the Cobb-Douglas model (Battese and Coelli, 1992, 1995).

District-wise Efficiency Results of Secondary Schools (Urban & Rural) in Dhaka Division

The results are presented in Table 4 that both Cobb-Douglas model (Battese & Coelli, 1995) and Translog model (Battese and Coelli, 1995) performed better than all other models in determining the average efficiency of both urban and rural secondary schools. In specific, Translog model (Battese and Coelli, 1995) performed better than Translog model (Battese and Coelli, 1992) in determining the average efficiency of both urban and rural secondary schools. Again, Cobb-Douglas originated from Battese and Coelli (1992) model performed better than Cobb-Douglas with Battese and Coelli (1995) model for urban secondary schools and Cobb-Douglas suggested by Battese and Coelli (1995) performed better than Cobb-Douglas model with Battese and Coelli (1992) for rural secondary schools in Dhaka division. The urban secondary schools performed better than the rural secondary schools in Dhaka division. On an average the urban secondary schools of Gazipur district are comparatively better than other districts when Cobb-Douglas stochastic frontier (1992, 1995) were used. On an average the urban secondary schools of Dhaka

district are comparatively better than other districts when Translog stochastic frontier (1992, 1995) were used. On an average the rural secondary schools of Gazipur district are comparatively better than other districts.

Table 2: Maximum-Likelihood Estimates of Translog Stochastic Frontier Secondary School Inefficiency Effects Model based on Battese & Coelli (1995) for Dhaka Division

Variables	Parameters	Estimate	Std. Error	Z value	Pr(> z)
Intercept	β_0	4.508911	0.146288	30.8221	< 2.2e-16 ***
X ₁	β_1	-0.077342	0.073572	-1.0512	0.293149
X ₂	β_2	0.028644	0.062568	0.4578	0.647087
X ₃	β_3	0.102264	0.034865	2.9331	0.003355 **
X ₄	β_4	-0.148894	0.036467	-4.0829	4.447e-05 ***
X ₁ ²	β_1^2	0.023770	0.010137	2.3448	0.019036 *
X ₂ ²	β_2^2	-0.006087	0.012638	-0.4816	0.630054
X ₃ ²	β_3^2	-0.006048	0.002585	-2.3396	0.019304 *
X ₄ ²	β_4^2	0.015718	0.061158	0.2570	0.797168
X ₁ X ₂	$\beta_1\beta_2$	0.003904	0.011184	0.3491	0.726998
X ₁ X ₃	$\beta_1\beta_3$	0.002385	0.005854	0.4074	0.683677
X ₁ X ₄	$\beta_1\beta_4$	-0.088761	0.043642	-2.0338	0.041969 *
X ₂ X ₃	$\beta_2\beta_3$	-0.011362	0.005686	-1.9983	0.045688 *
X ₂ X ₄	$\beta_2\beta_4$	0.069983	0.010594	6.6055	3.961e-11 ***
X ₃ X ₄	$\beta_3\beta_4$	-0.007593	0.018237	-0.4164	0.677141
Estimation of Inefficiency Effects Model					
Z ₁	δ_1	0.105351	0.103859	1.0144	0.310407
Z ₂	δ_2	0.047871	0.131935	0.3628	0.716721
Z ₃	δ_3	-0.606088	0.103170	-5.8746	4.238e-09 ***
Z ₄	δ_4	-0.382578	0.125196	-3.0558	0.002244 **
Z ₅	δ_5	-0.271002	0.145821	-1.8584	0.063105
Z ₆	δ_6	-0.903387	0.254443	-3.5504	0.000384 ***
Z ₇	δ_7	-1.817411	0.379308	-4.7914	1.656e-06 ***
Variance Parameters					
sigmaSq	σ^2	0.026354	0.00308214	8.5506	< 2.2e-16 ***
gamma	γ	0.999999	0.00013666	7317.59	< 2.2e-16 ***
Log likelihood function: 119.1216; Mean Efficiency: 0.93376;					

*, **, *** Significance level at 1, 5, and 10%, respectively, @ indicates insignificant.

Table 3: Results of Likelihood Ratio Test for an Appropriate Model for Dhaka Division with Battese and Coelli (1992, 1995)

Model	Log Likelihood Value	Degrees of freedom	Chisq	Pr(>Chisq)
Trans_Dhaka_92	95.504	17		
CD_Dhaka_92	90.786	7	9.4354	0.4913
Trans_Dhaka_95	119.122	24		
CD_Dhaka_95	96.915	14	44.413	2.775e-06 ***

Table 4: Average Efficiency of Secondary Schools (Urban & Rural) in Dhaka Division by Districts

District	Urban				Rural			
	TL 92	TL 95	CD 92	CD 95	TL 92	TL 95	CD 92	CD 95
Dhaka	0.95571	0.96436	0.95114	0.96597	0.80487	0.81622	0.81403	0.82472
Gazipur	0.94956	0.96399	0.95228	0.96607	0.91487	0.93376	0.91105	0.92831
Narayanganj	0.95318	0.96262	0.94512	0.96146	0.76999	0.77795	0.76582	0.77231
Overall Mean	0.95281	0.96365	0.94951	0.96450	0.82991	0.84264	0.83030	0.84178

Results of Tobit Regression Model with Secondary School Efficiency for Dhaka Division

Table 5 represents the results of the factors affecting to secondary school efficiency derived from both stochastic Cobb-Douglas and Translog models for Dhaka division. In case of Cobb-Douglas with Battese and Coelli (1992, 1995) models, the teacher-student ratio had a positive and significant influence on the secondary school efficiency. The teaching experiences those who have 1 to 5 years, 10 years above have positive and significant influence on the secondary school efficiency. MPO type school was found positive and significant impact to school efficiency in Cobb-Douglas model. School location (rural) was observed negative but significant in case of both Translog and Cobb-Douglas models with Battese and Coelli (1995). Conventional method as the preference of teaching was found negative but significant in Translog model with Battese and Coelli (1992, 1995). Both medium and high-level ICT teaching ability have positive and significant impact on secondary school efficiency.

Table 5: Determinants of Factors Affecting to Dhaka Division Secondary School Efficiency by using Tobit Regression Model

Variables	Parameters	Tobit Regression Model				
		TL_1992	TL_1995	CD_1992	CD_1995	
Intercept	ϕ_0	0.875***	0.957***	0.838***	0.825***	
Teacher Student Ratio	ϕ_1	-0.00003	0.00001	0.0009**	0.001**	
Teaching Experience	< 1 Year					
	1-5 Years	ϕ_2	0.033	0.009	0.044*	0.053**
	6-10 Years	ϕ_3	0.047	-0.013	0.052**	0.042
	> 10 Years	ϕ_4	0.046*	0.005	0.085***	0.100***
School Type	Government					
	Non-government	ϕ_5	-0.034*	-0.056**	-0.035**	-0.019
	MPO	ϕ_6	0.046	-0.010	0.006	0.026**
School Location	Urban					
	Rural	ϕ_7	-0.021	-0.064**	-0.013	-0.055**
Preference of Teaching Methods	Modern					
	Conventional	ϕ_8	-0.092**	-0.093*	-0.068	-0.005
ICT Teaching Ability	Low					
	Medium	ϕ_9	0.044*	0.030	0.025	-0.018
	High	ϕ_{10}	0.063**	0.014	0.040**	0.017
Log likelihood		63.810				
Sigma		0.039				

*, **, *** means significant at 10%, 5% and 1% level

Conclusions

In this study, Translog stochastic frontier model was found an appropriate than Cobb-Douglas model in measuring the average efficiency of both urban and rural secondary schools in Dhaka divisions of Bangladesh. It is antithetic from the former studies as it employs a two-stage (Tobit) model also to look into the role of ICT determinants of the secondary school efficiency of Dhaka division. The coefficient of classrooms, the coefficient of squared effect of the number of teachers, the interaction effects of the number of students, and teaching ability of the teachers were observed positively significant, which indicated that these have direct influence and positive impacts to increase the grade of secondary school efficiency of Dhaka division in Bangladesh. The coefficients of teacher's preference ICT tool like multimedia projector used in teaching and learning were found negative and significant for Dhaka division, indicated that these played significantly contributor role in decreasing the secondary school inefficiency of Bangladesh. The urban secondary schools performed better than the rural secondary schools of Dhaka division in Bangladesh. In specific, on an average the rural secondary schools of Gazipur district in Dhaka division was found comparatively better than other respective districts. In case of Tobit regression, the teacher student ratio, the teaching experiences those who have 1 to 5 years, 10 years above, both medium and high-level ICT teaching ability were recorded positive and significant for Dhaka division, which implied that these variables had a positive influence towards the secondary school efficiency of Bangladesh.

Acknowledgement:

The authors would like to acknowledge the financial support provided by The World Academy of Sciences (TWAS) (RGA No. 20-301 RG/MATHS/AS_G) Italy, for conducting this research.

References

- Agbatogun A. O. 2012. Investigating Nigerian Primary School Teachers' Preparedness to Adopt Personal Response System In Esl Classroom, *International Electronic Journal of Elementary Education*, vol. 4, no. 4, pp. 377-394.
- Ali R. 2015. ICT Using Situation in Rural and Urban Primary Schools of Bangladesh: A Comparative Study. *Education & Literacy Curriculum Manage*. Dhaka, Bangladesh: FH Association, Bangladesh.
- Battese G. E. & Coelli T. J. 1992. Frontier Production Functions, Technical Efficiency And Panel Data: With Application to Paddy Farmers in India, *Journal of Productivity Analysis*, vol. 3, pp. 153-169.
- Battese G. E. & Coelli T. J. 1995. A Model for Technical Inefficiency Effects in a Stochastic Frontier Production for Panel Data, *Empirical Economics*, vol. 24, pp. 325-332.
- Chakraborty K. 2009. Efficiency in Public Education – The Role Of Socioeconomic Variables, *Research in Applied Economics*, vol. 1, no. 1, pp. 1-18.
- Ghavifekr S. & Rosdy W.A.W. 2015. Teaching and Learning with Technology: Effectiveness of ICT Integration in Schools, *International Journal of Research in Education and Science (IJRES)*, vol. 1, no. 2, pp. 175-191.
- Hennessy S. Ruthven K. & Brindley S. 2005. Teacher Perspectives on Integrating ICT into Subject Teaching: Commitment, Constraints, Caution And Change, *Journal of Curriculum Studies*, vol. 37, no. 2, pp. 155–192.
- Hermans R. Tondeur J. Van-Braak J. & Valcke M. 2008. The Impact of Primary School Teachers' Educational Beliefs on the Classroom Use of Computers, *Computers & Education*, vol. 51, no. 4, pp. 1499-1509.
- Jamieson-Proctor R. Albion P. Finger G. Cavanagh R. Fitzgerald R. Bond T. & Grimbeek P. 2013. Development of the Ttf Tpack Survey Instrument, *Australian Educational Computing*, vol. 27, no. 3, pp. 26-35.
- Katitia D. M. O. 2015. Teacher Education Preparation Program for the 21st Century. Which Way Forward For Kenya?, *Journal of Education And Practice*, vol. 6, no. 24, pp. 57-63.
- Khan S. H. Hassan M. & Clement C. K. 2012. Barriers to the Introduction of ICT into Education in Developing Countries: The Example of Banglades, *International Journal of Instruction*, vol. 5, no. 2, pp. 61-80.
- Khan A. R. Hadi R. S. & Ashraf D. M. 2013. The Impact of ICT on Education: A Study on Rural Schools, *Communications in Information Science and Management Engineering*, vol. 3, no. 8, pp. 367-368.
- Most T. M. 2015. A Statistical Case Study of using ICT in Educational Sector in Rural Context of Bangladesh, *Global Journal of HUMAN-SOCIAL SCIENCE: C Sociology & Culture*, vol. 15, no. 3, pp. 25-27.
- Rahman M. A. 2015. Access to Global Information—A case of Digital Divide in Bangladesh.

Scippacercola S. & D'Ambra L. 2014. Estimating the Relative Efficiency of Secondary Schools by Stochastic Frontier Analysis, *Procedia Economics and Finance*, vol. 17, pp. 79-88.

Sengupta J. K. & Sfeir R.E. 1986. Production Frontier Estimates of Scale in Public Schools in California, *Economics of Education Review*, vol. 5, pp. 297–307.

Sengupta J. K. 1987. Production Frontier Estimation to Measure Efficiency: A Critical Evaluation in Light of Data Envelopment Analysis, *Management and Decision Economics*, vol. 8, no. 2, pp. 93-99.

Case Study: Experiential Learning Activities that Build Trustworthiness in AI Across Multiple STEM Disciplines

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Abstract

Recent advances in artificial intelligence (AI) research and technologies have led to widely reported of successes in tasks that were earlier thought too difficult or impossible to accomplish. These include multilingual translation and other natural language processing tasks, as well as smart manufacturing and logistics, and of course autonomous driving. Evidently, AI technologies are now increasingly being applied to quantitative disciplines beyond computer science (CS). Some of these applications, such as autonomous driving, can be classified as mission critical in nature. However, many of the most advanced AI systems rely heavily on statistical machine learning (ML), which perform well in a statistical sense but can be unreliable on an individual basis. Using safe, secure, and reliable (SSR) computing principles in an AI systems context, it is possible to enhance the trustworthiness of AI among users of AI technologies. This paper describes a case study involving the use of specifically developed experiential learning materials in a classroom setting. The main feature of these learning materials is an emphasis on SSR principles that enhance AI trustworthiness. The study initially involved only CS majors, but work is currently underway to expand the study to include non-CS STEM majors and other quantitative disciplines. These include business analytics, statistics, mechanical engineering, civil engineering, and computer engineering. Findings to date, as well as suggestions for use of the materials, are presented. The research is currently being expanded in multiple directions and interested educators and learners are invited to participate in this exciting endeavor.

Keywords: *STEM education, case study, artificial intelligence trustworthiness.*

Introduction

Advances in artificial intelligence (AI) have recently been widely reported in the popular press and elsewhere well beyond the traditional scientific literature. AI technologies are now routinely applied toward everyday tasks, such as multilingual translation, speech recognition / synthesis, financial and statistical analysis, and many more. Evidently, AI is increasingly having an impact on ordinary daily activities. Apart from positive contributions to society, some people are also concerned about possible negative impacts of AI on their lives.

In a study on attitudes toward AI, Zhang and Dafoe (2019) found that an overwhelming majority of U.S. respondents (82%) believed that development in AI must be carefully managed; the finding drew parallels with EU respondents. While not surprising, these findings suggest a widespread concern among different general populations. Specifically, according to the report by Zhang and Dafoe, governance challenges perceived to be the most important all relate to safety and security, e.g., preventing AI from spreading fake or harmful online content and preventing AI cyberattacks. Other issues, such as critical AI system failures and biases in hiring or criminal justice, are also considered important (Zhang and Dafoe, 2019).

In another study, Brennen *et al.* (2018) found that in the UK, media coverage of AI is dominated by self-interest groups. Public debate in AI is predominantly driven by products, announcements, and research from industry. For example, the authors reported that nearly 60% of news articles about AI are on new products, announcements, and commercial initiatives; 33% of articles come from commercial sources – company CEOs and senior executives – six times as many as from government and almost twice as many as from academic researchers. More worryingly, AI products and services are often portrayed as “fix-all” solutions in a wide range of domains, from healthcare to renewable energy. Finally, Brennen *et al.* (2018) concluded that

“... some outlets struggled to show the strengths and the weaknesses of AI as applied across sectors or to position AI as a fully public problem, one that requires a diversity of voices to address.”

Based on these studies, we postulate that skewed reporting of AI is a widespread problem. Unbalanced coverage of AI in the public domain is potentially a serious threat to future widespread AI deployment and, by extension, as the potential to cause damage to humanity and human society. There is an urgent need to reach out to the wider AI users and AI contributor communities across multiple quantitative disciplines, and ultimately the public, such that well-informed, meaningful, and balanced debate about AI can take place before AI systems become truly inseparable from us.

We consider Safety, Security, and Reliability (SSR) as three dimensions of achieving the vision of trustworthy and human-friendly AI broadly for all segments of the society. In trying to define SSR AI, we draw inspirations from the thematic pillars of the Partnership on AI (Partnership on AI web resource), the first of which stipulates that AI tools used in safety-critical areas must be safe, trustworthy, and aligned with customary ethical standards. Our working definition of SSR AI is broader, encompassing not just safety-critical applications of AI, but all types of AI deployment that can affect people in both cyberspace and the real world.

For example, safe interaction with chatbots is a significant concern because it can affect users’ moods and behaviors (including some that are self-destructive and/or life threatening) both online and offline. Negative feelings developed through interactions with “bad” chatbots can potentially lead to depression and even suicidal thoughts or tendencies. This is especially true when it involves children, the elderly, the mentally handicapped, and other especially vulnerable groups of people. Further, and in alignment with the second thematic pillar (Partnership on AI web resource), SSR AI aims to minimize biases so that disparate user groups across political, geographical, and socioeconomical spectra will feel fairly treated.

In this research, members of the Western Michigan University Transformative Interdisciplinary Human+AI Research (WMU TI-HAIR web resource) Group, together with other academic, industry, and government agency partners, have embarked on a case study with the aim of building AI trustworthiness among STEM users of AI systems and technologies. A main research thrust is the development of modular experiential learning materials that can rapidly help diverse STEM users of AI gain trust, confidence, and competence in AI systems and technologies. Moreover, use cases are customizable so that the diverse STEM AI users can apply their newly acquired skills and knowledge toward solving their domain-specific problems.

This paper presents a case study of the developed learning materials in a classroom setting. Note, however, that the learning materials can also be used by motivated self-learners to acquire new skills and knowledge in their own time. The rest of this paper is organized as follows. In the next section, we describe the method and materials used in this case study. Then, we present and discuss the findings to date, having piloted the study in the fall 2021 semester. Finally, we conclude the paper and highlight activities that are currently underway in spring 2022.

Method and Materials

The primary method used in this case study is to observe the before and after changes (if any) of learning materials developed to elevate the levels of confidence, trust, and competence in the use of a range of AI technologies. An emphasis is placed on relevance of the use cases across multiple STEM disciplines. As such, the research team developed a range of SSR AI learning materials in the form of experiential learning modules that can cater to different STEM majors, many of whom lack the programming skills of computer science (CS) majors.

Table I Summary of 12 initial learning modules.

#	level	Module Name
1	F	Math Toolkit for SSR AI running on HPC CI
2	F	Algorithmic Exploration and Exploitation of an Intelligent System's weakness
3	F	Modular and Structured Software Development for Robust Intelligent Systems that run on HPC CI
4	I	Data Structures for SSR AI running on HPC CI.
5	I	Deep learning with HPC
6	A	SSRAI Software Development for HPC CI deployment
7	A	Vulnerabilities of Machine Learning.
8	A	Beyond current generation AI and Toward Artificial General Intelligence
9	A	Adversarial Machine Learning and Robust Trust Scoring Models
10	A	Societal Impact of AI
11	A	Pitfalls of applying AI to Information Retrieval tasks
12	A	Real-Time SSR AI with HPC CI

*Tentatively assigned

Twelve initial experiential learning modules (summarized in Table 1) have been developed. To cater to a range of abilities and preparedness, the modules are categorized into three levels of difficulty as shown in Fig. 1. Several more modules are planned in the near future. Specifically, the distribution of the three levels of difficulty seems somewhat unbalanced now. The initial twelve modules are predominantly categorized as "advanced". This is a direct consequence of the fact that a classical AI course is typically offered at a late stage in an undergraduate program. However, the research team is mindful of the importance of nurturing AI trustworthiness from an early stage. Further development of modules at lower levels is an important direction of current and future research.

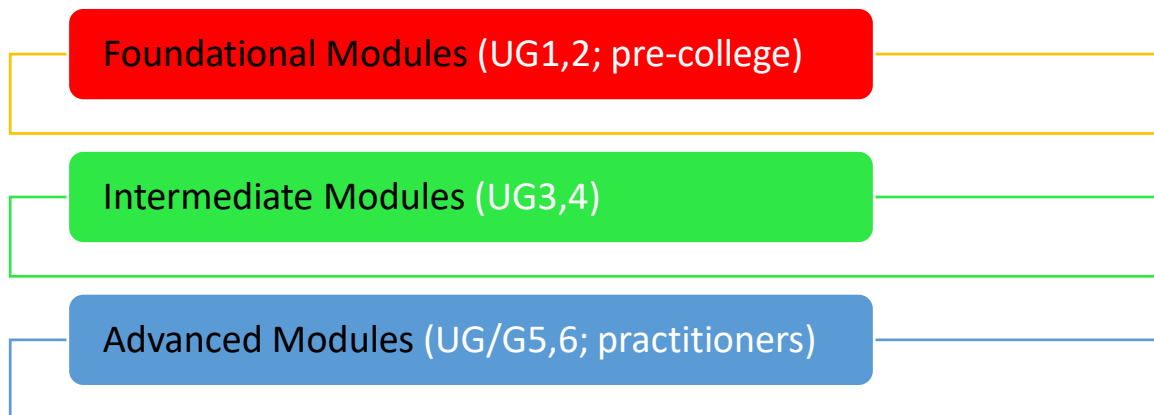


Fig. 1. Flexible framework.

It should be emphasized that the division of levels of difficulty are not strictly applicable. For example, if a first-year undergraduate student is especially well prepared to take on a learning module categorized as “advanced”, it is entirely possible for the student to take it. In fact, they are encouraged to do so. Conversely, if a graduate student, especially one who does not have a CS background, does not feel comfortable taking an advanced learning module, it is perfectly fine for the student to try a foundational learning module first before venturing into something more advanced. In fact, there is no strict ordering of how the learning modules must be taken. It is furthermore possible for someone to take only one modules or multiple segments drawn from different learning modules unless the modules are taken for course credit. The expectation is that students know how best to manage their time and they should all benefit from the materials, even if the learning modules are not completed in full.

It is also important to stress that the experiential learning modules are designed to complement, not compete with, available resources. For example, Udacity (Udacity AI curriculum), EdX (EdX on AI), Google (Google AI education), and Microsoft (Microsoft AI School) all have their own programs that teach AI to broad segments of the society. There are others, too, but we emphasize on building trust through the injection of SSR computing principles. Furthermore, we develop easy-to-digest “bite-size” modules that do not seem overwhelming and can rapidly upgrade the skills of non-CS AI users.

As for the assessment of any before and after changes, the research team is working with an independent evaluator. The evaluator developed pre- and post-module questionnaires with a customizable part for different learning modules and learner groups. The evaluator is also responsible for conducting analysis on the returned questionnaires and the analysis is done independently of the research team.

The initial pilot conducted in fall 2021 was limited to two small groups of CS students in a classroom setting. This allowed the research team to finetune the materials before a larger scale study that is being conducted in the current spring 2022 semester.

Results and Discussion

As mentioned above, a small-scale pilot study was conducted in the fall 2021 semester, which went from late August 2021 to mid-December 2021. The actual launch of the learning modules happened during the second half of the semester. Specifically, Module 4 Data Structures for SSRAI running on HPC CI and Module 11 Pitfalls of applying AI to Information Retrieval tasks were launched. They were introduced to students in the Level 3000 Big Data (BD) class and Level 6 Information Retrieval (IR) classes, respectively. Notably, the BD class consisted of both CS and Data Science (DS) undergraduate students. This meant it was possible to expose the learning material to at least some non-CS students. It is typically quite noticeable in any class of mixed CS and DS students that the former group will have significantly better programming skills than the latter. The IR class consisted of only CS graduate students, with a mix of doctoral and master’s students. A total of approximately 20 students were affected in fall 2021.

While the completion of the assigned learning module was mandatory with credit going toward a student’s final grade, we did not require students to also complete the pre-/post-module questionnaires. We do not believe it is ethical to make students complete the questionnaires. However, we encourage them to spend the additional ten minutes or so to complete the questionnaires, which we explain will help in the research effort. In the IR class, the voluntary response rate of questionnaires completion was 75%. In the BD class, this dropped to approximately 50%. On a Likert scale of 5, the mean score of overall effectiveness of the modules was approximately 4.5. Some of the students also wrote free text comments on the questionnaires and these were subsequently used to finetune the learning materials.

A much larger scale study is currently underway in the current spring 2022 semester. In this study, six multidisciplinary faculty members in multiple disciplines (branches of engineering, statistics, and business analytics) across the WMU campus are involved in launching many of these learning materials in their own classroom settings. Additionally, three external faculty members are doing the same in their respective universities. The spectra of a) levels of difficulty / classes, b) quantitative disciplines, and c) institutional settings will make this an interesting study. Future findings will be reported as soon as they become available. It is hoped that as other like-minded educators and researchers find out about this research, they will consider participating in and contributing to this exciting venture.

Conclusion

Artificial Intelligence and especially statistical machine learning are increasingly being applied beyond the traditional boundaries of computer science. Statisticians, business analysts, engineers now routinely apply AI methods and systems to toward solving their domain-specific problems. Often, learners in these disciplines lack the programming skills necessary to make full use of the resources available. With limited exposure to the limitations of contemporary AI/ML technologies, cross discipline learners and users of AI might also have unrealistic expectations on what AI can do for them.

Taking a balanced approach toward what AI can or cannot do, the research team has developed flexible and customizable experiential learning materials aimed at rapidly upgrading the levels of confidence, trust, and competence for a diverse spectrum of AI users. These learning materials are modular in nature and have been designed to complement existing learning resources. The flexibility of these learning materials allows learners to mix and match modules – or indeed segments within a module – to best match their needs and aspirations.

This paper has described a case study involving the use of these learning modules in a classroom setting. It should be noted that the learning materials can also be used by self-driven individuals outside a classroom environment in their own time. Preliminary findings from a small-scale study conducted in late 2021 was presented. A much larger scale study involving three variables (levels of difficulties, disciplines, and institutions) is currently in progress in spring 2022. New findings should be ready in summer 2022 once the evaluator has conducted his independent analysis. These will be reported in due course.

Current and future directions include expanding the offering of experiential learning materials and expanding the reach of this research program beyond the existing participating departments and institutions. As noted in the main text above, there is currently an imbalance of offerings that is tilted toward the more advanced materials. This is a consequence of the fact that AI is typically offered late in a CS program primarily to more senior undergraduates and graduate students. The research team is interested in offering more learning materials for more junior undergraduate populations across the STEM disciplines. This should better prepare them for a journey of exploration in AI research and applications to their respective domains. In the second research direction, it is hoped that by disseminating our work at prominent conferences, symposia, and workshops, such as this one will help the research team propagate the work beyond our existing partners. In fact, like-minded educators and researchers are strongly encouraged to participate in and/or contribute to this exciting venture. This work can only be as successful as the reach it can extend to, and it really should be a collaborative effort in driving a balanced agenda toward AI usage across multiple quantitative disciplines.

Acknowledgments

The research described in this paper is supported by a U.S. National Science Foundation under grant number 2017289

References

- Brennen JS, Howard PN, and Nielsen RK, An Industry-Led Debate: How UK Media Cover Artificial Intelligence, Reuters Institute for the Study of Journalism, University of Oxford, December 2018. Available at https://reutersinstitute.politics.ox.ac.uk/sites/default/files/2018-12/Brennen_UK_Media_Coverage_of_AI_FINAL.pdf.
- Edx on AI. Available at <https://www.edx.org/microsoft-professional-program-artificial-intelligence>.
- Google AI education. Available at <https://ai.google/education/>.
- Microsoft AI School. Available at <https://aischool.microsoft.com/en-us/home>.
- Partnership on AI. Thematic Pillars. Available at www.partnershiponai.org/.
- Udacity AI curriculum. Available at <https://blog.udacity.com/2016/11/artificial-intelligence-curriculum.html>.
- Western Michigan University Transformative Interdisciplinary Human+AI Research website. Available at <https://fong.cs.wmich.edu/>
- Zhang B and Dafoe A. “Artificial Intelligence: American Attitudes and Trends.” Oxford, UK: Center for the Governance of AI, Future of Humanity Institute, University of Oxford, 2019. Available at https://governanceai.github.io/US-Public-Opinion-Report-Jan-2019/us_public_opinion_report_jan_2019.pdf.

Reflecting, Reframing & Re(writing) Virtual Reality: A poetic exploration of the online teaching experience with part-time adult learners during the pandemic.

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Abstract

Teaching and learning online during a pandemic are not easily negotiated experiences, as educators have come to realize in the last two years. Admittedly, there are many advantages associated with online learning, not the least of which is the opportunity to continue to attend classes, though virtually, during pandemic lockdowns. Nonetheless, virtual learning can be a technological and psychological nightmare for students and facilitators alike. The shift from technology in the classroom to technology as the classroom, as evidenced by the various learning management systems and interfaces, mitigated significant disruptions to the activities of teaching and learning. This shift signals a new era in teaching and warrants an examination of how faculty and students navigate the experiences of virtual learning. Understanding how students are connecting to what is being taught and what hinders or supports their learning are critical aspects of reflective practice, which is underscored in this paper. Hence, the purpose in writing this paper is to reflect in and on the experiences of (dis)connection in the virtual teaching and learning process. The paper utilizes writing as method in its capacity to help the writer discover, analyze, and determine one's relationship to a topic. I use poetized reflection in a two-fold manner: to channel my musings about the lived experience of teaching adult learners who work at full time jobs, access classes in the evening, and often while on their commute home, and to problematize the theory of connectivism, given the disruptions that are often experienced in the virtual space. The opportunity to (re)write the narrative provides a deeper awareness of the challenges and issues associated with teaching and learning in virtual spaces and the outcomes for students' learning in post pandemic situations.

Keywords: *teaching and learning, poetized reflection, virtual reality, pandemic lockdown*

For near three years now, the world has been forced to acknowledge the role that technology will inevitably play in our lives. Our education systems have had to pivot and adjust to hybrid ways of teaching and learning on a long-term basis, given the incursions of variant after variant, and subvariants of the novel coronavirus (COVID-19) pandemic. Teachers and students have encountered and are acclimating to digital technologies in ways that were not on previously envisaged. Still, widescale access to modern technologies and the means to connect to online environments remain challenging, especially for students in underprivileged circumstances across the globe. Teaching and learning online during a pandemic are not easily negotiated experiences. Admittedly, there are many advantages associated with online learning, not the least of which is the opportunity to continue to attend classes, though virtually, during pandemic lockdowns. Nonetheless, virtual learning can be a technological and psychological nightmare for students and facilitators alike. Hence, an understanding of how students are connecting to what is being taught and what hinders or supports their learning are crucial aspects of the reflective process for educators. This reflective paper opens a conversation about teaching and learning during the Covid-19 pandemic, while “simultaneously living in the moment” (Owton 2017). Reflecting in the moment allows me to write from my “self” which, according to Richardson (1994, p. 516) enables writers to be “fully present in our work, more honest, more engaged” as I attempt to give creative expression to the experience (Willis 2002).

“The new (virtual) reality”

Trends in teacher education in the 21st century classroom, reveal an emphasis on innovation, critical thinking, and reflective practice. Innovation in teaching and learning is woven into the designs of instructional time, fostering opportunities for creativity. When new ideas are incorporated, the educator must critically assess the relevance of those ideas and reflect on the value added to the learning process. Reflection helps us to make sense of what we do in the classroom and to determine, during and upon completion of a teaching episode, whether what was planned—learning opportunities and activities—has yielded the desired results, and the extent to which the integration of technology has optimized teaching and learning. When the pandemic ousted teachers and students from the physical classrooms to contain the spread of the virus, the space of learning became the virtual realm. This shifted the focus from technology as a tool for facilitating learning in the classroom to technology as the classroom itself. The move set the stage for learning beyond the physical classroom, as virtual learning became our reality in the ensuing months. Virtual learning depends on the presence of technology and the internet to allow for connections and interactions between teachers and students. Thus, learning virtually does not negate community building and collaboration. Some educators (see for example DeBrock, Scagnoll, & Taghaboni-Dutta 2020) believe that there is an intimacy that the online space allows, that has been previously overlooked and argue that online education creates opportunities for students who would typically take a “back seat” in instructional settings, to become more centred. Cairns, Ebinger, Stinson, and Jordan (2020) have found that technology not only facilitated connections but created new modes of interaction and fostered relationship building. These findings have merit, as seen in the seminal work of Garrison, Anderson, and Archer (2000) who conceptualized a Community of Inquiry Framework. The framework adopts three primary elements, allowing for the examination of online educational experiences. These elements are social presence; cognitive presence; and teaching presence. Social presence is critical to enabling the connectivity and community that students and facilitators experience with each other (Devika, Sasanka, & Priya 2020). Social presence is that which fosters trust, emotional expression, communication, and cohesion within the community of learning while cognitive presence is the meaning making that happens through reflection and interaction. The teaching presence is the glue that facilitates and supports the social and cognitive processes, ensuring that all educational purposes operate to the benefit the community.

Theory of Connectivism.

In the post-pandemic climate, many institutions have adopted a hybrid mode of teaching/learning or have opted to offer some programs in virtual modality, only, so as to ensure safety for their members. This situation has heightened theorizing around how effectively learning outcomes are being met through these modalities. Vaill (1996) has asserted that, “learning must be a way of being – an ongoing set of attitudes and actions by individuals and groups that they employ to try to keep abreast of the surprising, novel, messy, obtrusive, recurring events...” (p. 42). This idea appreciates that learning is living proactively, taking a posture of readiness for any eventuality, and maintaining currency in our knowledge systems. His statement appears prescient, as we reflect on what has ensued between 2020 when the Covid-19 pandemic was declared and the present, as societies continue to reel from its effects.

Siemens (2004) agrees that a more proactive approach to learning should be considered. He has posited that “learning that occurs outside of people” [which is] “stored and manipulated by technology” (p.3) will address the gap in the learning theories of behaviourism, cognitivism, and constructivism. Subsequently, Siemens has developed what he has described as a learning theory for the digital age – a theory that would respond to any significant changes in the environment and ensure accessibility to information in any condition. The theory of Connectivism brings technology and connection making into the learning process so that exchange of knowledge happens in meaningful ways. Connectivism is premised on the following ideas, inter alia: knowledge is acquired through diverse opinions; our capacity to know is

more critical than what we know at present; being current and relevant are benchmarks of connectivist learning activities; and nurturing and maintaining connections enable continual learning (Siemens 2004, pp. 5 – 6). The underlying assumption of these ideas is that online learning environments must facilitate exchanges between teachers and learners that foster development of the participants in the space. Nonetheless, the facility to connect does not guarantee that connecting happens and the appreciation for technology does not negate the challenges faced in contexts where technological resources and capacity for sustainable use are limited.

Theory meets the lived experiences.

The 21st century is an age of technological explosion and myriad social media platforms where the myth that people experience little or no challenge connecting with each other is perpetuated. Yet, many developing countries in the Caribbean and across the globe, remain under-resourced and ill-prepared to sustain educational programs in a time of crisis, such as the Covid-19 pandemic (Blackman, 2021). In Jamaica, the efforts by governments to support students and institutions in the early months of the pandemic by partnering with different service providers and technological entities were difficult to sustain. Many postsecondary students struggled and continue to struggle to pursue their education remotely, especially those who live in communities with limited access to internet facilities to enable virtual learning. Institutions are cognizant of the issues, but are challenged to minimize learning loss, as best as possible. Minimizing learning loss under these conditions is problematic as several reports (see for example, Caribbean Policy Research Institute 2021; OECD 2020; World Bank 2022) have confirmed.

Seale (2020) has asked a poignant question concerning how schools that struggle to produce equitable results in a normal “brick and mortar setting, overcome the challenges inherent in distance learning?” The conversation about equitable outcomes underlies much of the narrative about how student learning and classroom teaching are impacted by the pandemic. For example, Mavuru, Pila, and Kuhudzai (2021) have written about challenges experienced by pre-service teachers in adapting to remote teaching and learning, specifically in disadvantaged communities where students’ struggles included financing access to classes and materials via data plans, limitations of devices and learning spaces, the experience of isolation and disconnection with respect to peers and facilitators, and overall stress of balancing home and school activities. Similar studies have discussed the effects of life and learning on a college campus during Covid-19, highlighting the distractions created by work, home and social media platforms and pressures faced by students in higher education (Bailey & Bergman 2021; Banks 2021). Undoubtedly, the challenges of online/virtual learning have been widely acknowledged in research on the educational experiences from pre-school to postsecondary levels in both developed and developing countries during the Covid-19 pandemic. My paper contributes to the narrative by offering a personal experience of instructing students who work and study part-time/ evening in a university college in a developing nation post pandemic. The writing of this experience is a mixture of poetry and self-reflection that potentially provokes an inquiry into the outcomes for students who have limited access or ability to “connect” to the online learning environment. The issue of connectivity is very nuanced as connectivity can be disrupted for various reasons—physical, financial, psychological—complicating the possibility of an optimal learning experience. These are elements of the experience (Willis 2002) that this poetized reflection contemplates.

Writing as method: Poetized reflection

Reflective teaching and learning are integral to the teacher development process. Reflective practice provides insights about self and practice as teachers learn through and from the classroom experiences (Finlay 2008). Poetry is one form that our reflections can take because, as we engage in the act of questioning, poetry offers the opportunity for creative interpretations to be evoked. In this iteration, writing

a poem is a method of inquiry (Richardson 1994 p. 516) that allows one to “know about self and topic” (ibid). I will borrow from Willis (2002) who chose to present the “livedness” of adult learning experiences (p.3) as “reflections in verse” (p.4) or “poetized reflections,” believing that what I write here is not a strict poetic form. Rather, it “has the ability to illuminate and crystallize experience” (Willis 2002, p.7). Writing is “embodied learning – a process of understanding and expressing creativity” (Aadlandsvik, 2009). Writing this reflection allows for “ruminating on a pedagogical encounter that I want to continue to learn from” (Leggo & Irwin 2018, p. 50). In this process of learning, I am thinking about what I am doing while doing it. This is what Yancey and Smith (2000) describe as reflection. As I record my experiences and encounters in the moment, I am conscious that the expressions evoked are not the traditional, pre(scribed) forms. When I logged out of my meeting with my students, my fingers turned their attention to this inquiry about what transpired during the lesson, and it spilled out onto the newly opened Word document, urging me to learn “what it is like” for these lives that are negotiating the pandemic related restrictions and technological issues registered in the online space. The reflection-on my reflection-in the session centred on my students’ access. I toy with the word access for a moment and think how overused it has been during the pandemic; connoting entry, wireless availability to the class—to me and to this space. How do they access me and I them in this “distanced” modality? In this “poetizing activity” (van Manen, 1990, p.13), what I attempt here is to ruminate on my new reality of teaching in online modality and the lives that are participating in space with me.

(Dis)connecting realities

The computer is booted, and I log on, open my meeting, then mute “myself.”

I tilt my laptop to just the right angle to obscure my “personal space” and reveal little more than my face. Lines blurred between private and public as I zoom in ...

And wait.

I hear the voices behind the names in the frames etched across my screen as they filter in one by one

And I feel like I know them.

I think I must be crazy! What is it sorcery?

That I can teach in this strange time; commiserating with the tiny white letters, labelling the blackness of my screen, faces erased?

That pictures poised and postured can pretend to keep me company in my imaginary classroom

How can I reconcile this new reality?

How can one experience camaraderie with voices and pictures?

How derive satisfaction in the comingling of my voice with those who dare release theirs in this untamed space?

Is it possible to find community?

Can I laugh at their joys; empathize with their pain; wear a presence that draws them in – all the while wondering – is this real?

Can I seriously be teaching frames on a screen?

“I can’t talk right now. I am in transit, miss!”

And I visualize my student—enclosed in an iron cocoon—being transported from her labour; labour that ensures that she can pay her debts.

Her wage grants her ACCESS to the coveted higher learning experience.

As the scene unfolds in my mind, I see her attempting to squeeze her entire body behind the mask—the mask—powerless to shield her from the sneeze that escapes the face that occupies the seat beside her.

An unmasked face.

Yet, she dares believe that “in-class” learning on a bus stuffed with far more bodies than pandemic protocols permit, is possible. ‘Nothing ventured. Nothing gained!’

Another voice jolts me back to REALITY as it informs, “I have to log off for the time being, miss. I am walking home now, and I cannot have my device in my hand.”

I am puzzled by her statement – we are in a classroom, after all! A safe space!

How could she feel threatened?

Who lurks in the shadows to steal her ACCESS?

The access she holds in the palm of her hand—her means of entry to the latest info-drama of my 5 to 8 class.

The fluttering of the frames, in and out, erratically, summons me back into the “real time” theatrics taking place in my virtual world.

Pale words announce, “Your internet connection is unstable!”

Slurred speech hiccups across the waves and betrays the fluency of the words my tongue expels – “We cannot hear you miss! You are breaking up!”

I am a little bemused by the image that this statement conjures in my mind – “Breaking up!” I exclaim. “How am I breaking up?”

But I know what they mean. I repeat... and again ... and again! Not for emphasis nor reinforcement.

The point is lost among the cackling words that spill unintelligibly across the “space”, so I resort to baby talk – slowing my speech so they understand. And, as I hear myself, I wonder at the gains and losses of this reality!

It is important that they understand. They matter – even as framed voices occupying my screen. I must seek out ways to **connect** with them.

“Pack some patience!” I remind them. “We are all navigating this Covidian era together.”

But I silently wonder, is this what it has come to?

Some voices remain hushed, and some disperse, unable to negotiate the cost of “living” and “being” in this space; I realize I am competing for their attention – I call the name I see; the invisible presence, but as “it” attempts a response a more urgent cry for attention – a small cry too young for higher learning has won!

This is the REALITY of being in higher education in the virtual realm in pandemic times. Behind those named and imaged frames are lives that feed hungry mouths; attend to sick loved ones; rock babies to sleep; supervise homework. They rest, and wake, rising to do it all again, another day – negotiating a virtual reality!

As I conclude this poetized reflection, I am encouraged by the possibilities offered by this method, that is, the use of poetry to ruminate on, reframe, and (re)write the lived realities of teaching and learning post pandemic, helping me learn how to “live creatively in the pedagogic context of classrooms” (Leggo 2005). The paper was written to reflect on the challenges encountered in a virtual learning environment as a facilitator of post secondary students negotiating the pandemic. I offer two observations following the writing of the reflection. First, the act of “reflecting in” (Schon 1983, 1991) made me more receptive to the pedagogic context of my classroom (Leggo 2005) and helped me appreciate how the “out-classroom space has intruded on the in-classroom space” (Jones & Kessler, 2020). By attending to the challenges that emerged while teaching students virtually, I was more keenly aware of the issues they face in their pursuit of higher education. Interacting with the written text made the issues more vivid and resonated more clearly so I could “hear, see and feel the world in new dimensions” (Richardson 1994, p.522). Second, although connectivism is a relevant learning theory in a digital age, it must be appropriated in the context of the lived realities of geography and socioeconomics, especially in developing and underdeveloped settings. Virtual learning is opportune in pandemic times, but many students in remote regions have limited access to online classes and the technological facilities to enable their participation in the virtual space. They cannot “connect in” the learning environment if they cannot “connect to” it; hence, connectivism is problematic. Technology is meant to enhance and augment teaching and learning experiences; however, this purpose cannot be optimized when access is limited or non-existent. Opportunities for individual enhancement and collaboration are lost to students if they do not have adequate resources to sustain the learning experience. All the interactive features and digital tools that educators are encouraged to utilize will be of little effect without students input in online classes. It is imperative, therefore, as governments and educational institutions assess the post pandemic impact on teaching and learning, that they pause to reflect, to reframe, and to rewrite policies that prioritize and address the gaps created by the current reality.

References

- Aadlandsvik, R. 2009. "In Search of a Lost Eye: The Mythopoetic Dimension in Pedagogy" A Review of Timothy Leonard & Peter Willis' (Eds.) *Pedagogies of the Imagination. Mythopoetic Curriculum in Educational Practice. Phenomenology & Practice.* 3. 10.29173/pandpr19823.
- Bailey, O. & Bergman, E. 2021. The covid college experience: The effects of Covid-19 on the life and learning on a college campus. *The Cupola 2020-2021, Vol. 15. The Undergraduate Research Journal of Christopher Newport University.* Newport News, VA: The Office of Undergraduate Research and Creative Activities. pp. 30 – 49.
- Banks, A.C. 2021. Pandemic pressures: Student experiences in higher education during the Covid-19 pandemic. *The Cupola 2020-2021, Vol. 15. The Undergraduate Research Journal of Christopher Newport University.* Newport News, VA: The Office of Undergraduate Research and Creative Activities. pp. 50 – 70.
- Blackman, S.N.J. The impact of Covid-19 on education equity: A view from Barbados and Jamaica. *Prospects* (2021). <https://doi.org/10.1007/s11125-021-09568-4>
- Cairns, M., Ebinger, M., Stinson, C., & Jordan, J. 2020. COVID-19 and Human Connection: Collaborative Research on Loneliness and Online Worlds from a Socially-Distanced Academy. *Human Organization* 79(4), pp. 281 - 291
- DeBrock, L., Scagnoli, N. & Taghaboni-Dutta, F. (2020, March 18). *The human element in online learning.* Inside Higher Ed. <https://www.insidehighered.com/advice/2020/03/18/how-make-online-learning-more-intimate-and-engaging-students-opinion>
- Devika, B., Sasanka, L.K., & Priya, V.V. 2020. Perception on Online Teaching and Classroom Teaching Among Students. *The Journal of Contemporary Issues in Business and Government*, 26, 1680-1694.
- Finlay, L. 2008. Reflecting on 'Reflective Practice'. Practice-based Professional Learning Paper 52, The Open University.
- Garrison, D., Anderson, T., & Archer, W. 1999. Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education. *The Internet and Higher Education.* 2, 87-105. 10.1016/S1096-7516(00)00016-6.
- Jones, A.L. and Kessler, M.A. 2020. Teachers' Emotion and Identity Work During a Pandemic. *Front.Educ.* 5:583775. doi: 10.3389/educ.2020.583775
- Leggo, C. 2005. The heart of pedagogy: on poetic knowing and living, *Teachers and Teaching*, 11:5, 439-455, DOI: 10.1080/13450600500238436
- Leggo, C. & Irwin, R. 2018. Ways of attending: Art and poetry. *Canadian Review of Art Education*, 45(1). <https://crae.mcgill.ca/article/view/48>
- Mavuru, L., Pila, O.K., & Kuhudzai, A.G. (2021). Pre-Service Teachers' Levels of Adaptations to Remote Teaching and Learning at A University in A Developing Country in the Context of COVID-19. *International Journal of Higher Education.* DOI:10.5430/ijhe.v11n1p12
- Owton, H. 2017. Poetry as Reflective Writing. In: *Doing Poetic Inquiry.* Palgrave Studies in Creativity and Culture. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-64577-3_6
- Richardson, L. 1994. Writing. A method of inquiry, 516 -529 in Denzin, N. & Lincoln, Y. (eds.). *Handbook of Qualitative Research.* Thousand Oaks, CA: Sage Publishers.

- Schon, D. 1983; 1991). *The Reflective Practitioner: How professionals think in action*. New York, NY: Basic Books.
- Seale, C. 2020. Distance Learning during the coronavirus pandemic: Equity and access questions for school leaders. <https://www.forbes.com/sites/colinseale/2020/03/17/distance-learning-during-the-coronavirus-pandemic-equity-and-access-questions-for-school-leaders/>
- Siemens, G. 2004. Connectivism: A Learning Theory for the Digital Age. *International Journal of Instructional Technology and Distance Learning*, 2.
- Vaill, P. B. 1996. *Learning as a way of being*. San Francisco, CA: Jossey-Bass Inc.
- Van Manen, M. 1997. *Researching lived experience: Human science for an action sensitive pedagogy*, (2nd edition). Canada: The Athlouse Press.
- Willis, P. 2002. Risky Journeys: Using Expressive Research to Portray Cross-Cultural Adult Education Practice in Aboriginal Australia. *Alberta Journal of Educational Research*. 48.
- Yancey, K. B. & Smith, J. B. 2000. Reflections on self-assessment. In J. B. Smith and K. B. Yancey (Eds.) *Self-Assessment and Development in Writing: A Collaborative Inquiry*. Cresskill, NJ: Hampton.

A Systematic Literature Review of the Psychological Well-being of Students by the PRISMA Method

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Abstract

For first-year students, university opens door to a new world, successfully applying and starting university is one of the most decisive moments of their lives. Once at university, a student spends almost half of their days at the institution during their higher education. During this time, lectures, seminars, works in various group projects are attended, a network of contacts and university experiences are gathered. However, a significant proportion of students also need to generate the necessary resources to earn a living in addition to studying. Therefore, they will be both new students in higher education and new entrants to the labour market, which means that they will have to meet both needs at the same time.

Psychological well-being is one of the most important research areas in positive psychology, but adolescents are not expected to have fully developed the components of psychological well-being at an early age. We think that the preservation and improvement of students' mental health should be in the major focus of attention for all higher education institutions. In our view, improving the psychological well-being of students should be a priority for any higher education institution that wants to attract high achieving students and maintain a high position in national and international rankings of higher education. With the review of the literature of psychological well-being of students by PRISMA method, our main goal is to organise and synthesize the articles published in the Web of Science database in recent years.

Keywords: *Mental health, Positive psychology, PRISMA model, University*

Introduction

Researchers began to occupy themselves with quality production of literature processing. Quality production of literature processing began to occupy researchers in the 1990's. In an article in 1995, Daryl Bem describes in detail the steps to take if one wants to make a review of the literature in the Psychological Bulletin (Bem, 1995). The Quality of Reporting of Meta-Analysis (QUOROM) standards were developed at a health conference in 1996. Thirty clinicians, researchers, and statisticians were asked to develop a standardized model that includes all checkpoints that can be used to perform a meta-analysis to help systematically review health interventions. Later, in 2009, QUOROM was updated and now it is named as 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)' (Moher et al., 1999; Liberati et al., 2009; Fenyvesi and Vágány, 2020).

This method is a systematic, comprehensive processing of the literature in a given field. PRISMA aims to help authors improve the reporting of systematic reviews and meta-analyses (Moher et al., 1999; Liberati et al., 2009). The method has since become more and more popular in other disciplines. According to Moher and co-authors (2009: nd): 'A systematic review is a review of a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyse data from the studies that are included in the review.' The purpose of the literature

review is to present changes in the selected topic over a period of time and / or to summarize current knowledge of the topic. In this way, it provides the reader with an overview of the development of research results in the given field.

Method and Materials

A quantitative systematic review was conducted to estimate the global prevalence of anxiety and fear among university students during the COVID-19 pandemic. A systematic search of cross-sectional studies was conducted on the Web of Science database using PRISMA guidelines in May 2022. A literature review synthesizes the results of several primary literatures to present coherent criteria on a particular topic or area of research to predict what research directions are needed in the discipline under study (Liberati et al., 2009; Page et al., 2021).

The PRISMA Statement consists of a 27-item checklist and a four-phase flow diagram (Moher, 2009). The PRISMA flow diagram demonstrates screening method for articles (Figure 1). It maps out the number of records identified, screened, included and excluded, and the reasons for exclusions.

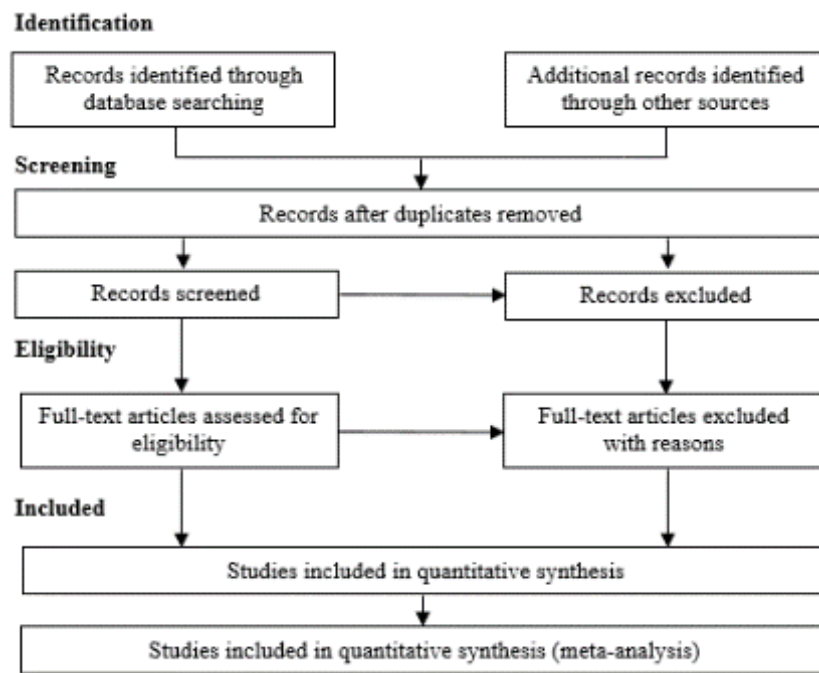


Figure 1. PRISMA flow diagram

Source: Moher (2009)

In our literature review on mental health of university students, we have aimed for completeness. The following 10 rules developed by Pautasso (2013) were used in the research.

1. Defining a topic and audience.
2. Searching and re-searching the literature.
3. Taking notes while reading.
4. Choosing the type of review.
5. Keeping the review focused but making it of broad interest.
6. Being critical and consistent.

7. Finding a logical structure.
8. Making use of feedback.
9. Including our own relevant research but being objective.
10. Being up-to-date.

The input factors of literature included in our analysis are as follows:

1. The Web of Science database was used to search the international literatures.
2. The search was carried out in May 2022.
3. The language of publications included in the analysis is English.
4. Only scientific articles were included.
5. The articles were published between 2019 and 2021.
6. The full publication must be available (directly or indirectly).

Results and Discussion

Through the process of searching, the numbers of records have steadily decreased. The literature searching consisted of several steps. The first search term was the mental health. As shown in Figure 2, the number of records identified through database searching was 184,132 publications. Since only the Web of Science database was used, the number of additional records identified from other sources was 0. In the second step of the literature review process, we have defined our new selection criteria. The well-being, COVID and students terms were included as search criteria. The number of records identified through database searching was 347. The sexual, gender and employee terms were excluded as search criteria. The number of records identified through database searching was 347. The sexual, gender and employee terms were excluded as search criteria. The total number of excluded records was 52. We excluded publications that were not journal articles, so 29 articles were excluded. Only full-text, open access journal articles were selected. With this restriction, 43 articles were excluded. After the full-text articles assessed for eligibility, 223 records were accepted.

Identification

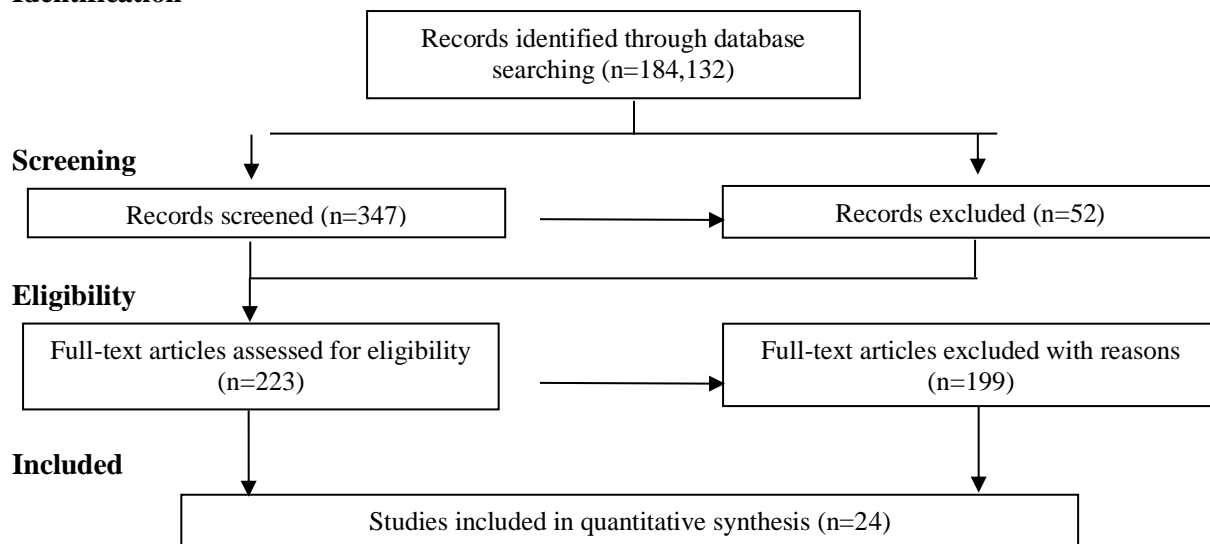


Figure 2. PRISMA flow diagram

Source: author's own research

In the next step, the irrelevant articles were excluded by titles and abstracts of publications (n=199). Thus, the number of studies included in quantitative synthesis was 24 (Table 1).

Finally, the synthesis of these international scientific publications was carried out. To sum up, at the end of 2019, the COVID-19 coronavirus outbreak appeared in China and then spread to all the continents. The disease since its first detection in China in 2019 spread to over 200 countries in the world. The emergence of pandemic and its consequences have led to fears, anxieties and distress among individuals worldwide. Increasing competition in higher education and the changing environment make it clear to more and more higher education institutions that protecting the mental health and psychological well-being of their students, staff and faculty will be essential to ensure long-term student and faculty satisfaction.

The majority of the 24 publications reviewed agree that the mental health in public upper education (college, university) have become increasingly important over the last 3 years. As can be seen from the table, the selected literature comes from all over the world, as COVID-19 has led to new teaching methods in almost all countries due to partial or complete closures. It can be concluded that the same problems are encountered by higher education institutions and university students worldwide, as can be seen from the publications.

Table 1. PRISMA results

	Authors	Publ. year	Article title
1.	Ahammed B. et al.	2021	Exploring the association between mental health and subjective sleep quality during the COVID-19 pandemic among Bangladeshi university students
2.	Bartos L.J. et al.	2021	Developing resilience during the COVID-19 pandemic: yoga and mindfulness for the well-being of student musicians in Spain
3.	Bolatov A.K. et al.	2021	Online or blended learning: the COVID-19 pandemic and first-year medical students' academic motivation
4.	Browning M.H.E.M. et al.	2021	Psychological impacts from COVID-19 among university students: Risk factors across seven states in the United States
5.	Cobo-Rendon R. et al.	2020	Perceived social support and its effects on changes in the affective and eudaimonic well-being of Chilean university students
6.	Eden A.L. et al.	2020	Media for coping during COVID-19 social distancing: stress, anxiety, and psychological well-being
7.	Egcas R.A. et al.	2021	After over a year of pandemic: mental well-being and life satisfaction of Filipino college students
8.	Finnerty R. et al.	2021	Extra-curricular activities and well-being: results from a survey of undergraduate university students during COVID-19 lockdown restrictions
9.	Fuller K.A. et al.	2020	A paradigm shift in US experiential pharmacy education accelerated by the COVID-19 pandemic
10.	Hagedorn R.L. et al.	2021	My entire world stopped: college students' psychosocial and academic frustrations during the COVID-19 pandemic
11.	Huang L. and Zhang T.	2021	Perceived social support, psychological capital, and subjective well-being among college students in the context of online learning during the COVID-19 pandemic
12.	Kecojevic A. et al.	2020	The impact of the COVID-19 epidemic on mental health of undergraduate students in New Jersey, cross-sectional study
13.	Li H. et al.	2021	COVID-19 and pretentious psychological well-being of students: a threat to educational sustainability
14.	Loda T. et al.	2020	Medical education in times of COVID-19: German students' expectations - A cross-sectional study
15.	Lopes A.R. and Nihei O.K.	2021	Depression, anxiety and stress symptoms in Brazilian university students during the COVID-19 pandemic: Predictors and association with life satisfaction, psychological well-being and coping strategies

16.	Marzoli I. et al.	2021	Effects of emergency remote instruction during the COVID-19 pandemic on university physics students in Italy
17.	Oducado, R.M.F. et al.	2021	Personal resilience and its influence on COVID-19 stress, anxiety and fear among graduate students in the Philippines
18.	Peixoto E.M. et al.	2021	The role of passion for studies on academic procrastination and mental health during the COVID-19 pandemic
19.	Plakhotnik M.S. et al.	2021	The perceived impact of COVID-19 on student well-being and the mediating role of the university support: evidence from France, Germany, Russia, and the UK
20.	Schindler A.K. et al.	2021	A longitudinal investigation of mental health, perceived learning environment and burdens in a cohort of first-year German medical students' before and during the COVID-19 'new normal'
21.	Schwartz K.D. et al.	2021	COVID-19 and student well-being: stress and mental health during return-to-school
22.	Spasovski O. and Kenig N.	2021	Psychological well-being in students during self-isolation due to the COVID-19 pandemic
23.	Varadarajan J. et al.	2021	Biomedical graduate student experiences during the COVID-19 university closure
24.	Wu J. et al.	2021	Flow as a key predictor of subjective well-being among Chinese university students: A chain mediating model

Source: author's own research (or: compilation)

Conclusions

When we want to do scientific research, we need to show that our topic has contribution. To justify that we are contributing to the current body of knowledge we need to do a good literature review. If we do a good literature review then, we can find the gaps that we do not know. Thus, to identify what we do not know, first we need to know what we know. In other words, how we know what we know, we need to do literature review. In our research, a quantitative systematic review was conducted to estimate the global prevalence of anxiety and fear among university students during the COVID-19 pandemic. A systematic search of cross-sectional studies was conducted on the Web of Science database using PRISMA guidelines in May 2022. It is important to note that further research is needed to obtain results that are more detailed.

To sum up, it can be concluded that the same problems are encountered by higher education institutions and university students worldwide, as can be seen from the publications. Some of the students are severely affected and need rapid and immediate help to improve their mental health and psychological well-being. A review of the academic literature suggests that mental health and life skills advisory networks operate very differently across universities and that students and staff attach different levels of importance to mental health.

Acknowledgments

The authors say thank for the National Research, Development and Innovation Office (Hungary) (MEC_R_21) for their support (MEC_R_141160).

Reference List

- Ahammed B., Jahan N., Seddeque A., Hossain, M.T., Shovo T.E.A., Khan B., Mamun M.A. and Islam M.N. 2021. Exploring the association between mental health and subjective sleep quality during the COVID-19 pandemic among Bangladeshi university students. *Heliyon*, 7 (5)
- Bartos L.J., Funes M.J., Ouellet M., Posadas M.P. and Krageloh, C. 2021. Developing resilience during the COVID-19 pandemic: Yoga and mindfulness for the well-being of student musicians in Spain. *Frontiers in Psychology*, 12
- Bem D. J. 1995. Writing a review article for *Psychological Bulletin*, *Psychological Bulletin*, vol. 118. no. 2. pp. 172–177.
- Bolatov A.K., Gabbasova A.M., Baikanova R.K., Igenbayeva B.B. and Pavalkis D. 2021. Online or blended learning: The COVID-19 pandemic and first-year medical students' academic motivation. *Medical Science Educator*, 32 (1), pp. 221–228.
- Browning M.H.E.M., Larson L.R., Sharaievska I., Rigolon A., McAnirlin O., Mullenbach L., Cloutier S., Vu T.M., Thomsen J., Reigner N., Metcalf E.C., D'Antonio A., Helbich M., Bratman G.N. and Alvarez H.O. 2021. Psychological impacts from COVID-19 among university students: Risk factors across seven states in the United States. *PLOS ONE*, 16 (1)
- Cobo-Rendon R., Lopez-Angulo Y., Perez-Villalobos M.V. and Diaz-Mujica, A. 2020. Perceived social support and its effects on changes in the effective and eudaimonic well-being of Chilean university students. *Frontiers in Psychology*, 11
- Eden A.L., Johnson B.K., Reinecke L. and Grady S.M. 2020. Media for coping during COVID-19 social distancing: Stress, anxiety, and psychological well-being. *Frontiers in Psychology*, 11
- Egcas R.A., Oducado R.M.F., Cleofas J.V., Rabacal J.S. and Lausa S.M. . 2021. After over a year of pandemic: Mental well-being and life satisfaction of Filipino college students. *Pertanika Journal of Social Science and Humanities*, 29 (4), pp. 2401–2416.
- Fenyvesi É. and Vágány J. 2020. A rejtett gazdaság néhány területének szisztematikus szakirodalmi áttekintése. *Közgazdasági Szemle*, 67 (5). pp. 512–532.
- Finnerty R., Marshall S.A., Imbault C. and Trainor, L.J. 2021. Extra-curricular activities and well-being: results from a survey of undergraduate university students during COVID-19 lockdown restrictions. *Frontiers in Psychology*, 12
- Fuller K.A., Heldenbrand S.D., Smith M.D. and Malcom, D.R. 2020. A paradigm shift in US experiential pharmacy education accelerated by the COVID-19 pandemic. *American Journal of Pharmaceutical Education*, 84 (6), pp. 692–696.
- Hagedorn R.L., Wattick R.A. and Olfert M.D. 2021. My entire world stopped: College students' psychosocial and academic frustrations during the COVID-19 pandemic. *Applied Research in Quality of Life*, 17 (2), pp. 1069–1090.
- Huang L. and Zhang T. 2021. Perceived social support, psychological capital, and subjective well-being among college students in the context of online learning during the COVID-19 pandemic. *Asia-Pacific Education Researcher*.
- Kecejevic A., Basch C.H., Sullivan M. and Davi N.K. 2020. The impact of the COVID-19 epidemic on mental health of undergraduate students in New Jersey, cross-sectional study. *PLOS ONE*, 15 (9)

- Li H., Hafeez H. and Zaheer M.A. 2020. COVID-19 and pretentious psychological well-being of students: A threat to educational sustainability. *Frontiers in Psychology*, 11
- Liberati A., Altman D.G., Tetzlaff J., Mulrow C., Gøtzsche P.C., Ioannidis J.P.A., Clarke M., Devereaux P.J., Kleijnen J. and Moher D. 2009. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Journal of Clinical Epidemiology*, 62, pp. 1–34.
- Loda T., Loffler T., Erschens R., Zipfel S. and Herrmann-Werner A. 2020. Medical education in times of COVID-19: German students' expectations - A cross-sectional study. *PLOS ONE*, 15 (11)
- Lopes A.R. and Nihei O.K. 2021. Depression, anxiety and stress symptoms in Brazilian university students during the COVID-19 pandemic: Predictors and association with life satisfaction, psychological well-being and coping strategies. *PLOS ONE*, 16 (10)
- Marzoli I., Colantonio A., Fazio C., Giliberti M., di Uccio U.S. and Testa I. 2021. Effects of emergency remote instruction during the COVID-19 pandemic on university physics students in Italy. *Physical Review Physics Education Research*, 17 (2)
- Moher D., Cook D.J., Eastwood S., Olkin I., Rennie D, and Stroup D.F. 1999. Improving the quality of reports of meta-analyses of randomised controlled trials: The QUOROM Statement. *British Journal of Surgery*, Vol. 87. No. 11. pp. 1448–1454.
- Moher D. 2009. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA Statement. *PLOS Med*, 6 (7)
- Oducado R.M.F., Parreno-Lachica G.M. and Rabacal J.S. 2021. Personal resilience and its influence on COVID-19 stress, anxiety and fear among graduate students in the Philippines. *IJERI-International Journal of Educational Research and Innovation*, (15), pp. 431–443.
- Page M. J. et al. 2021. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Systematic Reviews*, Vol. 10, No. 89.
- Pautasso M. 2013. Ten simple rules for writing a literature review. *PLoS Computational Biology*, Vol. 9. No. 7.
- Peixoto E.M., Pallini A.C., Vallerand R.J., Rahimi S. and Silva M.V. 2021. The role of passion for studies on academic procrastination and mental health during the COVID-19 pandemic. *Social Psychology of Education*, 24 (3), pp. 877–893.
- Plakhotnik M.S., Volkova N.V., Jiang C.L., Yahiaoui D., Pheiffer G., McKay K., Newman S. and Reissig-Thust S. 2021. The perceived impact of COVID-19 on student well-being and the mediating role of the university support: Evidence from France, Germany, Russia, and the UK. *Frontiers in Psychology*, 12
- Schindler A.K., Polujanski S. and Rothhoff T. 2021. A longitudinal investigation of mental health, perceived learning environment and burdens in a cohort of first-year German medical students' before and during the COVID-19 'new normal'. *BMC Medical Education*, 21 (1)
- Schwartz K.D., Exner-Cortens D., McMorris C.A., Makarenko E., Arnold P., Van Bavel M., Williams S. and Canfield R. 2021. COVID-19 and student well-being: Stress and mental health during return-to-school. *Canadian Journal of School Psychology*, 36 (2), pp. 166–185.

- Spasovski O. and Kenig N. 2020. Psychological well-being in students during self-isolation due to the COVID-19 pandemic. *Primenjena Psihologija*, 13 (4), pp. 427–447.
- Varadarajan J., Brown A.M. and Chalkley R. 2021. Biomedical graduate student experiences during the COVID-19 university closure. *PLOS ONE*, 16 (10)
- Wu J., Xie M., Lai Y., Mao Y.H. and Harmat L. 2021. Flow as a key predictor of subjective well-being among Chinese university students: A chain mediating model. *Frontiers in Psychology*, 12

Creating Recommendations for Eating Disorder Practices and Policies at Canadian Higher Education Institutions

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Abstract

During the past several years, mental health conditions among students increased worldwide. However, while university students are at the highest risk of developing certain mental illnesses, such as eating disorders (EDs), the deadliest mental health illness, higher education institutions (HEIs) currently face a significant gap in practices addressing the management of this condition on their campuses. This study aimed to create recommendations for effective ED practices and policies for Canadian universities. To define existing initiatives directed at helping students with EDs achieve academic success, 49 Canadian public universities were examined for the existence of ED practices and policies. Afterward, the most common policies and practices were discussed with four ED specialists who have experience working with university students. The results of this study showed a lack of ED practices and the absence of ED policies at Canadian HEIs. Findings showed that when incorporating ED-related practices and policies, there is a need to overcome certain challenges first, such as lack of awareness, resources, and prevention and early intervention practices. Other key elements of effective practices and policies are the inclusion of different stakeholders and consideration of the needs of certain groups, such as LGBTQ+, BIPOC, international, and male students.

Keywords: *mental health; higher education*

Introduction

Universities across the globe have different visions, missions, and values, but at their core, they all have one common aim – to help their students succeed. Student success can be defined as “academic achievement, engagement in educationally purposeful activities, satisfaction, acquisition of desired knowledge, skills and competencies, persistence, attainment of educational outcomes, and post-college performance” (Kuh et al., 2006, p. 5). Many factors contribute to students' ability to achieve their potential in the post-secondary education environment. However, one of the key elements that contributes to success is the health of students, including both mental and physical (Minkinen et al., 2017). This statement implies that incorporating practices focused on mental health awareness and improvement is essential to help students reach their potential in the academic environment.

Many types of mental illness may impact students' well-being and therefore, their academic performance. One of the disorders that started to gain more attention recently due to a rise in the number of people who struggle with it is eating disorders (Galmiche et al., 2019), a mental illness with the highest mortality rates (Edakubo & Fushimi, 2020). The importance of addressing this illness in universities is highlighted by the increased probability of developing an ED in the transition phase from adolescence to young adulthood (Potterton et al., 2020). Additionally, not only does students' physical and psychosocial well-being suffers (Holtzhausen et al., 2020) and their quality of life (DeJong et al., 2013) and motivation decreases (Geller et al., 2011), but they are also more likely to experience depression (Sander et al., 2021), fatigue, difficulties concentrating, and problems with updating memories (Vogel & Schwabe, 2016).

Given the constant rise in EDs and their prevalence among students in post-secondary institutions (Potterton et al., 2020), it is essential for university governance to pay attention to the issue. Thus, the purpose of this study was to create recommendations for effective ED policies and practices for Canadian universities. The objectives of this study were to identify practices and policies that Canadian public universities implement to address eating disorders and obtain insights from ED specialists regarding future directions for policies and initiatives directed at managing this mental illness.

Method and Materials

This research focused on examining and implementing practices that can improve students' academic experience. For this reason, a qualitative method of research was chosen because it allows researchers and readers of the study to "understand people's beliefs, experiences, attitudes, behavior, and interactions" (Pathak et al., 2013). This study fitted a case study approach because it involved several data collection methods, such as document analysis and semi-structured interviews, and it examined different cases, such as practices at various Canadian universities and opinions of different ED specialists.

The initial data were gathered through Google and website searches for ED policies and practices at 49 Canadian public universities that are grouped into three categories as identified through the Maclean's university ranking; the three types of universities are medical doctoral, comprehensive, and primarily undergraduate (Macleans, 2021). Afterward, the researcher created a document with the themes found in universities' policies and practices. This document was discussed during semi-structured interviews with four specialists who work with individuals with EDs. They reflected on the practices that they consider effective, the gaps that exist in ED policies and practices, the role of different stakeholders in ED practices, and the needs of different students who struggle with this illness. Subsequently, the researcher conducted a thematic analysis of the interviews based on the Braun and Clarke (2006) approach and created recommendations for ED practices for higher education institutions.

Results

Web-based searches

Three Google searches and four website searches were conducted for each of the 49 universities recognized by the Maclean's ranking between January 15th and February 5th, 2022. None of the universities under analysis had an ED policy or any other health- or accommodation-related policy that would elaborate on this mental illness. Out of 15 medical doctoral universities, eight institutions had ED-related practices found through a Google search, and six institutions provided information about the available eating disorder-related practices on their websites. The search among 19 primarily undergraduate universities showed that five institutions had ED-related practices found through a Google search and seven institutions had practices that the researcher found through the universities' websites. Out of 15 comprehensive universities, the researcher found six institutions that provided information on ED-related practices through a Google search and six institutions also had this information available on their websites.

The next step after conducting Google and website searches was e-mailing university personnel about the existence of ED policies and practices on campuses. Out of 15 medical doctoral universities, only three universities confirmed the presence of certain ED-related practices that are directed either toward athletes or students' general population. Seven responses from primarily undergraduate universities showed that, surprisingly, none of the institutions implemented any practices specifically directed at managing this

mental illness. The researcher received responses from the representatives of eight comprehensive universities, and five of them indicated the existence of certain ED practices on campus.

After conducting a thematic analysis of available ED-related practices, the researcher found three themes, each of which had four to six patterns. These themes included: A) Understanding eating disorders, which included general information about this illness; 2) Recovery, which included contact information about universities' wellness centers and ED centers in the cities, as well as wellness plans for students and information on ED support groups; and 3) Educational Resources, which consisted of elements such as websites, books, presentations, and tests on having an ED.

Interview Data

The researcher conducted semi-structured interviews with four individuals, namely two dietitians, one psychiatrist, and one pediatrician. All specialists had work experience at medical doctoral universities in different parts of Canada. Through the data analysis, five main themes emerged from the experience of the participants. They included existing eating disorder practices, stakeholders, needs of different groups, challenges, and recommendations.

Existing Eating Disorder Practices

The participants were asked to describe available practices at their universities that are directed at managing eating disorders among students. Based on their answers, four subthemes were identified, including eating disorder awareness week/month, treatment teams, ED groups, and lack of initiatives.

The majority of the interviewees stated that their universities put more effort into raising awareness about this illness during an ED awareness week or month. Some participants reflected on active students' involvement during this period, which manifested in implementing ED awareness week events, such as recording podcasts, documentary viewings, and raising awareness on social media. However, it was also stated that attaching a campaign to an entire month can be challenging because an institution has other priorities, so eventually, the topic of EDs receives not as much attention as it should.

Half of the participants stressed that the ED treatment team makes the biggest contribution to managing this illness on campuses. It was also mentioned that the topic of mental health became an important subject matter for universities' governance in recent years, which allowed to invest more in counseling and, as a result, increase the number of psychologists on campus.

Regarding ED support groups, a popular practice aimed at helping individuals overcome their illness, participants' viewpoints differed. Half of the interviewees stated that they are not convinced about the positive outcomes of an ED group for students because the commitment that it requires might be too overwhelming for students, or it can often lack a specific structure, which can become an additional trigger that can worsen the symptoms. On the other hand, one participant strongly expressed her support for ED groups and saw it as an important element of recovery.

Despite the availability of certain ED-related practices on campuses, the participants stressed that post-secondary institutions "could be doing a lot more". The support that students with EDs receive on campus is often very limited, and one participant claimed that he has never seen any specific practices related to this illness. It was also highlighted that staff should take more ownership in addressing this topic on campus rather than simply relying on what students do.

Stakeholders

To implement effective ED practices, there is a need to engage different parties whose contribution can be crucial in the detection, prevention, and management of this illness. The roles of students' parents, educators, and student health centers were addressed the most during the discussions with ED specialists.

When discussing the contribution of students' parents to helping young people to manage an ED, the interviewees did not have a unanimous opinion. From one side, it was stated that patients' body image was often negatively affected by their parents, which led to the development of an ED. Additionally, participants who did not support strong parents' involvement explained that learning to manage this illness without parental involvement is one of the integral parts of the ED treatment. At the same time, another half of the participants mentioned that parents can provide students with support crucial for recovery. Especially for students who live with their families, parents' involvement is critical because parents are often responsible for cooking, and proper nutrition is a critical element of ED recovery. It was also stated that although a family-based approach to treatment is usually offered to individuals of a younger age, it can still work for any person as long as they do not have a major reason why parents should not be involved.

When discussing the role of educators, the idea was to understand how faculty members who are not related to the areas of nutrition, psychology, or psychiatry can contribute to managing EDs on campus. However, for the most part, interviewees either could not see the contribution this stakeholder can make, or reflected only on practices that can be made by educators who teach in the fields that can be connected to EDs. Participants stressed the need to pay special attention to courses that usually put more importance on the body image, such as drama or art, eliminate weight bias from the curriculum, and raise awareness about EDs among future healthcare professionals.

The university wellness centers were the stakeholders, whose contributions were considered essential by all the participants of the study. As the interviewees stated, wellness centers should take more ownership in raising awareness about this illness on campus, promoting ED practices, and encouraging the administration to adopt more ED-related initiatives. Instead of relying on a top-down approach and waiting for institutional administrators to make the first step, universities' wellness centers should bring up this topic, because they are the ones who are aware of the effects that eating disorders have on students.

Needs of Different Groups

One of the interview sections was dedicated to the consideration of the needs of different populations when creating ED practices. Despite the common belief that this illness only affects thin white females (Gordon et al., 2002), many other groups are at a higher risk because they are not perceived as "typical" eating disorder cases. For this reason, the needs of students with different cultural backgrounds, members of the LGBTQ+ community, and male students were discussed.

Participants stressed that people of color are less likely to be diagnosed with an ED, and stigma around mental health can become an additional barrier for these students that prevents them from reaching out for help. Additionally, a different approach to treatment for students from certain countries might be required, which creates a need for the importance of including the opinions of individuals with different cultural backgrounds when creating ED practices. Interviewees also highlighted the importance of addressing the needs of Indigenous students, who are at a higher risk of developing an ED due to intergenerational trauma. Furthermore, although participants did not confirm that having separate ED practices for these students can bring extra benefits for them, it was stated that being more sensitive to the needs of different populations is an essential part of an effective ED practice.

Because members of the LGBTQ+ community are more likely to develop an eating disorder (Parker & Harriger, 2020), the importance of addressing the needs of this group was highlighted by all the interviewees. It was stated that special attention should be paid to transgender students because surveys that aim at identifying individuals with EDs often consider the existence of only two genders, which makes it more difficult to identify this illness among transgender students (Diemer et al., 2018).

Although women are more likely to develop an ED (Murray et al., 2017), males still are at high risk because of the common belief that they cannot have this illness, which creates stigma and prevents this group from reaching out for help. Additionally, men are extremely underrepresented in nutrition major programs, which can make their knowledge in this area more limited.

Challenges

To manage this illness on campuses better, it is crucial to overcome certain barriers that prevent universities from creating more ED-related policies and practices. First, it is important to increase awareness of this topic, because a lack of knowledge and recognition of this illness leads to bias among health professionals and the general population. Second, because people do not perceive this illness seriously enough, resources are not allocated to the initiatives related to the prevention and management of EDs. Third, to decrease the number of individuals with EDs on campuses, it is crucial to implement prevention and early intervention practices, which currently do not exist in the majority of institutions. Another challenge is the lack of healthcare professionals' education. Participants stressed that learning materials of healthcare professionals often include bias that can lead to difficulties in identifying and managing this mental illness. Last but not least, universities often show a lack of consistency in treatment practices. Despite the existence of evidence-based research, wellness centers' personnel often use non-specific interventions, which might hinder students' progress in recovery.

Discussion

This study aimed to identify practices and policies that Canadian public universities implement to address EDs and obtain insights from ED specialists regarding future directions for policies and initiatives directed at managing this mental illness. The web-based search that was conducted during the first stage of this study confirmed that Canadian public post-secondary institutions lack policies and practices that address this mental illness, which can be the case due to several challenges identified during the second stage of this study, such as lack of awareness and knowledge about this illness and, as a result, lack of resources directed at managing EDs on campus. Discussions with ED specialists shed light on existing ED practices and highlighted the importance of addressing the needs of different student groups as well as considering the role of certain stakeholders in incorporating ED-related initiatives.

Although some universities have ED treatment teams and conduct events during an ED awareness week or month, this study showed the lack of ED-related practices on Canadian campuses. The literature shows that one of the most common ways for universities to address eating disorders is through the implementation of prevention programs that focus on the work with body dissatisfaction and disassociating with beauty ideals (Stice et al., 2010). However, all the participants of the study stressed that one of the biggest gaps in ED-related initiatives on campuses is an absence or lack of prevention practices. Additionally, despite that some researchers stressed that online screening and online discussions related to positive body image became more common (O'Dea & Cinelli, 2012), none of the interviewees described the availability of such projects at the universities with which they were affiliated.

Needs of different groups

Culture and ethnicity

Understanding ways in which universities can help different students manage their EDs is essential considering diversity in Canadian post-secondary institutions. The majority of the participants agreed with the point of O'Dea and Cinelli (2012) who claimed that a universal ED program that is adapted to the needs of different students can be as effective as separate ED programs for these populations. At the same time, it was found that involving specialists whose backgrounds are similar to those of the students can be beneficial for their recovery. Although ethnic minorities are affected by eating disorders as much as white people (Cheng et al., 2019), participants stated that minorities are at a higher risk because they are less likely to be diagnosed. The need to consider the different cultural backgrounds of students was also highlighted because different countries may have different perceptions of mental health illnesses. This view was supported by Ran et al. (2021) who revealed that cultural factors play an important role in affecting the rate and perception of the stigma of mental illnesses. For this reason, promotion channels for ED programs may vary. For example, it could be useful for wellness centers to cooperate with international or Aboriginal students centers on campuses for organizing events that could decrease the stigma around mental health among these populations.

Males

Although being a female is one of the risk factors to develop an ED (Striegel-Moore et al., 2009), it is essential to address the needs of those groups that are not regarded as "typical" eating disorder cases. Consideration of eating disorders as "female illnesses" often prevents males from reaching out for help and getting treatment (Collier, 2013); this point was also highlighted by the participants of the study. Thus, collaborating with initiatives on campus that are directed at providing services to males and opening a conversation about nutrition and EDs can also encourage more men not just to learn more about this illness but to reach out for help if needed.

LGBTQ+

Taking into consideration the needs of LGBTQ+ students is essential because they are more likely to develop an ED (Parker & Harriger, 2020). This study also confirmed the findings of Diemer et al. (2018), which stressed that identifying an ED is more difficult among transgender and non-binary individuals. For this reason, there is a need to focus on creating practices directed at the LGBTQ+ community, and transgender and non-binary individuals specifically, whose identity development is often accompanied by stigma, discrimination, and internalized homophobia or transphobia (Meyer, 2015). Surveys aimed at identifying an ED and treatment practices should be analyzed for the presence of more gender-neutral terms, and universities should consider creating more mental health-related practices in collaboration with pride centers.

Role of different stakeholders

To understand how to address EDs on campuses most effectively, it is essential not only to discuss practices that are useful for students with this illness but also the role of stakeholders who are responsible for implementing these practices on campus. This study paid special attention to the contribution of students' parents, educators, and wellness centers.

Students' parents

The opinions on the role of students' parents in the literature vary, similarly to what was observed during interviews. Some researchers noted that parents can contribute to the development of their child's

eating disorder by expressing negative attitudes towards their or their children's bodies and weight (Woolley & Wheatcroft, 1998). Half of the interviewees supported this viewpoint when explaining why parental involvement in the management of students' eating disorders should be minimal, while the other participants supported the statement that parental support can be critical in recovery. Considering that there is not a unanimous opinion on the role of parents, it is suggested that the best way to involve students' parents is during treatment in cases where the students ask for the support; however, there is no need to engage this stakeholder in other possible ED-related activities on campus.

Educators

When discussing the role of educators in managing eating disorders on campuses, participants often did not see how faculty and staff whose disciplines are not related to this area can contribute to solving this problem on campus. They did not discuss any teaching methodologies, such as feminist pedagogy, andragogy, or trauma-informed learning that can better address the needs of students with EDs. Only one participant highlighted the need for trauma-informed learning when educating individuals with this mental illness. However, it was mentioned that being aware of the seriousness of eating disorders, understanding the importance of special accommodation, and knowing where to refer students when they reach out for help can make a great contribution to the lives of students with this illness.

More responsibility for addressing EDs through education lies on educators who teach in medical colleges. The findings showed that medical students who later become healthcare specialists do not receive enough training that addresses ED. This issue can be managed by reviewing medical syllabi on the presence of ED-related materials and offering more training that is specifically aimed at treating this mental illness. Another possible solution is creating a mandatory course for healthcare students that would aim to foster a healthy relationship with the body and food.

Wellness Centers

Last but not least, the findings showed that the role of universities' wellness centers in supporting students with eating disorders is essential. Despite that it might be an obvious point, the participants highlighted that the role of wellness centers does not manifest only in treating students with this illness. Wellness centers should also be responsible for raising awareness about EDs on campuses and organizing prevention initiatives. Besides that, they have a major role to play in explaining to university governance the seriousness of this illness and its prevalence among the university-aged population, as well as pitching projects that would allow bringing more resources directed at treating eating disorders on campuses.

Conclusions

Eating disorders are serious mental health illnesses that require more attention from Canadian post-secondary institutions due to their high prevalence among students and strong negative effects on individuals' well-being, and, as a result, academic success. The findings of this study showed that universities today mostly do not address this mental illness, which was proved by the absence of ED-related policies and lack of practices. This study showed the difficulties in the identification of this illness among BIPOC, LGBTQ+, and male students, which highlights the necessity to pay more attention to these individuals when creating ED-related practices. Additionally, the contribution of different stakeholders, especially wellness centers and educators can make a crucial contribution to decreasing the prevalence of EDs in Canadian post-secondary institutions.

Reference List

- Cheng, Z., Perko, V., Fuller-Marashi, L., Gau, J. and Stice, E., 2019. Ethnic differences in eating disorder prevalence, risk factors, and predictive effects of risk factors among young women. *Eating Behaviors*, 32, pp. 23-30.
- Collier, R., 2013. Gender perceptions on eating disorders slow to change. *Canadian Medical Association Journal*, 185(3), pp. E151-E152.
- DeJong, H., Oldershaw, A., Sternheim, L., Samarawickrema, N., Kenyon, M., Broadbent, H., Lavender, A., Startup, H., Treasure, J. and Schmidt, U., 2013. Quality of life in anorexia nervosa, bulimia nervosa and eating disorder not-otherwise-specified. *Journal of Eating Disorders*, 1(1).
- Diemer, E., White Hughto, J., Gordon, A., Guss, C., Austin, S. and Reisner, S., 2018. Beyond the Binary: Differences in Eating Disorder Prevalence by Gender Identity in a Transgender Sample. *Transgender Health*, 3(1), pp.17-23.
- Edakubo, S. and Fushimi, K., 2020. Mortality and risk assessment for anorexia nervosa in acute-care hospitals: a nationwide administrative database analysis. *BMC Psychiatry*, 20(1).
- Galmiche, M., Déchelotte, P., Lambert, G. and Tivolacci, M., 2019. Prevalence of eating disorders over the 2000–2018 period: a systematic literature review. *The American Journal of Clinical Nutrition*, 109(5), pp.1402-1413.
- Geller, J., Brown, K. and Srikaneswaran, S., 2010. The efficacy of a brief motivational intervention for individuals with eating disorders: A randomized control trial. *International Journal of Eating Disorders*, 44(6), pp.497-505.
- Gordon, K., Perez, M. and Joiner, T., 2002. The impact of racial stereotypes on eating disorder recognition. *International Journal of Eating Disorders*, 32(2), pp.219-224.
- Holtzhausen, N., Mannan, H., Foroughi, N. and Hay, P., 2020. Effects associated with the use of healthcare for eating disorders by women in the community: a longitudinal cohort study. *BMJ Open*, 10(8), p.e033986.
- Kalra, S., Pathak, V. and Jena, B., 2013. Qualitative research. *Perspectives in Clinical Research*, 4(3), p.192.
- Kuh, G., Kinzie, J., Buckley, J., Bridges, B. and Hayek, J., 2022. *What Matters to Student Success: A Review of the Literature*. [online] Washington: NPEC, p.7. Available at: <https://nces.ed.gov/npec/pdf/kuh_team_report.pdf> [Accessed 8 May 2022].
- Maclean's, 2022. *MACLEAN'S UNIVERSITY RANKINGS*. [online] Available at: <<https://www.macleans.ca/hub/education-rankings/>> [Accessed 8 May 2022].
- Meyer, I., 2015. Resilience in the study of minority stress and health of sexual and gender minorities. *Psychology of Sexual Orientation and Gender Diversity*, 2(3), pp.209-213.
- Minkinen, J., Lindfors, P., Kinnunen, J., Finell, E., Vainikainen, M., Karvonen, S. and Rimpelä, A., 2017. Health as a Predictor of Students' Academic Achievement: A 3-Level Longitudinal Study of Finnish Adolescents. *Journal of School Health*, 87(12), pp.902-910.

- Murray, S., Pila, E., Griffiths, S. and Le Grange, D., 2017. When illness severity and research dollars do not align: are we overlooking eating disorders?. *World Psychiatry*, 16(3), pp.321-321.
- O'Dea, J., n.d. *Current issues and controversies in school and community health, sport and physical education*. Hauppauge: Nova Science Pub Inc, pp.91-103.
- Parker, L. and Harriger, J., 2020. Eating disorders and disordered eating behaviors in the LGBT population: a review of the literature. *Journal of Eating Disorders*, 8(1).
- Potterton, R., Richards, K., Allen, K. and Schmidt, U., 2020. Eating Disorders During Emerging Adulthood: A Systematic Scoping Review. *Frontiers in Psychology*, 10.
- Ran, M., Hall, B., Su, T., Prawira, B., Breth-Petersen, M., Li, X. and Zhang, T., 2021. Stigma of mental illness and cultural factors in Pacific Rim region: a systematic review. *BMC Psychiatry*, 21(1).
- Sander, J., Moessner, M. and Bauer, S., 2021. Depression, Anxiety and Eating Disorder-Related Impairment: Moderators in Female Adolescents and Young Adults. *International Journal of Environmental Research and Public Health*, 18(5), p.2779.
- Stice, E., Marti, C. and Durant, S., 2011. Risk factors for onset of eating disorders: Evidence of multiple risk pathways from an 8-year prospective study. *Behaviour Research and Therapy*, 49(10), pp.622-627.
- Striegel-Moore, R., Rosselli, F., Perrin, N., DeBar, L., Wilson, G., May, A. and Kraemer, H., 2009. Gender difference in the prevalence of eating disorder symptoms. *International Journal of Eating Disorders*, 42(5), pp.471-474.
- Vogel, S. and Schwabe, L., 2016. Learning and memory under stress: implications for the classroom. *Science of Learning*, 1(1).

Exploring Text Adventure Game Development as a Viable Interdisciplinary Pedagogical Activity in K-12 Learning Environments

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Abstract

This research explores text adventure game development as an interdisciplinary pedagogical activity. Despite literature being sparse on digital interactive fiction, a review of existing articles uncovers three main categories of game development activities: a) authorship with guidance; b) learning by modifying; and c) low-fidelity prototyping—each with unique learning benefits. These insights are then applied within the context of the text adventure game genre, resulting in a blueprint by which educators may introduce pertinent activities that build creative writing ability and technological acumen. The hope is that this framework inspires discussion related to the viability of these pedagogical options not only for the purposes of teaching programming to young learners, but also in providing a valuable prompt for dynamic creative writing exercises.

Keywords: *computer programming instruction; game development; text adventure games; interdisciplinary learning*

Introduction

Offering computer game development activities to students could prove advantageous in their development of competencies beyond simply learning how to write code. According to Begel & Klopfer, (2004), computer programming is a powerful medium for young students to express themselves creatively, develop problem-solving skills, and create interdisciplinary links (p. 2). Developing traditional text adventure games, for instance, bolsters a student's ability to write code as well as exposes them to creative literature. They are one of the easier projects that a beginner could accomplish, even with no coding experience, and is our focus for this research.

Alternately referred to as interactive fiction, text adventure games require the author to describe in detail the world in which the player resides and all the components which makes interaction by the player possible. The first adventure games were entirely text-driven and allowed the player to input commands as short verb and noun combinations to progress the story (Cavallari et al., 1992). Being that text adventure game development has the student pull from a variety of hard and soft skills, this is naturally a unique instructional/curricular intervention with which one could analyze the medium (game development) for interdisciplinary benefits.

Furthermore, it is important that K-12 institutions be open to fostering programming skills in the younger generations so that we might adequately meet the challenges that a society steeped in technology demands of its workforce. Díaz-Herrera (2017), describes these distinct challenges in detail:

Even if we could substantially increase the number of computing programs in colleges and universities, the gap between the demand for computing-proficient professionals and the number of prepared graduates would continue to widen; there are simply not enough computing graduates, and there are not likely to be, to satisfy the ever increasing [sic] demand for talent (p. 178)

Methods

This paper explores text adventure game development as an interdisciplinary pedagogical activity. Despite the limited nature of literature on digital interactive fiction, a review of existing articles uncovers a few main categories of game development activities and their respective learning benefits. Insights acquired through a review of the literature are then applied within the context of the text adventure game genre. The hope is that this framework inspires discussions related to the viability of these pedagogical options not only for the purposes of teaching programming to young learners, but also in providing a valuable prompt for dynamic creative writing exercises.

Educational Benefits of Game Development Activities

Robertson & Good (2005), points out the well-known learning benefits of playing games, but also acknowledges that game creation opens a greater range of learning opportunities to the student (pg. 1). Digital game development as a pedagogical approach helps to facilitate a student's transformation from a consumer of technology to a creator (Alves & Hostins, 2019). One systematic analysis of 68 articles suggests that computer design and programming largely enhances problem-solving capabilities and programming expertise (Denner et al., 2019); however one could speculate further as to other disciplines exercised beyond the more obvious.

Studies which investigate digital game creation often describe several specific skills that young developers might practice within a single activity. Given games are systems, system thinking is naturally a skill developed in the game developer as they can describe the individual components of their game and how it all interacts as a cohesive whole (Nordby et al., 2016). One study examined opportunities for children to create computer games as art, noting that students developed themselves as artists and technologists throughout the experience (Keifer-Boyd, 2005). One study demonstrated that computer game development as a pedagogical aid resulted in improved learning of basic literacy skills (vocabulary, passage comprehension, and sentence comprehension), over that of more traditional teaching approaches (Owston et al., 2009). These are but a few of the benefits to game development instruction and is not intended to be an exhaustive summary.

Defining Game Development Activities

A variety of pedagogical practices exist in digital game development, comprising three distinct classifications of activities: a) authorship with guidance; b) learning by modifying; and c) low-fidelity prototyping. Each of these broad categories have their own distinguishing characteristics, however it must be acknowledged that approaches differ in significant ways with no two activities being the same. These categories were designed to make sense of and organize the practices in game development within existing K-12 learning environments.

Authorship with Guidance

Game development practices are representative of both game design elements as well as the actual programming work involved, providing students with an assortment of vantage points and tasks to explore. It has been demonstrated that children are quite capable of creating advanced games and products if they have the support of educators and tutors vested in their learning experience (Yatim, N.d.). In one study, low-fidelity prototypes and game design documents made by children were offered to college students who then developed high-fidelity interactive versions (Corral et al., 2015). Another study investigated the

learning experiences of 15 students paired with one instructor tasked with developing a computer game, exposing students to all the details involved in building a game from scratch (Hava et al., 2020). Learning how to develop a game from scratch by actually performing the work required to build one provides an unparalleled real-world experience.

Learning by Modifying

When children modify games, they learn about graphics design and animation, programming, game design, system thinking, and collaboration (Nordby et al., 2016), to name a few, and this is sometimes an introduction to pursuing actual game development later in life. Pedagogical co-design may allow for the modification of games with a game editor and scripting so that students may learn game development practices and design (Wu & Wang, 2012), behind beloved games. Johnson (2018) introduces a book-length tutorial on programming text adventure games in Python by encouraging readers to modify the included source code to realize their own games (p. 1). Reviewing and modifying the code of games already in existence may support a student's understanding of the inner mechanics of a game as well as build comprehension in programming concepts and practices.

Low-fidelity Prototyping

A third category emerged from the literature, comprising workshops and activities that teach skills that are particularly useful in game development, but stopping short of any actual computer programming experience. These activities are particularly popular for younger learners and as beginner experiences in theory, problem solving, and conjuring up scenarios that closely resemble what one might experience during game production.

Low-fidelity prototyping is a way for students to create tangible game prototypes which produce working models of game ideas and mechanics explored through play (Moser, 2012). A card-based model for digital game design is an activity which allows students to create low-fidelity prototype games with physical cards which may then be digitized into workable digital counterparts (Marchetti & Valente, 2015). Students who are more inclined to work with their hands may develop physical characters which would then be digitized into the actual computer game (Giannakos & Jaccheri, 2018), making use of different talents and abilities.

Possible Text Adventure Game Activities

Mladenović et al. (2016), recommends that programming activities for elementary-aged students serve as gentle introductions into programming as the difficulty level of learning a new language can be off-putting (p. 7). It is for this reason that simple text adventure games or interactive fictions be conceptualized and developed by K-12 students, building basic programming acumen in addition to other skills belonging to other disciplines. Table 1 presents the results of a thought-experiment which defines possible text adventure game development activities that are in keeping with insights acquired through the prior analysis of general K-12 computer game development initiatives.

Table 1 *Possible Text Adventure Game Development Activities*

Category	Activities
Authorship with guidance	Develop a text adventure with available resources and tutor guidance. Establish appropriate levels of complexity.
Learning by modifying	Create a new game with an existing text adventure game engine. Modify events/rooms/ending within an existing game.
Low-fidelity prototyping	Write a group interactive fiction with plot development exercises and map game mechanics into a physical prototype.

Note: These constructivist learning activities were developed within the parameters of categories discovered during a review of existing K-12 computer game development literature

Conclusion

The scope of this research was to identify the viability of text adventure game development activities that strengthen student skills and academic ability in a variety of disciplines beyond the computer sciences. A review of literature describing previous game development initiatives in the K-12 education system revealed themes which might direct strategies to incorporate text adventure projects into various curricula. Further research into text adventure game development activities is warranted, given their popularity as introductory computer programming projects which command a lower difficulty curve. Another strength of this activity category is that assignments may be developed with the maturity level of the students in mind.

Given the demands placed on a developer to write storylines and narrative, future studies could reasonably assess creative output and student performance in writing and language arts. The excitement of developing a digital world and characters through interactive fiction writing may be just as influential to the student's overall development as writing game code. The dichotomous nature of text adventures allows students to explore both their artistic creative ability as well as developing skills in the hard sciences, warranting its consideration in many educational settings.

Finally, introducing gateway computer programming challenges to elementary-aged students might end up being the difference between a future workforce equipped to meet societal demands, versus one who falls short of the requisite knowledge and experience to participate more fully in the digital age.

References

- Alves, A., & Hostins, R. (2019). Development of imagination and creativity through the game design by children in inclusive school. *Revista Brasileira De Educacao Especial*, 25(1), 17–36.
- Begel, A., & Klopfer, E. (2004). Starlogo TNG: An introduction to game development. *Journal of E-Learning*, 1–15. https://doi.org/10.1007/978-1-84882-285-6_6
- Cavallari, B., Heldberg, J., & Harper, B. (1992). Adventure Games in Education: A Review. *Australasian Journal of Educational Technology*, 8(2). <https://doi.org/10.14742/ajet.2254>
- Corral, L., Fronza, I., Gennari, R., & Melonio, A. (2015). From game design with children to game development with University Students. *Proceedings of the 11th Biannual Conference on Italian SIGCHI Chapter*. <https://doi.org/10.1145/2808435.2808441>
- Denner, J., Campe, S., & Werner, L. (2019). Does Computer Game Design and programming benefit children? A meta-synthesis of research. *ACM Transactions on Computing Education*, 19(3), 1–35. <https://doi.org/10.1145/3277565>
- Díaz-Herrera, J. (2017). The education of the 21st century professional. *VNU Journal of Science: Policy and Management Studies*, 33(2), 175–183.
- Giannakos, M. N., & Jaccheri, L. (2018). From players to makers: An empirical examination of factors that affect creative game development. *International Journal of Child-Computer Interaction*, 18, 27–36. <https://doi.org/10.1016/j.ijcci.2018.06.002>
- Hava, K., Guyer, T., & Cakir, H. (2020). Gifted students' learning experiences in systematic game development process in after-school activities. *Educational Technology Research and Development*, 68(3), 1439–1459. <https://doi.org/10.1007/s11423-020-09750-z>
- Johnson, P. (2018). *Make your own python text adventure: A guide to learning programming*. Apress.
- Keifer-Boyd, K. (2005). Children teaching children with their computer game creation. *Visual Arts Research*, 31(1).
- Marchetti, E., & Valente, A. (2015). Learning via game design: From digital to card games and back again. *The Electronic Journal of e-Learning*, 13(3), 167–180.
- Mladenović, M., Krpan, D., & Mladenović, S. (2016). Introducing programming to elementary students novices by using game development in Python and Scratch. *EDULEARN Proceedings*. <https://doi.org/10.21125/edulearn.2016.1323>
- Moser, C. (2012). Child-centered game development (CCGD): Developing games with children at school. *Personal and Ubiquitous Computing*, 17(8), 1647–1661. <https://doi.org/10.1007/s00779-012-0528-z>
- Nordby, A., Øygardslia, K., Sverdrup, U., & Sverdrup, H. (2016). The art of gamification; teaching sustainability and system thinking by pervasive game development. *The Electronic Journal of e-Learning*, 14(3), 152–168.
- Owston, R., Wideman, H., Ronda, N. S., & Brown, C. (2009). Computer game development as a literacy activity. *Computers & Education*, 53(3), 977–989. <https://doi.org/10.1016/j.compedu.2009.05.015>

Robertson, J., & Good, J. (2005). Children's narrative development through computer game authoring. *TechTrends*, 49(5), 43–59. <https://doi.org/10.1007/bf02763689>

Wu, B., & Wang, A. I. (2012). A guideline for game development-based learning: A literature review. *International Journal of Computer Games Technology*, 2012, 1–20. <https://doi.org/10.1155/2012/103710>

Yatim, M., & Masuch, M. (n.d.). Educating children through game making activity. *University of Magdeburg*.

Adjustment of Inclusive Education Courses with Inclusive Elementary Schools Needs: Part of the University School Collaborative Partnership in Indonesia

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Abstract

Collaboration between universities and inclusive elementary schools, especially in the adjustment of inclusive education courses, has not overcome the problem of inclusive education practices. Although some topics of inclusive education lessons are relevant to problems in inclusive classrooms, they have not been able to fully meet the needs of inclusive elementary schools. The purpose of this study was to explore the opinions of faculty lecturers regarding the adjustment of inclusive education courses to overcome the problems faced by inclusive elementary schools. This research is a case study involving five department lecturers who teach inclusive education courses. Data were collected through semi-structured interviews and analyzed using thematic analysis. The study results resulted in three main themes: benefits, formulations, and topics of inclusive education courses. The adjustment of inclusive education courses is the basis for universities and inclusive elementary schools in dealing with the dynamics of change and development of inclusive education. In addition, as a form of collaboration between the two parties to obtain positive reciprocal benefits in implementing inclusive education.

Keywords: *Inclusive elementary school; collaborative; partnership; university*

Introduction

The commitment of Indonesian government to implementing inclusive education, particularly in elementary schools, is by issuing a rule that universities that run the primary school teacher education department must provide inclusive education courses. This rule is an obligation for every department of primary school teacher education at universities, so there must be adjustments that are in line and relevant to the needs of inclusive primary schools. For this reason, a collaboration between departments and inclusive primary schools must be well established.

Collaboration between universities and inclusive elementary schools is one form of cooperation that must carry out in inclusive implementation (Causton-Theoharis et al., 2011; Waitoller & Kozleski, 2013). So far, various problems in inclusive education in inclusive elementary schools have not received a comprehensive solution (Carrington, 1999; Rasmitadila et al., 2021). Although there has been a cooperative relationship between universities--departments-- such as the elementary school teacher education as the provider of inclusive education courses, it has not been able to meet the needs and solve problems faced by inclusive elementary schools (Rasmitadila et.al, 2021; Loreman, 2007). Several programs from the department, such as student internships, field practices, and research conducted by students and lecturers, only position inclusive elementary schools as objects (Forlin & Chambers, 2011; Sharma et al., 2006). There are no direct benefits for inclusive primary schools, especially in solving inclusive problems. This study aimed to explore the opinion of faculty lecturers regarding the adjustment of inclusive education courses to overcome the difficulties faced by inclusive elementary schools. Adjustment of courses must

involve all parties, both the university--department-- and inclusive elementary schools, as a form of collaboration between the two parties.

Methods and Materials

This research uses qualitative research with a case study approach. The study involved five lecturers at a university that organizes elementary school teacher education programs and teaches inclusive education courses. The average teaching experience is 5-10 years. Data were collected through in-depth semi-structured interviews. Interviews were conducted for 1-2 hours for five days and discussed the adjustment of inclusive education courses that were relevant to the issue of inclusive education in inclusive primary schools. The data from the interviews were then transcribed as a basis for analyzing the data. Data were analyzed using thematic analysis. Thematic analysis is used to obtain relevant themes from the results of this study (Braun & Clarke, 2012). To make it easier for researchers to code and analyze data, Nvivo 12 is used, especially in making categorizations and producing accurate themes. Data from interviews are entered into Nodes and Codes to be grouped into data with relevant codes. Thematic maps show the organization of concepts according to various levels, and potential interactions between concepts are then developed.

Results and Discussion

Research findings indicate that the adjustment of inclusive education courses to the needs of inclusive elementary schools produces four main themes: benefits, formulation, and subject topics.

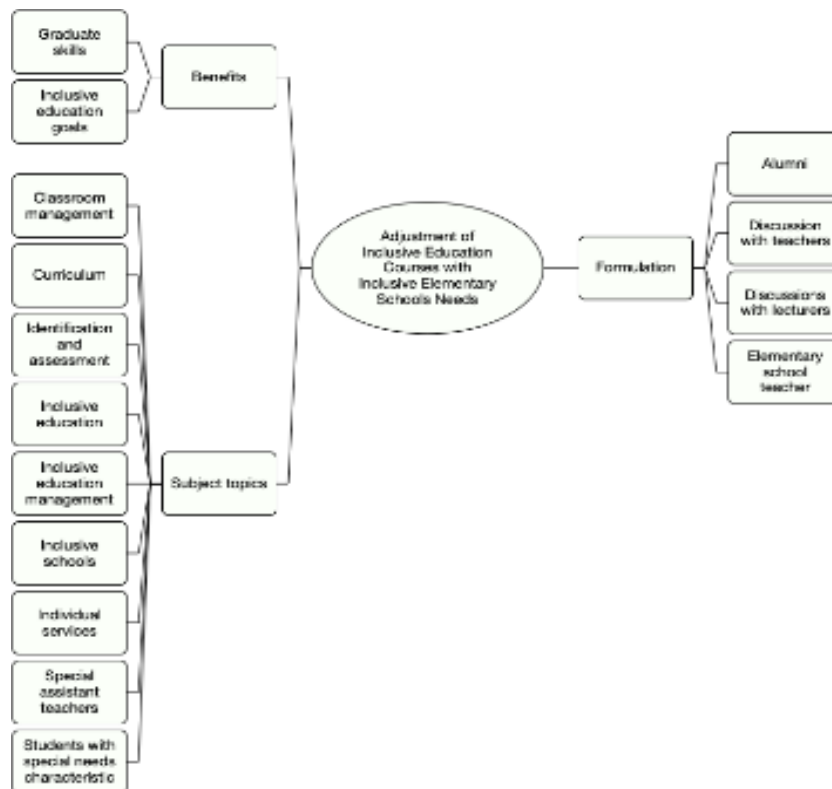


Figure 1. Themes of the data analysis

Benefits

The findings of the benefits are the benefits of inclusive education courses related to graduate skills and inclusive education goals. Graduate skills relate to graduates' output when they finish their studies. In the opinion of participants, inclusive education courses will benefit students. Students will learn about handling students with special needs (SSNs), adding insight into inclusive education when they become teachers. Students will also get an overview of the practice of inclusive education in inclusive elementary schools through various programs from this course. So that the purpose of inclusive education is apparent, and in particular, students are expected to understand the concept and apply it in inclusive primary schools. This opinion is appropriate to be expressed by one of the lecturers:

"The graduate teacher candidates have the knowledge, insight, and skills in dealing with those with special needs."

The benefits of inclusive education courses for students must be obtained so that the concept of inclusive education is theoretical and can also be practiced in inclusive classrooms through internships and field practices (Carrington et al., 2015; Brandon & Charlton, 2011). This program aims to provide students with a teaching experience in inclusive primary schools and help classroom teachers solve problems in inclusive classrooms.

Formulation

The formulation of inclusive education courses is the initial plan of choosing the topic of the courses that will be given to students. This formulation found that the formulation of subject topics came from the involvement of alumni, discussions with lecturers, teachers, and elementary school teacher education associations. The participation of alumni is essential so that there is relevance between the content of the courses and the problems teachers face in inclusive elementary schools. Usually, the alumni involved are alumni who have taught in inclusive elementary schools. Likewise, the teachers involved are teachers who teach in inclusive classes. The university--department--invites teachers to discuss problems in inclusive classes. In addition to teachers, the department also invites lecturers directly involved in teaching inclusive education courses. The lecturers discuss with each other, formulate subject topics, and make lesson plans together--team teaching-- to become courses following the problems in inclusive elementary schools. Usually, another reference for the department is the guide from the elementary school teacher education association. So, the department can combine input from lecturers and associations. One of the lecturers expressed his opinion:

" Usually, we discuss with Inclusive Elementary School teachers to find out the problems in the field regarding inclusive education in Elementary Schools."

The formulation of inclusive education courses must be carried out by all stakeholders involved so that they are relevant and in sync with the problems and needs of inclusive elementary schools (Majoko, 2019; Budnyk & Sydoriv, 2019). All parties can formulate together by mapping the problems and needs in inclusive classes. Based on this formula, the teacher education department can create subject topics and basic standard learning plans that each lecturer can flexibly develop.

Subject topics

One of the results of the formulation of inclusive education courses is the subject topics used in semester lectures. Subject topics in inclusive education courses include inclusive education, inclusive

schools, students with special needs characteristics, identification and assessment, special assistant teachers, curriculum, individual services, inclusive education management, and classroom management. This topic must exist and be studied by students because many problems that occur in inclusive elementary schools are related to these topics. One of the lecturers argued:

"... must be introduced to the characteristics of children, any students in inclusive schools, starting with regular students there are also SSNs."

The topic of the courses given by the lecturer must be able to describe the whole practice of inclusive education. The topic content of the course is the result of a joint formulation of all stakeholders of inclusive education providers so that they can solve problems that occur in inclusive elementary schools. The universities and inclusive elementary schools must reach a mutual agreement in determining the topic of inclusive education courses (Mittler, 2012; Rasmitadila et al., 2022). The needs needed by inclusive elementary schools can be met (Ainscow & Sandill, 2010; Slee, 2011). At the same time, the department gets the best input related to inclusive education courses.

Conclusions

This study aimed to explore the opinion of faculty lecturers regarding the adjustment of inclusive education courses to overcome the problems faced by inclusive elementary schools. Adjustment of courses must involve all parties, both the university (department) and inclusive elementary schools, as a form of collaboration between the two parties. The adjustment of inclusive education courses is the basis for university and inclusive elementary schools in dealing with the dynamics of change and development of inclusive education. In addition, as a form of collaboration between the two parties to obtain positive reciprocal benefits in implementing inclusive education.

Acknowledgments

The authors wish to thank the Ministry of Education and Culture, Research and Technology of the Republic of Indonesia, which has funded research as a part of Research Grants of Higher Education Applied Research (PTUPT) (2022). Thank you also to the Directorate of Research and Service of Universitas Djuanda, which supported the research.

References

- Ainscow, M., & Sandill, A. (2010). Developing inclusive education systems: The role of organisational cultures and leadership. *International Journal of Inclusive Education*, 14(4), 401–416.
- Brandon, T., & Charlton, J. (2011). The lessons learned from developing an inclusive learning and teaching community of practice. *International Journal of Inclusive Education*, 15(1), 165–178.
- Braun, V., & Clarke, V. (2012). Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbook of research methods in psychology, Vol 2: Research designs: Quantitative, qualitative, neuropsychological, and biological*. (pp. 57–71). American Psychological Association. <https://doi.org/10.1037/13620-004>
- Budnyk, O., & Sydoriv, S. (2019). Social and pedagogical aspects of the development of inclusive education. *Socialni Pedagogika*, 7(1), 36–48.
- Carrington, S. (1999). Inclusion needs a different school culture. *International Journal of Inclusive Education*, 3(3), 257–268.
- Carrington, S., Mercer, K. L., Iyer, R., & Selva, G. (2015). The impact of transformative learning in a critical service-learning program on teacher development: Building a foundation for inclusive teaching. *Reflective Practice*, 16(1), 61–72.
- Causton-Theoharis, J., Theoharis, G., Bull, T., Cosier, M., & Dempf-Aldrich, K. (2011). Schools of promise: A school district—University partnership centered on inclusive school reform. *Remedial and Special Education*, 32(3), 192–205.
- Forlin, C., & Chambers, D. (2011). Teacher preparation for inclusive education: Increasing knowledge but raising concerns. *Asia-Pacific Journal of Teacher Education*, 39(1), 17–32.
- Loreman, T. (2007). Seven pillars of support for inclusive education: Moving from. *International Journal of Whole Schooling*, 3(2), 22–38.
- Majoko, T. (2019). Teacher key competencies for inclusive education: Tapping pragmatic realities of Zimbabwean special needs education teachers. *Sage Open*, 9(1), 2158244018823455.
- Mittler, P. (2012). *Working towards inclusive education: Social contexts*. David Fulton Publishers.
- Rasmitadila, R., Humaira, M. A., & Rachmadtullah, R. (2022). Student teachers' perceptions of the collaborative relationships form between universities and inclusive elementary schools in Indonesia. *F1000Research*, 10, 1289.
- Rasmitadila, R., Humaira, M. A., Rachmadtullah, R., Sesrita, A., Laeli, S., Muhdiyati, I., & Firmansyah, W. (2021). Teacher Perceptions of University Mentoring Programs Planning for Inclusive Elementary Schools: A Case Study in Indonesia. *International Journal of Special Education (IJSE)*, 36(2).
- Sharma, U., Forlin, C., Loreman, T., & Earle, C. (2006). Pre-Service Teachers' Attitudes, Concerns and Sentiments about Inclusive Education: An International Comparison of Novice Pre-Service Teachers. *International Journal of Special Education*, 21(2), 80–93.

Slee, R. (2011). *The irregular school: Exclusion, schooling and inclusive education*. Routledge.

Waitoller, F. R., & Kozleski, E. B. (2013). Understanding and Dismantling Barriers for Partnerships for Inclusive Education: A Cultural Historical Activity Theory Perspective. *International Journal of Whole Schooling*, 9(1), 23–42.

Augmented Reality IN Increasing Accessibility AND Confidence IN Student Design-Builds

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Abstract

An architectural education has always been steeped in a balance among the Vitruvian trifecta of durability, utility, and beauty. While this paradigm has persisted, the past two centuries in architecture have increasingly raised the need for valuing feasibility. Unfortunately, this also marked an overt divide between architecture and construction. The rapid rise of architectural developments globally has been firmly rooted in its synthesis of materials and methods through technologies. From the development of rebar in reinforced concrete to the incredible formal icons of architecture generated with advanced computation, architecture is the real-world manifestation of cultural aspirations. While the aspirational and theoretical architecture existent solely as imagery in the past sowed the seeds for the visionary architects of today, they are responsible for understanding a diversity of technologies to bring these ideas to built reality. Whereas in the past, to bring design ideas to reality typically mandated licensure or at the very least graduation, contemporary architectural pedagogy makes accessible these opportunities possible well before that. Though overwhelming, current architecture students have access to emergent technologies that are instrumental in the design visualization, detailed fabrication, and delivery of a project well before they even complete their undergraduate degrees. This paper presents a case study at Canada's largest accredited architectural program demonstrating the range of accessible technologies that empower students to translate their design ideas into built work including parametric modeling, virtual reality, augmented reality, and digital fabrication. In doing so, the authors posit that such agency also cultivates confidence and comfort in narrowing the divide between architecture and construction.

Keywords: *architecture, design-build, mixed reality, digital fabrication*

Introduction

The objective of the paper is to share the results of integrating augmented reality visualization technology in architectural education through the student extracurricular activities as an effective option to guide students in construction methodologies. Moreover, the paper briefly discusses the conventional path of architectural education in Canada and the effectiveness of revisiting the tools used to teach students in efforts to train students with contemporary digital skills sought after in current architectural practice.

The Role of the Architect

The purpose of the architect has evolved over time from the title “master builder”, as the central figure leading construction, to the licensed architect we know today, and while the requirement to be an architect has inevitably changed to conform to modern safety standards, the purpose that remains is the role of designing spaces to shelter humanity adhering to functionality and aesthetic quality (Landrum, 2015). The design process of a building begins in the theoretical and conceptual realm in conjunction with purposeful function and aesthetic (D’Souza, 2009). While a building’s purpose and artful composition promise a vision, the architect is also responsible for the fruition of their conception. The skills of coordination, cooperation, and collectivism must also be proficient to see an idea of a building become

reality (Liebing, 2008). However, within every evolving project, it is very common for the design concept to change as a result of financial barriers, constructability, client influence, and many more external factors (Ghassemi and Becerik-Gerber, 2011). To optimize the workflow for an architect can be done in various avenues, stemming from bettering project management skills to a broader understanding of construction techniques and methods. This paper aims to look at the basis of an architect's creative process through the examination of contemporary digital tools to increase efficiency within the iterative design process, while introducing visualization techniques that allows designers to spatially experience their designs before it is built. Thus, giving the designer one to one scale replications of their design and ability to evaluate their architectural concept in an iterative design process before construction to mitigate future revisions in construction.

Architectural Pedagogy and Contemporary Design Methods

Emerging technologies such as virtual reality (VR), mixed reality (MR), and augmented reality (AR) have been increasingly integrated within architectural praxis to amend the existing bridge between construction and design concept. The use of MR technologies as a means to visualize unbuilt ideas assists in digital fabrication projects such as design builds. Within student design projects, the use of virtual reality is useful in helping students rationalize the spaces they have created through mocking up one to one scale panoramic renderings of their designs (Petric, Conti and Ucelli, 2003). Students are able to use the technology to visualize and receive direct feedback on areas of development within their project through self-reflection. Leveraging digital tools such as laser cutting, CNC machining, and 3D printing, models and mockups become relatively easy for students to create, with MR methods being a cost saving method with building materials. During construction in practice, augmented reality plays a role in assisting the sequence of assembly within design builds, noting the instructions for constructors to build and with efficiency in organization of assembly parts. In addition, novel digital tools provide users with the ability to envision and holistically experience a project prior to construction. Some instances of the emerging or recently developed technologies include real-time rendering software, virtual reality, and augmented reality (Alvarado and Maver, 1999). By being able to iteratively design with visualization, unexpected or troublesome design problems can be solved prior to the transition to reality. These issues could relate to a sense of space and aspects of a project that can only be experienced outside of the typical architectural drawing set. A major benefit pertains to the lack of a need for licensure to utilize these tools, which in tandem with relatively quick delivery proves to be instrumental in the education of students looking to join the industry.

Architectural Education and Emerging Technologies

Design studios are a core course within architectural pedagogy in which students learn the fundamentals of architecture. At Toronto Metropolitan University (TMU, formerly known as Ryerson University), the Architectural Science program prepares students for the Architecture, Engineering, and Construction (AEC) industry through the implementation of design, structures, and building science curriculum. Seeing that architecture is an immersive field in which two-dimensional orthographic drawings such as floor plans are utilized, these drawings alone are often not enough for students to visualize a design. Perspective drawings can stimulate atmosphere and aid in visualization, and it grew increasingly popular as CAD programs were developed. Hand-drawn renderings evolved into computer renderings using ray-traced technology, and students are now able to create realistic visualizations. Utilizing virtual reality provides students an opportunity to further understand conceptual ideas through experience (Whyte *et al.*, 2000). However, these visualizations can often be deceiving, as the drawings are not fully immersive and only represent a specific angle or moment within a studio project. Therefore, the use of emerging technologies such as virtual reality allow students to interact with three-dimensional digital models that expand the visual perception of a project (Scaglia, 1991). Additionally, utilizing virtual reality increases the ability to work collaboratively.

Extra-Curricular Student Competitions and Technology Visualizations

While learning to design is important in architectural pedagogy, a substantial focus must be placed on project delivery. Integrating extracurricular design builds allow students to undergo and experience the real-life processes from conceptual design to construction stages. *S'Winter Station*, designed by TMU undergraduate students, was one of six finalists for the Winter Stations 2022 International Design Competition. The competition reimagines Toronto's lifeguard stations that are unused during the winter seasons at Woodbine Beach. The structure (see Fig. 1) represents the resilience of the beach and the public, displaying the transition between summer and winter seasons. The pavilion consists of concrete cladding with varying openings, controlling light, snow, and wind forces on the structure. Normally used in summer months, beach towels and marine ropes were implemented into the design to represent resilience and they allow the pavilion to act as a shelter from weather conditions.



Fig. 1. *S'Winter Station* pavilion.

The increasing use of virtual reality allows users to insert themselves into a virtual environment to observe and interact with a space (Aydin and Aktaş, 2020). This has become even more important during the COVID-19 pandemic, as architectural pedagogy had to shift to accommodate the inability to be physically present on site (Ibrahim *et al.*, 2020). The *S'Winter Station* team utilized real-time and path tracing rendering software to design the interior of the pavilion in its earliest stages, paying most attention to how both adults and children experience the varying aperture sizes at different heights. Rhinoceros 6 was utilized to create the base geometry, and Grasshopper was integrated to construct the parametric panels. Lighting, materials, and aesthetics were visualized using Vray 5, as shown in Figure 2, however imagining the physical spatial quality and feasibility of construction was difficult.



Fig. 2. Rendered image using Vray 5 and Rhinoceros 6.

Therefore, the design team integrated virtual reality (VR) into the design process, using Enscape, a 3-D real time rendering software. The VR Headset allowed students to immerse themselves into the pavilion and experience the structure's spatial qualities, however, was limiting in understanding scale. As a result, augmented reality (AR) was utilized, using *Fologram* for Rhinoceros3D and a Microsoft HoloLens 2. Prototypes were created of the concrete parametric panels alongside AR, allowing for design changes without needing to constantly fabricate new panels, as shown in Figure 3.



Fig. 3. AR allowed for adjustments to be made digitally.

Implementing emerging technologies such as virtual reality and augmented reality into extracurricular design allows students to easily visualize the built result before construction. This is especially important as students are not experienced early in their careers, and it is important to mitigate issues before construction begins. Within the *S'Winter Station* design process, the two technologies were utilized to address structural concerns regarding the main overhead beam and its 6m cantilever, and the result was adding additional diagonal bracing to reduce the cantilever to 2m.

Method and Materials

In addition to the emerging digital workflow, *S'Winter Station* also took advantage of various experimental fabrication techniques which enabled the design team in the realization of the project. The 13 Meter long pavilion is primarily constructed with two distinct elements; the plywood egg-crate structure, and the textile concrete cladding. The primary structure of the pavilion is composed of three wings, each fastened to the existing lifeguard station which sits on a concrete footing. The plywood wings are constructed with 270 pieces CNC cut out of baltic birch plywood and digitally optimized to friction fit into modules. These pieces are fit and screwed together into a total of 30 prefabricated modules.

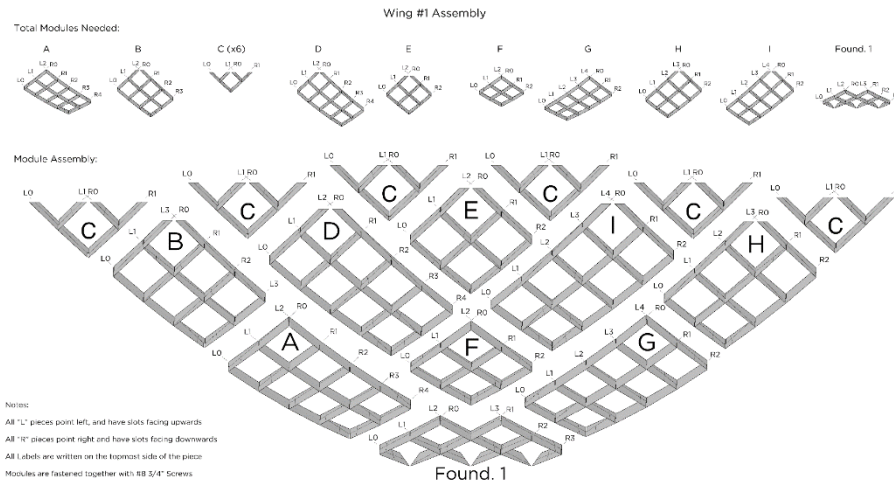


Fig. 4. An exploded plan showing the pieces and module layout for the pavilion's central wing

Module sizes range from 7ft to 4ft long and are rationalized to fit in a car for ease of transportation. The modules were then driven out to site, assembled on the ground, and hoisted up onto the existing life-guard station. The assembled egg-crate wings then rest on a custom built 6"x10" spf beam which is fastened to the existing life-guard station in order to cantilever away from it. Once assembled, a large wing on the north side, and two smaller wings on the south side work to counterbalance each other's lateral forces and give the pavilion its unique form. While the structural assembly of the pavilion uses traditional material and assembly methods like fitting and screwing, the digital CNC workflow of planning, categorizing, cutting, and assembling was a key element of the fabrication of the pavilion.

In addition to the traditional fabrication, S'Winter Station takes advantage of experimental fabrication techniques in the form of its sculptural textile cladding made out of traditional beach towels cast in concrete. This material was born out of an experiment done at summer camp where the children were asked to cast a flower pot using a towel and concrete mix. The design team then built upon this experiment with the injection of digital tools and architectural intention in order to create the cladding. Different types of towels were first experimented, and prototyped in the form of 1:1 mockups. This was done multiple times in order to ensure that the material would hold stiff as well as to experiment with different sizes and thicknesses of towel. After ensuring the material would work, the design team created conical molds using sectionally fastened CNC cut pieces of MDF. These molds would then be used to cast towels over in order to give the cladding its shape.



Fig. 5. An assembled MDF conical mold (left), and a concrete cast towel being cast onto the mold (right)

After having the molds assembled, 150 towels are categorized into different aperture conditions. Different sized circular holes are cut into the towels in order to give the cladding its variable and sculptural shape. The towels are rationalized to have a total of 4 unique aperture conditions which respond to the environmental aspects of the site. After cutting these towels to shape, a single mold can be used in order to cast 4 towels at a time - one on top of the other. Casting the largest apertures at the bottom and smaller apertures on top of each other ensures that the towels are made as efficiently as possible given the high number of panels needed. Additionally, stacking these panels while curing allows the concrete to cure slower and stronger.

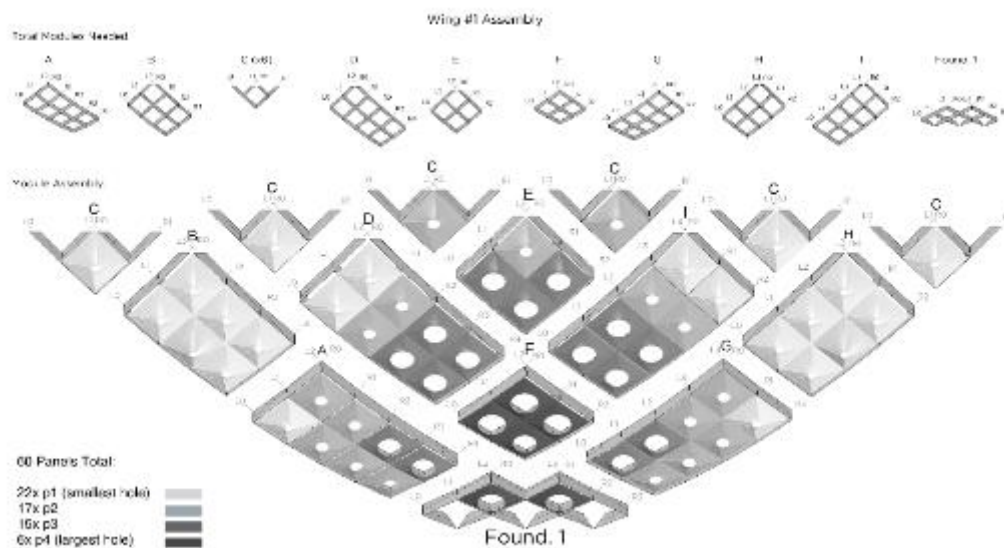


Fig. 6. An exploded plan showing the panel mix and assembly order on the pavilion's central wing

Results and Discussion

After repeating this process of cutting, casting, stacking, spraying, and curing, 150 panels were transported to site where they could then be screwed onto the aforementioned plywood egg-crate structure in order to complete the pavilion. In conclusion, this experimental fabrication process not only worked, but unlocked an enormous amount of potential within this newly found material process. Using a combination of emerging tools such as AR and VR, digital tools such as the CNC, and experimental techniques such as concrete cast textiles, the design team was enabled to deliver on the initial and ambitious rendering of the project in a faithful and realistic way. The result of this project is not only the finished pavilion, but a collection of applied knowledge in the form of architectural visualization, extracurricular activity, and hands-on construction methodology.

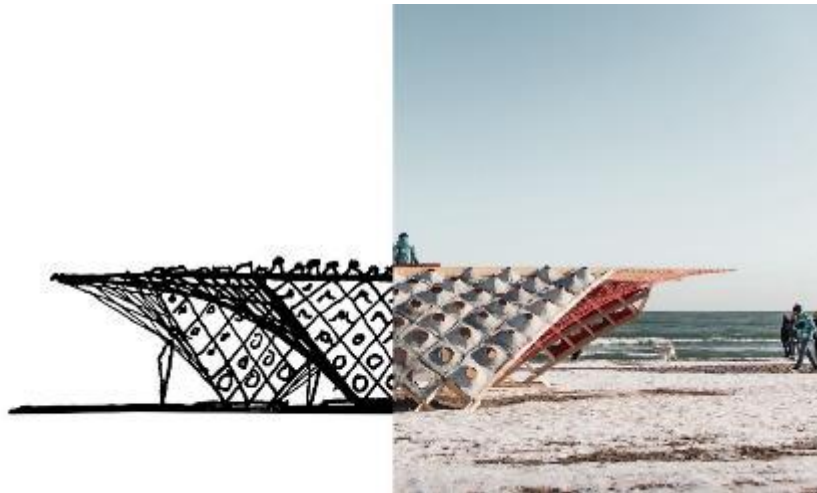


Fig. 7. A sketch showing the development of the project from initial sketch to built pavilion

Conclusions

In conclusion, this first paper examines the role of the architect as a master builder. Not only do architects have to design the physical project, but they must also see through the various other stages of a design like the project management, design development, and construction methods. In looking at the various ways an architect can increase efficiency in the representation of their design, this paper studies the role of digital tools aimed at giving the architect a one to one scale representation of their designs. Different forms of digital tools are analyzed through the use of a winning design-build proposal done at TMU as a case study. Both real-time and path tracing rendering engines are studied and used practically in the case study, but are found to lack a good understanding of three dimensional spatial qualities and scale. VR is then integrated into the project as a form of three dimensional rendering whereby the design team could digitally walk through and understand their design decisions. Additionally, AR is integrated as a form of rendering whereby the design team could fuse the digital model of the pavilion with a physical environment in a one to one scaled hybrid environment. Finally, different forms of experimental fabrication techniques are created and explored in order to physically build the pavilion in an efficiently managed and practically constructed manner as per the responsibilities of a master builder..

Reference List / Bibliography

- Alvarado, R. G. and Maver, T. (1999) 'Virtual Reality in Architectural Education: Defining Possibilities', *ACADIA Quarterly*, 18(4), pp. 97–99. Available at: [http://cumincad.scix.net/cgi-bin/works/Show?_id=4d95&sort=DEFAULT&search=virtual reality&hits=2442](http://cumincad.scix.net/cgi-bin/works/Show?_id=4d95&sort=DEFAULT&search=virtual+reality&hits=2442).
- Aydin, S. and Aktaş, B. (2020) 'Developing an Integrated VR Infrastructure in Architectural Design Education', *Frontiers in Robotics and AI*, 7(October). doi: 10.3389/frobt.2020.495468.
- D'Souza, N. (2009) 'Revisiting a Vitruvian preface: The value of multiple skills in contemporary architectural pedagogy', *Architectural Research Quarterly*, 13(2), pp. 173–181. doi: 10.1017/S1359135509990261.
- Ghassemi, R. and Becerik-Gerber, B. (2011) 'Transitioning to integrated project delivery: Potential barriers and lessons learned', *Lean Construction Journal*, 2011, pp. 32–52.
- Ibrahim, A. F. *et al.* (2020) 'Evaluation of the online teaching of architectural design and basic design courses case study: College of Architecture at JUST, Jordan', *Ain Shams Engineering Journal*, (xxxx). doi: 10.1016/j.asej.2020.10.006.
- Landrum, L. (2015) 'Before Architecture: Archai, Architects, and Architectonics in Plato and Aristotle', *Montreal Architectural Review*, 2, pp. 5–25.
- Liebing, R. W. (2008) *Construction of Architecture: From Design to Built*. illustrate. John Wiley & Sons.
- Petric, J., Conti, G. and Ucelli, G. (2003) 'Designing within Virtual Worlds', *Proceedings of the 10th International Conference on Computer Aided Architectural Design Futures*, pp. 213–224.
- Scaglia, G. (1991) 'Building the Cathedral in Florence', *Scientific American*, 264(1), pp. 66–72. doi: 10.1038/scientificamerican0191-66.
- Whyte, J. *et al.* (2000) 'From CAD to virtual reality: Modelling approaches, data exchange and interactive 3D building design tools', *Automation in construction*, 10(1), pp. 43–55. doi: 10.1016/S0926-5805(99)00012-6.

Integrating Technology Pedagogy and Content Knowledge (TPACK) in Qatar's Preparatory and Secondary Schools: The Perceptions and Practices of STEM Teachers.

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Abstract

This paper is part of a project on Enhancing STEM teaching through teacher professional development (TPD). The aim is to explore K-12 Science and Math teachers' views and practices about implementing STEM through TPACK model in Qatar and identify their challenges, in order to develop and implement a teacher professional development program using PBL pedagogical intervention to support K-12 science and Math teachers in Qatar to develop TPACK-STEM and to train them on how to implement PBL in their teaching practices,

Two hundred forty five STEM teachers from 16 preparatory and secondary schools representing equal number of males, and females responded to, a STEM-TPACK survey on perceptions on, and practices in, teaching STEM subjects. One hundred thirty seven preparatory (grades 7-9) and 108 secondary school teachers (grade 10-11). Generally, there are no significant differences between the different dual groups in understanding STEM, TPACK and embedding technology with few exceptions and in some aspects. This reflect a high consistency in teaching, pedagogy and learning environments, among these groups (gender, teaching level, and STEM subjects taught).

Preparatory school teachers show more variations in all elements of TPACK than secondary school teachers as reflected from values of standard errors of the mean(SEM). Male teachers show slightly more understanding of elements of TPACK and have slightly higher means than female teachers have. The standard error of the mean (SEM) for female teachers is slightly higher indicating more variation among female teachers than male teachers are. However, the difference is also not significant as reflected from the relatively small effect sizes, which range from 0.13 to 0.31, small t-Test values and high p-values.

Key Words: *Pedagogy, Project based Learning PBL, STEM, Technology Integration, TPACK*

Introduction

Unfortunately, the science and mathematics attitudes of Qatari students are not as strong as those of students in many other countries. Results generated from our previous projects, together with results from international tests such as PISA (Programme for International Student Assessment) and TIMMS (Trends in International Mathematics and Science Study) which showed only a modest progress, while the averages and rank remain below the international benchmark (Fig.1) substantiate this statement. from our previous research [1]-[4] it was found that:

(a) A declining interest of Qatari students, when compared with their counterparts from other nationalities (Arab non-Qatari and non-Arab expatriates). Qatari students' attitudes toward science, as well as their intentions to study science in the future, decrease as they approach high school

(b) There is an inconsistency, or a gap, between positive views of science (and its utility) of the majority of students and the lack of interest in enrolment in science programs and the pursuit of science based careers.

(c) Female students' attitudes are comparable to those of males, which is uncommon in most countries of the world where males show more interest in taking up science courses or work in science related careers.

(d) Non-Qatari Arab students studying in Qatari schools show less interest and declining attitude when compared with Qatari nationals studying in their community schools or in International schools. These findings are in agreement with the published results of PISA 2018 [5] which indicate that performance of students in Qatar (in the three subjects) remained among the lower third ranking among the list of the 79 participant countries and Jurisdictions, with no significant change from the last PISA cycle in 2015. For example, the average score in mathematics was 414, compared with OECD average of 487, and 419 points in science, compared with OECD average of 489.

The above PISA results are alarming and reflect a state of stagnation in teaching practices with a lack of awareness on the need to implement changes required by the new curriculum standards to improve other conditions pertinent to science and mathematics teaching and learning processes.

Research suggests that among educational variables influencing student achievement, the quality of teaching is the most important variable. Research also indicates that, on average, number of high performing students taught by very qualified teachers are 2-3 times higher than number of high performing students taught by low qualified teachers in standardized tests [6].

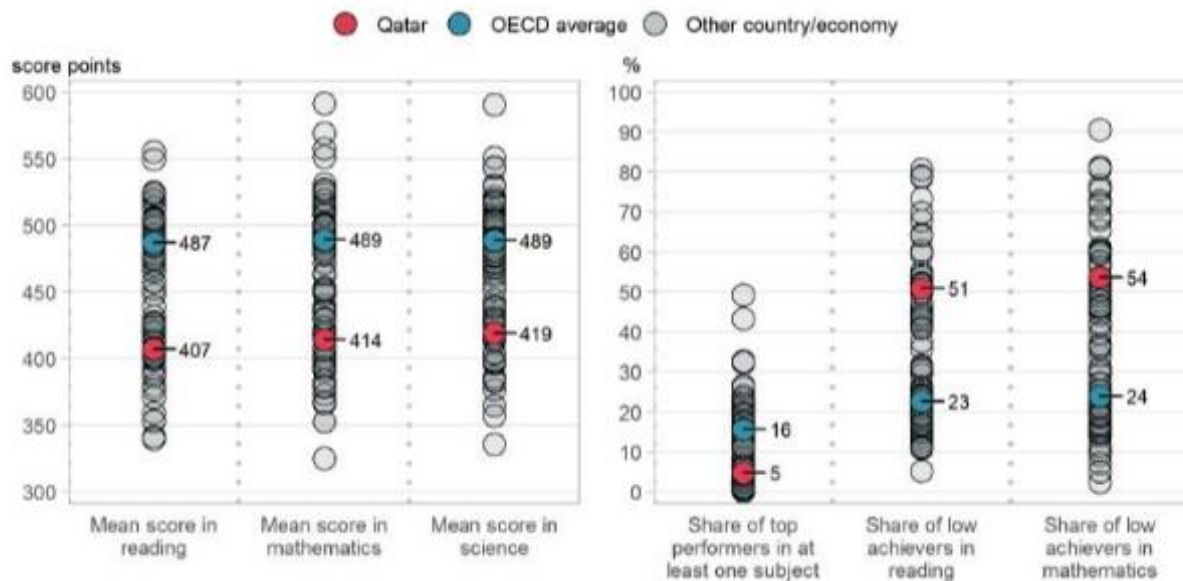


Figure 1. Performance of Students in Qatar during the last PISA 2018 test as compared to international students.
(Source OECD 2019- ref. [5])

For students to develop mastery of knowledge content, problem-solving, critical thinking effective communication and collaboration, and self-direction, teachers must employ a variety of pedagogical approaches and teaching strategies. Effective professional development (PD) is the key for teachers learning and delivery skills' improvement [7]. This project focuses on how to improve science and mathematics

teachers' quality by training them on effective delivery of practical integrated STEM activities in a life-context environment (to be distinguished from traditional learning style) which includes providing facts and guide students on practicing the procedures) integrates formal and informal science with extensive use of technology; training teachers on delivery skills of STEM activities in alignment with science and mathematics curriculum standards.

Teacher education generally focuses on one or two subject matter and on pedagogy, and most teachers are not familiar with engineering which is one essential element of STEM [8].

The Technological Pedagogical and content knowledge (TPACK) framework introduced by Mishra and Koehler of Michigan State University in 2006 [9] is considered as the model of teachers' expertise for the 21st century [10] - [11]. With it, they identified three primary forms of knowledge: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK)]. Majority of science and mathematics teachers in Qatar have sufficient knowledge and technological skills and well-equipped classrooms [5].

Project –based Learning (PBL) has been used during the last decade as a pedagogy to implement STEM; PBL promotes deeper connections to content and fosters the essential inquiry skills through a series of questions and finding ways to solution. The real world problems, which are the cornerstone of STEM approach, require intensive questioning as well as the critical thinking, and creative problem solving needed for success in STEM. Therefore, implementing PBL approach to STEM learning can help students form deeper connections to content, connect ideas across disciplines, and build the questioning, thinking, and metacognitive skills necessary for success in today's rapidly changing world [12].

Method

a. Survey instrument

The TPACK measures survey is adopted from a self-reported questionnaire developed by Sang, Tondeur, Chai and Dong [13]. The survey was adapted to fit STEM education in Qatar and the specific objectives of this study. The adapted 5-likert scale survey consists of 39-items distributed among 7 constructs (originally it was 42 items). Two hundred forty five STEM teachers responded to the survey, among them 124 males and 121 females. One hundred thirty seven preparatory and 108 secondary school teachers from 16 schools (8 Male and 8 Female Schools). Table-1 shows the eight constructs and example items after changes to fit the STEM Context.

B- Analysis

Data collected were analyzed using IBM SPSS version 28 [14]. Very high reliability indicated by Cronbach's Alfa coefficient (α) of the seven constructs were observed (Table-I). Removing each item from the adapted survey to check the impact did not show a significant change in the values, and therefore no item was removed.

Results indicate a high satisfactory level of construct validity and internal consistency of the questionnaire similar to the original survey [13] from which it was adapted. However, high value of alpha does not indicate uni-dimensionality; because each of (majority items) measures a discrete aspect [15]. Although high alpha value may suggest that, a lot of the variance is due to general respondent-related factors (e.g. intelligence, study diligence, motivation in the subject) and consequently, the instrument may not differentiate well between different features of the concepts being tested; however statistical test show high

consistency with the obtained reliability, with slightly high variances were obtained among groups as will be explained next section (tables 2 & 3).

Table-1. Constructs and example items after changes to fit the STEM Context

Constructs & Number of items	Definition	Example of Sample items	Reliability Coefficient (α) (Cronbach's Alpha)
CK 4 items	Knowledge of the subject matter.	I have sufficient knowledge about my teaching subject STEM topics.	0.950
PK 8 items	Knowledge about the student learning, instructional methods and processes, different educational theories, and learning assessment.	I am able to guide my students to adopt appropriate learning strategies related to STEM-based projects and problems.	0.980
PCK 7 items	Knowledge of adopting pedagogical strategies to make the subject matter more understandable for learners.	Without using technology, I cannot address common learning difficulties that my students have for my teaching STEM subject.	0.967
TK 8 items	Knowledge about technology features, capacities, and applications.	I have the technical skills to use computers effectively to design learning activities related to STEM.	0.960
TPK 4 items	Knowledge of the existence and specifications of various technologies to enable teaching approaches.	I am able to facilitate students' use of technology to find more information on their own related to issues in STEM.	0.971
TCK 3 items	Knowledge about how to use technology to represent the content in different ways.	I know about the available technologies that I can use for the research of content regarding my teaching subject and STEM topics.	0.933
TPCK 5 items	Knowledge of using various technologies to teach and represent the designed subject content.	I can craft real-world problems about the content knowledge and represent them through computers to engage my students.	0.953

About eighty percent of STEM teachers show understanding and knowledge of TPACK (Fig.2). Secondary school teachers show slightly more understanding of all elements of TPACK and have slightly higher means than preparatory school teachers have. However, about 30% of teachers reported lack of knowledge about design of inquiry-based activities using ICT Tools and lack of sufficient skills (Fig. 3). Twenty-five percent cannot solve technical problems.

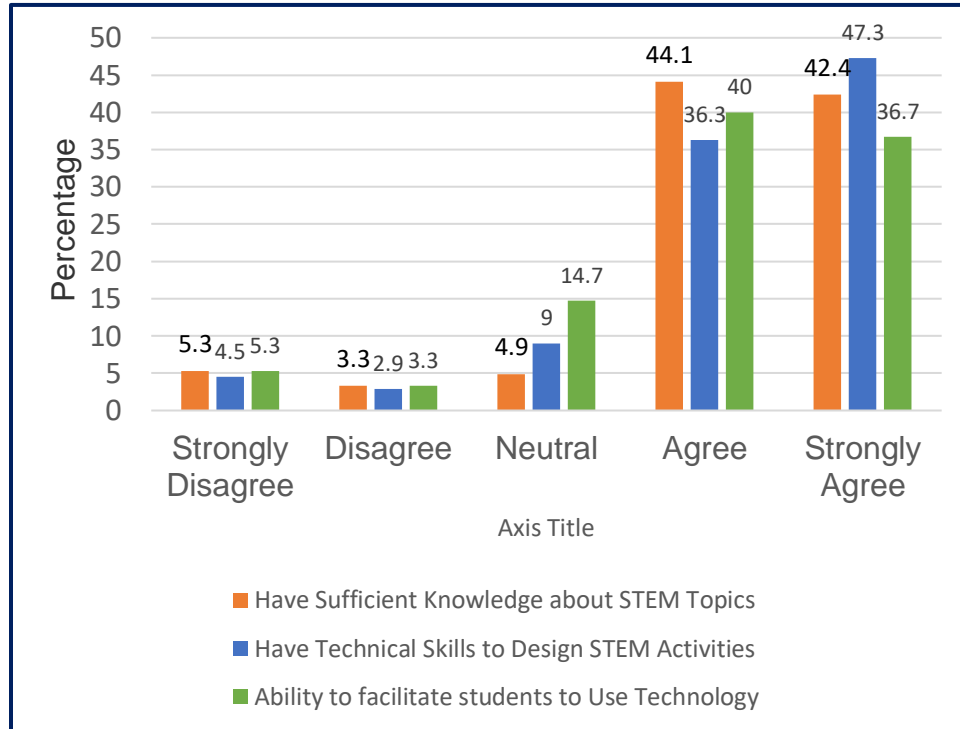


Figure 2. Teachers ‘Knowledge about STEM and Activities Design with Technology

The differences between preparatory and secondary school teachers are not significant as reflected from the very small effect sizes which range from 0.03 to 0.17, small t-Test values and high p-values (table 2).

Table 2. Group Descriptive Statistics - 95% Confidence Interval Comparison based on school Level (Significant level 0.05)

Construct	School level	N	Mean	Std. Deviation	Std. Error Mean	Effect Size $d_{(cohen)}$	T-Test ^a	p-value one -sided
CK	Preparatoy	137	21.2701	5.38039	.45968	0.125	0.987	0.162
	Secondary	108	21.8704	4.13576	.39796			
PCK	Preparatoy	137	29.1679	7.53674	.64391	0.143	1.083	0.130
	Secondary	108	30.1204	5.69262	.54777			
TK	Preparatoy	137	28.6788	7.16090	.61180	0.116	1.127	0.183
	Secondary	108	29.4630	6.34878	.61091			
TPK	Preparatory	137	19.9708	5.23975	.44766	0.085	0.907	0.255
	Secondary	108	20.3889	4.64000	.44648			
TCK	Preparatory	137	12.0657	3.32814	.28434	0.158	0.661	0.107
	Secondary	108	12.5463	2.71852	.26159			
TPCK	Preparatoy	137	19.5839	5.07103	.43325	0.028	1.244	0.414
	Secondary	108	19.7222	4.87380	.46898			

TPACK	Preparatoy	137	160.5036	39.14662	3.34452	0.128	1.0020	0.159
	Secondary	108	165.0278	31.48815	3.02995			

^aEqual Variance not assumed

However, about 30% of teachers reported lack of knowledge about design of inquiry based activities using ICT Tools (Figure-2). Twenty-five percent cannot solve technical problems. In addition; nearly 15% of them have insufficient knowledge of communication, 25% have insufficient of collaboration tools such as, google site, google Doc, and WebEx (Fig.-2) which are necessary tools to design activities on real world problems, which are, also, the context of project-based learning, PBL[16]. PBL has been introduced recently as one pedagogical approach into Qatari education system [17], and therefore, the TPD training will put more emphasis during teachers' knowledge training, on these aspects of STEM teaching pedagogy.

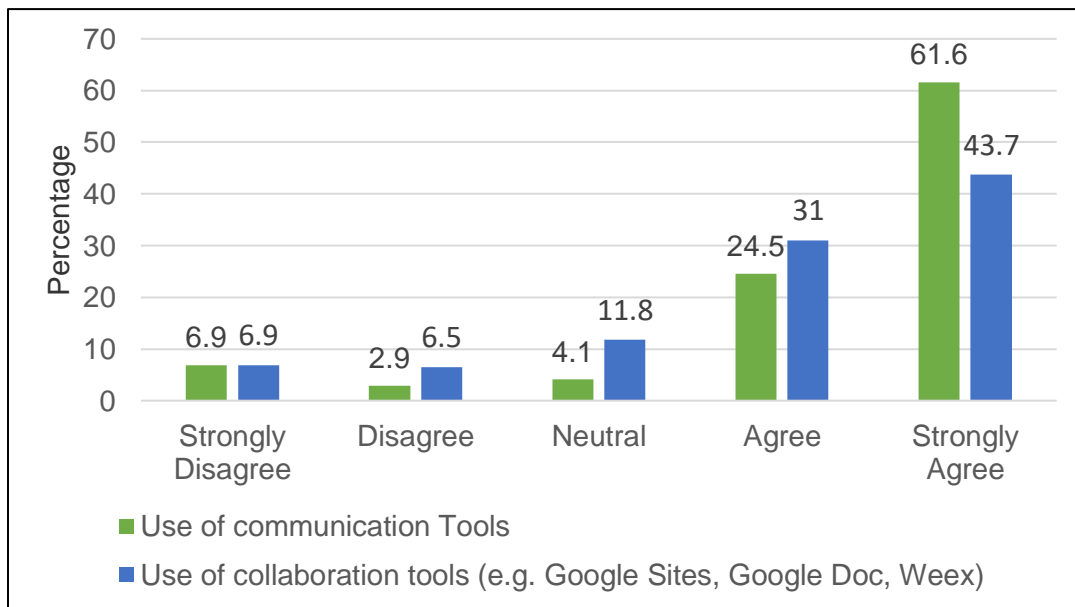


Figure .3 Ability to use Technology tools in classroom

Comparing results among the groups on one hand, and between groups on the other, using ANOVA indicates significant differences in all elements except the technical knowledge (TK), as reflected in the difference in mean square values, high F-ratio and low p- values (Table-3).

There were significant differences Using Mann-Whitney U test for the influence of the teachers' specialization in education on teachers' views of CK, PK, CPK, TPK, TPCK, and TPACK in favor of holding a certificate in education except in Technological knowledge TK (table-4). These results indicate the need of collaboration between teachers teaching different disciplines of STEM subjects.

Table 3. Group Descriptive Statistics – 95% Confidence Interval Comparison based on Gender (Significant level 0.05)

	Gender	N	Group Mean	Std. Deviation	Std. Error Mean	T-Test (Equal Variance not assumed)	Effect Size (D _{cohen})	p-value one-sided
CK	Male	124	22.1452	4.31803	.38777	1.993	0.255	0.086
	Female	121	20.9091	5.32447	.48404			
PK	Male	124	30.7500	6.53026	.58643	1.075	0.138	0.31
	Female	121	29.7851	7.47129	.67921			
PCK	Male	124	30.0161	6.05662	.54390	0.997	0.128	0.075
	Female	121	29.1488	7.46621	.67875			
TK	Male	124	29.6048	6.36405	.57151	1.350	0.173	0.152
	Female	121	28.4298	7.22130	.65648			
TPK	Male	124	20.8387	4.55925	.40943	2.189	0.280	0.088
	Female	121	19.4545	5.30252	.48205			
TCK	Male	124	12.6048	2.78153	.24979	1.688	0.216	0.218
	Female	121	11.9421	3.33241	.30295			
TPCK	Male	124	20.4032	4.66943	.41933	2.436	0.312	0.058
	Female	121	18.8678	5.17517	.47047			
TPACK	Male	124	166.3629	32.80674	2.94613	1.706	0.218	0.158
	Female	121	158.5372	38.68765	3.51706			

Table 4. The influence of teachers' specialization in education on TPACK

	Null hypothesis	Test	Significance ^{a,b}	Description
CK	The distribution of CK is the same across categories of (Do you hold a certificate in Education Other than a STEM Degree?)	Independent – Samples Mann-Whitney U Test	< 0.001	Reject the null hypothesis
PK	The distribution of PK is the same across categories of (Do you hold a certificate in Education Other than a STEM Degree?)	Independent – Samples Mann-Whitney U Test	0.002	Reject the null hypothesis
PCK	The distribution of PCK is the same across categories of (Do you hold a certificate in Education Other than a STEM Degree?)	Independent – Samples Mann-Whitney U Test	0.003	Reject the null hypothesis
TK	The distribution of TK is the same across categories of (Do you hold a certificate in Education Other than a STEM Degree?)	Independent – Samples Mann-Whitney U Test	0.073	Retain the null hypothesis
TPK	The distribution of TPK is the same across categories of (Do you hold a certificate in Education Other than a STEM Degree?)	Independent – Samples Mann-Whitney U Test	0.002	Reject the null hypothesis
TCK	The distribution of TCK is the same across categories of (Do you hold a certificate in Education Other than a STEM Degree?)	Independent – Samples Mann-Whitney U Test	0.004	Reject the null hypothesis

TPCK	The distribution of TPCK is the same across categories of (Do you hold a certificate in Education Other than a STEM Degree?)	Independent – Samples Mann-Whitney U Test	-0.001	Reject the null hypothesis
TPACK	The distribution of TPAC is the same across categories of (Do you hold a certificate in Education Other than a STEM Degree?)	Independent – Samples Mann-Whitney U Test	-0.001	Reject the null hypothesis

- a. The significant level is 0.05 b. Asymptotic significance is displayed

Conclusions and Implication

- Regardless of the school level and gender, teachers have, almost, the same views and needs of TPACK-PBL in STEM
- Specialism in Education is very significant and influential for teachers' views of TPACK-PBL in STEM and for the context and settings of TPD
- Teachers' major specialism and their teaching subjects are significant for views of TPACK-PBL in STEM. This needs to be considered when planning for CPD training and teachers' practices.
- Teachers' Bachelor degree was an influential factor on forming teachers' views of TPACK-PBL in STEM.
- Attention needs to be given to Math, Physics and Biology subjects in relation to PBL and STEM.
- A qualitative study including interviews with teachers and students together with classroom observations is very important for interpreting and understanding these quantitative findings

Acknowledgement

The research team would like to thank the Qatar National Research Fund for the generous support of this research through the National Priority Research Program (grant Number NPRP12C-0828-190023). Any opinions, findings and conclusions or recommendations expressed in this report are those of the PIs and do not necessarily reflect the views of the Qatar National Research Fund; QNRF has not approved or endorsed its content.

References

- Z. Said, A. A. Al-Emadi, H.F. Friesen, and E. Adam). “Assessing the Science Interest, Attitude, and Self-Efficacy of Qatari Students at the Preparatory, Secondary, and University Levels”. *EURASIA J. Math., Sci Tech. Ed* vol. 14(12), 2019. DOI: <https://doi.org/10.29333/ejmste/94733>
- Z. Said, *Science Education Reform in Qatar: Progress and Challenges*, *Eurasia Journal of Math, Science & Technology Education*, 12(8), 2253-2265, 2016.
- Z. Said, R. Summers, F. Abd-El-Khalick, and S.Wang, “Attitudes toward science among grades 3 through 12 Arab students in Qatar: findings from a cross sectional national study”, *International Journal of Science Education*, vol. 38(4), pp.621-643, 1916.
- A. A. Al-Emadi, Z. Said, and H.F. Friesen, *Teaching Style Differences between Male and Female Science Teachers in Qatari Schools: Possible Impact on Student Achievement* *EURASIA J. Math., Sci Tech. Ed* 2019;15(12):em1800 DOI: <https://doi.org/10.29333/ejmste/109236>
- OECD “performance of students in Qatar in PISA -18, Qatar country report. 2019.
- L. Darling-Hammond, “Teacher quality and student achievement: A review of state policy evidence,” *Education Policy Analysis Archives*, vol. 8(1), pp. 1-44, 2000.
- L. Darling-Hammond, M. E. Hytler, and M. Gardner, “Effective teacher professional development,” *Learning Policy Institute. Report* Retrieved Feb. 20, 2022, from (<https://learningpolicyinstitute.org/product/effective-teacher-professional-development-report>).
- G. A. Fore, C. R. Feldhaus., B. H. Sorge., M. Agarwal, and K. Varahramyan, “Learning at the nano-level: Accounting for complexity in the internalization of secondary STEM teacher professional development,” *Teaching and Teacher Education*, vol. 51, 101–112, 2015.
- P. Mishra, and M. J. Koehler, “Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054, 2006
- Al Salami, M.K., Makela, C.J. & de Miranda, M.A. *Assessing changes in teachers’ attitudes toward interdisciplinary STEM teaching. Int J Technol Des Educ* 27, 63–88 (2017). <https://doi.org/10.1007/s10798-015-9341-0>
- Ching Sing Chai, *Teacher Professional Development for Science, Technology, Engineering and Mathematics (STEM) Education: A Review from the Perspectives of Technological Pedagogical Content (TPACK)*, *The Asia-Pacific Education Researcher*, 10.1007/s40299-018-0400-7, 28, 1, (5-13), (2018).
- R.M. Capraro, M.M. Capraro and J. Morgan (eds.), *STEM Project-Based Learning: An Integrated Science, Technology, Engineering, and Mathematics (STEM) Approach*, 1–5, 2013. Sense Publishers.
- G. Sang, J. Tondeur, C. S. Chai, and Y. Dong, “Validation and profile of Chinese pre-service teachers’ technological pedagogical content . knowledge scale. *Asia-Pacific Journal of Teacher Education*, Vol. 44(1), 49-65, 2016
- IBM SPSS Statistics for Windows, Version 28.0, Armonk, NY: IBM Corp. 2021.

- K. S. Taber, “The Use of Cronbach’s Alpha When Developing and Reporting Research Instruments in Science Education,” *Research in Science Education*, vol. 48, 1273–1296 (2018).
- K. Holmes, E. Mackenzie, N. Berger, and M. Walker, “Linking K-12 STEM Pedagogy to Local Contexts: A Scoping Review of Benefits and Limitations,” *Front. Educ.* vol.6, August 2021. doi: 10.3389/educ.2021.693808.
- R.S. Al Said, X. Du, H. Alkhatib, M.H. Romanowski, A.I. Barham, “Math teachers’ beliefs, practices, and belief change in implementing problem-based learning in Qatari Primary governmental schools,” *Eurasia J. Math. Sci. Technol. Educ.*, 15 (5) (2019), Article ISSN: 1305-8223.

Use of Student-Centered Learning as Stimulus for Creating Situational Interest in Adult Learners – A Case Study in a Vocational Education Institute in United Arab Emirates

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Abstract

Interest has been identified as a significant motivational factor in learning for its positive impact on students' engagement in learning and intention to participate in future. Scholars have identified two types of interest i.e. Individual and Situational Interest. Individual Interest indicates relatively long-term orientation of an individual toward a type of object, activity or area of knowledge. Situational Interest (SI) signifies short-term, spontaneous emotional reaction triggered by contextual stimuli. SI is changeable and partially under control of teachers, making it a significant area of research. While concept of SI suggest that contextual stimuli can lead to student engagement with learning, the concept of Student-Centered Learning (SCL) focuses on creating these stimuli. Existing literature on SI and SCL mostly focuses on younger students in school stage, with limited studies done on adult learners in vocational learning environment. The concept of andragogy (adult learning) states that adults learn differently from children. This study focuses on adult learners in a vocational educational environment in United Arab Emirates and aims at determining impact of adopting teaching strategy, aligned with adult learning characteristics, on SI of adult learners, and their intention to engage with the topic in future. The study measures SI by its 'Feelings' and 'Value' components, and future intention by measuring Behavioral Intention (BI). Comparison of SI-Feelings and SI-Value before and after the teaching session, through paired sample t-test, showed enhanced SI-Feelings and SI-Value after the session. Linear Regression Analysis indicated significant positive correlations and suggested that SI-Feelings could count for 31.7% and SI-Value could count for 12.3% of the variance in BI to engage with the topic in future. The study recommends that aligning teaching with adult learning preferences has the potential to create SI in adult learners.

Key Words: Individual Interest, Situational Interest, Student-Centered Learning, Adult Learning

1. Introduction

1.1 Background of the Study

This research has been conducted on adult learners in a vocational learning institute in United Arab Emirates. The research aims at determining how interest of adult learners can be enhanced, leading to their active engagement in the learning process. For this purpose, the study adopted a teaching strategy based on real life problem-based autonomous learning, as suggested in adult learning characteristics.

1.2 Significance of the Study

The outcomes of this study are of high importance for educational institutes as well as work organizations, as these will help them in aligning adult learning with the recommendations of this study to create learning interest in adult learners, enhance learning effectiveness and stimulate their intention to engage with their learning in future as well.

2 Concept of Interest in Learning

2.1 Role of Interest in Learning

The role of 'interest' as a significant motivational factor in learning and development emerged in the beginning of 20th century from scholarly work of Dewey (1913) and Thorndike (1935). Various studies towards the end of 20th century (for example Schiefele, 1991; Krapp, Hidi & Renninger, 1992; Hoffmann et al, 1998) have indicated interest as an important explanatory construct in learning. According to Durik & Jenkins (2020), interested learners are intrinsically motivated, they are more effortful, resistant in the face of challenges and more often set and achieve goals. Interest has also been identified as an important motivational construct that influences students' learning behaviour and intention to participate in the future (Solmon, 1996; Xiang et al, 2005).

2.2 Types of Interest

Researchers have focused on two different concepts of interest i.e. 'Individual Interest' and 'Situational Interest' (Hidi & Baird, 1988; Hidi, 1990).

2.2.1 Individual Interest

'Individual Interest' is the relatively long-term orientation of an individual toward a type of object, an activity or an area of knowledge (Schiefele et al, 1983; Hidi, 1990; Renninger, 1990). Researchers have identified two components of Individual Interest i.e. feeling-related valences and value-related valences. Feeling-related valences refer to the feelings that are associated with a topic, object or activities, such as pleasure, excitement and enjoyment, and are intrinsic in nature (Schiefele, 1991; Hidi & Renninger, 2006). Value-related valences refer to the attribution of personal significance to an object, which may be due to a variety of reasons, such as its contribution to one's personality development, competence, or understanding of important problems (Schiefele, 1991; Krapp, 1999; Hidi & Renninger, 2006). Scholars (Schiefele, 1991; Chen & Ennis, 2004; Hidi & Harackiewicz, 2000; Xiang et al, 2005) have noted the positive impact of Individual Interest on learning behaviour and intention to participate in future.

2.2.2 Situational Interest

Situational Interest (SI) is spontaneous, transitory and environmentally activated (Krapp et al., 1992). It is an emotional state triggered by situational or contextual stimuli (Anderson et al, 1987; Hidi & Baird, 1986; Hidi, 1990), which may have short-term effect and may marginally influence an individual's knowledge and values (Subramaniam, 2009). According to Schraw, Flowerday Lehman (2001), SI is changeable and partially under control of teachers, and this is what makes SI a significant area of research. Many scholars suggest that SI can be enhanced through modification of aspects of learning context and environment like teaching strategies, task presentation and structuring of learning experiences (Hidi & Harackiewicz, 2000; Chen, Darst, & Pangrazi, 2001; Durik & Harackiewicz, 2007). Different studies have suggested activities that trigger SI, for example, inducing suspense (Jose & Brewer, 1984); making task as novel (Hidi, 1990); promoting student autonomy and choice (Deci, 1992); student engagement (Mitchell, 1993); making information relevant to a task or learning goal (Schraw & Dennison, 1994; Shirey, 1992); giving choices to students about what to read (Høgheim & Reber, 2015; Bernacki & Walkington, 2018) and collaborative learning (Shubina *et al*, 2021).

Researchers (Krapp, 2003; Hidi & Renninger, 2006) have shown that SI can grow into Individual Interest. According to Krapp et al. (1992), SI often precedes and facilitates development of Individual Interest. Hidi and Renninger (2006) proposed a four-phase sequential model of interest development (Figure-1).

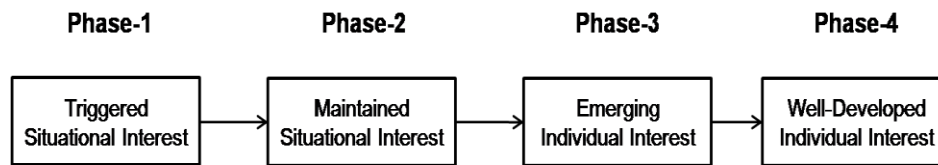


Figure-1: Four-phase Sequential Model

Triggered SI denotes sparking of a person's interest for a particular topic due to a contextual stimulus. Maintained SI implies sustenance of SI by consistent presentation of the trigger. Emerging Individual Interest is the stage that marks transition of SI to Individual Interest, and leads to a person's interest for the topic and tendency to seek frequent engagements with the topic. The last phase, Well-Developed Individual Interest, signifies a person's deep-seated interest for the topic over longer periods of time (Hidi & Renninger, 2006). Garcia et al. (2010) have suggested that if SI can develop into Individual Interest, it is possible that SI is structured similarly to Individual Interest i.e. having 'feeling' and 'value' components.

3. Student Centered Learning

Learning has traditionally been centered on teacher, where teacher decided on 'what to teach', 'how to teach' and 'how the students will be assessed' on their learning. In this model, students act as passive receivers of information flowing from teachers, participating actively only when asked by the teacher. Unlike the traditional model, Student Centered Learning (SCL) keeps students' interests at the focus and makes students' voice as central to the learning. In SCL, students choose what they will learn, how they will learn and how they will assess their learning (Rogers, 1983; Hannafin & Hannafin, 2010). According to Weimer (2002), role of teacher in SCL changes from 'sage on the stage' to 'guide on the side' who views the students not as empty vessels but as seekers to be guided along their intellectual developmental journey. SCL suggests putting responsibility for learning in hands of students (Hannafin & Hannafin, 2010; Johnson, 2013), giving learners autonomy and independence (Jones, 2007), allowing them control over their learning process (Slunt & Giancarlo, 2004; Tärnvik, 2007) and requiring a fundamental shift in approach to innovate, not simply replicate existing practices either online or in person (Pickering, 2021).

4. Conclusions from Literature

Research on SI and SCL so far mostly focuses on students in school/university stage, with limited studies done on adult learners in vocational learning environment. The concepts of andragogy (adult learning) state that adult learn differently from children; they are self-directing, motivated by self-interest, life centered and pragmatic, rely on change as the primary driver to learn, rely on experience to learn (Knowles, Holton & Swanson, 1998). Therefore, there is need for integrating and studying adult learning characteristics as triggers or stimuli of SI when dealing with adult learners.

5. Research Methodology

5.1 Research Objectives

RO-1: Determine whether the Situational Interest of adult working professionals can be significantly increased with adoption of a teaching strategy based on real life problem-based autonomous learning in group settings.

RO-2: Determine whether the Situational Interest of adult working professionals would lead to their intention to engage with the topic in future.

5.2 Conceptual Framework & Hypotheses

This study uses SCL, in that the adult learning characteristic, as a trigger to enhance SI of students in the topic, measured through 'Feelings' and 'Value' for the topic, and then determining the impact of 'Feelings' and 'Value' on intention of students to engage with the topic in future (Figure-2).

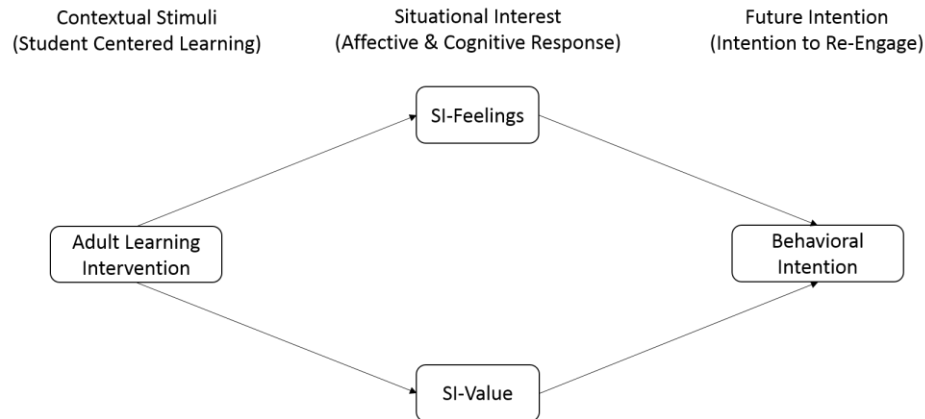


Fig-2: Conceptual Framework of the Study

H-1: Adoption of teaching strategy based on real life, problem-based autonomous learning will significantly increase adult learners' Situational Interest (SI)-Feelings for the topic.

H-2: Adoption of teaching strategy based on real life, problem-based autonomous learning will significantly increase adult learners' Situational Interest (SI)-Value for the topic.

H-3: Adult learners' Situational Interest (SI)-Feelings aroused due to adoption of teaching strategy based on real life, problem-based autonomous learning will lead to their Behavioral Intention to engage with the topic in future.

H-4: Adult learners' Situational Interest (SI)-Value aroused due to adoption of teaching strategy based on real life, problem-based autonomous learning will lead to their Behavioral Intention to engage with the topic in future.

5.3 Research Design & Sampling

This research adopts deductive approach, which involves testing theory by generating and testing hypotheses (Robson, 2002) and explaining causal relationships between variables by collecting and analyzing quantitative data. However, this research, being a case study with limited sample size, is not aimed at generating generalizable outcomes; it rather aims at getting insights into the matter that can guide future research with a larger sample size. The sampling frame of this study comprised students in a vocational training institute in United Arab Emirates. At any given time, average number of students is around 300. A complete class of 33 students was used as sample, yielding a sample size of 10% of the total sampling frame (N=33).

5.4 Data Collection Instrument

In order to measure interest in academic settings, this study uses two-component measures comprising 'Feelings' and 'Value' (Schiefele et al., 1988; Linnenbrink-Garcia et al., 2010; Maurice et al., 2014; Høgheim & Reber, 2015). For determining the impact of 'Feelings' and 'Value' on predisposition to engage with the particular content, the study uses the construct of 'Behavioral Intention' from Khalid (2014) and Rotgans (2015). From these studies, this study adopts phrases "interested", 'excited', 'enjoy' measuring

SI-Feelings, adopts phrases 'useful', 'important', 'helpful to measure SI-Value, and adopts phrases 'plan', 'intend' to measure Behavioral Intention. The questionnaire comprised 9 statements; 3 statements each on SI-Feelings, SI-Value and Behavioral Intention, on Likert's 5-point scale ranging from Strongly Agree=5 to Strongly Disagree=1. Reliability of the questionnaire was measured by using Cronbach's Alpha Method and standard values suggested by George & Mallery (2003). Cronbach's Alpha values for all the variables were greater than 0.7, indicating good internal consistency (Table-1):

Variable	Cronbach's Alpha Value
SI-Feelings	0.756
SI-Value	0.831
Behavioral Intention	0.852

Table-1 – Cronbach's Alpha Values

6. Findings

6.1 Situational Interest – Feelings

In order to compare the SI-Feelings before and after the learning session, paired sample t-test was carried out. Descriptive statistics showed that participants reported higher SI-Feelings ($M=4.44$, $SD=0.48$) after the session as compared to SI-Feelings ($M=3.66$, $SD=0.52$) before the session. T-test results ($T(32)=9.783$, $p<0.001$) indicated statistically significant difference. Result proves Hypothesis-1.

6.2 Situational Interest – Value

In order to compare the SI-Value before and after the learning session, paired sample t-test was carried out. Descriptive statistics showed that participants reported higher SI-Value ($M=4.67$, $SD=0.33$) after the session as compared to SI-Value ($M=3.83$, $SD=0.49$) before the session. T-test results ($T(32)=10.53$, $p<0.001$) indicated statistically significant difference. Result proves Hypothesis-2.

6.3 Impact of SI-Feelings on Behavioral Intention (BI)

In order to determine the impact of SI-Feelings after the session on BI to engage with the topic in future ($M=4.40$, $SD=0.10$), Linear Regression Analysis was carried out. Pearson's r indicated a significant positive moderate correlation between SI-Feelings after the session and BI ($r = 0.582$, $p<0.001$, $N=33$). Regression results ($F(1, 31)=15.859$, $p<0.001$, $R\text{ Square}=0.338$, $Adjusted\ R\ Square=0.317$) indicated that SI-Feelings aroused due to the session could count for 31.7% of variance in BI to engage with the topic in future. Result proves Hypothesis-3.

6.4 Impact of SI-Value on Behavioral Intention

In order to determine the impact of SI-Value after the session on BI to engage with topic in future ($M=4.40$, $SD=0.10$), Linear Regression Analysis was carried out. Pearson's r indicated a significant positive weak correlation between SI-Value after the session and BI ($r=0.388$, $p<0.05$, $N=33$). Regression results ($F(1, 31)=5.496$, $p<0.05$, $R\text{ Square}=0.151$, $Adjusted\ R\ Square=0.123$) indicated that SI-Value aroused due to the session could count for 12.3% of variance in BI to engage with the topic in future. Result proves Hypothesis-4.

7. Discussion

Comparison of SI-Feelings and SI-Value before and after the session, through the paired sample t-test, indicated statistically significant differences, with SI-Feelings and SI-Value enhancing after lesson delivery aligned with adult learning characteristics suggested by Knowles, Holton & Swanson (1998).

This outcome is also in line with the assertions that SI can be enhanced through modification of aspects of teaching strategies, task presentation and structuring of learning experiences (Hidi & Harackiewicz, 2000; Chen, Darst, & Pangrazi, 2001; Durik & Harackiewicz, 2007). The finding of this study, that SI has positive correlation and predictive impact on students' intention to engage with the topic in future (Behavioral Intention), is in line with the earlier research findings on role of interest in influencing students' engagement (Hidi & Harackiewicz, 2000) and intention to participate in the future (Solmon, 1996; Xiang et al, 2005). Overall, this study supports the assertion that Situational Interest is changeable and partially under the control of teachers (Schraw, Flowerday Lehman, 2001).

This study has an implicit implication with regard to the 4-phase model of interest development by Hidi and Renninger (2006). Since Situational Interest is spontaneous and transitory (Krapp et al., 1992; Anderson et al, 1987; Hidi & Baird, 1986; Hidi, 1990), Triggered Situational Interest and Maintained Situational Interest can be measured and confirmed in a shorter span of time. However, Individual Interest being a relatively long-term orientation of an individual toward a type of object, an activity or an area of knowledge (Schiefele et al, 1983; Hidi, 1990; Renninger, 1990), measurement of Emerging Individual Interest requires observations and measurements over a relatively longer duration. The construct of 'Behavioral Intention' used by this study, has the potential to be seen as an intermediate step that can be measured simultaneously with SI-Feelings and SI-Value for indicating likelihood of development of Emerging Individual Interest in future (Figure-4).

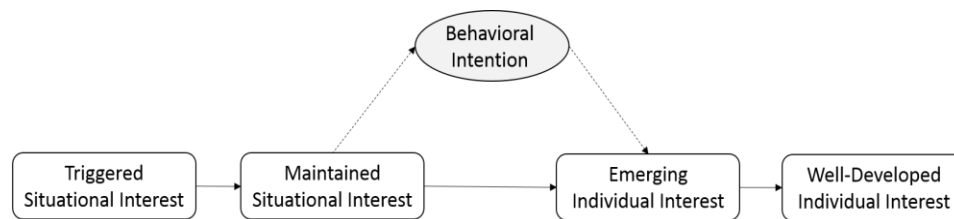


Fig-4: Inclusion of BI into 4-Phase Model

8. Conclusion & Recommendations

Employing the concepts of Student-Centered Learning (SCL) and Situational Interest (SI), this study employed teaching strategy based on real life problem-based autonomous learning to see whether such a strategy created SI for adult working professionals in the topic. The study further explored whether this SI of adult learners would give rise to their intention to engage with the topic in future as well. Measuring SI through its 'Feelings' and 'Value' components, the study has shown that teaching strategy that is aligned with adult learning characteristics does create SI in adult students. By bringing in the construct of Behavioral Intention, the study has further proved that the SI impacts intention of adult learners to engage with the topic in future as well. Implicitly, the study has also proposed that the construct of 'Behavioral Intention' could help as an intermediate measure to determine likely transformation of Maintained SI to Emerging Individual Interest. Based on the outcomes, this study makes the following recommendations:

- a. When teaching adult learners, adopting a teaching strategy based on real life problem-based autonomous learning is likely to act as a stimulus for creation of Situational Interest for the topic and impact their intention to engage with the topic in future as well.
- b. With regard to 4-phase model of interest development, construct of Behavioral Intention has potential to act as an intermediate step that can be measured simultaneously with SI-Feelings and SI-Value for indicating likelihood of development of Emerging Individual Interest in future.
- c. This research, being a case study with limited sample size, needs to be conducted with a larger sample size using probability sampling to ascertain generalizability of its outcomes.

References:

- Anderson, R. C., Shirey, L. L., Wilson, P. T. & Fielding, L. G. (1987) Interestingness of children's reading material, in R. E. Snow & M. J. Farr (Eds.) *Aptitude, learning, and instruction, Vol. 3: Cognitive and affective process analyses* (pp. 287-299). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Bernacki, M. L. & Walkington, C. (2018) The Role of Situational Interest in Personalized Learning, *Journal of Educational Psychology, 110*(6), 864-881
- Chen, A., Darst, P. W. & Pangrazi, R. P. (2001) An examination of Situational Interest and its sources, *British Journal of Educational Psychology, 71*, 383-400
- Deci, E. L. (1992) The relation of interest to the motivation of behavior: A self-determination theory perspective, in Renninger, A., Hidi, S., and Krapp, A. (eds.), *The Role of Interest in Learning and Development*, Erlbaum, Hillsdale, NJ, 43–70
- Dewey, J. (1913) *Interest and Effort in Education*, Boston: Riverside Press
- Durik, A. M. & Harackiewicz, J. M. (2007) Different strokes for different folks: How Individual Interest moderates the effects of situational factors on task interest, *Journal of Educational Psychology, 99*, 597-610
- Durik, A. M., & Jenkins, J. S. (2020) Variability in certainty of self-reported interest: Implications for theory and research, *Frontline Learning Research, 8*(3), 85-103
- George, D., & Mallery, P. (2003) SPSS for Windows step by step: A simple guide and reference. 11.0 update (4th ed.). Boston: Allyn & Bacon, cited in https://en.wikipedia.org/wiki/Cronbach's_alpha (accessed 3 Oct 2017)
- Hannafin, M. J. & Hannafin, K. M. (2010) Cognition and student-centered, web-based learning: Issues and implications for research and theory, In *Learning and instruction in the digital age*, Springer US, 11-23
- Hidi, S. & Baird, W. (1986) Interestingness – A neglected variable in discourse processing, *Cognitive Science, 10*, 179-194
- Hidi, S. & Baird, W. (1988) Strategies for increasing text-based interest and students' recall of expository texts, *Reading Research Quarterly, 23*, 465-483
- Hidi, S. & Harackiewicz, J. M. (2000) Motivating the academically unmotivated: A critical issue for the 21st century, *Review of Educational Research, 70*, 151-179
- Hidi, S. & Renninger, K. A. (2006) The four-phase model of interest development, *Educational Psychologist, 41*(2), 111-127
- Hidi, S. (1990) Interest and its contribution as a mental resource for learning, *Review of Educational Research, 60*, 549-571
- Hoffmann, L., Krapp, A., Renninger, A. & Baumert, J. (Eds.) (1998) Interest and learning, Proceedings of the Seon conference on interest and gender, Kiel: Germany, IPN, 301-316

- Høgheim, S. & Reber, R. (2015) Supporting interest of middle school students in mathematics through context personalization and example choice, *Contemporary Educational Psychology*, 42, 17-25
- Johnson, E. (2013) *The Student-Centered Classroom*, Vol. 1: Social Studies and History
- Jose, P. E. & Brewer, W. F. (1984) Development of story liking: Character identification, suspense and outcome resolution, *Developmental Psychology* (20), 911–924
- Khalid, N. (2014) The Role of Perceived Usefulness and Perceived Enjoyment in Assessing Students' Intention to use LMS using 3-Tum, *Proceeding of the Global Summit on Education GSE 2014 (E-ISBN 978-967-11768-5-6)*, 4-5 March 2014, Kuala Lumpur, Malaysia
- Knowles, M., Holton, E. F. & Swanson, R. A. (1998) *The Adult Learner: A Neglected Species*, 5th Ed., Houston, Texas: Gulf Publishing
- Krapp, A., Hidi, S. & Renninger, K. A. (1992) Interest, learning and development, in K. A. Renninger, S. Hidi & A. Krapp (eds.) *The role of interest in learning and development*, Hillsdale, NJ: Erlbaum, 3-25
- Linnenbrink-Garcia, L., Durik, A. M., Conley, A. M., Barron, K. E., Tauer, J. M., Karabenick, S. A. & Harackiewicz, J. M. (2010) Measuring Situational Interest in Academic Domains, *Educational and Psychological Measurement*, 70(4), 647-671
- Maurice, J. V., Dörfler, T. & Artelt, C. (2014) The relation between interests and grades: path analyses in primary school age, *Int. J. Educ. Res.* 64, 1-11
- Mitchell, M. (1993) Situational Interest: Its multifaceted structure in the secondary school mathematics classroom, *Journal of Educational Psychology* (85), 424–436
- Pickering, J. (2021) *The active lecture: student-centered learning for the future*, <https://www.timeshighereducation.com/campus/active-lecture-studentcentred-learning-future> (accessed 23 May 2022)
- Renninger, K. A. (1990) Children's play interests, representation, and activity, in R. Fivush & J. Hudson (Eds.) *Knowing and remembering in young children* (pp. 127-165). Cambridge, MA: Cambridge University Press
- Robson, C. (2002) *Real World Research*, 2nd Ed., Oxford: Blackwell
- Rogers, C. (1983) As a teacher, can I be myself? In *Freedom to learn for the 80s*, Ohio: Charles E. Merrill Publishing Company
- Schiefele, H., Krapp, A., Prenzel, M., Heiland, A. & Kasten, H. (1983) *Principles of an educational theory of interest*, Paper presented at the 7th biennial meeting of the International Society for the Study of Behavioral Development, Munich
- Schiefele, U. (1991) Interest, learning, and motivation, *Educational Psychologist*, 26 (1991) 3 & 4, S, 299-323

- Schiefele, U., Krapp, A. & Winteler, A. (1988) "Conceptualization and measurement of interest," in Paper Presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA
- Schraw, G. & Dennison, R. S. (1994) The effect of reader purpose on interest and recall, *Journal of Reading Behaviour*, 26, 1–18
- Schraw, G., Flowerday, T. & Lehman, S. (2001) Increasing Situational Interest in the Classroom, *Educational Psychology Review*, Vol. 13, No. 3, 2001
- Shirey, L. (1992) Importance, interest, and selective attention, In Renninger, A., Hidi, S., and Krapp, A. (eds.), *The Role of Interest in Learning and Development*, Erlbaum, Hillsdale, NJ, p. 281–296
- Shubina T., Järvenoja, H., Mänty, K., Peltonen, J. & Järvelä, S. (2021) The changes in lower secondary school students' interest during collaborative learning, *Scandinavian Journal of Educational Research*
- Slunt, K. M. & Giancarlo, L. C. (2004) Student-centered learning: A comparison of two different methods of instruction, *Journal of Chemical Education*, 81(7), 985-988
- Solmon, M. A. (1996) Impact of motivational climate on students' behaviors and perceptions in a physical education setting, *Journal of Educational Psychology*, 88, 731-738
- Subramaniam, P. R. (2009) Motivational Effects of Interest on Student Engagement and Learning in Physical Education: A Review, *International Journal of Physical Education*, 46, No 2
- Tärnvik, A. (2007) Revival of the case method: A way to retain student-centered learning in a post-PBL era, *Medical Teacher*, 29(1), 32-36
- Thorndike, E. L. (1935) *The Psychology of Wants, Interests and Attitudes*, New York: Appleton-Century
- Tones, L. (2007) *The Student-Centered Classroom*, Cambridge University Press
- Weimer, M. (2002) *Learner-centered teaching: Five key changes to practice*, San Francisco, CA: Jossey-Bass
- Xiang, P., Chen, A. & Bruene, A. (2005) Interactive impact of intrinsic motivators and extrinsic rewards on behavior and motivation outcomes, *Journal of Teaching in Physical Education*, 24, 179-197