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Volume 10 – Issue 3 – 2022

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Foreword

Dear Readers,

As the world settles into a new normal following the global pandemic, education systems around the globe are looking at different forms of educational provision. It has become imperative to move on and continue with renewed enthusiasm, identifying new ways of working whilst respecting the values of the past. This is as true for the field of education as it is for so many other aspects of life.

The six papers in this excellent volume, addressing the theme of "Student Learning: Building on the Past, Innovating for the Future", are a testament to the strength and range of the journal, that reflect the international, intercultural and interdisciplinary mission and strengths of IAFOR. There are articles from authors from the USA, Australia, Zambia, Philippines, Hong Kong SAR, Spain, Malaysia, Burnei Darussalam and Panama.

I would like to thank the authors, reviewers, and the IAFOR editorial team for their work on this exceptional issue, but most of all to the editor of this edition, Dr Pearl Subban of Monash University, Australia, who has worked so hard to bring this issue to completion.

Happy Reading!

Joseph Haldane
Editor-in-Chief
IAFOR Journal of Education

Editorial Advice

Preparing a submission to the *IAFOR Journal of Education* is more than writing about your research study: it involves paying careful attention to our submission requirements. Different journals have different requirements in terms of format, structure and referencing style, among other things. There are also some common expectations between all journals such as the use of good academic language and lack of plagiarism. To assist you in reaching the review stage for this or any other peer-reviewed journal, we provide the following advice which you should check carefully and ensure that you adhere to.

1. Avoiding Plagiarism

Plagiarism is a practice that is not acceptable in any journal. Avoiding plagiarism is the cardinal rule of academic integrity because plagiarism, whether intentional or unintentional, is presenting someone else's work as your own. The *IAFOR Journal of Education* immediately rejects any submission with evidence of plagiarism.

There are three common forms of plagiarism, none of which are acceptable:

1. ***Plagiarism with no referencing***. This is copying the words from another source (article, book, website, etc.) without any form of referencing.
2. ***Plagiarism with incorrect referencing***. This involves using the words from another source and only putting the name of the author and/or date as a reference. Whilst not as grave as the plagiarism just mentioned, it is still not acceptable academic practice. Direct quoting requires quotation marks and a page number in the reference. This is best avoided by paraphrasing rather than copying.
3. ***Self-plagiarism***. It is not acceptable academic practice to use material that you have already had published (which includes in conference proceedings) in a new submission. You should not use your previously published words and you should not submit about the same data unless it is used in a completely new way.

2. Meeting the Journal Aims and Scope

Different journals have different aims and scope, and papers submitted should fit the specific journal. A "scattergun" approach (where you submit anywhere in the hope of being published) is not sound practice. Like in darts, your article needs to hit the journal's "bullseye", it needs to fit within the journal's interest area. For example, a submission that is about building bridges, will not be acceptable in a journal dedicated to education. Ensure that your paper is clearly about education.

3. Follow the Author Guidelines

Most journals will supply a template to be followed for formatting your paper. Often, there will also be a list of style requirements on the website (font, word length, title length, page layout, and referencing style, among other things). There may also be suggestions about the preferred structure of the paper. For the *IAFOR Journal of Education* these can all be found here: https://iafor.org/journal/iafor-journal-of-education/author-guidelines/

4. Use Academic Language

The *IAFOR Journal of Education* only accepts papers written in correct and fluent English at a high academic standard. Any use of another language (whether in the paper or the reference list) requires the inclusion of an English translation.

The style of expression must serve to articulate the complex ideas and concepts being presented, conveying explicit, coherent, unambiguous meaning to scholarly readers. Moreover, manuscripts must have a formal tone and quality, employing third-person rather than first-person standpoint (when feasible), placing emphasis on the research and not on unsubstantiated subjective impressions.

Contributors whose command of English is not at the level outlined above are responsible for having their manuscript corrected by a native-level, English-speaking academic prior to submitting their paper for publication.

5. Literature Reviews

Any paper should have reference to the corpus of **scholarly** literature on the topic. A review of the literature should:

- Predominantly be about contemporary literature (the last 5 years) unless you are discussing a seminal piece of work.
- Make explicit international connections for relevant ideas.
- Analyse published papers in the related field rather than describe them.
- Outline the gaps in the literature.
- Highlight your contribution to the field.

Referencing

Referencing is the main way to avoid allegations of plagiarism. The *IAFOR Journal of Education* uses the APA referencing style for both in-text citations and the reference list. If you are unsure of the correct use of APA please use the Purdue Online Writing Lab (Purdue OWL), – https://owl.english.purdue.edu/owl/resource/560/01/ – which has excellent examples of all forms of APA referencing. Please note APA is used for referencing not for the general format of the paper. Your reference list should be alphabetical by author surname and include DOIs whenever possible.

This short guide to getting published should assist you to move beyond the first editorial review. Failure to follow the guidelines will result in your paper being immediately rejected.

Good luck in your publishing endeavours,

Dr Yvonne Masters
Executive Editor, *IAFOR Journal of Education*

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From the Editor

So much of our world has changed. Human interaction has been profoundly impacted by the global pandemic, and political shifts across the globe have altered the way we think and operate. These global movements and shifting thinking have resulted in a progressive awareness of how socially equitable and socially just frameworks should influence all human behaviours. It is heartening to note that Indigenous and traditional knowledge are being valued and embedded into educational contexts, driving change to alter the paths of the younger generations to a healthier future. Despite significant strides however, much remains to be done. As educators, we understand that our work is ongoing, consistent and continuous. Learning is not a destination, it is a voyage, often into unknown spaces, and therefore requiring courage and wisdom. Accommodating all students, celebrating diversity and valuing individual skill is now fundamental to our work. Against this backdrop, we seek daily to identify strategies that are responsive, respectful and sensitive to student needs.

This issue draws together six key articles, located in environments across the world, and touching on a range of central concerns, as we emerge from the era of the pandemic. Recent research in education has focused on the virtual classroom, examining the most effective means of catering to student needs in the online classrooms. Additionally, the ubiquitous nature of social media platforms compels educators to rethink its position in classrooms, and to explore ways in which these forums can be used in the learning and teaching process. Dialogue and discourse in classrooms remain a central feature of learning environments, and an investigation of how these forms of communication can be fostered and encouraged is essential. Apart from these technological innovations, the need to advance education in rural and regional contexts is being viewed as a priority, with both technology and in-situ experiences being amalgamated to provide equitably for students. The isolating experiences of the pandemic triggered the need for greater collaboration among students, drawing them together to not just imbibe knowledge more socially, but to become aware of the range of social dynamics that now inhabit our world.

Teacher shortages across the world are now endemic and will impact on educational provision for all young people. In the first manuscript, the authors draw on a comparative study among three nations, examining hiring practices to strengthen the work force, and the incentivisation of staff especially with regard to teaching in rural contexts. Evidently, greater dialogue and support is required to draw educators into these vulnerable contexts. With much of the world transitioning to online learning, our second featured piece reflects on how online collaborative learning impacts on student achievement and engagement. Located in the Philippines, this quantitative study drew on pre-test and post-test scores to consider student cooperation, interest and participation in the online classroom. Results revealed that intentional strategies improved the overall student experience in this context. Remaining within the arena of virtual learning, a joint collaboration spanning Hong Kong and Spain, reflected on the innovative use of e-portfolios in contemporary learning contexts. The use of a review of several articles yielded positive results, however more longitudinal research would be appropriate to more accurately gauge the effective use of the e-portfolio.

The fourth submission curated for this issue, also hones in on student experiences, exploring social interdependence and its impact on academic outcomes in learning contexts. As a qualitative exploration located in Malaysia, and utilising interviews, this study yielded the view that motivation during collaboration was influenced by mutual interests, accountability and the group size. Following this, a Bruneian study examined discourse in the classroom, assessing the nature and quality of dialogue with a view to strengthening engagement, prompting

prepared thinking around questioning techniques, and facilitating critical thinking in classrooms. The final submission considered how social media platforms could be effectively utilised to promote learning. Contextualised in Panama, the study utilised a 12-week intervention to contemplate the feasibility of utilising social media platforms in educational contexts. Evidently, the use of more accessible mediums of communication in the modern age, could also facilitate effective communication and collaboration in classrooms.

The classroom of the future certainly appears different. Multiple dynamics now interplay to alter the perceptions and provision of education. Both educators and learners are poised for a varied experience from that offered a mere decade ago. This compilation of articles illustrates this diversity in thinking as we forge ahead into the post pandemic era.

Pearl Subban, PhD
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Notes on Contributors

Article 1:
Teacher Futures: Global Reaction to Teacher Shortages in Rural Locations

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Dr Mitchell is an Assistant Professor in the Department of Leadership, Research, and Foundations (LRF) at the University of Colorado Colorado Springs. He has a background in k-12 education as a classroom teacher at the elementary, middle, and high school levels, and has served as a governmental administrator in Massachusetts and with the Colorado Department of Higher Education. Robert received his Ph.D. in Global Education from The Ohio State University and has presented at academic conferences in Australia, the United States, Morocco, Iran, Egypt, Brunei, and Bahrain, and continues to focus on challenges related to rural education across the globe. His recent work has been published in *The Rural Educator, American School Board Journal,* and *Action in Teacher Education.*
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Patrick Hampton is a Senior Lecturer and a Literacy Coordinator at the University of Notre Dame Australia in Freeport, Western Australia. He has over 20 years' experience teaching in rural and metropolitan primary schools, working in all year levels and curriculum areas. Past work has included serving in school administration as a Principal, Deputy Principal and teacher, leading school communities in curriculum development, and coordinating programs to support students-at-risk. Patrick focuses on curriculum improvement and fieldwork projects involving remote and rural schools and communities. In 2020 Patrick established the Spinifex Education Network – a pathway for pre-service teachers to develop the knowledge and skills required for effective teaching in rural, regional and remote schools throughout Western Australia.
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Robinson Mambwe has headed the Department of Primary Education since 2017. His career motivation is to help students of social studies and through these students, citizens of the country become responsible, critical, reflective, and active citizens who can make informed and reasoned decisions about the societal issues confronting the community. His approach to teaching of social studies is inspired by the constructivist and inquiry-oriented approaches. Dr. Mambwe received his doctoral degree from the University of Zambia and his MEd from Chonbuk National University in South Korea. He continues to focus his teaching and research on teacher preparation, social studies curriculum development, and fieldwork-based learning experiences.
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Article 2:
The Effects of Online Collaborative Learning (OCL) on Student Achievement and Engagement

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Ana Liza Villano Gaad is a science teacher at a public stand-alone senior high school in the Philippines. She holds a bachelor's degree in secondary education and completed her academic requirements for a Master of Arts in Education at the University of the Philippines

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Article 3:
Educational e-Portfolio Overview: Aspiring for the Future by Building on the Past

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Article 4:
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Article 5:
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Teacher Futures: Global Reaction to Teacher Shortages in Rural Locations

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Abstract

Upcoming changes in the teacher labor supply will have an impact on nations that provide government-based education for their youth. Faced with a significant global shortfall of educators, most countries have taken steps to incentivize teaching as a profession and ensure that qualified teachers are available to students in all locations – particularly in rural environments. To understand these initiatives more thoroughly, a short-term policy analysis focused on incentives for teacher labor through a lens of governmental policy implementation has been completed. This resulted in a review of the efforts three nations (Australia, the United States and Zambia) have undertaken to ensure a viable and consistent teacher workforce in rural areas. While each nation has specific factors that contribute to current and projected shortages, each also provides unique solutions to assist in resolving this ongoing issue. Through the examination of multiple hiring factors and incentives used in each location, a better understanding of the specific challenges and strategies employed to secure a viable teaching workforce has been developed. Outcomes related to this policy analysis showed commonalities in the lack of developed strategies to prepare rural educators to address teacher shortages in more remote regions. In addition, while education leaders in each country continue to publicly call for additional support for rural teachers – very little legislation or policy implementation has been enacted to bolster this subsection of public education in any of the specified nations. Additional discussion about the long-term concerns regarding rural teacher supply and student equity is also developed.

Keywords: global education, incentivize teaching, rural education, teacher shortage

It has been made clear that a primary factor, if not the most important component, of effective learning for students is directly related to the effectiveness of the classroom teacher and the community of educators that interact with individual students (Carroll & Foster, 2010; Metzler & Woessmann, 2012). Without a qualified and effective teacher, student achievement is limited – leading to reduced student academic achievement (Stronge, 2010). The role of the teacher is essential in the development of strong learning opportunities in the classroom. Yet, there is growing concern about the viability of providing qualified and talented teachers and educators to schools around the world (Ingersoll et al., 2018; Sutcher, Darling-Hammond, & Carver-Thomas, 2016).

During the last forty-years, there has been a discernable shift in the educator labor market as, in many instances and locations, fewer individuals have elected to pursue careers in classroom teaching (Zarra, 2019). The challenges facing schools and governmental organizations in relation to locating, developing, and retaining qualified educators continues to be difficult in many parts of the world. The United Nations has estimated that 69 million new teachers will need to be developed in the next decade (UNESCO, 2016). In many countries, teacher shortages are impacting student instruction – particularly in hard-to-staff content areas such as secondary science and secondary math (Cross, 2017).

This study looks at three specific nations and their ongoing efforts to attract new individuals into the education profession, particularly for more difficult-to-staff positions in rural regions. Rural schools are a particular focus, as they are typically the first institutions impacted by educator shortages. This is especially true for schools in very remote locations. Within this context, the shortages existing in rural schools can be seen as a potential precursor to emerging teacher labor shortage issues that will eventually impact urban and suburban schools. Through this examination of three distinct nations, a greater understanding of the global magnitude of this problem can be explored, as can emerging solutions for this international concern.

Existing Research

The impact of the teacher on student achievement has been a primary area of study for many years (Rockoff, 2004; Stronge, 2010). In rural schools, where teachers maybe the primary educator for a subject for multiple grade levels, teacher quality becomes even more important (Jenkins & Cornish, 2015; Taole, 2014). Understanding the unique challenges rural school districts and rural hiring entities have in recruiting and retaining quality educators has resulted in new knowledge regarding best-practices, but a comprehensive solution to this ongoing problem remains elusive (Bouck, 2018; du Plessis & Mestry, 2019).

In contrast, there is extensive research available regarding ongoing teacher shortages, challenges in recruiting teachers, and the potential impact these shortages can and will have on the global economy. Many studies focus on the unique approaches individual schools have taken to help recruit and retain teachers - some with moderate success (Arinaitwe & Corbett, 2022; O'Doherty & Harford, 2018). Other areas of inquiry have centered on general trends in securing teacher labor (Balter & Duncombe, 2008; Mngomezulu, Lawrence, & Mabusela. 2021), hiring international teachers (Ingersoll et al., 2018; Kissau et al., 2019) or incentivizing specific segments of the labor pool to enter and remain in the classroom (Baker, 2014; Olitsky, Perfetti, & Coughlin, 2020).

Simultaneously, studies on education in rural and remote regions provide a base of knowledge regarding the preparation of rural teachers (Kline, White, & Lock, 2013; Mitchell et al., 2019), the unique challenges of teaching in rural schools (Goodpaster, Adedokun, & Weaver, 2018; Kahu, 2012), and the importance of the teacher within a rural school and community (Adams & Farnsworth, 2020; Eppley, 2015). The linkage between rural schools and teacher shortage issues has also been an area of study and focus (Oyen & Schweinle, 2020; Qian et al., 2020; Sindelar et al., 2018).

One of the more prolific areas of ongoing research focuses on governmental policy related to rural education and the role of teachers in rural schools (Brenner, 2016; Johnson & Howley, 2015; Sher, 2019). A common critique by rural school advocates continues to center on the marginalization of rural schools or the lack of governmental action on addressing the needs of regional learning centers (Schafft, 2016). The call for specific governmental interventions to mitigate various challenges impacting rural schools has been continual and frequent (Arsen et al., 2021; Sher, 2019; Stephens & Perry, 1991). Further, the focus on reshaping financial policy related to the funding of rural schools shows a common refrain regarding the specific differences found between rural and remote schools, and their urban and suburban cousins (Debertin et al., 1986; Ramirez, 2013; Sielke, 2004).

Regarding rural teacher recruitment, several studies and reports have focused on the role of housing, and the lack of housing inventories, regarding rural schools and rural teachers (Mitchell et al., 2019; Shaw, 2005; Superville, 2018). The prominence of this issue continues in many locations and has impacted normal rural school operations as many school districts now also have become managers for property designated for teaching housing (Kelley, 2017; Kennedy, 2018; Pratt, 2018). This issue continues to impact the recruitment and retention of teachers to rural schools and continues to be a primary barrier for many new teachers exploring a teaching role in a rural region (Branch, 2018).

This housing issue also connects to ongoing challenges related to teacher compensation and pay, as in some locations, such as the United States, the pay rates for rural teachers is far less than for teachers in urban and suburban districts (Nguyen, 2020; Tran & Smith, 2019). The importance of compensation and how it applies to rural teachers continues to be explored (Moeller, Moeller, & Schmidt, 2018), but has largely become a non-issue in nations and regions where a national salary schedule has been developed and implemented (Taimalu, 2021). When the cost of university attendance and completion, a common requirement for teachers in many nations, is factored against the future earnings of teachers, research shows that in the United States, for example, it is impossible for teachers to recoup a significant return on investment for the university degree (Lobo & Burke-Smalley, 2018). While this is not as common in regions featuring national compensation practices, the earning power of teachers around the world continues to lag comparable professions in the governmental or private sectors (Allegretto & Mishel, 2016; Taylor, 2008).

Methodology and Framework

Policy analysis as a methodology has been well established as an essential tool for studies involving governmental policy interventions and environments related to the public good or public sector (Kraft and Furlong, 2020). Policy analysis related to education, and all its components such as school building construction, the use of educational technology, and a litany of other interventions, has been an area of concentrated research throughout the last century (Mayer & van Daalen, 2013). Within the greater frame of policy analysis exists six

major clusters of activity that include: research and analysis, design and recommendations, clarification of values and arguments, strategic advising, democratization, and mediation (Mayer, Bots, & van Daalen, 2004). This study centers on the first three components of this cluster, as several of the policy interventions outlined within the study just beginning implementation.

This analysis largely connects to the theoretical framework of "justice as fairness" as developed through the work of John Rawls in the 20th century (Rawls, 1971). Schools and educational systems are generally seen as both political and social institutions, that could and should be guided, at least in part, by fairness (Rawls, 1985). As we are seeking to investigate governmental approaches to resolve variances in teacher supply and teacher quality found between urban/suburban schools and their rural counterparts, it is logical to apply this Rawls' approach to the political and social institutions that impact daily school operations – namely governmental oversight of schools and the teachers that work within them. If fairness is an objective supported by governmental institutions (Gooden, 2015), the equity challenges found in rural schools indicates a challenge to the of the application to this construct of fairness.

To understand the implementation of policy interventions used within three distinct locations, a specialized document analysis was conducted in the three distinct countries and regions. Within the scope of this research, document analysis is appropriate as it focuses on "the content of documents—such as the words, images, ideas or patterns contained therein" (Hard, Lee, & Dockett, 2018). As all research sites, Australia, the United States, and Zambia, utilize English as a primary language, the challenge related to misinterpretation due to translation was largely avoided. Further, the participating authors all reside in the various countries of focus, minimizing issues of cultural or historical misunderstanding.

Following a review of the various policy interventions used throughout all three countries, an analysis of similarities and variances within the collective documents was completed. These results are included within the discussion section of the study and link directly to recommendations regarding the support of rural educator recruitment and retention. This singular focus on rural education further refines the process of policy intervention analysis, as it is a common effort found in all three countries of focus.

Objectives and Research Questions

The objectives of this study are to understand the various challenges and interventions currently being used to recruit teachers to rural areas in three different nations. It is hoped that through this examination of what has worked, as well as what has not, in specific locations that an initial discovery of the global best practices associated with rural teacher recruitment and retention can be developed and replicated in other nations that struggle with finding and keeping teachers in more remote locations. While there are significant differences between the educational systems across all nations, some of the common challenges related to providing outstanding educational opportunities to students in rural areas exist everywhere.

To help provide structure to this study, the following lines of inquiry have been developed:

1. To what extent are the identified nations impacted by a shortage of teachers in more rural and remote areas? How does national or regional education workforce policy reflect the various challenges associated with rural teacher recruitment and retention?

2. What specific interventions have been developed to support rural teacher recruitment and retention in Australia, the United States, and Zambia?

The development the previously stated research questions are beneficial to help guide research and highlight the primary areas of inquiry. As three distinct and different nations are the area of focus for this study, it is also assumed that significant variance in terms of the level of impact and the extent of the interventions will vary. And while this may present challenges related to the development of unified outcomes and conclusions, it also provides an opportunity to explore and understand the unique nature of rural teacher recruitment and retention in three very different regions of the world.

Countries of Focus

The three countries of focus were developed through a review of research related to rural teachers in specific locations. In Australia, the problem of rural teacher shortages has been significantly defined and highlighted, with extensive research completed that emphasizes the challenge of placing and retaining teachers in the most remote parts of the nation (Kline, White, & Lock, 2013; Plunkett & Dyson, 2011; Trinidad, Sharplin, Ledger, & Broadley, 2014). Both Zambia and the United States recognize the issues related to rural teacher recruitment and retention as well, but the extent of implementation of various policy interventions varies widely – particularly when compared to Australia. This comparative analysis is possible due to the availability of information and resources within each nation, and the physical location of the researchers who reside within each nation of focus. Additional detail about the policy implementation and approaches with each nation follows.

Australia

The majority of Australia's population lives and attend schools in major urban centers (and the proximal suburban spaces) that are situated on the coastlines. Major metropolitan areas such as Sydney, Melbourne and, to a lesser extent, Perth comprise more than 80% of the total Australian population. Accordingly, the vast majority of Australia's primary and secondary (ages 5-17) student populations, as well as the majority of universities that prepare educators, are also located within these metropolitan areas. In total, there are more than 320,000 classroom teachers in Australian schools (Australian Bureau of Statistics, 2018a) – with the majority living within 100 kilometers/62 miles of the coastline.

As a nation, however, Australia has large expanses of rural regions that encompasses the majority of the interior of the continent. Within these remote and rural regions, more than 74,000 students attend schools (Australian Bureau of Statistics, 2018b). Finding classroom teachers for these remote schools has been a difficult undertaking (Kline, White, & Lock, 2013). Emerging and newly prepared educators have historically been hesitant to apply to the most remote and rural schools due to individual perceptions regarding social opportunities and professional limitations (Cuervo & Acquaro, 2018).

In response, various Australian states and territories have developed incentives, primarily monetary, to bolster the educator pipelines into more rural and remote regions. These incentives focus on financial benefits, but several regions have also included other incentives related to enhanced professional development opportunities and additional off-time for teachers during the academic year. Table 1 lists a sample of these incentives to entice teachers to rural schools.

Table 1
Australian Rural Teaching Incentives

State/Territory	Salary Incentives	Development Incentives	Other Incentives
New South Wales	Up to $25,000 (AUD) salary adjustment; up to $10,000 recruitment bonus	4 additional professional development days	Up to five additional personal leave days; potential subsidies for rental accommodation
Western Australia	Up to $24,901 salary adjustment	Professional development offered through web-based platforms.	Additional leave for teachers in remote regions; free or subsidized accommodation; relocation costs provided; subsidized vehicle lease/purchase
Northern Territory	Up to $23,952 salary adjustment	Specialized training (e.g., 4WD driver training)	Free or subsidized accommodation; up to four free flights to neighboring urban centers.

Many of the challenges related to rural teaching in Australia center on the remote nature of the smaller towns and villages throughout the country (Cornish, 2015). While some nations, such as the United States, may define remoteness as being more than two hours away from a major metropolitan area, there are regions in Australia that require driving time of more than 15 hours to reach the location of the rural school. This vast distance can be daunting to new teachers embarking on their initial teaching roles and requires them to make significant modifications to a cosmopolitan lifestyle that they may have developed during their time at university (Lavery, Cain, & Hampton, 2018). To compensate for this dramatic change in location and environment, some institutions have started shorter-term immersive experiences for pre-service teachers to experience teaching and living in these remote regions. These experiences have been beneficial as an increase in the number of students interested in teaching in remote locations has developed, but this process is dependent on a significant contribution of time and money on the part of the university and the university faculty to provide this opportunity (Mitchell et al., 2019).

The impact of these developed incentives, at this time, is largely unknown due to the nature of exploring the long-term development and retention of rural educators. It is evident, however, that student enrollment in Australian schools is projected to significantly increase, up to 50% by 2035, in nearly all states and territories – placing further demand on a limited teacher/educator labor pool (Australian Bureau of Statistics, 2013). This increase in student populations has a direct impact on rural teacher supply as it provides additional opportunities for existing rural teachers to relocate to more suburban or urban locations – leaving their rural school a vacancy that is difficult to replace. Without a unified approach to ensuring that all students have qualified and effective teachers in the classroom, there is a concern that educational equity for all Australia's students can be ensured.

Zambia

Zambian education is highlighted by the unique population distribution throughout the southern African nation that shows a relatively balanced number of students in each region of the country. The 4.2 million students attending school in Zambia are dispersed throughout the country with the Copperbelt, Lusaka, Central and Southern provinces posting student enrollments of more than 500,000 students (Ministry of Education, 2018). To support these students, Zambia employs more than 107,000 teachers throughout the country. These teachers facilitate student learning at the early childhood (ages 3-6), primary (7-13) and secondary 14-18) levels. According to the country's 2018 Educational Statistical Bulletin (Ministry of Education, 2018), the highest distribution of teachers in the country is within the Copperbelt province – the mining hub of the nation and inclusive of the cities of Ndola and Chingola. In this region, 19,761 teachers are employed, representing 18% of all teachers in the country. Other regions with significant numbers of employed teachers include Lusaka, the nation's administrative center, and the significantly populated Southern province. In contrast, the Western province of Zambia, in the most remote region of the country, has the fewest number of teachers currently employed.

Of particular concern in Zambia is the projected dramatic growth of school-attending populations within the next 15 years. At present, there are roughly 4.2 million enrolled students at the early childhood, primary, and secondary levels. This number is projected to increase dramatically by 2035 with a projected population growth of all Zambians from ages 0-19 of approximately 40% (Zambian Central Statistical Office, 2013). Based on this projection, it can be estimated that more than 5.8 million students will be enrolled by 2035 – an increase of 1.6 million students from today.

In Zambia, this student enrollment will, and has, increased more rapidly in urban areas than in rural areas. Yet increasingly the majority of African children who do not attend school are rural students (World Bank, 2005). A combination of demand-side and supply-side factors contribute to lower educational participation in rural areas, including aspects related to parental encouragement to attend school, and alternative demands on their time, such as helping with family farming and other agricultural tasks. Even when they attend school, rural children often find the curriculum less relevant to their lives and find less support for their learning from the home environment (World Bank, 2005). This makes children in rural areas more difficult to engage in education and often results in a lower quality education. It is hardly surprising then, that rural areas in Zambia show lower participation in education, and lower attainment.

Contrary to labor shortage patterns seen in other nations and regions of the world, it would seem that Zambia may be uniquely prepared for an increase in total student numbers. At present, the number of trained teachers far surpasses the number of available vacant teaching positions (Phiri, 2019). This has resulted in Zambia developing agreements with regional external African governments, such as Seychelles and Madagascar, to have Zambian teachers sent to another country to address teacher shortages in those countries (Lusaka Times, 2019a; Zambia Daily Mail, 2019). Yet, despite the current surplus of teachers, there are also indications that Zambia continues to face teacher shortages in some circumstances and locations. This problem centers on the nation's lack of capacity to employ teachers by the government (e.g., having teachers vetted, processed, and hired), and even where this process is completed, there remains issues with deployment patterns and teacher retention – particularly in rural areas.

As seen in the United States and in other global locations, successful governments continue to find it more difficult to supply quality education services in rural areas (Biddle & Azano, 2016). Within the African context, three primary factors combine to weaken the quality of teaching in rural areas. First, in many African countries, teachers have a preference to teach and live in urban areas with proximity to services and commercial/shopping enterprises. Accordingly, rural schools are often left with empty posts, or have longer delays in filling these vacancies (du Plessis & Mestry, 2019). And even if posts are filled, the number of qualified teachers seeking employment in rural schools remains low. In most cases, better qualified teachers have a greater choice of jobs and based on patterns of preference, many choose to work and live in urban areas. This can result in rural schools having less experienced teachers, as the more experienced teachers find ways to move to the more desired schools (World Bank, 2005).

To support these rural regions in Zambia, governmental incentives have been developed and implemented, resulting in increased compensation for teachers in remote and rural areas. While there is some evidence that these efforts have proven to be beneficial in supporting academic achievement for rural students (Chelwa, Pellicer, & Maboshe, 2019), it is unclear as to how these efforts align with the current issue of over-supply of teachers within Zambia. This pattern of simultaneous surplus and shortage of qualified teachers within parts of Zambia, especially between rural and urban schools, provides evidence that the problem of teacher labor in Zambia is not just a problem of numbers, but also an issue of ensuring that teachers are deployed to the schools where they are most needed. To resolve this unusual issue, it would seem to be important that government to address the various demand-side factors that cause teachers not to stay in rural areas despite the rural and remote hardship allowances currently in place. Teachers in rural areas do not just need monetary incentives, because the disadvantages of teaching in rural areas (such as limited access to services, technology, and other modern conveniences) far outweigh these salary-based incentives. It is, therefore, not surprising that most teachers prefer to work in urban areas, because the incentives for teachers in remote rural areas are not sufficient to compensate for the various hardships (Pugatch & Schroeder, 2014; World Bank, 2006).

Further compounding this issue is a higher-than-projected teacher annual attrition rate across Zambia. While a standard attrition figure of 5,000 teachers is projected by the Ministry of Education, recent years have seen more than 7,000 teachers elect to leave their classroom positions (Ministry of Education, 2018). A reduction in the number of teachers when the pupil enrollment is increasing will have an adverse impact on education quality within the country. Various factors currently contribute to the high rate of teacher attrition in Zambia – particularly in the rural areas (Das, Dercon, Habyarimana, & Krishnan, 2007). For instance, once the teacher has been deployed and assigned a teaching location, they are able to request transfers to other areas. Many times, these transfers are often requested based on marriage, as it is logical that a teacher would want to live in the same area as his/her/their spouse. Hence, it is rare to find female teachers in rural areas, unless they are with their husbands (e.g., both are teachers). Male teachers are also able to transfer on the basis of their need to complete further academic study, necessitating access to electricity which may not be available in some remote locations (Haanyika, 2008). Lastly, teacher illness is another major justification for movement, particularly from rural areas to more urban schools.

Student-teacher ratios may also be a contributing factor to this level of attrition as the nation averages 61.9 students for every early childhood and primary teacher and 37 students for every secondary teacher (Ministry of Education, 2018). With additional students, educator

workloads tend to rise and job satisfaction declines – elements that frequently have a direct impact on teacher retention (He, Cooper, & Tangredi, 2015).

In addition, Zambia also possesses a unique characteristic related to teacher qualifications. In Zambia, roughly 25% of all teachers possess university degrees, far surpassing regional comparative nations such as the Democratic Republic of Congo (3.6%) and Senegal (4.8%) (Bashir, Lockheed, Ninan, & Tan, 2018). The connection between teacher qualifications and student achievement has been extensively researched (see Bietenbeck, Piopiunik, & Wiederhold, 2018; Coenen, Cornelisz, Groot, Maassen van den Brink, & Van Klaveren, 2018), and is a significant factor impacting the potential future opportunities and benefits for Zambia's students.

Recent political actions, however, will likely have a long-term impact in regards to teacher labor force development within Zambia. The operationalization of the Higher Education Authority (HEA) in 2015, as established under the Higher Education Act No. 4 of 2013, and the establishment of the Teaching Council of Zambia (TCZ), and the National Action for Quality Education in Zambia (NAQEZ) have largely been well-received, as these organizations seek to provide mechanisms related to quality assurance and quality promotion in higher education. This is done primarily through enhancing governmental policy related to educator preparation and teacher labor supply in Zambia (Mwalimu, 2014). This pattern of simultaneous surplus and shortage of qualified teachers is not unique to Zambia, as it is also seen in other nations in Africa (Irving, 2012). The challenges related to teacher deployment, the lack of funds by governments to employ teachers, as well as the supply factors that make rural areas unattractive to teachers are commonplace throughout the continent. However, compared to current teacher labor supply limitations found throughout most of the world, the case of Zambia makes it a nation worthy of future study regarding teacher labor supply and policy.

United States

Concerns over educator shortages throughout the United States have been well-documented and have led to increased speculation about the viability of classroom-based careers and the retention of existing educators throughout the nation. At present, there are more than 3.5 million teachers employed throughout the United States (U.S. Department of Education, 2019a), with the majority of educators working in urban or suburban schools and school districts. One unique aspect of the American educational system is the lack of a nationalized curriculum or nationalized salary scale for teachers. Accordingly, there are more than 13,000 independent school districts that control the majority of educational operations – including the approval of curriculum and the establishment of compensation policies for individual educators (U.S. Department of Education, 2019b).

A projected shortfall of approximately 200,000 classroom teachers is anticipated in the United States by 2025 (Garcia & Weiss, 2019). Specialized teaching domains such as secondary math and secondary science continue to have limited applicants to local schools in all school location types - urban, suburban, and rural (Sutcher, Darling-Hammond, & Carver-Thomas, 2016). Yet, there are little commonalities regarding teacher shortages based on geography. Where some states, such as Massachusetts and Ohio, continue to have applicant numbers that far exceed available teaching positions, other states such as Colorado and Alabama, frequently have vacancies in rural schools that attract zero applicants (Whaley, 2016).

To combat these challenges, both federal and state governments have developed various initiatives in an effort to promote teaching careers to potential future educators and to provide financial incentives for new educators entering the profession. With lower salary rates available for classroom educators in the United States as compared to other occupations requiring similar education levels, the number of individuals pursuing careers in education has been in decline through most of the start of the 21st century (Sutcher et al., 2016). To remedy this shortage, several states have instituted financial incentives for teachers or teacher candidates – particularly for those interested in rural schools (Loewus, 2018). From a federal level, programs have been developed to help offset the high costs of university attendance as all states throughout the United States require that teachers possess a four-year degree (Hegji, Heisler, & Smole, 2018). In order to pay for the costly university education, many teachers are required to take out extensive loans, with the average loan debt for university graduates in the United States exceeding $30,000 (Carrig, 2019).

In the United States, several individual states have also taken steps to remarket the profession or make teaching more appealing to younger university graduates. Many states have examined avenues to reduce the barriers associated with teaching – particularly for those entering the classroom as a second career or those without formal training in pedagogy or teaching methods (Lilly, 1992). Other unique efforts to increase the number of individuals into the classroom also include the established "Troops to Teachers" program that supports former military members in developing a professional pathway to becoming a classroom teacher. This specific program has been seen as significantly successful as student achievement has been accelerated in classrooms with these former members of the military (Owings et al., 2016).

Despite these initiatives, many rural schools throughout the country continue to be impacted by a scarce pool of teacher labor, and many positions remain unfilled (Hernandez & Cohen, 2019). Without significant governmental intervention that leads to resolution of many of the issues related to teaching in the United States, including low salaries, overwhelming workloads, and school safety, it is difficult to foresee a significant increase of individuals seeking careers within government/public schools. Until these issues are resolved, American schools will continue to struggle with teacher recruitment and retention – particularly in the more rural and remote regions of the country.

Findings and Commonalities

In all three nations of focus, there exists some overlapping commonalities related to interventions designed to bolster the teacher workforce in rural locations. One shared approach clearly centers on financial incentives for individuals interested in rural teaching – a factor that has seen some success in Australia with a more limited success rate in the United States and Zambia. It is clear that compensation and salary does play a role in both the recruitment and retention of teachers in rural regions (Livengood, 2021; See et al., 2020). As we find in all three countries of focus, these financial incentives are a significant component of efforts to recruit and retain rural teachers. The Australian approach of offering both higher wages and recruitment bonuses for teachers willing to work in remote areas has largely been effective (Sattin-Bajaj, Walker-Gibbs, & Thomas, 2019).

A second key commonality within all three countries is the recognition by key stakeholders within national and local/state/provincial governments that the issue of rural teacher recruitment and retention is worthy of focus. This focus is exemplified by the development of

specific communications and associated interventions to address educator shortages in rural schools. In Zambia, for example, the Ministry of Education formally recognized the lack of teachers in the rural parts of the nation and, as a result, implemented a "hardship allowance" for teachers working in more remote regions (Chelwa, Pellicer, & Maboshe, 2019). This recognition of the issue and the development of an intervention specifically designed to address the rural teacher shortage issue demonstrates that the federal government does identify rural teacher placement as a problem. The US response to rural teacher shortages has less to do with the implementation of specific interventions, but rather focuses more on the development of data and reports that highlight the concern. (USGAO, 2022). While the lack of a developed intervention in the US system is notable, there are official communications within the US federal government that highlight rural teacher challenges. This approach of recognizing the ongoing problems of teacher staffing in rural schools is common in all three locations, but the mitigation of these concerns differs in Australia, the United States, and Zambia.

When examining the commonalities in all three locations, it also becomes clear that – in each country – there is little evidence that efforts to integrate rural teaching into existing educator preparation programs at colleges and universities is taking place. In most educator preparation programs at the university level, future teachers are prepared, generally, to teach in either urban or suburban schools (Coffey et al., 2019; Siwatu, 2011). There seems to be very little information or indication that colleges and universities, generally, are focusing on preparing educators for roles in rural schools. While preparing teachers for life as a rural teacher may take place in a limited fashion at individual institutions of higher education, there is not a universal national requirement in any of the three countries of focus to emphasize the preparation of rural teachers. In many instances, particularly in the United States, educators are more likely to be prepared to work in suburban school districts that include the majority of students in the nation (Riser-Kositsky, 2020). This lack of focus on the preparation of rural educators likely has impact on the limited number of new teachers electing to work and live in more remote locations. If emerging teachers do not visit, student-teach, or engage with rural schools during their preparation, it is logical to assume that they will be less likely to consider a teaching role in the rural environment (Brundin, 2019). Without a mandate or incentive for educator preparation programs to focus on rural schools, it is unlikely that these programs will emerge organically.

Discussion

With a developing shortfall of 69 million teachers worldwide within the next 15 years, concentrated and specific efforts need to be developed and undertaken to ensure that all students, regardless of physical location or postal code, have access to relevant and beneficial educational opportunities. The incentives developed by many nations that seek to promote teaching careers and expand the pool of potential teachers are important first-steps, but these initial efforts cannot be the only initiatives developed in support of bolstering teacher pipelines into the classroom. Specific efforts should be developed to help resolve ongoing problems with retaining existing educators (in all locations – including rural schools), addressing factors that lead to teacher frustration and burn-out, and developing a new generation of school leaders that will be needed to replace retiring or departing principals, headmasters, and superintendents (Wallace Foundation, 2022). Without the development of comprehensive and extensive initiatives that directly impact and benefit classroom teachers, teacher shortages will continue, and likely expand, well into the mid-21st century. As teacher numbers dwindle, the impact on student learning will be substantial – a very concerning

development as global events and ecological concerns will require a highly educated generation of young people that will emerge in the mid-21st century (Kotok & Knight, 2022).

Rural schools are frequently the first educational institutions to be impacted by educator shortages and serve as an indicator for larger issues related to the appeal and desirability of teaching as a profession. Local rural students frequently find themselves attending schools that may have a low-quality or nonexistent teacher, simply as a result of the imbalance related to the current teacher labor supply (Zhang et al., 2018). Today, many rural schools are operating without qualitied teachers and instructors in key academic disciplines such as math and science (Dobo, 2022). Students in rural schools are required to either self-teach themselves these subjects or forgo classwork and learning in specific content areas. While it is admirable that these students continue to push forward despite significant odds, this situation highlights larger issues related to rural education and equity.

In suburban and urban schools, particularly in the affluent sections of a city, it is assumed and expected that students will have access to a highly trained teacher with knowledge about specific academic subjects or pedagogical approaches. In rural schools, however, having this skilled individual leading a classroom is not always a safe assumption. Vacant teaching positions and ineffective teachers are common in more remote parts of the world (Amminson, 2022). This has led to the emergence of a concerns regarding school equity and educational access. Students who are fortunate to be able to attend schools in suburban or urban areas with qualified teachers in all classrooms, contrast dramatically with their peers in poorly staffed rural locations (Coenen et al., 2018).

Today, many schools look to technology to help “level the playing field” and provide instruction through internet-based video applications and platforms (Economist, 2017). Yet, this implementation of virtual teachers or on-line education highlights the inequity found between those students in rural schools and urban/suburban schools that continue to employ in-person faculty. Where rural students are frequently provided a virtual teacher to provide instruction from a distance, non-rural schools infrequently use video instruction as their primary mode of teaching (Barry & Easterly, 2021; Li, Sun, & Gee, 2019).

This lack of qualified educators staffing rural schools leads to additional questions regarding educational equity and the role of geography on the quality of education available to a student. Ideally, the student in a rural school in a remote location will have the same opportunities and resources as their peers in urban and suburban locations, yet there is emerging evidence that this is not the reality in most rural schools (Gagnon & Mattingly, 2015). The current shortages of qualified teachers in rural schools should be seen as a precursor to future staffing challenges in urban and suburban schools. While a school in a remote location today may not be able to secure the services of a secondary chemistry teacher, this vacancy could well exist tomorrow in schools in large urban areas or in suburban schools. Without proactive and intentional action to secure the services of qualified and enthusiastic rural teachers, school effectiveness will be limited and academic development for students in more remote location will be impeded.

Conclusion

In Australia, the United States, and Zambia, numerous initiatives and communications have been developed to support the placement of classroom teachers in rural and remote locations. While each country approaches the concern differently, there is a common thread between all

three about the recognition of the challenges related to recruiting and retaining rural educators. Now that the problem has been identified and analyzed, each nation has embarked on trying to address the issue with incentives, additional studies, or reallocation of teachers to support rural schools. This challenge will remain as the teacher labor supply continues to shrink, but it is hoped that the initial steps taken by each country will yield positive results that lead to effective learning opportunities for the children in the rural regions of the world.

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The Effects of Online Collaborative Learning (OCL) on Student Achievement and Engagement

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Abstract

This study determined the effects of Online Collaborative Learning (OCL) on student achievement and engagement in physical science. A one-group pretest/posttest pre-experimental research design was employed. The participants were Grade 11 students (n=30) in a public stand-alone senior high school in Congressional District 1, Quezon City, Philippines, who were selected using purposive sampling. This study utilized five research instruments: (1) OCL-based lesson plans, (2) Learning Activity Sheets (LAS), (3) Physical Science Achievement Test (PSAT), (4) CIP Engagement Questionnaire, and (5) Student Learning Experience Survey. The collected data were analyzed and interpreted quantitatively and qualitatively. Quantitative data were obtained from the validated 40-item achievement test and the adopted engagement questionnaire, while responses to the Student Learning Experience Survey provided qualitative data. Paired t-test was employed to determine the significant difference in achievement and engagement before and after the OCL's implementation. The results showed a significant difference between the pretest and posttest mean scores of the students in the achievement and engagement in physical science. Likewise, there was a statistically significant difference between the pretest and posttest mean scores for all engagement factors: cooperation, interest, and participation. The result of the survey revealed that students' exposure to the OCL strategy was effective in facilitating significant improvements in their achievement and engagement in physical science. Overall, the findings signified that Online Collaborative Learning (OCL) as a teaching-learning strategy enhanced students' achievement and engagement in physical science.

Keywords: achievement, engagement, online collaborative learning, physical science

Looking closely at science learning, engaging all students to participate actively in science class activities has been one of the challenges that science teachers encounter most of the time. Students previously regarded to be more able by their peers frequently dominated the class, whereas students with poor academic track records chose not to participate (Lowry-Brock, 2016). According to research, academic achievement will improve if teachers can better engage their students (Hirtz, 2020). As to Carini et al. (2006), if students are actively involved in the classroom, they are more likely to show greater interest and participation in the lesson, thus leading to better performance. However, as schools transitioned to online learning in response to the COVID-19 pandemic, student engagement has been recognized as a challenge (Farooq et al., 2020; Nickerson & Shea, 2020; Perets et al., 2020). Similarly, according to Kukard (2020), maintaining a sense of collaboration and connection has been one of the most challenging components of teaching during a global pandemic.

Given the physical distance between online students, collaborative learning initiatives may help them connect and overcome feelings of isolation (Writers, 2018). According to Leow and Neo (2016), collaboration can strengthen student-to-student relationships that encourage engagement leading to increased achievement in the course. Additionally, collaboration contributes to topic understanding and interpersonal skills development that assist students outside the classroom (Falcione et al., 2019). However, a virtual-based collaboration differs from one held in a physical classroom in terms of interactions between group participants over geographic distances and from dispersed locations (Othman et al., 2013). Thus, online collaboration tools are often used to facilitate online collaborative learning (Writers, 2018).

Collaborative learning can take on many forms in the traditional classroom setting. Common examples include jigsaw activities, problem-based learning, peer review, and think-pair-share (Nokes-Malach et al., 2015). All these strategies can be used in online learning using an online collaboration tool (Writers, 2018). For instance, the digital version of Think-Pair-Share (TPS) allows students to collaborate in the same way that the traditional Think-Pair-Share activity does, but at a distance, using simple online tools like Google Docs. According to Othman et al. (2013), The "Think-Pair-Share" method is a low-risk, quick collaborative learning strategy that works well in a virtual environment. Students could benefit from the Google Docs TPS adaptation by focusing on teacher-led questions in one area and collaborating with others to better understand the concept (Slone & Mitchell, 2014).

Online collaboration tools like Google Docs promote engagement and student-centered learning, which is critical for developing communication and inquiry skills (Schneckenberg, 2014). Students can accomplish assignments while collaborating with peers to agree on assigned tasks. Teachers can provide immediate feedback to students, observe, motivate, and facilitate their work while they collect information for an assignment. By utilizing the cloud approach in teaching and learning, students and teachers can work on the same document simultaneously, offering more information, making corrections, and providing comments (Faulkner, 2019). Teachers that used 21st-century collaborative technologies like Google Docs discovered that students were more enthusiastic and motivated to learn and agreed that talking with their peers helped them better understand the learning content (Lin et al., 2016).

Online Collaborative Learning (OCL) is a widely used distance learning and teaching approach comparable to face-to-face collaborative learning; however, meetings in a group are held asynchronously or synchronously over the internet (Magen-Nagar & Shonfeld, 2017). Despite development in distance learning research, there is still no consensus on the effective utilization of ICT technologies in online teaching with virtual groups to produce interactive, collaborative

learning that fosters effective learning (Ng, 2017). Moreover, it has not made much headway in the Philippines. There are also few to no empirical studies on the use of OCL in teaching physical science, and little is known about its application. This prompted the researcher to investigate whether OCL can improve students' achievement and engagement in the online classroom. Hence, this study determined the effects of Online Collaborative Learning (OCL) on student achievement and engagement in learning physical science. This study also utilized Google Docs as a collaborative learning tool to create and format text documents in real-time. Furthermore, the think-pair-share technique was adopted to facilitate online group activities, as it is short and ideal for use in a virtual learning environment (Othman et al., 2013). The following research questions guided the present study:

1. What is the student's achievement in physical science before and after their exposure to Online Collaborative Learning (OCL) strategy?
2. Is there a difference between the pretest and posttest mean scores of the students in the physical science achievement test before and after their exposure to the Online Collaborative Learning (OCL) strategy?
3. What is the student's engagement in physical science before and after their exposure to the Online Collaborative Learning (OCL) strategy in terms of:
4. cooperation
5. interest
6. participation
7. Is there a difference between the pretest and posttest mean scores of the students in the Cooperation, Interest, Participation (CIP) Engagement Questionnaire before and after their exposure to the Online Collaborative Learning (OCL) strategy?
8. What are the students' learning experiences of the Online Collaborative Learning (OCL) strategy?

Literature Review

Online Collaborative Learning (OCL) Strategy

Online Collaborative Learning (OCL) stems from social constructivism, in which students are encouraged to work collaboratively to solve problems through discussions. In OCL, the teacher is a facilitator and part of the learning community (Harasim, 2012). In distance learning, OCL is a widely used teaching approach based on the conventional collaborative learning method. The goal is to utilize technology to enhance communication between teachers and learners, focusing on the knowledge-based learning development supported and developed through social discourse (Bates, 2015). According to Koh and Hill (2009), online collaboration entails students working together to finish a task using electronic modes of communication regardless of time or geographic isolation. However, as Bates (2019) pointed out, the teacher's role in facilitating and providing resources and learner activities to ensure the integration of the core concepts, practices, standards, and principles remains critical to the success of online collaborative learning.

As for the effects of Online Collaborative Learning (OCL), Al-Ammary (2013) found that OCL has a significant impact on student achievement. However, OCL may influence student contributions because some students may rely on others to complete their work and may have a lower level of commitment to the group, which may impede communication among group members. Additionally, Ajayi and Ajayi (2020) used an online collaborative learning strategy with a quasi-experimental research design, notably the pre-and post-test control. The findings

indicate that online collaborative learning techniques in Science Education improved undergraduate learning outcomes and retention. Furthermore, according to Nguyen (2015), there is strong evidence that online learning is as successful as traditional learning. In fact, according to Bernard et al. (2014); Means et al. (2010), some studies have shown that online learning has been reported to be more effective. Lastly, Tsai and Guo (2012) on the impact of Online Collaborative Learning (OCL) on student achievement. Results have shown that OCL had a favorable impact on student achievement, with various criteria emerging as predictors of student achievement.

However, some studies found that collaboration in virtual teams can be more challenging than in a conventional one. For example, during the COVID-19 pandemic, Mustakim and Adha (2021) discovered that, despite the teacher's ability to use online learning applications effectively, they still had difficulty fostering collaborative learning due to the presence of students in different locations, making coordination challenging. Andres and Shipps (2010) discovered that technology-mediated collaboration had more instances of communication failures and misunderstandings. A similar study by Koh and Hill (2009) found that online group activities were more difficult for students than working in face-to-face groups. The most challenging factors identified by students were communication issues and a lack of a sense of community.

Meanwhile, recent studies have shown that students enjoy and are engaged in collaborative learning when it is done digitally with innovative learning technology (Gopinathan et al., 2022). Baanqud et al. (2020) found that during the COVID-19 pandemic, digital collaboration is essential for student engagement to help them perform better in and out of the classroom. Even though students are participating remotely in the teaching and learning process, digital collaboration ensures that everyone gets the chance to share information and retain it. It was also found in other research by Chiero et al. (2015) and Fedynich et al. (2015) that online interaction between teachers and students improves learning outcomes and student satisfaction, which leads to better student engagement. Additionally, students' ability to communicate with their peers contributed to their enjoyment of learning (Lee et al., 2018), and the student's enjoyment of sharing ideas and working with others fostered cooperation (Lamina, 2020).

Google Docs Think-Pair-Share

Lyman introduced the Think-Pair-Share (TPS) structure in 1981, a collaborative learning structure in which students first think individually before forming ideas about the questions, then pair up with other students to discuss their answers. Finally, after the pair discussions, students share their responses with the entire class (Lightner & Tomaswick, 2017). This form of classroom activity encourages students to interact with one another and the lecturer, resulting in an active learning environment. It also encourages everyone in the class to participate, even those who are more reserved and less likely to speak up in class unless prodded. Studies using this structure have reported increased student engagement and enhanced learning outcomes (Razak, 2016; Raba, 2017). The digital version of Think-Pair-Share (TPS) offers new affordances, allowing students to work collaboratively but at a distance. Students engage well with the idea of messaging each other and creating some excitement around the task. Google Docs, a simple online tool, may provide a platform for the Think-Pair-Share (TPS) activities. When students use Google Docs to facilitate a TPS activity, they are encouraged to investigate a teacher-prompted question, collaborate with peers, write their answers to an electronic document, and finally project their collective results to the larger group (Slone & Mitchell, 2014).

Methodology

Research Design

This study employed a one-group pretest/posttest pre-experimental design, using quantitative and qualitative methods to analyze the data collected to address the research questions. The effect of the Online Collaborative Learning (OCL) strategy on student achievement and engagement was determined using quantitative analysis. The participants' learning experiences with OCL were analyzed qualitatively using thematic analysis.

Participants of the Study

The participants involved grade 11 (n = 30) senior high school students from one physical science class at a public stand-alone senior high school in Congressional District 1, Quezon City, Philippines. Purposive sampling was applied to select 30 students (4 males and 26 females) from the 42 students enrolled in the class. The inclusion criteria were: (1) Students who took the Online Distance Learning or ODL (the teacher facilitates the learning and engages the learners' active participation using technology via the internet during instruction). (2) With sufficient experience in online distance (ODL) learning (for one semester) during the pandemic outbreak. Students with above-average levels were paired up with below-average levels. Those having the same average level were paired together based on the Stanine scores taken from their first-semester final grade in the Earth & Life Science subject, forming a total of 15 pairs. This study did not include the twelve (12) students who took the Modular Distance Learning or MDL (learners who used self-learning modules or SLMs in digital/electronic copy).

Research Instruments

OCL-based Lesson Plans

The OCL-based lesson plans were adapted from the Teaching Guide (TG) for Senior High School in physical science. All the lesson plans aim to provide a general outline of the teaching goals on how students should learn, how it will be delivered, and measured, following the policy guidelines on daily lesson preparation for the K-12 Basic Education Program based on the principle of sound instructional planning. The researcher incorporated the Google Docs Think-Pair-Share activities on the lesson plans. All the lesson plans used in this study went through the phases of validation by experts and the research adviser using the Lesson Plan Evaluation Matrix before the implementation. Then, the researcher incorporated the comments and suggestions in refining the lesson plans.

Learning Activity Sheets (Google Docs Think-Pair-Share Activities)

The Learning Activity Sheet (LAS) is a self-directed instructional material that guides learners in completing activities at their own pace and time using contextualized community resources. Four collaborative Learning Activity Sheets (Google Docs Think-Pair-Share Activities) were developed on the topics: Polarity of Molecules, Intermolecular Forces, and Biological Macromolecules, with contents validated by the experts, peers, and the research adviser. The Learning Activity Sheets (LAS) were validated alongside the lesson plans, as these activities are incorporated into the lesson proper. The validators were given copies of the lesson plans with the learning activity sheets to provide feedback and suggestions for improving and

refining the questions. Accordingly, changes were made based on the feedback and suggestions.

Physical Science Achievement Test (PSAT)

The Physical Science Achievement Test (PSAT) was constructed to measure students' level of understanding related to the topics: Polarity of molecules, Intermolecular Forces, and Biological Macromolecules, with sample questions in Appendix A. It measures three cognitive learning domains: remembering, understanding, and applying. The research adviser and the three science education experts evaluated the test's content and face validity using the validation tool adopted from the study of Lamina (2020). Then, it was pilot tested on 40 senior high school students who were not participants in the study and subjected to item analysis. From the initial pool of 60- multiple choice test items, only 40 good items were included in the final form using the index difficulty of 0.25 to 0.75 and the discrimination index of 0.3 and above as the acceptable item. The reliability coefficient is 0.83, which indicates that the test was highly reliable and appropriate for administration as a pretest and posttest of the study.

Cooperation-Interest-Participation (CIP) Engagement Questionnaire

The CIP Engagement questionnaire (in appendix B), adopted from the study of Lamina (2020), is a four-point scale self-assessment tool that measures the cooperation, interest, and participation (CIP) factors of engagement. This questionnaire contains 15 questions given as follows: the cooperation factor has four (4) questions (item nos.1-4), the interest factor has nine (9) questions (nos. 5-13), and the participation factor has two (2) questions (item nos. 14-15). The students have four responses to rate their engagement ranging from Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). The minimum score in the instrument is 15, and the maximum is 60.

Student Learning Experience Survey

The Student Learning Experience Survey contains three open-ended questions prepared by the researcher and validated by the same science expert-validators. The survey questions sought students' accounts of their experiences with OCL. The student responses to the three open-ended questions were thematically analyzed using the framework developed by Braun and Clarke (2006). This approach was chosen because it is useful for summarizing key features and generating unexpected insights (Braun & Clarke, 2006). The themes, sub-themes, and codes of the open-ended questions were derived from the answers that have the same concepts and ideas (Braun & Clarke, 2012). The researcher manually performed the data collection and coding procedure to identify similarities and differences in the participants' responses. The researcher applied the six-step process by Braun and Clarke (2006) to identify common ideas that came up repeatedly. The process involved (1) Familiarization, (2) Coding, (3) Generating Themes, (4) Reviewing Themes, (5) Naming Themes, and (6) Writing Up.

Data Gathering Procedures

Before the implementation of the study, the researcher obtained permission from the school head where the study was conducted. After the list of participants had been finalized, the researcher gave the Informed Consent letter to the selected participants. After this, an orientation session on online collaborative learning was carried out using Google Docs to introduce and familiarize students with the platform and its tools. The students were then paired

up based on their computed Stanine scores. After grouping, the teacher discussed how the activity would run. The data-gathering procedure went through three different phases described below:

Phase I- Pretesting. Before the first lesson of the study, the teacher-researcher delivered a trial lesson about Exploring the Formation of Elements During Stellar Formation and Evolution, and the students completed an OCL activity using Google Docs Think-Pair-Share. The purpose of this trial lesson was to control the novelty effect. The pretest and the CIP Engagement Questionnaire were administered following the trial lesson to determine the pretest scores in the Physical Science Achievement Test and the CIP Engagement Questionnaire. The pretest lasted 60 minutes in the first session and 30 minutes in the second session for the CIP Engagement questionnaire.

Phase II- This phase involved the implementation of Online Collaborative Learning (OCL) using the Google Docs Think-Pair-Share Strategy. Physical science is generally taught four times per week in senior high, with two 1-hour synchronous class sessions and two 1-hour asynchronous sessions conducted each week based on the approved teacher's schedule.

Session 1 (Synchronous). The teacher-researcher discussed the topic for the week, guided by the OCL-based Lesson Plan for 60 minutes.

Session 2 (Asynchronous). The Learning Activity Sheet (Google Docs Think-Pair-Share Activity), created and saved in Google Drive by the teacher-researcher, was given to each pair via Google Classroom. A question was posed in the Learning Activity Sheet, requiring students to think individually about the question and record their answers/ideas in the activity sheet. In pairs, students discussed and compared their answers to the given question. While both students worked in Google Documents, they could view information simultaneously while chatting – allowing them to collaborate remotely.

Session 3 (Synchronous). Students shared their work with the whole class via Padlet, an online virtual board that supports collaborative learning in classroom teaching. Padlet is a free multimedia wall that encourages whole-class involvement by allowing real-time interaction among students and between students and the teacher (Fuchs, 2014). Four minutes were allotted for each pair to share and discuss their output with the whole class.

Session 4. (Asynchronous). Students were given a short evaluation via Google Forms to assess their understanding of the lesson.

Phase III- Post-testing and Learning Experience Survey. This phase involved administering the posttest using the PSAT and the CIP Engagement Questionnaire. The posttest lasted 60 minutes, while the CIP Engagement questionnaire took 30 minutes to complete. Then, the students responded to the Student Learning Experience Survey in the next session.

The study lasted six (6) weeks without interruption. All the gathered data were subjected to statistical treatment and analysis to determine the effect of the Online Collaborative Learning (OCL) strategy on students' achievement and engagement.

Data Analysis

The raw data were statistically processed and analyzed using the Excel "Data Analysis" tool. The mean and standard deviation were used to describe the students' achievement and engagement. The paired t-test was applied to determine the significant difference in the pretest and posttest mean scores in the achievement test and the CIP engagement in physical science before and after their exposure to the Online Collaborative Learning (OCL) Strategy at a 0.05 level of significance. Moreover, students' responses to the Learning Experience Survey were analyzed thematically using the framework developed by Braun and Clarke (2006).

Results

Student Achievement in Physical Science Before and After Their Exposure to Online Collaborative Learning (OCL) Strategy

The pretest and posttest were administered to determine student achievement before and after exposure to OCL. Table 1 shows the summary of the descriptive statistics based on the results of the pretest and posttest given to the students, which corresponds to the first research question.

Table 1
Descriptive Statistics of the Pretest and Posttest Scores of the Students in the Physical Science Achievement Test (n = 30)

Test	Highest Score	Lowest Score	Mean	Mean Difference	SD
Posttest	40	18	31.00		6.54
				13.83	
Pretest	27	6	17.17		5.32

Table 1 shows that the posttest has a mean score of 31.00, while the pretest has a mean score of 17.17, with a mean difference of 13.83. The result indicates that the student's scores in the achievement test improved after exposure to the OCL strategy suggesting that OCL is effective in enhancing student achievement.

Test of Significant Difference Between Students' Pretest and Posttest Mean Scores in the Physical Science Achievement Test (PSAT)

A paired t-test was applied to determine whether there was a significant difference between the pretest and posttest mean scores in the PSAT. Table 2 shows the paired t-test result, which corresponds to the second research question.

Table 2
Paired t-Test Between Students' Pretest and Posttest Mean Scores in the Physical Science Achievement Test (n =30)

Test	Mean	Standard Deviation	df	*t*-value	*p*-value	Remark
Posttest	31.00	6.54				
			29	9.89	<.001	Significant
Pretest	17.17	5.32				

Table 2 shows that the computed *p*-value is less than the 0.05 level of significance. Therefore, there is a significant difference between the student's pretest and posttest mean scores before and after exposure to the OCL strategy. The result suggests that students' achievement in physical science significantly improved with OCL.

Student Engagement in Physical Science Before and After Their Exposure to Online Collaborative Learning (OCL) Strategy

To determine the students' engagement in learning Physical Science before and after exposure to the OCL strategy, Cooperation-Interest- Participation (CIP) Engagement Questionnaire was administered among students. The engagement score of students in the pre and post-test in each factor was individually analyzed, which corresponds to the third research question.

Table 3
The Pretest and Posttest Mean Score in the Cooperation Factor of Student Engagement

Test	Mean Score	Mean Difference	Standard Deviation
Posttest	14.47		1.87
		2.00	
Pretest	12.47		1.43

Table 3 shows an increase in the students' mean score in the cooperation factor of engagement after exposure to the OCL strategy. This suggests that OCL is effective in encouraging student cooperation.

Table 4
The Pretest and Posttest Mean Score in the Interest Factor of Student Engagement

Test	Mean Score	Mean Difference	Standard Deviation
Posttest	33.37		3.51
		3.84	
Pretest	29.53		2.64

Table 4 shows an increase in the students' mean score in the interest factor of engagement after exposure to the OCL strategy. The result implies that OCL is effective in increasing student interest.

Table 5
The Pretest and Posttest Mean Score in the Participation Factor of Student Engagement

Test	Mean Score	Mean Difference	Standard Deviation
Posttest	6.90		1.09
		0.97	
Pretest	5.93		1.05

Table 5 also shows an improvement in the students' mean score in the participation factor of engagement after exposure to the OCL strategy. This result also indicates that OCL is effective in encouraging student participation.

Table 6
Students' Overall Mean Scores in the Cooperation, Interest, and Participation (CIP) Factors of Student Engagement (n = 30)

Test	Mean Score	Mean Difference	Standard Deviation
Posttest	54.73		5.64
		6.8	
Pretest	47.93		4.22

Table 6 shows an increase in the overall engagement mean score. This result indicates that OCL enhanced students' engagement in terms of cooperation, interest, and participation.

Test of Significant Difference Between the Pretest and Posttest Mean Scores of the Students in the Cooperation, Interest, and Participation (CIP) Factors of Engagement

The mean score of each factor in the engagement pretest and posttest were analyzed using paired t-tests to determine the significant difference between test scores, which corresponds to the fourth research question.

Table 7
Paired t-Test Between the Pretest and Posttest Scores of the Students in the Cooperation, Interest, and Participation (CIP) Engagement Questionnaire (n = 30)

Engagement Factor	Posttest Mean Score	Pretest Mean Score	*df*	*t*- value	*p*-value	Remark
Cooperation	14.47	12.47	29	5.34	<.001	Significant
Interest	33.37	29.53	29	4.94	<.001	Significant
Participation	6.90	5.93	29	3.59	.001	Significant
Overall	54.73	47.93	29	5.59	<.001	Significant

Table 7 shows that the overall computed *p*-value is less than the 0.05 level of significance. Therefore, there is a significant difference between the student's pretest and posttest mean scores in the three factors of engagement (cooperation, interest, and participation) before and after exposure to the OCL strategy. These findings indicate that OCL has a significant effect on improving students' engagement in physical science.

Students' Responses to the Learning Experience Survey

Analysis of the response data identified four major themes: (a) improvement in students' achievement, (b) facilitating students' engagement, (c) challenges encountered during the OCL implementation, and (d) convenience in the usage of the collaborative tool (Google Docs). Each is described below with illustrative student responses.

Improvement in Students' Achievement

The Student Learning Experience Survey results confirmed further that the OCL strategy improved student achievement. From the survey, three subthemes emerged across the student-participant responses: develop understanding, build knowledge, and knowledge retention. Understanding the lesson was by far the most frequently reported response from students. Fifty

percent of the class stated that their partners provided additional explanations and assistance. Thus, they understand the lessons easily. A student-participant stated that OCL activities helped him understand the lessons much better. "*I understand the lesson clearly because my partner explains it further.*" He explained. Another student-participant said, "*Working with a partner helps because you have different points of view that can help you better understand the topic, and having different ideas made us more critical.*" Furthermore, two students expressed that having pair discussions naturally helps them retain information. "*I remember almost all the lessons taught because of this activity.*" *A* student-participant stated. Another student reported that his achievement improved with OCL because Google Docs think-pair-share activities allowed him to deepen his understanding and knowledge of the topics by exchanging ideas with others. Another shared that her scores improved as her partner pointed out her mistakes and guided her through the process. Another noteworthy finding was that students indicated that OCL helps them learn more as they work in pairs. A participant elaborated on this: "*I was able to understand complex topics through his explanations,*" referring to his partner.

Facilitating Students' Engagement

In terms of engagement, the common subthemes evident in the student-participant responses were cooperation, interest, and participation. Interestingly, most participants preferred working in pairs over individual activities, as their partners provided additional explanations. A student-participant commented, "*I got more interested and motivated to do our task as I got ideas from my partner.*" While another said*,* "*This method taught me to be more confident in sharing my ideas*." "*It was fun; we got to talk to our friends instead of listening to the teacher all the time,*" a student-participant added. The interest factor of engagement appears to be the most frequent response, followed by cooperation and participation. Overall, the findings indicate that OCL using the Google Docs Think-Pair-Share technique is a viable method for assisting students in becoming more involved and engaged in learning.

Challenges Encountered During the OCL Implementation

One of the primary issues that students encountered during the OCL implementation was poor internet connectivity. This problem resulted in lagging and spending more time than expected in sending answers. A participant noted, "*Working simultaneously with a partner was difficult due to an unstable internet connection.*" Time management was also a problem, as some students took a long time to respond to their partners. While most students enjoyed the Google Docs Think-Pair-Share activities, others lacked the confidence to share their opinions with the entire class. One participant stated, "*I'm a bit shy and intimidated as my partner dominates our conversation.*" Shyness, intimidation, and fear of embarrassment from giving incorrect responses shown by the students remain a concern that must consider when teaching.

Convenience in the Usage of the Collaborative Tool (Google Docs)

Apart from the challenges the students encountered during the OCL implementation, another theme that emerged was convenience, defined as the quality of being easy, useful, or suitable to proceed with something without difficulty (Oxford Dictionary). The analysis specifically identified Google Docs as a collaborative tool that was convenient for everyone, easy to access, and used. A student pointed out, "*It was convenient and easy to access compared to other apps*." "*It was very nice; no need to use Facebook messenger to chat,*" she said. They also found it interesting as they could see each other's answers while working on the document,

allowing them to catch any issues upfront. A student elaborated on this: "*It was very nice; we were able to discuss when there is a problem or issues right away.*"

Discussion

The mean difference between the pretest and posttest scores confirmed that student achievement improved significantly at the end of the study. This result could be attributed to the OCL Google Docs Think-Pair-Share activities that allow students to craft and share ideas that address the guiding questions posed in the activities. Likewise, this finding could be also linked to the students' collaboration that contributes to topic understanding (Falcione et al., 2019) and student-student interactions that encourages engagement leading to increased achievement (Leow & Neo, 2016). Further, the paired t-test result revealed a significant difference between the pretest and posttest mean scores in the PSAT. This suggests that the OCL strategy, in which students learn collaboratively and in pairs, has a significant effect on their achievement in Physical Science. This conforms with the findings of Al-Ammary (2013), Ajayi et al. (2020), and Tsai and Guo (2012) that Online Collaborative Learning has a significant influence and positive impact on student achievement and learning outcomes. Moreover, this finding is also consistent with those of Othman et al. (2013), that a well-known "Think-Pair-Share" collaborative learning technique, which has been modelled in OCL, significantly provides a positive impact on student performance.

In the present study, students performed Online Collaborative Learning (OCL) using Google Docs Think-Pair-Share activities, which fosters social skills and develops cooperation when students brainstorm in pairs while each learns from their partners. Thus, the improvement in the cooperation factor of engagement in Table 3 could be associated with the Google Docs Think-Pair-Share activities in the OCL approach. This result conforms to the study of Lamina (2020) that the enjoyment of sharing ideas and working with others enhanced cooperation. Table 4 also shows a significant improvement in the interest factor of engagement, which could be attributed to the emphasis on pair activities and intense thinking about the topic while working on the task. According to Hidi & Harackiewicz (2000), when students are interested in the lesson, they are more likely to attend class, listen and participate, process information well, and eventually perform better. Like the cooperation and interest factors of engagement, the result in table 5 also indicates an improvement in the participation factor. This improvement seems to be attributed to the Google Docs think-pair-share activities in the OCL approach, as students had more opportunities to express themselves when they discussed and worked together. This result is consistent with the findings of Lee et al. (2018), who found that exposure to social interactions can help students improve their participation in the Think-pair-Share activity. Overall, the findings revealed that the OCL strategy significantly improved the students' engagement in terms of cooperation, interest, and participation factors in learning physical science. This supports the findings of Gopinathan et al. (2022) that there is a considerably significant relationship between digital collaboration tools, interaction, and motivation toward student engagement.

Meanwhile, the summary of the student responses to the Learning Experience Survey showed that students viewed OCL as a learning strategy positively, as most students reported improved performance and engagement. This result conforms with the findings of Al-Ammary (2013) that most students claimed that by participating in OCL, they felt more comfortable sharing their thoughts and comments. The result also backs up the findings of Othman et al. (2013) that students like to work in small groups to learn more effectively. Additionally, this is consistent with the study of Faulkner (2019), which showed that Google Docs promotes student learning

by increasing opportunities for collaboration. Furthermore, this coincides with Ding and Harskamp (2011), who found that student participation in collaborative learning boosts student confidence and interest in science classes. Finally, the outcomes of this study confirmed the theory of Lev Vygotsky (1978), a famous social constructivist thinker, that one might achieve more depth comprehension than one's capacity by engaging with and learning from more knowledgeable peers.

Conclusion

This study determined the effects of the Online Collaborative Learning (OCL) strategy on student achievement and engagement. Based on the findings of this study, the following conclusions were drawn: (1) OCL strategy improved student achievement in physical science. (2) OCL strategy increased student engagement in learning physical science. (3) Cooperation, interest, and participation were the factors that prompted student engagement in learning Physical Science. (4) Students' positive responses to the OCL were evident during the implementation of the study.

Considering the positive effects of OCL in improving students' achievement and engagement, teachers are encouraged to adopt this pedagogical approach to teaching other topics in physical science as it was proven to improve student achievement and engagement. Further studies on OCL might be conducted in different science disciplines to improve 21st - century skills such as collaboration and communication across grade levels. Lastly, future studies might also employ other research designs, such as quasi-experimental, to generate more substantial data on the effectiveness of OCL strategy in science teaching and learning.

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Appendix A

Physical Science Achievement Test (Example)

1. Which of the following can determine a molecule's polarity?
   a. The number of electrons shared in the bond.
   b. The difference in atomic radius between the elements.
   c. The difference in first ionization energy between the elements.
   d. The difference in electronegativity between the elements.

12. Which of the following is true of intermolecular forces?
   a. The strongest force in chemistry.
   b. The forces that exist within molecules.
   c. The forces that exist between molecules.
   d. The force that bonds hydrogen and oxygen in water.

30. Why is cellulose so difficult for most animals to digest?
   a. Cellulose is made up of chitin, which is indigestible.
   b. There are many hydrogen bonds holding the subunits together.
   c. The bonds holding cellulose subunits together are extremely strong.
   d. They do not have the proper enzyme to break the bonds between subunits.

Appendix B

Cooperation, Interest, and Participation (CIP) Engagement Questionnaire

THE CIP ENGAGEMENT QUESTIONNAIRE

Directions: Please put a check mark (✓) on the column and rate yourself honestly based on what you know or do in the given statements below:

No.	Statements	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)
1	Other students in my class like me the way I am.				
2	Other students at school care about me.				
3	Students at my class are there for me when I need them.				
4	Other students in our class respect what I have to say				
5	After finishing my schoolwork, I check it over to see if its correct.				
6	Most of what is important to know you learn in school.				
7	When I do schoolwork, I check to see whether I understand what I'm doing.				
8	When I do well in school it's because I work hard.				
9	The tests in my classes do a good job of measuring what I'm able to do.				
10	I feel like I have a say about what happens to me at school				
11	Learning is fun because I get better at something.				
12	What I'm learning in my classes will be important in my future.				
13	The grades in my classes do a good job of measuring what I'm able to do.				
14	I raise my hand whenever I have a question, inquiries and something to share about the lesson				
15	I enjoy talking and sharing ideas to the students in our class.				

Educational e-Portfolio Overview: Aspiring for the Future by Building on the Past

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Abstract

Education institutions are rethinking their approaches as the world adjusts to a new normal after the pandemic. The e-Portfolio, an emerging tool in education that suits the current context, was reviewed in the study to aspire for better future implementation. Numerous studies have broadly investigated e-portfolios' use in teaching, learning, or assessment. It has risen to prominence, becoming commonplace. To narrow down the considerable volume of research, develop new knowledge, and detect gaps in the existing literature, this study conducted a systematic review of existing literature on e-portfolio use in education. This approach synthesises secondary publications during the past decade. A keyword search of e-portfolio and reviews yielded 812 review papers. These articles were examined further to determine whether they met the predetermined criteria, and 12 review articles were identified. It was discovered that if successfully implemented, e-portfolios have promising benefits. Nevertheless, the implementation of e-portfolios also faces specific challenges. This article also synthesised the participants' perceptions of their e-portfolio experience. The focus of the paper is to offer implementation suggestions for practitioners. The diversity of technological e-portfolio platforms and related pedagogical frameworks were also discussed to inspire future implementation. Conclusions in this research advocate further longitudinal research into the pedagogical design of e-portfolio implementation.

Keywords: educational technology, e-portfolio, research synthesis, systematic review

As the world readjusts to a new normal in the aftermath of the global pandemic, educational institutions throughout the globe are considering alternate models for educational offerings. It is now crucial to go ahead and continue to take them up with enthusiasm, establishing new methods of functioning while honouring the principles of the past. As a digital learning tool to track the learning process, e-portfolios are flourishing in the areas of education, particularly in teaching, learning, and assessment. Under these circumstances, this study conducted a systematic review of the e-portfolio, discussed the current findings and emerging new knowledge, and further made implementation recommendations for future practitioners and further research.

Literature Review

Electronic portfolios, or e-portfolios, have grown in popularity since their early implementation in the 1990s. While they became mainstream during the first decade of the 21st century, a shift in focus from portfolio to e-portfolio has occurred in research and practice (Farrell, 2020). The term "portfolio" was first used to describe a compact container to convey an unstructured collection of documents and materials; it has developed over time from paper to electronic, from local networks to the worldwide web (Farrell, 2020).

An e-portfolio is a web-based interface that houses a portfolio (Bryant & Chittum, 2013). They have been referred to by multiple names, such as efolio, digital portfolio, web-based portfolio, and online portfolio (Scully et al., 2018). These terms indicate whether material is saved on a web-based platform or a mobile device. A web-based interface allows users to add to and modify their e-portfolios to be immediately accessible to others (Scully et al., 2018).

Multiple scholars have defined e-portfolios in various ways. Barrett (2007) comprehensively defines an e-portfolio, pointing out several characteristics: using electronic technology, allowing users to collect and arrange artefacts in multiple modalities, showing evidence, and being hyper-connected. Meyer et al. (2010) claimed that an electronic portfolio is a digital archive of visual and aural materials, including text, pictures, videos, and sounds. They may also serve as learning aids since, in addition to organizing material, they are created to assist a range of pedagogical procedures and assessment goals (Meyer et al., 2010). In addition, they argued that e-portfolios are the Information Age's equivalent of the artist's portfolio for students in that they not only summarise a student's creative accomplishments but also depict the process of achieving those accomplishments (Meyer et al., 2010). Lorenzo and Ittelson (2005, p. 2) stated that an e-portfolio is "a digitised collection of artefacts, including demonstrations, resources, and accomplishments that represent an individual, group, organisation, or institution." Haig et al. (2007) regarded an e-portfolio as a digital collection of personal data that explains and demonstrates a person's learning experiences and accomplishments. Building on prior studies, Balaban et al. (2013) stated that an e-portfolio is a personal digital record that enables formal, informal, and non-traditional learning that captures proof of accomplishments in the configuration of artefacts; learning reflection may be shared with whomever the owner has granted a licence. Some other definitions brought up different aspects of e-portfolio, such as self-evaluation (Morrison, 2003), learning reflection (Balaban et al., 2013), reacting to feedback (Siemens, 2004), assessment tools (Yang et al., 2017), and career passport (Clark & Eynon, 2009). Recently, an e-portfolio has been defined as an assortment to give evidence of the owner's experience, both teachers and learners, and as an instrument to collect assessments (Barak & Maskit, 2017).

e-Portfolio Emergence in Education

The gaining popularity of e-portfolios implementation in education stems from the development of educational technology. Policymakers, academics, and practitioners all acknowledge that technology has the capacity to significantly alter and enhance education (Meyer et al., 2010; Zimmerman & Tsikalas, 2005). Developments in web technologies have opened up new opportunities for educational experiences, including those for lifelong learning, leading to the recommendation that e-portfolios be used as Personal Learning Environments (PLE) (henceforth, PLE) or to represent one's digital identity of the twenty-first century (Barrett & Garrett, 2009; Meyer et al., 2010). As a multifunctional tool, an e-portfolio can provide beneficial prospects for incorporating technology into education; in addition to being the multimedia container, it also serves to improve students' learning experiences by putting the student at the centre of learning and supporting crucial metacognitive abilities like goal setting, strategy identification, and learning reflection (Meyer et al., 2010).

The growing adoption of educational technology for teaching and learning, especially in the context of PLE, enables the flourishing of e-portfolios in educational settings (Castañeda & Tur, 2020). As a learning method, PLE is inextricably linked to promoting the learners' agency via establishing circumstances and resources (Dabbagh & Castañeda, 2020). The notion of agency has been more prevalent in learning research and highlighted as a vital aspect of the educational process. In addition, PLE enables agency growth, according to Castañeda and Tur (2020). Among all PLE-related experiences, e-portfolios appear to play a significant function. As they spring up as potential tools for enforcing agency, e-portfolios have the potential to be unique resources for reflective practice, a relational resource for peer-to-peer support and dialogic learning, and contextual resource for learning-related decision-making (Buchem et al., 2020).

Apart from the rising popularity of PLE adoption in education, the advent of Self-Regulated Learning (SRL) has also boosted the usage of e-portfolios in education. Process e-portfolios are emphasised as a potential development strategy for SRL (Tur et al., 2022). The argument for SRL skills development has been connected to the concept of psychological ownership. Buchem et al. (2020) claim that psychological ownership in the context of learning and education is founded in SRL and has been seen as a crucial element in the development of metacognitive and critical thinking abilities. Diverse areas of study, including organisational development and leadership, education, and consumption patterns, have paid growing attention to psychological ownership (Buchem et al., 2020). e-Portfolios facilitate the development of psychological ownership in learners, which is advantageous in numerous ways: including being viewed as a positive resource for attitudes (e.g., higher commitment and responsibility), self-esteem, self-efficacy, motivation, accountability, performance, self-identity, self-identity, self-adjustment, accountability, sense of belonging, and citizenship (Buchem et al., 2020).

As an educational technology tool reflecting PLE, SRL, and psychological ownership, e-portfolio is flourishing in educational settings. In light of this, many governments globally, particularly western countries, have encouraged the adoption of e-portfolios in their educational policies (Hallam et al., 2008). Besides, educators at all levels employ e-portfolios in their pedagogical practice to facilitate teaching and learning, especially in higher education contexts (Farrell, 2020). Many universities or colleges actively create institution-wide e-portfolio projects to cover a student's college experience (Bryant & Chittum, 2013). As e-

portfolios are becoming increasingly prevalent at all levels of education, there is a rapidly expanding body of research. Therefore, it is essential to review what we already know about them. Under this circumstance, this study was created to review the existing secondary e-portfolio literature landscape to synthesise the existing research and further examine the implementation of e-portfolios in teaching, learning, or assessment.

Research Synthesis

This study adopted research synthesis, a method for systematically integrating data; it has emerged as an essential tool for organising, integrating, and summarising the booming research sector (Cooper, 2017). Research synthesis is the synthesis of existing knowledge and relevant research results; it incorporates and evaluates information from previous studies relevant to a given subject to increase its generalizability, applicability, and availability. (Wyborn et al., 2018). Researchers have begun to incorporate the syntheses due to the rise in systematic reviews (Polanin et al., 2017). Through the process of integration, the purpose of synthesis is to expand the generalizability and application of the results and to generate new knowledge. Synthesis is presented as a method that addresses the issue of "information overload" by producing products that enhance our comprehension of situations and distil substantial evidence for decision-making (Wyborn et al., 2018). Research findings have demonstrated that synthesis promotes the research world by fostering collaborative initiatives and generating new knowledge (Baron et al., 2017; Wyborn et al., 2018).

Traditionally, research synthesis reviews and meta-analyses of primary research and its findings. It can also be implemented in systematically reviewing secondary studies (Becker & Oxman, 2008), where the review is analysed rather than the primary study, providing another way to narrow down the large research volume and further generate comprehensive knowledge (Bastian et al., 2010). Typically, researchers use syntheses of secondary studies to develop new information and detect gaps in the existing large body of literature (Lipsey & Wilson, 2001; Pigott, 2012). Polanin et al. (2017) summarised that this method has multiple names: meta-meta-analysis, meta-synthesis, overview, an overview of reviews, review of reviews, second-order meta-analysis, tertiary review, and umbrella review.

As stated in the preceding section, the use of e-portfolios in education has thrived in both practice and academic research; many primary studies and reviews based on these primary studies have been conducted. Thus, the research synthesis of reviews was utilized to narrow it down, drawing on previous reviews and providing new knowledge for future research and practice. The following research questions were formulated to guide the study (Based on these overarching research questions, detailed research objectives were proposed under various categories with each research question):

RQ1: What are the classifications of e-portfolio and their functions?

- To analyse classifications of e-portfolios and categorize their functions

RQ2: How are e-portfolio implementations described in existing secondary literature?

- To synthesize the benefits of e-portfolio and the underpinning constraints in implementation.
- To identify stakeholders' perceptions on e-portfolios from the existing literature.
- To describe e-portfolio platforms/tools, and the underpinning educational frameworks.

RQ3: What are the implications and recommendations for future practitioners?

- To make recommendations for practitioners employing e-portfolios in education.

Method

The systematic review methodology was applied to answer the above-mentioned research objectives and further review the implementation of e-portfolios in teaching, learning, or assessment by scoping, synthesising, and analysing existing secondary studies (reviews). The paradigm for a systematic review proposed by Tawfik et al. (2019) was employed in this study. Besides, the updated version of Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) reporting guidelines (Page et al., 2020) and systematic review tool Rayyan (Ouzzani et al., 2016) were utilised for data collection and screening.

This study conducted a preliminary search to discover relevant publications, confirm the validity of the research idea, and confirm that there are enough articles to complete its analysis before beginning the official systematic review procedure. Additionally, Tawfik et al. (2019) recommend that all phases of a systematic review be completed separately by two to three reviewers to guarantee data quality and accuracy. Considering this, two reviewers were engaged in all processes in this study.

Inclusion Criteria

The following inclusion criteria (see Table 1) were created to generate a selection of relevant publications that precisely address the research questions.

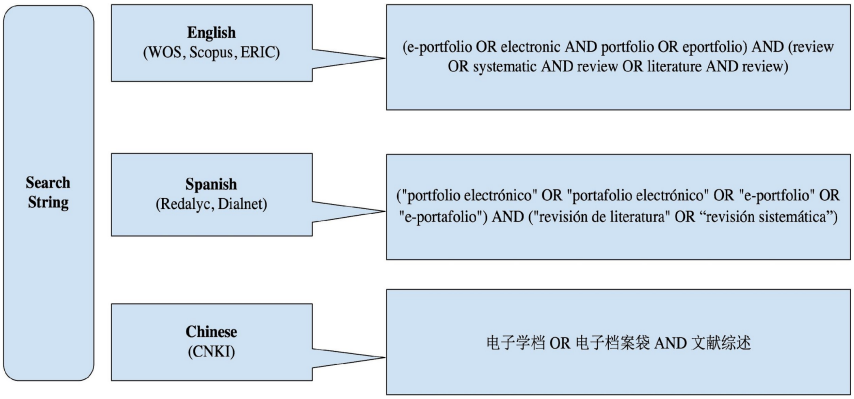
Table 1
Inclusion Criteria

Inclusion Criteria
Refer to e-portfolio
Secondary studies, including literature review and systematic review
In the area of education or educational technology
Written in English, Chinese, and Spanish
Papers published within the last decade (2011-2022)
Related to teaching, learning, or assessment

Search Parameter

This study aims to get a holistic view of secondary studies without the bias of English-only papers. Consequently, review papers were sought in three languages: English, Chinese, and Spanish. In the three languages, different variants of the following keywords were applied (boolean operators “AND” and “OR” were employed to divide the keywords): “e-portfolio”, “electronic portfolio”, “digital portfolio”, and “review”. Considering that different databases consist of academic papers in different languages, six academic databases covering these three languages were chosen: Web of Science (WOS), Scopus, ERIC, Redalyc, Dialnet, and China Academic Journals Full-text Database (also known as CNKI). The search strings depicted in Figure 1 were developed cooperatively by two researchers (see Figure 1).

Figure 1
The Search Strings

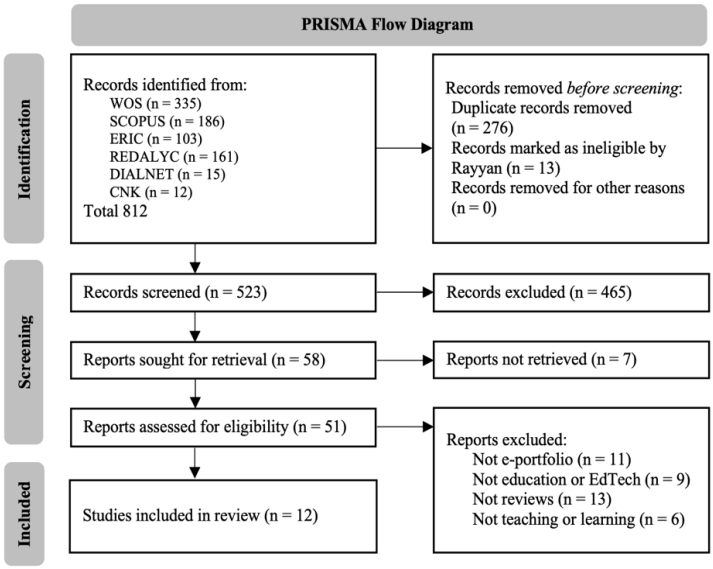


Data Selection and Extraction

Rayyan, a collaborative platform for performing systematic literature reviews (Ouzzani et al., 2016), was employed to extract results from the original search (n = 812). Rayyan flagged 13 papers as ineligible, and duplicates (n = 276) were automatically excluded from the total. Two researchers then conducted title and abstract screening and examined papers (n = 523) using the previously agreed-upon inclusion criteria (see Table 1). It is noted that additional duplicates that Rayyan did not remove were still identified at this phase. In this screening phase, 465 papers were excluded by the researchers.

After the title and abstract screening process, 58 reports were sought for retrieval. However, seven of them were not retrieved. Before finalising the papers, the researchers downloaded the full text and evaluated the 51 papers for eligibility based on the previously mentioned criteria, 39 were excluded, and the final selection was 12 review papers. Figure 2 depicts the entire selection and extraction procedure. Among the 12 publications included in this study, four are written in Chinese from the CNKI database, eight are in English, and no secondary studies in Spanish fully match the selection criteria.

Figure 2
PRISMA Flow Diagram



Analytical Procedures

For all 12 chosen papers, the content analysis approach was utilised, and the research questions previously presented directed the analysis for the quality-of-study review. After selecting the articles that match the inclusion criteria, they were accessed, read, and evaluated. At this stage, data collection was carried out using an instrument created ad-hoc using Google Forms. The researchers validated the form through a pilot implementation to ensure its unambiguity and unify the procedures for analysing and collecting qualitative evidence.

The findings in the articles were categorised based on the research questions. In each inquiry theme, there are detailed objectives to guide the analysis. Then, a qualitative analysis was performed, and the texts were retrieved and contrasted between recurring themes, considering the various scenarios that appeared in the reviews in which e-portfolios were implemented in teaching, learning, or assessment.

Findings

Findings from the retrieved data analysis are presented in the following themes: general information, classification of e-portfolios, benefits and constraints, participants' perceptions, educational and technological frameworks, and recommendations for implementation.

General Information

Before addressing the research questions, the search results were classified into the following general aspects: country and educational context, research methodology, and inquiry theme (this section is only about the general information, the findings corresponding to specific research questions are exhibited, and discussed in subsequent sections). The general retrieved information is displayed in Table 2.

In this study, we intend to diversify the country context, reduce the constraints of not being inclusive, and improve generalizability. Thus, review studies in different languages (English, Chinese, and Spanish) were included in the initial search; the final selections were mainly in English (n = 8), and some were in Chinese (n = 4). Also, the chosen papers cover a wide range of countries: Canada, the USA, the Netherlands, Indonesia, Malaysia, Ireland, Australia, the UK, and China.

Regarding the research methodology, most of the selected reviews adopted a systematic review approach (n = 7); one was a systematic scoping review, and the other conducted a meta-analysis. Some selected papers employed the traditional narrative review method (n = 3), and some utilised Cite Space II to visualise patterns and trends in their bibliometric mapping reviews (n = 2). The search results also reflected that those systematic reviews account for the vast majority of the bibliometric review papers on e-portfolios in education.

Regarding educational level, it was uncovered that some of the existing review papers are contextualised in higher education; some are general reviews without a specific context. None of the review studies primarily discussed the implementation of e-portfolios in K-12 education. Besides, within the area of higher education, it has been found that there is one review article that has a specific focus on teacher education (Harun et al., 2021). Furthermore, various themes were identified among the 12 review papers (See Table 2). The

themes cover the areas of teaching, learning, assessment, digital ethics, implementation, research summary, and research trend.

Table 1
General Information about the Papers Included in the Study

Author / Date	Context	Educational Level	Method	Theme
Harun et al. (2021)	Malaysia	Higher Education: Teacher Training	Systematic review	Pedagogical affordances of e-portfolio
Segaran & Hasim (2021)	Malaysia	Not specified	Systematic review: meta-analysis	Self-regulated learning
Scully et al. (2018)	Ireland	Higher Education	Narrative review	Learning e-portfolio in higher education
Wilson et al. (2018)	Australia	Higher Education	Scoping review	Digital ethics in using of e-portfolio
Beckers et al. (2016)	Canada; USA; Netherlands	Not specified	Systematic review	Self-directed learning
Rahayu et al. (2016)	Indonesia; USA	Not specified	Systematic review	E-portfolio definition, model, type and system
Liang et al. (2016)	China	Not specified	Mapping Review (CiteSpace II)	Progress and trend on e-portfolio research in China
Dai & Jiang (2016)	China	Not specified	Mapping Review (CiteSpace II)	Research on e-portfolio assessment
Rahayu & Sensuse (2015)	Indonesia	Not specified	Systematic review	Critical success factor (CSF) for implementation E-portfolio model
Wang & Xu (2014)	USA, Australia, UK	Not specified	Narrative review	Progress and trend on e-portfolio research globally
Bryant & Chittum (2013)	USA	Higher Education	Systematic review	Evidence for e-portfolios' impact on learners' outcomes
Zhang (2011)	China	Not specified	Narrative review	Research summary of e-portfolio in China

The overall findings of the reviewed secondary literature broadly discussed the use of e-portfolio in education, specifically in teaching, learning, or assessment. The following discussions addressed the research questions and objectives based on the findings.

Classifications of e-Portfolio

The reviewed papers classify e-portfolios in diverse ways; the synthesised classifications of e-portfolios in the selections are shown in Table 3. It is noteworthy that translations from Chinese to English are carefully handled to make sure the term is consistent; also, synonyms were combined to compare better, synthesise, and further visualise the data to create a comprehensive overview of the categories (e.g., "collection" and "dossier"; "assessment" and "evaluation"; "presentation" and "showcase").

Table 3
Classification of e-Portfolio

Author / Date	Classification of e-portfolio
Beckers et al. (2016)	personal development, learning, collection/dossier, reflective
Rahayu et al. (2016)	collection/dossier, showcase/presentation, development, recognition
Rahayu & Sensuse (2015)	NA
Harun et al. (2021)	reflection, assessment/evaluation, teaching, learning, job-search
Scully et al. (2018)	showcase/presentation, development; assessment/evaluation
Wilson et al. (2018)	process tracking, showcase/presentation, assessment/evaluation
Bryant & Chittum (2013)	process tracking, collection/dossier, showcase/presentation, learning, teaching
Wang & Xu (2014)	NA
Liang et al. (2016)	showcase/presentation, assessment/evaluation, learning
Dai & Jiang (2016)	NA
Zhang (2011)	assessment/evaluation, showcase/presentation

e-Portfolios' Benefits and Constraints

The reviewed articles extensively discussed the advantages and disadvantages of e-portfolios in education, further pointing out some key issues that need to be considered and well addressed by practitioners.

Table 4 illustrates the synthesis of the positive effects that an e-portfolio can bring to education. More than half of the selections (n = 7, 58.3%, respectively) agreed that an e-portfolio could facilitate self-regulated learning, self-reflection, and self-evaluation; it also benefits inter-curricular knowledge and 21st-century skills development. The effectiveness of e-portfolios in promoting engagement, interaction, communication, and collaboration is also widely agreed upon (n = 6, 50%). Furthermore, the chosen papers also refer to the following values of e-portfolio: flexible and easy to access and use, prompting personal/professional development and lifelong learning, the possibility of tracking the learning process, motifs for learners, network building, enabling diverse assessments and feedbacks, potential use for

employment, facilitate teaching and learning, addressing technological skills, and the inclusion of multimedia (See Table 4).

Table 4
Benefits of e-Portfolios

Benefits of e-portfolio	n	%
Support self-regulation and develop self-directed learning (SDL) skills	7	58.3%
Address cross-curricular knowledge and 21st-century skills	7	58.3%
Encourage self-reflective learning, facilitate self-reflection and self-evaluation	7	58.3%
Nurture engagement, facilitate interaction, communication, and collaboration	6	50.0%
Flexibility and accessibility	5	41.7%
Facilitate personal/professional development and life-long learning	5	41.7%
Visualize learning; enable learners and educators to track the learning progress	5	41.7%
Motivate learners	4	33.3%
Strengthen social networks, facilitate building an online community, and enhance communication	4	33.3%
Enable learners to have feedback from peers and teachers	3	25.0%
Optimize learning outcomes	3	25.0%
Support educators regarding teaching and evaluation	3	25.0%
Easy to navigate and use: easy to keep/organize/arrange information	3	25.0%
Potential use for employment, enhance future employment prospects	3	25.0%
Demonstrate the technical skills and create an extensive digital footprint	2	16.7%
Emphasize process-based, authentic, and diversified assessment	2	16.7%
Enable learners to gather evidence of broad skills and competencies	1	8.3%
Possibility to incorporate multimedia	1	8.3%
Benefit information sharing and retrieval	1	8.3%
Embody student-centeredness	1	8.3%
Help with formulating study plans more purposefully	1	8.3%

Even though the benefits of e-portfolio inclusion in education are clear, there are also underpinning constraints; various issues should be addressed to reach its full potential and better implement e-portfolio in teaching and learning. The detailed findings are exhibited in Table 5.

Table 5
Constraints/Issues Need to be Addressed in e-Portfolio Implementation

Constraints/issues need to be addressed	n	%
Learners' uncertainty, concerns, and reluctance due to relatively intense workload and challenges in comprehending processes	3	25.0%
There was a shortage of support (technological skills, internet issues, structural aid)	3	25.0%
Digital ethics: issues of privacy, confidentiality, consent, copyright and intellectual property when they are used in the classroom	3	25.0%
Lack of interaction; has constraints in peer evaluation and collaborative learning	2	16.7%
Some platforms/tools are not user-friendly and difficult to navigate	2	16.7%
Lack of originality and creativity: many of the current options for software platforms are too standardized	2	16.7%
Heavily dependent on participants' skill and creativity	1	8.3%
Creating an e-portfolio can be time-consuming and challenging	1	8.3%
There is a conflict between the learning portfolio's developmental (process) and evaluative (product) conceptual frameworks	1	8.3%
Its reflective practice is limited in depth and flexibility	1	8.3%
Lack of motivating function, scalability, sustainability, adoption, interoperability, etc.	1	8.3%
Some software applications fail to integrate e-portfolio educational aims of stress reflection, self-reflection, and participation	1	8.3%
Skepticism about the spread of innovation	1	8.3%
Issues of accountability	1	8.3%

Participants' Perception

As the majority of the chosen secondary papers are reviews of empirical research, some of them provide the perspectives of participants based on a synthesis of the experimental investigations. The paper gathered, analysed, and summarised the results and arguments of the participants' perspectives from the empirical studies in the retrieved reviews. The following findings were obtained.

In general, participants' perceptions of e-portfolio implementation were positive in most publications. Bolliger and Shepherd (2010) found that a large proportion of participants (85%) felt that e-portfolios boosted their motivation to study, and many agreed with words like "assisted me in reflecting" and "helped me evaluate my own progress" (p. 304). Similarly, most of the participants (learners) in Wakimoto and Lewis' (2014) study found that e-portfolios could help them reflect on their abilities. The portfolios offered them insight into the developmental aspect of becoming a professional. Notably, the learners regarded the quality of this peer review process as vital to the e-portfolio program's success. The students also highlighted the significance of the rubrics used to examine and provide comments on each other's work (Wakimoto & Lewis, 2014).

Not all perceptions are positive. Some practitioners think developing an e-portfolio can be time-consuming and laborious (De Jager, 2019; Harun et al., 2021; Zhong & Hartsell, 2015), or the participants might be uncertain about using an e-portfolio (Chung & Kim, 2010;

Oakley et al., 2014). Besides, Razavi and Iverson (2006) claimed that younger learners thought themselves to be clustering information into specific areas and made decisions about sharing based on the sensitivity of the data. However, it is debated that students' views of their learning provide few details (Bryant & Chittum, 2013); questionnaires and interviews are simply a more roundabout technique to measure students' attitudes regarding e-portfolio. It is impossible to say whether individuals who had negative feelings about an e-portfolio's effect on their learning were influenced by defects in the programme or issues in its application (Bryant & Chittum, 2013).

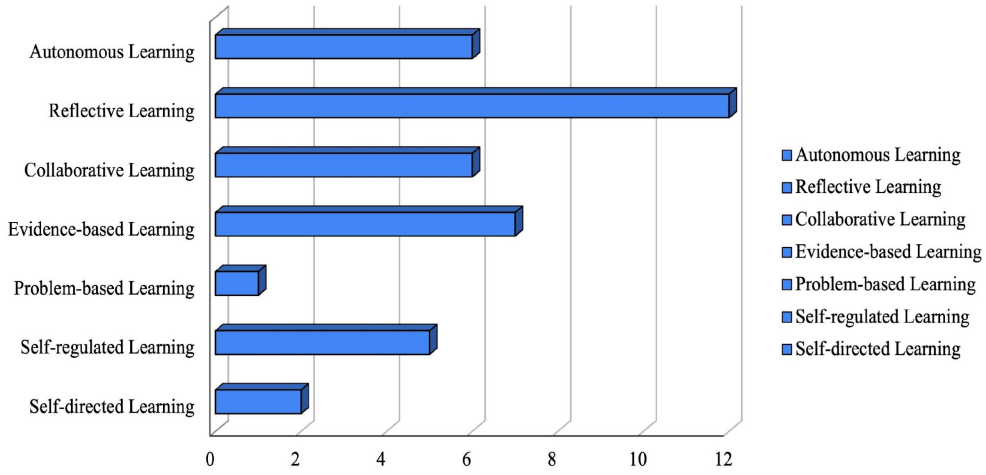
Some selected review articles also documented a shift in participants' perspectives. According to Wang and Xu (2014), participants who participated in a study shifted their attitudes from negative to positive about e-portfolios. They believed the e-portfolio was just a job-search tool initially, and they thought it was tedious and time-consuming to develop, needing the help of teachers and classmates. They also believed that the application's main goal was to achieve graduation requirements. Later, the participants thought the e-portfolio was a collection of items to demonstrate personal and professional improvement, allowing them to explore answers to problems via cooperation and ongoing reflection during the construction phase. This case is a reminder that how the e-portfolio is implemented will influence the attitude change of participants. According to Chye et al. (2013), participants' intrinsic motivation may influence favourable attitudes toward e-portfolio use. In practice, educators should use appropriate ways to motivate learners and optimise their learning experiences.

Lewis (2017) stated that incorporating constructivist learning and social pedagogy capabilities into e-portfolio implementation is crucial. In this way, learners perceive a more genuine learning experience when course designers and teachers strongly understand a learning portfolio's processes.

e-Portfolio and Educational Frameworks

The chosen articles referred to various educational frameworks; seven terms were identified through data retrieval, computing, and visualisation (see Figure 3). Among these frameworks, reflective learning is the most mentioned term, and evidence-based learning is the second most cited. Autonomous learning and collaborative learning are also widely discussed. Moreover, the papers talked about self-directed learning and self-regulated learning.

Figure 3
Educational Frameworks Related to e-Portfolios Implementation



e-Portfolio Platforms/Tools

Most of the reviewed papers mentioned the e-portfolio platforms/tools, but few discussed them in detail. PEARL, Pebblepad, Taskstream, and Elgg are the most mentioned platforms; LinguaFolio, Netfolio, STEPP, WIFI, and some Google platforms (Google Map, Google Sites, Google Earth) are also widely discussed. Other tools/platforms such as Moodle, Factline, Drupal ED, Behance, MOOC, Sakai, ASP, WordPress, NET, Factline, and Mahara are also mentioned in some reviewed papers.

Overall, some trends can be observed:

- The usage of specific e-portfolio tools (e.g., Mahara)
- The development of environments owned by institutions (e.g., ePearl)
- The use of Virtual Learning Systems (VLS) (e.g., Moodle)
- The usage of social media (e.g., blogs)

Implementation Recommendations

To offer synthetic guidance for implementing e-portfolios, the practical recommendations from the review papers were incorporated into four levels concerning the stakeholders of e-portfolio implementation: institutional level, educator level, learner level, and platform level (see Table 6).

Table 6
Recommendations for e-portfolio implementation

Institutional Level	Educator level	Learner Level	Platform Level
Making e-portfolios part of the educational process (e.g., implementing school-wide) (Beckers et al., 2016) Offering training for both the educator and learner (technology, ethics, etc.) (Beckers et al., 2016) Providing pedagogical and technical professional development in a formal setting (Beckers et al., 2016; Scully et al., 2018) Aligning e-portfolio with curriculum (Beckers et al., 2016)	Providing frequent coaching to their students (Beckers et al., 2016). Motivate students in using e-portfolio (Beckers et al., 2016; Wang & Xu, 2014). Considering the opinions of more than one evaluator while evaluating (Gencel, 2017; Harun et al., 2021). Integrating peer assessment (Harun & Jhee, 2012; Harun et al., 2021). Using e-portfolios as formative assessments with a long-term goal (Harun et al., 2021). Scaffolding Explicitly (Scully et al., 2018; Wilson et al., 2018). Giving students guidance and practice with reflective practice, especially writing reflection (Harun et al., 2021; Scully et al., 2018). Giving students sufficient time (Scully et al., 2018). Giving students formative feedback	Setting goals, analyzing tasks, implementing planning, having primary goals in mind (Scully et al., 2018; Harun et al., 2021) Self-evaluating the e-portfolio assignment in order to see what they have accomplished over time (Beckers et al., 2016; Harun et al., 2021). Avoiding a descriptive level of textual reflection without any more profound insight (Harun et al., 2021). Delving into the technological tools and applications that can aid in the creation of an e-portfolio (Harun et al., 2021; Scully et al., 2018). Strengthening self-regulation and self-evaluation (Beckers et al., 2016; Scully et al., 2018). Collecting and choosing information efficiently (Rahayu & Sensuse, 2015).	Building interactive and conversational e-portfolios (Wang & Xu, 2014). Optimising user characteristics, infrastructure, system quality, community, and service quality (Rahayu & Sensuse, 2015). Building comprehensive e-portfolios platforms with the traits to motivate users (Wang & Xu, 2014). Improving readability, usability, and accessibility (Rahayu & Sensuse, 2015). The process of e-portfolio creation should be facilitated rather than interrupted by technological platforms (Scully et al., 2018). Build a flexible and scalable social learning platform (Liang et al., 2016)

(Scully et al., 2018).

Engaging students in e-portfolio design (Harun et al., 2021; Scully et al., 2018).

Engaging in reflection and using reflective writing (Harun et al., 2021).

Utilising feedback from teachers and peers for improvement (Harun et al., 2021).

Offering continuous support (Scully et al., 2018)

Dual goal orientation: process and product (Scully et al., 2018)

Collaborating to develop a set of guidelines and procedures that include privacy laws that protect user information, visuals, personal reflections, etc (Cowper & Crompton, 2010; Fisher & Hill, 2017; Wilson et al., 2018).

Discussion

Data collected shows the heterogeneity of e-portfolio designs, in line with the experience by Roco and Barberà (2022), and the results presented in this study show a great variety in terms of design, aims and platforms. Thus, in order to answer the research questions, the following findings-based discussion is presented: categorization of e-portfolios, advantages and restrictions, participants' attitudes, educational frameworks, and implementation suggestions.

Multiple scholars have defined e-portfolio in various ways; the most cited scholar in the selected reviews is Helen C. Barrett. Grounding on the existing definition, this paper proposed a synthesized description of an e-portfolio: an e-portfolio is a comprehensive electronic collection of multimodal artifacts as learning evidence that can be used in teaching, learning, assessment, and showcasing; it illustrates skills development, focusing on the learning process, progress, and achievement. It requires self-regulation, self-reflection, and self-evaluation. Besides, it was discovered that scholars classified e-portfolios into different types: dossier, showcase or presentation, assessment, and learning-tracking (Beckers et al., 2016; Bryant & Chittum, 2013; Rahayu et al., 2016; Scully et al., 2018; Wilson et al., 2018; Mathur & Mahapatra, 2022). It argued that the classifications of different functions of e-portfolios are not isolated; instead, they are interconnected, and in education, they serve as multi-dimensional tools in various aspects. Also, a wide range of participants' views (both positive and negative) regarding the actual practice of e-portfolio implementation was disclosed (Bolliger & Shepherd, 2010; De Jager, 2019; Harun et al., 2021). It was also revealed that the participants' attitudes could be changed if the e-portfolio was employed appropriately and effectively (Wang & Xu, 2014). From the assessed data on the e-portfolio classification, we identified that e-portfolios have the following potential functions: boost learning, reflection, and self-development; they can also be employed in teaching, assessment, presentation, or even for recognition. The most mentioned types and functions of e-portfolio are assessment, learning, showcase, and dossier, followed by development e-portfolio and teaching e-portfolio. The findings resonate with Meyer et al. (2010)'s argument. According to them, e-portfolios serve three general purposes: process, showcase, and

assessment; they may be created as process portfolios that support the ways in which embedded structures and strategies help users learn. Process portfolios are instruments for managing learners' own learning. They are intended to promote self-improvement, personal development, and a dedication to lifelong learning (Meyer et al., 2010).

Regarding e-portfolios' benefits, it is widely accepted that the e-portfolio might foster a variety of factors, including self-regulated learning, self-reflection, self-evaluation, inter-curricular knowledge growth, and the development of 21st-century skills (Sutarno et al., 2019), such as collaboration skills, self-management skills, technological skills. These aspects demonstrate that e-portfolio is a 'practise of governance', as a deliberate activity designed to shape students' professional and personal behaviour using tactics that leverage students' ambitions, aspirations, and interests (O'Brien et al., 2014). E-portfolios may facilitate attempts at knowledge construction by facilitating reflection, refinement, conferencing, and other self-regulatory activities, which are crucial for lifelong learning and learning how to learn (Meyer et al., 2010; Roberts, 2018; Salazar & Arévalo, 2019). Furthermore, e-portfolios are excellent for cataloguing and organising learning resources and clearly illustrate the learner growth process; they can also allow remote access, promoting learning at any time and any place and facilitating feedback from classmates, parents, and instructors (Barrett, 2009; Meyer et al., 2010). According to Wade, Abrami, and Sclater (2005), e-portfolios are associated with students' capacities to self-regulate their learning and increase the development of crucial educational skills and abilities, particularly literacy skills. When students use e-portfolios, they undertake more ownership of their education, have a better awareness of their strengths and weaknesses, and develop the ability to create objectives (Meyer et al., 2010), which eventually is about autonomous learning and agency (Whitney et al., 2021). Apart from these aspects, e-portfolios also offer other advantages, including being flexible and straightforward to access and use, recording the learning process, network development, allowing for a variety of evaluations and feedback, possibilities for employment, and multimedia integration. Also, e-portfolios were seen as a flexible and straightforward tool to access and use, recording the learning process and network development, allowing for various evaluations and feedback, possibilities for employment, and multimedia integration (Beckers et al., 2016; Harun et al., 2021; Liang et al., 2016; Scully et al., 2018; Wilson et al., 2018)

However, there are also constraints on implementing e-portfolios, such as platforms' accountability, usability, reliability, scalability, sustainability, and interoperability (Bryant & Chittum, 2013); participants' uncertainty, reluctance, and unfamiliarity (Harun et al., 2021); lack of technical support and scaffolding for participants (both educators and learners) (Scully et al., 2018). Particularly, the following key concerns need to be well addressed: the issue of digital ethics, including privacy, confidentiality, consent, copyright, and intellectual property (Wilson et al., 2018).. According to Wilson et al. (2018), the new potential to utilise e-portfolios in online social pathways increases student engagement and accessibility of use. Nevertheless, they can also raise ethical problems specific to the virtual environment, such as privacy, confidentiality, and data protection (Denton & Wicks, 2013; Kirkham et al., 2010; Tan, 2011). These concerns need to be addressed to effectively employ e-portfolios in educational practice.

The widespread of new educational concepts offers opportunities for e-portfolio integration. The retrieved review papers also disclosed that various educational frameworks had been associated with e-portfolios' implementation, such as reflective learning, evidence-based learning, autonomous learning, collaborative learning, self-directed learning, and self-

regulated learning (Beckers et al., 2016; Bryant & Chittum, 2013; Harun et al., 2021; Liang et al., 2016; Rahayu et al., 2016; Rouco & Barberà, 2020, Scully et al., 2018; Wilson et al., 2018).Although e-portfolios are implemented under a wide variety of educational frameworks and learning theories, there are no models to address them. Even though self-regulated learning is commonly cited and analysed (López-Crespo et al., 2022), there are no references about how teachers should support students' cognitive skills. Likewise, collaborative learning is frequently mentioned. Zubizarreta (2009) suggested a theoretical model that highlighted the relationship between students and teachers; however, there are no designs that address such a collaboration. To address these gaps, the paper calls for more research on pedagogical or learning task design, particularly collaborative co-design models implementing e-portfolios in teaching and learning.

Besides, it is striking that social media, particularly blogs (Marín, 2020), have increased uptake for e-portfolio aims but do not seem to have such a prominent role in the reviews. In the context of social media research, the open and networked characteristics have been claimed as transformational for the e-portfolio style (Cambridge, 2010; Tur & Urbina, 2014). Furthermore, under the PLE (Personal Learning Environments) approach, e-portfolios have been claimed as one of the most agentic proposals in which learners deploy individual, relational, and contextual resources (Castañeda & Tur, 2020). Highly related, Rouco and Barberà argued the relationship of blog-based e-portfolio for networked learning (2022), which might allow further collaboration for learning. In light of this overview, there is a lack of research on e-portfolios in social media and PLEs and for students' agency, which should be addressed in future research.

It was also uncovered that the current review mainly focuses on higher education or post-secondary education; more research on e-portfolios in other educational contexts (e.g., K-12 education) is needed. Helen Barrett, one of the most well-known researchers in the field of e-portfolios, notes that the empirical study is quite restricted and focuses more on the construction of teaching portfolios than on K-12 student portfolios (2009). Besides, this paper advocates collaborative learning and interaction while implementing an e-portfolio. Peer and teacher-student collaboration should be strengthened to reduce the pressure of independently making e-portfolios and thus ease the uncertainty and reluctance of using e-portfolios. The research gap in collaborative pedagogical design on e-portfolio implementation was noticeable. No selected papers refer to reviewing how e-portfolios are implemented in a specific pedagogical design or employed in collaborative learning tasks; this area requires more studies, particularly reviews, for further investigation. Besides, there is a noticeable vacant area for reviewing studies on e-portfolio tools or platforms.

In the post-pandemic stage, e-portfolios are rising in various educational settings. To maximise the efficacy of e-portfolio use, the findings from the research synthesis suggest that all stakeholders should take actions, address the challenges and concerns, and cooperate in e-portfolio implementation. Detailed recommendations from the retired reviews were categorised for policymakers and practitioners in this paper. These suggestions could be a referential guideline for future e-portfolio implementation or policymaking. For institutions, providing training for educators and students is a significant action that will affect the users' technological skills, which are crucial in utilising an e-portfolio (Scully et al., 2018; Wilson et al., 2018). They all need to incorporate e-portfolios into their curriculum and make school policies for implementing e-portfolios (Beckers et al., 2016). Besides, they all need to look for suitable platforms and invest in building on their intuitional-level e-portfolio to protect school users' information (Rahayu & Sensuse, 2015). For teachers, e-portfolios can be

employed in daily teaching, formative and even summative assessments; teachers also need to offer constructive feedback to help students optimise their e-portfolio learning outcomes (Harun et al., 2021; Wilson et al., 2018). Simultaneously, to keep students motivated. When it comes to students, who are critical e-portfolio users, they need to utilise e-portfolio tools to track their learning and facilitate self-evaluation and reflection (Bryant & Chittum, 2013; Harun et al., 2021; Rahayu et al., 2016; Scully et al., 2018). Consequently, they become self-regulating and self-directing autonomous learners. As for the e-portfolio/tools, providers need to increase their usability, functionality, and readability to help users achieve better results; in particular, collaboration functions should be added (Liang et al., 2016; Wang & Xu, 2014).

Conclusion

This study aimed to comprehensively understand secondary research without being limited to English-only publications, potentially reducing cultural bias. Thus, English, Chinese, and Spanish review articles were searched, and papers from various backgrounds were included. The present study was designed to cover both extended research periods and contexts. It is based on the reviews of the last decade when e-portfolios became mainstream. Since only reviews are included, the number of the chosen publications is limited. Besides, we acknowledge that the study's main limitation is the search string. Intending to include unequivocal conceptions of e-portfolio that could work across languages and contexts, we only focused on the most straightforward terms. However, this could have emerged as a limitation of the study.

To conclude, e-portfolios are part of a new generation of Web 2.0 communication and educational technology. The immediate destination of e-portfolios may be found in this new, user-generated world, where an attitude of participation, cooperation, and sharing dominates (Knobel & Wilber, 2009). At present, the individual implementing e-portfolio is being made available to a larger audience, particularly in the area of education. We acknowledged the value of existing secondary research over the past decades on e-portfolio use in education and reviewed them. Through systematic reviews of secondary studies, the paper discusses the e-portfolios' definitions, functions, strengths, weaknesses, opportunities, and relevant educational frameworks. The following research gaps were identified: lack of studies on e-portfolio in K-12 education; few current studies investigating e-portfolio implementation in a collaborative (co-design) mode; and more research are needed in employing social media and PLEs in e-portfolio implementation for student agencies. Based on the overview, recommendations are made for the policymakers and stakeholders to use e-portfolio in education better.

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"What Motivates Me?": A Qualitative Perspective on Student Collaboration in Small Groups

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Abstract

Collaborative learning, social interdependence and computer mediated communication (CMC) have been broadly studied in higher education research. Collaborative learning has often been associated with a social interdependence understanding. However, this study explores the relationship from an exclusively student motivation perspective in order to gain insight over the factors that encourage students' positive interdependence in small peer groups. Moreover, due to the COVID-19 pandemic which, has shifted student learning to online platforms learners have found themselves engaging in computer mediated communication more than ever. Therefore, the study aims to explore CMC's influence over student motivations towards achieving mutual-interest in their small groups. Besides that, past studies concerning these areas have been mostly quantitative in nature, thus, this study used a qualitative approach by conducting semi-structured interviews with 9 participants from the Communications programme of a private higher educational institution in Klang Valley, Malaysia. The interview findings identified few factors that transformed their self-interest motivation to mutual-interest motivation. These being: accountability, quality of work outcome, type of coursework & group size. Additionally, CMC was not directly influential in encouraging students to grow mutual-interest in their small group. Besides that, there were no significant difference between the roles of synchronous or asynchronous communication in specifically motivating students towards achieving positive social interdependence. The findings prove beneficial for educators and educational administrators when designing collaborative tasks and relevant policies or guidelines.

Keywords: collaborative learning, computer mediated communication, higher learning, small group, social interdependence, student motivation

This paper looks at the higher education context, focusing on Year 1 undergraduate students' involvement in small peer groups (4 members per group). The study has observed specifically students from a private higher educational institution in Malaysia who are enrolled in the Communications programme. Often, a large part of the coursework undertaken centres on collaborative tasks involving peer learning in small groups. The coursework in the study programme have been mainly structured for group learning due to alignment with the work nature in the Communications discipline especially careers in public relations or organisational communication, which, will largely be centred around collaborative workplace environments. Moreover, as the world has become exponentially digital so has human communication. Computer mediated communication (CMC) has also been extensively used in the workplace for some time, among its advantage acting as a tool to communicate with others from different time zones or remote areas. Particularly in recent pandemic times, the students have had to adapt and rely solely on CMC for their learning and group working, thus, changing the dynamics of their day-to-day communication especially with their peers in the programme.

As the learning environment in the 21st century has seen extensive growth of a diverse student demography, tertiary education preferences and learner (dis)abilities; thus, to be on par educational institutions require pedagogical approaches and assessment methods that are equally varied, dynamic and improved. On that account, higher educational institutions have gravitated rapidly towards active learning approaches or what is, student-centred learning and since have been moving away from the traditional teaching practice of giving lectures and inducing rote-memorisation, lately seen even in scientific disciplines such as the natural sciences and formal sciences. For instance, the engineering academia has chosen to incorporate collaborative learning into its curricula whereby, students have exceeded in successfully acquiring skills related to communication, teamwork and design (Apte & Bhave-Gudipudi, 2020; Felder & Brent, 2007). Thus, group learning has grown in importance and lately used as pedagogy in higher education. Nevertheless, as a pedagogical approach collaborative learning method does pose its own challenges, yet has shown proven efficacy among students in learning settings that practise them. Students in collaborative learning settings learned to communicate better with their peers, encouraged to think critically and laterally, to have respect for diversity, develop learning communities and cooperative attitude plus, feel motivated (Laal & Ghodsi, 2012; Tsay & Brady, 2010). Additionally, technology use in active learning has noticeably been beneficial. The ECAR survey done in 2016 reported student participation was higher in technology-integrated classrooms (Elaine Gioiosa & Kinkela, 2019). Hence, suggesting that students participate a great deal in CMC these days. As such, this has encouraged more Malaysian higher education academics to pursue collaborative learning in their classroom activities and assessments.

Vygotsky's theorising on the social dimensions of learning led to the belief "that learners construct their own meanings within social environments" through the zone of proximal development which referred to "each person's range of potential for learning, where that learning is culturally shaped by the social environment in which learning takes place" and in which, based on this fundament collaborative learning has become an area well researched (McInerney, 2005). Therefore, collaborative learning is an educational approach that encourages interaction and transactive communication, knowledge/skill building through problem solving, product creation or task completion by groups of learners (Laal & Ghodsi, 2012; Schnaubert & Bodemer, 2018). The core of collaboration and cause of interdependence (Bonito, 2002; Cress, 2008 as cited in Schnaubert & Bodemer, 2018) has been due to "reciprocal influence" that signifies the supposed active interaction among learners who in time

influence each other in terms of "cognitions, motivation, and behavior, which may lead to both greater differences between groups and convergence within the groups." (p.2).

Collaborative learning has developed itself into many different methods to facilitate group learning with some being more established than others, namely: Cooperative learning, Problem-based learning and Team-based learning. However, compared to the rest collaborative learning and cooperative learning often are thought to be the same as both have a constructivist epistemological background. Hence, an assertion made is that this study focuses on collaborative learning, which is defined as a personal philosophy on consensus building where group members respect and work towards enhancing each other's abilities through contributions, sharing of authority besides being responsible for group actions in a cooperative manner (Panitz, 1999). In comparison, cooperative learning is more teacher-centred in approach, directive and based on a set of fundamental principles to facilitate group learners (p.5). In addition, Johnson, Johnson and Holubec's (1991) 5 basic elements (positive interdependence, individual accountability, group processing, face-to-face promotive interaction, interpersonal & small group skills) (pp. 8–9) have been broadly adopted into the practise of cooperative learning.

Terms of Reference

To address some of the terms that are used in this study, "social interdependence" in accordance to Deutsch (1962) and Johnson and Johnson (1989), "exists when individuals share common goals and each individual's outcomes are affected by the actions of the others" (as cited in Johnson & Johnson, 2001). As for the term "motivation", it is described as "the wants or needs that direct behavior toward a goal." (Lumen, 2022). A considerable part of this study's inquiry is aimed at student motivations structured around "self-interest" and "mutual-interest". On that note, "self-interest" is defined by actions performed for "the sole purpose of achieving a personal benefit or benefits." (Cropanzano, Goldman & Folger, 2005, p.985). Hence, "mutual-interest" has been defined in this study as any action that benefit or benefits another, whereby above all the intended beneficiary is to be other than the self.

Purpose & Significance of Study

Albeit social interdependence theory and collaborative learning both have been researched rather widely in the past, however, it is still an on-going inquiry and piques much interest on what actually drives students to do well or poorly in collaborative work. Therefore, through the concept lens of social interdependence, the study's purpose is to garner a student-centred perspective focusing exclusively on their motives in shifting gears from self-interest to mutual-interest in groupwork, factoring in a CMC setting. In effect, this would be an added observation in understanding the relationship between synchronous and asynchronous CMC with student learners' motivation, who currently in higher learning are made up of Millennials and Gen Z. Thus, significantly informing educators and educational administrators or others in similar positions to consider the motivating factors for students when designing group-based tasks or related policies. This paper provides some highlighted findings that have successfully boosted students' interest towards peer collaboration for a mutual benefit rather than individual gain; while adding knowledge whether the role of synchronous and asynchronous CMC enables a collaborative spirit.

Literature Review

Social Interdependence Theory

Social interdependence theory's (SIT) premise is that the type of structure in a group determines individual members interaction, such, determining the outcomes of the group (Johnson & Johnson, 2002). SIT's historical roots can be trailed back to the early 1900s with the emerging school of gestalt psychology at the University of Berlin. Accordingly, "[t]hey posited that humans develop organized and meaningful views of their world by perceiving events as integrated wholes rather than as a summation of parts or properties." (Johnson & Johnson, 2009, p. 366). In other words, the human mind and human behaviour is looked upon as a whole. This understanding lies directly from the German "gestalt" which closely means "form" or "shape" when translated; however, the word is often interpreted as "pattern" or "configuration" in psychology (Brittanica, 2020). Hence, the understanding is human minds tend to sense events as part of a greater whole and as components of wider complexed systems. According to Kurt Lewin (1935, 1948) it was proposed that a group's essence is the interdependence among members due to common goals, resulting in that group being a dynamic whole whereby changes to the state of any member/subgroup in turn changes the state of any other member/ subgroup; thus, drives them to accomplish the common goals (as cited in Johnson & Johnson, 2009; Johnson & Johnson, 2005).

Lewin's contribution was extended further by his student Morton Deutsch, who in 1949 firstly noted that there are a few types of social interdependence structures: positive (cooperation), negative (competition), or non-existent (individualistic efforts) (Deutsch, 1949, 1962 as cited in Johnson & Johnson, 2002). Accordingly, a positive social interdependence is achieved when "individuals' goal achievements are positively correlated; individuals perceive that they can reach their goals if and only if the others in the group also reach their goals" while a negative social interdependence "typically results in oppositional interaction as individuals discourage and obstruct each other's efforts to achieve" whereas a non-existent social interdependence occurs "[w]hen a situation is structured individualistically, there is no correlation among participants' goal attainments; each individual perceives that he or she can reach his or her goal regardless of whether other individuals attain or do not attain their goals." (p.120)

Computer Mediated Communication (CMC)

Metz (1994) defined computer mediated communication (CMC), which presence had existed since 1969, as "any communication patterns mediated through the computer" (as cited in Laghos & Nicolaides, 2016, p.15). However, a more known definition was described by December (1997) who had outlined it as "a process of human communication via computers, involving people, situated in particular contexts, engaging in processes to shape media for a variety of purposes." (p.1). Thus, when simplified to mean that CMC involves human- to-human communication mediated by computers while also encompassing any form of digital media or video telecommunication technology from the modern day. CMC's advantage lies in its availability anywhere and anytime through multi-platforms such as emails, social media platforms, instant messaging, discussion forums, online distance learning programmes and massive open online courses (MOOC). Furthermore, CMC's other appeal is the multidimensional communication such as: one-to-one, one-to-many, many-to-one, many-to-many and even one alone (Chew & Ng, 2021, p.27).

CMC is characterised by its synchronous and asynchronous communication means. Succinctly, synchronous communication in a CMC context, applies to a face-to-face discourse with the intervention of technology or other tools in circumstances usually involving distance, whereas asynchronous communication does not happen in real-time in which the person(s) involved can interact with the message at a later time (Lim, 2017). CMC has the ability to encourage online collaborative learning where students have shown to perform well since online discussions potentially have the ability to improve learner-learner relationship due to the teacher's non-presence in the online collaborative space (Chew & Ng, 2021). Thus, giving the freedom for students to interact and share opinions as peers. However, its success possible provided if only there is mutual respect and peer engagement.

Method

For this exploratory and descriptive study, a qualitative approach was undertaken by employing a semi-structured interview method. Characteristically, a benefit of the semi-structured interview method is that even though "[t]he interviewer follows the guide, but is able to follow topical trajectories in the conversation that may stray from the guide when he or she feels this is appropriate." (Cohen & Crabtree, 2006). However, such a method can be challenging due to its labour intensiveness and time-consumption in conducting the interviews and analysing data, while in need of interviewers who are knowledgeable, competent and adaptable (Adams, 2015). Nevertheless, semi-structured interviews enable deeper probing on the topic or matter in discussion and thus, provides in-depth perspectives to understand the circumstances surrounding it and of personal experiences.

Research Questions

Therefore, it is the study's aim to explore whether students from the communications field are driven by personal interest or incentivised by fellowship in groupwork. Whereas, the other aim is to focus on CMC's contributing role in shaping social interdependence in groupwork. Thus, the research questions (RQs) investigated are:

RQ1: What encourages Communications students to participate cooperatively in their groupwork?

a) Are the students motivated by self-interest or mutual-interest?
b) What are the factors behind their motivation?

RQ2: What role does CMC play in students' motivation in small group learning?

a) Which CMC modes assist mostly in transforming the communications programme students' self-interest to mutual interest in a group learning environment?
b) Does synchronous CMC or asynchronous CMC effect most in transforming the communications programme students' self-interest to mutual interest in a group learning environment?

Interview Participants & Interview Process

The following describes the study's targeted participants and how the interview sessions were carried out. The group of individuals chosen through purposive sampling represented Year 1 students (19-25 years) from the Communications programme in a private higher educational

institution in Malaysia. They were invited to participate as they took a core course in the same semester. The students had to produce a podcast segment (large assignment) as a group of 4 members within a 4-week duration.

To highlight, students were initially asked to fill in a survey questionnaire disclosing their abilities and skills in producing a podcast segment by the course instructor. This was mainly to facilitate grouping of students based on their present skillsets towards the completion of the project. Indirectly, it was to ensure each small group had an advantage and fairness observed from the beginning of their assigned task with one delegated member identified as the Podcast Editor. The rest of the members were given the opportunity to take on more fluid roles in the project such as being the Group Leader (GL), Assistant Group Leader (AGL), Researcher and Scriptwriter. In retrospect, the course instructor was careful to ensure that there was a balance maintained between: students having been assigned to a group and students' involvement at freewill in the group as it was to preserve the spirit of collaboration and engagement within the groupwork. Additionally, peer reviews were administered to ensure students worked towards enhancing their group dynamics as they will be evaluated on their collaborative skills by the members.

As for the interview process, a total of 34 invitations to participate were sent out to students that were either the designated GL or AGL for this project. This was mainly because every group had a student assigned as the GL and/or AGL. Hence, as a rationale, it was determined to include these students as to some degree the participants experiences would appear comparable as they had played similar roles in their respective groups. Moreover, it was observed being in Year 1, students were collaborating for the first time with peers who were relatively new to them. Therefore, it was anticipated that they would be more objective when assessing their motivation in a group with a lesser membership familiarity.

In the final outcome, a total of 9 participants from 7 different small groups had agreed to be interviewed for this study. The interviews were conducted only upon the submission of the project task so as to ensure participants did not feel obligated or bound to their small group, as they were meant to be comfortable and unrestrained when sharing their experiences when interviewed. Each in-depth single interview session lasted an average between 60-70 minutes, wherein "[a]bout one hour is considered a reasonable maximum length for [semi-structured interviews] in order to minimize fatigue for both interviewer and respondent." (p.493). All participants had been interviewed via the online Zoom meeting software.

Preceding to that, relevant documents were sent in for institutional review and had attained approval for ethics clearance. Before the interview session, all participants were provided with a participant information sheet that was sent via email for participant consent. A set of core interview questions were attached together for participants to know the scope of the interview discussion. All participants had consented to their session being video recorded for this study's purpose.

Data collection & Analysis

The semi-structured interviews that were video recorded were transcribed for analysis and reporting purposes. In order to preserve the ethical code, each participant feedback was anonymised using a codename (e.g.: P1, P2). Besides that, a copy of the recorded interview session was sent to the participants for reviewing and for omission purposes, if any. Every one

of the participants had reverted with no corrections or omissions to be made, therefore all data collected was transcribed in verbatim.

Subsequently, the data was thematically analysed. The researcher had applied a latent level of analysis as distinguished by Braun and Clarke (2006) which focuses "to identify or examine the underlying ideas, assumptions, and conceptualisations – and ideologies – that are theorised as shaping or informing the semantic content of the data" (p.84). Thus, the emergent themes conceptualised from the 9 participants from the Communications programme concerning reasons contributing to students' social interdependence motivation in small group peer learning (RQ1b) are: accountability (self & others), quality of task outcome, and type of coursework task & group size.

Findings and Discussion

This section discusses the findings on student social interdependence motivation in small group collaborative learning and the influence of CMC in harnessing their motivation.

Student Social Interdependence Motivation: Perspectives & Factors

One of the most significant aspect of social interdependence is the transformation of one's motivation from self-interest to mutual-interest (Shimizu et, al., 2020) in collaborative learning. Therefore, the findings for RQ1 of the study discovered that the Communications programme students had started out the project motivated by self-interest but for many of them in due course it had transformed into mutual-interest motivation. There were mainly 4 themes that surfaced from the interview findings in terms of factors that contributed to students' keenness in shifting their intent to do well for group benefit rather than personal benefit. These were: accountability, quality of work outcome, type of coursework & group size. In terms of self-interest motivation, participants are ostensibly prompted by individual task preference and also personal grade achievements.

To restate, a positive social interdependence happens "when the actions of individuals promote the achievement of joint goals" whereas a negative social interdependence occurs "when the actions of individuals obstruct the achievement of each other's goals" (p.366). Therefore, indicating positive social interdependence would advance the transformation of self-interest motivation to that of mutual-interest in groupwork. Interestingly, the interview findings reiterated these concepts with most participants expressing a positive social interdependence experience in their small groups. Conversely, students who did not seem to work on a mutual benefit spirit even until the project's end had experienced a non-existent social interdependence (members mostly worked independently) compared to a negative social interdependence in their groupwork. In this aspect, there was no progression in students' motivation towards achieving mutual-interest in the group.

The following are evinced descriptive responses (Table 1) by participants that had encountered positive social interdependence experience when collaborating in their small groups. In summation, these participants found their motivation turn into mutual-interest when all members in their small group stepped up and played equal roles towards achieving an optimal outcome for the given task. The responses suggest that the participants were becoming intrinsically motivated to deliver their best for the project when other members equally displayed similar behaviour, thus setting up an ad hoc support system within the small group. This finding supports the literature that a positive social interdependent cooperation not only

"tend[s] to result in more frequent use of higher-level reasoning and more intrinsic motivation, but also promotes more positive interpersonal relationships and greater social support." (Shimizu et.al., 2020).

Table 1
Responses to Positive Social Interdependence in Small Group Learning

Participant	Interview Response
P1	…it started off as personal interest. I really wanted to learn how to produce a podcast but after that, because it takes a lot of effort, […] I really needed support from other group members […] It was very helpful when they were always willing, […] So yeah, yeah, like they were very cooperative for this assignment […] Everyone was really trying their best, so I was also putting it as much effort as I could […] because I really think that everyone deserves to do well for that one. […] Yeah, that kind of like made you feel that you wanted everybody else to do well because everybody was pitching in to sort of help each other out, perhaps.
P3	I think it's a mixture of both. I can't say it's entirely like self-interest… because it's a group assignment. But in starting stages... yeah, it's self-interest. But when during we are discussing about the script, right? It's more like towards mutual interest. […] Because mainly it's a group project and how others perform will...will influence others. And so, if at the same time, everyone's thinking about self-interest, I don't think that everyone is going to get benefit because everyone is too self-centered. Everyone wants the best for them. […] But you also must want the best for others because you are a group. Yeah, basically, you are one body.
P5	I think that depends on the assignment. If it's interesting […], I will give my all for this assignment…it's my own interest; but mutual interest, probably comes from the team members, the other team members if they are themselves interested and, like encouraging. For example, the podcast assignment, […] They were all very, very interested. We set deadlines and everything […] we were all in it! So, I would say mutual interest, it was more mutual interest for this assignment.
P7	In relation to this assignment, I'd say both. […] as a student, […] there's also a personal motivation but at the same time as a group leader it is also my role to make sure that everyone in the group participates, knows what they're doing. We are all equally wanting, you know, for each other to do well in the assignment. So, I guess it's both personal motivation but… at the same time it's also a cooperative one.
P9	I think I'm more of a personal interest person when it comes to assignment. Yeah. Especially like this assignment… because grades are very important to me. So, I tend to focus more on my interests. However, for the assignment the team mates are good and hardworking… it tends to also be mutual interest as well. It gets like self-interest and then becomes mutual interest. Yeah, [be]cause I know they put in effort to get good marks so I will try my best to help them out as well. So, we all can get good marks together.

Nevertheless, there were 2 participants that had reported experiencing non-existent social interdependence in their small groups. In a nutshell, their responses (Table 2) have shown that there was lack of cooperation by members towards a "joint goal" which, in this instance, was

the completion of the project. Such, these members felt discouraged until the project's end to feel motivated by any mutual-interest.

Table 2
Responses to Non-Existent Social Interdependence in Small Group Learning

Participant	Interview Response
P2	I think it's more of self-interest because … I found out that after the group assigned, I noticed one group mate and I was like, oh my God, it's this person again! […] and I didn't know about the other two. So, I was like, okay, you know what? Maybe it won't be so bad, I kept like a positive mental attitude and then when the assignments started, I was like, oh my God… Okay, you know what? They are not responding on time, […] I'll just do it myself and just get it done. […] So, it was more self-interest at that point. It was mutual at first and then slowly slipped to like self-interest.
P4	Actually, for me it's based on what kind of assignment it is. […] So, I will be very motivated… own interest, I can say. […] my group they were not very motivated. […] So, in the end, my marks were important for me to do well.

Furthermore, an underlying supposition from P2 and P3 responses respectively has been indicative that students who enter groupwork tasks are aware of mutual-interest motivations, though superficially only. Apart from that, the interview findings revealed that the participants (P1, P4, P5 responses) may be more inclined towards self-interest motivation when involving a course task that they enjoyed working a lot at a personal level. Another reason attributed itself to maintaining student grades in the enrolled programme (P4, P9 responses). Nevertheless, for this study, the highlighted reasons were considered as peripheral factors since participants had only managed to gloss over these discussions during the interview.

Largely, from the interviews it can be understood that participants proved willingness to work with group members on a mutual (benefit) platform when members showed personal "accountability" in the given group task. Accountability, be it involving the self or others, was constantly a recurring emphasis among the interview participants. Thus, it can be identified as a factor related to the transformation of one's self-interest to mutual-interest in collaborative learning. Accountability is when every student takes individual responsibility to achieve a joint goal and bears ownership of the outcomes. During the interview, participants were candid to point out that their motivations had changed when they had observed accountability by group members who were showing commitment, reliability and competence over their delegated tasks (refer to Table 1). Besides that, group member familiarity encourages self-accountability, as P6 claimed "*let's say if I'm in a group with my friends… that I know, that means it's mutual interest. I want them to do well and I want myself to do well as well"*. As for P8, who also experienced positive social interdependence in the recent groupwork, opined that specific designated roles within the group encourages the accountability level of members stating that "*I think something that would create a mutual-interest is if…everyone has a specific role that they are good at. That only they can execute. So those kinds of settings, they really make me think about the group working… on a mutual-interest way, where I want everyone to do well*." Such, in relation, the presence of accountability (self and others) in a group nurtures camaraderie that encourages a member's motivation to grow from self-interest into mutual-interest.

From the interview discussions, participants have also identified "quality of task outcome" as being a relevant factor in informing their motivations to a mutually interested one. Participants were keen to work on a common benefit basis when group members were committedly producing high quality work based on their assigned roles while consistently trying to enhance the overall outcome of the given task. For instance, P8 shared experiences that "*when the members do a lot more of good work, I can't help it, that… I want to step it up, than expected, for the group"*. P9 additionally exemplifies, *"when we delegate tasks, each one of the group members will have their own parts. So, you know, like because you're going through the document as well. So, you see how their performances are. So, when you know the work performances, like how well they elaborate the points, how well they can do and find their points. Even the mistakes they do is very low. And, they do it like quick. It's quick but the quality is good, […] That becomes like the mutual interest."* On the other hand, P2 highlighted that poor work quality has been instrumental in hindering the transformation of the individual mindset to a group mindset. In the interview discussion, P2 stated, *"if it's in a group, yes, that should be high quality results. But I think that if, if everyone else doesn't have the same energy as you to put it in the effort, then there's no point in being a group. To like, not give any high-quality work. And that's when I started thinking that maybe I should just do it alone. I probably can do it better alone."* Therefore, the stress on work quality put in by individual group members has been pivotal to the transitioning of self-interest encouraged motivation to a mutual-interest motivation for the participants in these small groups.

The third and final common factor given emphasised "type of coursework task and group size". A number of participants interviewed pointed out that the nature of the course task would influence the way they would want to approach the task, either individually or as a group. For the recent project, generally participants felt that the podcast segment required members to approach it from a mutual-interest standpoint due to the many production levels involved in the task such as researching, scriptwriting, podcast segment conceptualisation, production, role-playing and editing. Yet, more of the participants' responses drew attention to small group size in boosting group closeness that embodies mutual-interest motivations. P2 had stated that, *"I think it is possible and you can actually get to know them like personally too, in like a smaller group. Whereas if it's in a bigger group … you can feel left out sometimes because the group is too big and then everyone's like talking and often your kind of, like, should I join in, but it's already so many people here."* According to P3, *"I've been in groups with 13 people, that one, I felt was more self-centered. Smaller groups, tend to have better dynamics, lesser personalities to deal with and more connection in the group."* P7 agrees strongly that the sizing of the group, whether small or large, matters by expressing that *"there is a difference, because the more group mates you have, you will have to receive more different opinions, it gets tougher and maybe, sometimes, one of them might not respond since everyone else is responding.[…] To be honest, I think the podcast assignment, 4 people is just nice, perfectly fine… because usually the more people, the more conflict there'll be"* Hence, in brief small group settings offer its members closer proximity. Such, members commonly find themselves able to deal with lesser disputes since there's lesser communication lines crossed among them. Also, member involvement in the group task is higher, bringing about latent circumstances such as group bonding and positive social interdependence.

CMC: Preference of Mode & Role in Encouraging Student Motivation

The other aspect of this study explored was the role of computer mediated communication (CMC) in encouraging students' motivation. The interview responses had answered RQ2 of the study by imparting students' perspective of their preferred tools of communication for

groupwork which, were mainly (in sequence of preference): the multiplatform messaging app – WhatsApp, online word processor – Google Docs and video teleconferencing software – Zoom. Hence, their preferred CMC mode was mainly textual based while supplemented by audio, image and/or video information. Furthermore, the students did not find disparity between synchronous CMC or asynchronous CMC in transforming their self-interest to mutual interest in the small groups, though generally they predominantly agreed CMC was able to foster positive social interdependence due to reciprocal influence by members. However, it was discovered from the interviews that the asynchronous communication was preferred and that it did not dissuade students from feeling lesser of a member in their small group.

The Internet has become the most common source of information today and happens to be a platform where social media presence is thriving, thus, much of the communication among users are engaged online. In recent times, due to the Covid-19 pandemic the Communications programme students have been participating in their coursework tasks fully online. Thus, students have found various CMC tools to stay connected and to complete given tasks, particularly when involving groupwork. P9 iterated that CMC, "*definitely does help, because, even though it is online, we are still working to complete the assignment together*" but, since CMC is technology-based P6 asserts that *"it has its challenges, there are some with poor internet…or simply low bandwidth to connect for our discussions. Then, it becomes a problem for the group"*. Subsequently from this study, all participants strongly claimed that they preferred communicating using the multiplatform app WhatsApp with their group members. The primary reason being its accessibility since it is a free application. Another reason highlighted by participants was due to its convenience since students were able to text message, record voice or video messages, upload files and check unread message and/or reply them at their disposal. This is further evinced by the participants responses; for instance, P5 who stated, "*[w]e used three platforms. First… we created WhatsApp group for casual texting and updating everything on that script, […] Why? Because everyone has it, so that's the first thing we thought of,*" whereas P7 shared, "*WhatsApp. It's friendly. Fairly informal. Anytime. As long as you have access to internet data, whatever place you are you can check messages.*" Subsequently, Google Docs was also highly regarded as a productive cooperative work space as group members could compile work that were delegated to them, leave comments and even improve on each other's work. In P8's response, it was mentioned that "*working on Google Docs was great. Sometimes, when I was checking on the script …requested by members, I could make the changes there and then. […] They understood the changes made, when they read the changes…[be]cause they trusted my judgment …that I was wanting to improve the script for us all.*"

Hence, the text-based feature in WhatsApp and Google Docs was substantially useful to participants and treated akin to progress(ion) records on their project work. To add, mediated communication is rarely impersonal (Walther, 1995 as cited in Wrench & Punyanunt-Carter, 2007). Therefore, WhatsApp and Google Docs' writing-texting as well as direct editing features can be seen as useful in tracing the development of each individual's contribution, timeliness and efficiency in the groupwork. P6 shares that "*Yeah, it plays a part in our group mates feeling. Like, yes, I think they are a good team player because they're responsive and they're able to convey the information to the group well, and on time and effectively.*" Consequently, this has helped form certain opinions and feelings for specific members that are more affirmative and optimistic, in consequence expanding on group members interactivity levels in a positive manner leading to positive interdependence. Thus, CMC used for groupwork has capabilities to rouse happiness and trustworthiness, correlating with one's "emotivation". In short, the portmanteau "emotivation" has been conceived to explain our

distinct emotions which motivate behaviour (Beall & Tracy, 2017). Accordingly, the feeling of happiness may have coevolved with "a fundamental motivational system geared toward promoting affiliation with peers" (Kenrick et al., 2010 cited in Beall & Tracy, 2017, p.4). In this regard, CMC shows capability to promote peer affiliation which, by nature is inherently motivated by mutual-interest and a sense to avoid solitariness.

As for the roles played by synchronous or asynchronous CMC, participants were quick to report there were no differences between the two sets of communication pattern in influencing their motivations. However, the discussion findings prove intriguing when participants initially highlighted their general preference for face-to-face communication, yet found synchronous communication rather uncomfortable from their experiences. As mentioned by P1, "*we were all feeling shy with the video call,"* and further to that, P3 who illustrates in-depth, *"with face-to-face meetings, it's different […] there's body language and just something about… the interaction level, better connection is fostered […] but on our Zoom call, it wasn't the same. Some did not turn on the video, […] one participant was directly staring at the member speaking […] also, on screen people, just show you what parts they want you to see of them…it's easier to filter*". Therefore, to these participants synchronous communication could not replace face-to-face communication, even though both had similar characteristics in terms of being communication done in real-time. This finding can be supported by Chen and Wang's study (2009) who found that an obvious difference between synchronous online and face-to-face communication discussions is the direct interaction that incurs in the latter whereby learners chatter noisily and laugh together whereas members in online discussions appear silent as they are more engaged in typing on the keyboard.

By comparison, the interview responses had leaned towards participants being partial over asynchronous communication in this project. Though the finding was unclear whether their motivations had changed when engaging in CMC, but almost all participants claimed that they still felt group affiliation in CMC caused by member reciprocal influence. This was clearly seen in P6's response, "*because usually, WhatsApp feature, you can like send multiple things… like links, documents, and pictures and you can even record your audio if you… don't want to have an awkward call with your group mates, you can just voice record it and send it to the group. So, everyone can listen to it at the same time. […] so, we get a sense of belonging. […] We feel connected as part of that group,*". As a bid to answer why CMC did not affect participants social interdependence motivation, this could be linked to one's communication competency and length of that active communication when using computer mediated technology (Wrench & Punyanunt-Carter, 2007). For the recent podcast group project, most of the participants cited that the 4-week timeline was insufficient to get to know their members socially or personally as communication was mainly reserved for work-related matters. Besides that, some members online communication had proven poor causing unnecessary miscommunication as highlighted by P2, "*I was surprised at the way he replied in the group, it was… somewhat like rude, […] then in the video meeting a week later, actually he was okay*". As a conclusion, the likely online communication incompetency among some members may have demotivated others from nurturing a positive social interdependence in their small groups.

Conclusion

As an overview, the study's qualitative inclined findings through both RQs inquiries have revealed that students showed motivation towards a mutual-interest in circumstances where the small group working experiences have been such that: members show accountability, members produce good quality of task outcome, the nature or type of coursework given and the allotted group size. Thus, in general 7 interviewed participants from the Communications programme

were able to have experienced positive social interdependence in their podcast segment project. As for the remaining 2 participants, they were unable to achieve social interdependence in their group due to lack of member accountability, thus, stayed motivated by self-interest until the completion of their group project. As for CMC's role in transforming motivation in small peer groups, students generally appeared in consensus that CMC assisted with the reciprocal influence, such, enhanced the overall groupwork experience and group affiliation. It still remains unclear on the direct influence of CMC on mutual-interest motivation since participants stressed member accountability as being most important to their group membership. Moreover, to the participants neither synchronous nor asynchronous communication particularly heightened their recent collaborative experience. Yet, the indicated notion has been that the participants preferred asynchronous communication for its non-restrictive nature in checking/replying messages to the rest of the group members.

The study's limitation is set in the fact that all participants wore a leadership hat in the small peer groups as either a Group Leader or Assistant Group Leader. Therefore, the study was not able to explore the power-distribution paradigm to have gained a fuller insight into the interpersonal interaction between leader-member relationships and its relationship to social interdependence motivations. It is recommended that perhaps future research work could explore these dynamics.

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An Exploratory Investigation into Classroom Discourse in a Bruneian University

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Abstract

The paper inquired into the discourse practices in classroom teaching in a State university in Brunei Darussalam. Respondents comprised four (4), local Bruneian lecturers, from two (2) academic streams: STEM-driven and entrepreneurship programmes. Subjected to data saturation, teaching observations of each respondent were shadowed over several weeks. Data were recorded, transcribed, and analysed using the Classroom Discourse Observation Protocol (CDOP) to determine the types and frequencies of teacher-student utterances. Findings showed that the students were provided insufficient opportunities to interact meaningfully and that the lecturers who were leaning toward conventional teaching did minimal attempts to engage the students, failing to utilise appropriate prompts and basic questioning techniques believed to facilitate critical thinking and deep learning. Classroom discourse was propelled by a corresponding approach in teaching; hence continuous readiness in classroom teaching needs to be sustained, should students' quality of learning be improved.

Keywords: Brunei, classroom communication, classroom discourse, teaching and learning

With globalisation and technological advancements, higher education institutions have seen an increase in teaching approaches that prioritise student engagement and reciprocal interaction with the lecturers. Cao and colleagues (2019) determined that teaching approaches can be defined as the methods used in the delivery of the module content or how the lecturer fosters their students' conceptual development of the subject matter via their linguistic intention and strategies within the class. An element of these approaches is the use of classroom discourse to engage students and strengthen learning. Classroom discourse refers to the specific language used within the constructs of the classroom and can include delivery, feedback, instructional language, or even basic conversational utterances (Tsui, 2008). It is recognised as being instrumental in the construction of meaningful learning and so an awareness of a lecturer's discourse in the classroom can lead to not only an enhancement of students' knowledge but also their ability to comprehend and critically evaluate information (Howe & Abedin, 2013).

In higher education institutions, universities generally adhere to using mass teaching methodologies such as lectures to deliver content to the students. A methodology where lecturers tend to monologue extensively with very little active construction of the meaning of the delivered content. An insight into the discourse used by the lecturers can aid in minimising or addressing the routinely one-sided interaction as well as the notable disengagement of students reported in higher education lectures (Trigwell & Prosser, 2020; Wang & Wang, 2021). The creation of a more collaborative and interactive classroom by way of activities that incorporates the subject matter can aid in knowledge retention long past the classroom (Shan et al., 2014). In addition, this inclusion of interactional communication in the classroom has been shown to have a positive impact on student learning outcomes and by association, help develop and nurture students' soft skills such as critical thinking and learner autonomy (Hardman, 2016).

In Brunei, classroom communication is heavily influenced by the national philosophy *Melayu Islam Beraja* (MIB) or Malay Islamic Monarchy which by large has formed the Bruneian Malay identity (Hj Othman, 2012). The MIB philosophy is entrenched in all aspects of life in Brunei and the Malay culture is seen to impact behaviour, beliefs, and values which are simultaneously aligned with Islamic religious beliefs resulting in a level of reverence and obedience afforded to lecturers and teachers alike (Othman, 2014) creating a significant communicative and social gap. Cultural studies have placed Brunei in the same group as other Malay dominant countries such as Malaysia and Indonesia, portraying Malay culture as polite and self-effacing (Blunt, 1988; Mulder, 1996) as well as highly collectivist, hierarchical with high power distance as per Hofstede's cultural dimension theories (Hofstede, 1980). Thus, due to prior exposure and continuous immersion in rote-based or traditional teaching methods, Bruneian students are accustomed to the view of lecturers as a figure of authority and so conform to the behavioural construct of only speaking when spoken to (Salbrina & Deterding, 2018).

Therefore, it stands to reason that in this case, the onus for a collaborative and interactive classroom will fall on the lecturer. This study will indicate the importance of a two-way collaboration in higher education between both lecturers and students during the teaching and learning process. Identifying the lecturers' discourse moves made in the classroom can help with the advancement of teaching skills.

Objectives of the Study

This study seeks to investigate the following problems:

1. The emerging typologies of lecturer discourse practices in a higher education institution in Brunei Darussalam;
2. Any differences in teaching approaches between lecturers from different programmes.

Literature Review

The use of lectures as a teaching approach in universities has persevered over the years and remained the main teaching method as it enables the mass delivery of knowledge over a short period of time. Despite its popularity, academicians are well-aware of its shortcomings with regards to the lack of student engagement, its one-sided communication and of course its inability to stimulate higher-order thinking (Charlton, 2006). To ensure the quality of teaching, a lecturer must be committed to developing a "constructional alignment of the course instructional design", to maintain an element of curiosity among the students thus peaking their interests long enough to be inquisitive and alter their learning style accordingly (Teaiwa, 2011). It is therefore important for the lecturer to determine the kinds of teaching approaches suitable which can mean the difference between a quiet and monologic class and a dynamic classroom experience (Tienken et al., 2019).

A dynamic class can also be achieved by encouraging students' participation in lectures by implementing a few strategies such as providing ample thinking time, conducting discussions in smaller groups, encouraging knowledge sharing and implementing activities related to the subject matter (Abdul et al., 2020). This was supported by Balwant and Doon (2021) in their research on teaching effectiveness, where it was determined that making modifications to the teaching approach and strategies by implementing summative and collaborative activities can lead to more understanding and increase communication among the students in their attempt to explore their learning. Further to this, it is pertinent for lecturers to be aware of the instructional strategies or teaching approaches used as it is shown to have strong links to students' learning experiences which can lead to an increase in comprehension and understanding among the students (Lak et al., 2017).

Sinclair and Coulthard (1975) theorised that in any classroom there is principally a three-part sequence that happens between any educator and student known as the IRF exchange structure. This would consist of the I -initiation part, which would usually be in the form of a closed or a recall question, R- response from the student followed by the F- feedback statement or remark from the educator in form of an acknowledgement of the response. Research has indicated that in the third part of the sequence, Feedback can be used in a number of ways. More commonly, it is used either as a closing statement in order to move on to the next planned lesson or activity or as an opportunity for further learning thus extending the interaction. Classrooms which have followed this basic pattern of interaction have been noted to be limited in their ability to encourage participation (Mehan & Cazden, 2015). Essentially, lecturers would need to employ a more comprehensive style of questioning.

The act of questioning by the lecturer can greatly increase the student's learning as well as open up new avenues of knowledge. There is also a number of research conducted on the types of questions, their uses and expectations, as well as others on the analysis of feedback given, its purpose and effectiveness in responding to the question (Garcia-Carrion et al., 2020).

Therefore, a lecturer must be aware of their communication and feedback so that they will be able to easily adjust their teaching and their content to address the gaps in students' knowledge and understanding. This however requires flexibility not just in the lesson plan but also in the lecturer's delivery and explanation of the content (Howe et al., 2019). One way of achieving this would be looking toward improving the lecturer's communicative discourse in the overall delivery of the content as well as interaction with the students.

Kranzfelder and colleagues (2020) developed the Classroom Discourse Observation Protocol (CDOP), a tool to evaluate classroom discourse, specifically focusing on those made by the lecturers – teacher discourse moves (TDM). This allowed the identification of different discourse moves used by the different lecturers using similar teaching approaches. By quantifying and analysing the TDMs uttered, the data can then be used to pinpoint areas of weakness and strengths within the lecturers' discourse and how they can impact students' learning experiences.

Methodology

The observations were conducted in February and March 2021, prior to the second wave of COVID-19 infections in Brunei Darussalam. Thus, all observations were of physical face-to-face classrooms. As the main point of the study is to look at the lecturer-student interaction as well as any guided instructions by the lecturer, the utterances were recorded and transcribed verbatim.

Participants

Purposive convenience sampling (Creswell, 2014) was used, and the participants were local lecturers from two different faculties in the university, the Engineering and School of Business. Participation was voluntary and all participants consented to be observed and recorded during their classes for the purpose of this study. All the lecturers have undertaken a nine-month teaching training diploma at another local university. The full information on the lecturers can be found in Table 1.

Table 1
Information on Lecturers

	Engineering		School of Business	
Lecturer	AS	BD	CG	DZ
Number of years teaching in higher education	7	12	18	15
Received formal teaching training	Yes	Yes	Yes	Yes
Level of students taught	2	2	4	3
Number of students	44	32	9	11
Number of times observed	4	3	4	4

Instrument

The transcriptions were then analysed using the Classroom Discourse Observation Protocol (CDOP) as developed by Kranzfelder and colleagues (2019). The instrument was used to identify the lecturers' utterances and categorise them into specific lecturer-centred and student-centred utterances to find out the most commonly used type of interaction. The CDOP coding system differentiates between lecturer-centred utterances and student-centred utterances to determine how each classroom is taught. The intention was to gain a reflection on the dynamics of teaching and learning in the lectures within the four classrooms as well as gain an insight into any differences that can be seen between the two faculties.

The CDOP features 15 codes, five of which are lecturer-centred: sharing, real-worlding, evaluating, linking, and forecasting. Whereas the remaining 10 codes were more student-centred: generative, checking in, clarifying, connecting, contextualising, representing, explaining, constructing, requesting, and challenging. With CDOP, the quantifying of the teacher's discourse markers (TDM) was conducted every 2 mins within the length of the class. For this research, the TDMs were transcribed verbatim and coded throughout to ensure all utterances were accounted for and categorised accordingly. This was done so to allow for the data to give a true account of the communication happening in the lectures.

Results

The results show that the classes were predominantly using lecturer-centred discourse markers with three of the lecturers' classroom communication (BD, CG and DZ) recorded as containing more than 50% of lecturer-centred TDMs. On the other hand, lecturer AS's classroom communication although containing mainly student-centred TDM also featured a high percentage of lecturer-centred TDM (46.9%) albeit significantly lower than the other lecturers. This can be seen in Figure 1 which illustrates the overall division of utterances between the lecturer-centred and student-centred utterances during the classes observed. Looking at the data overall, there do not seem to be any significant differences or similarities between the lecturers' classroom dialogue based on any of the variables mentioned in Table 1.

Figure 1

Usage Comparison of Lecturer-Centred Versus Students-Centred TDMs

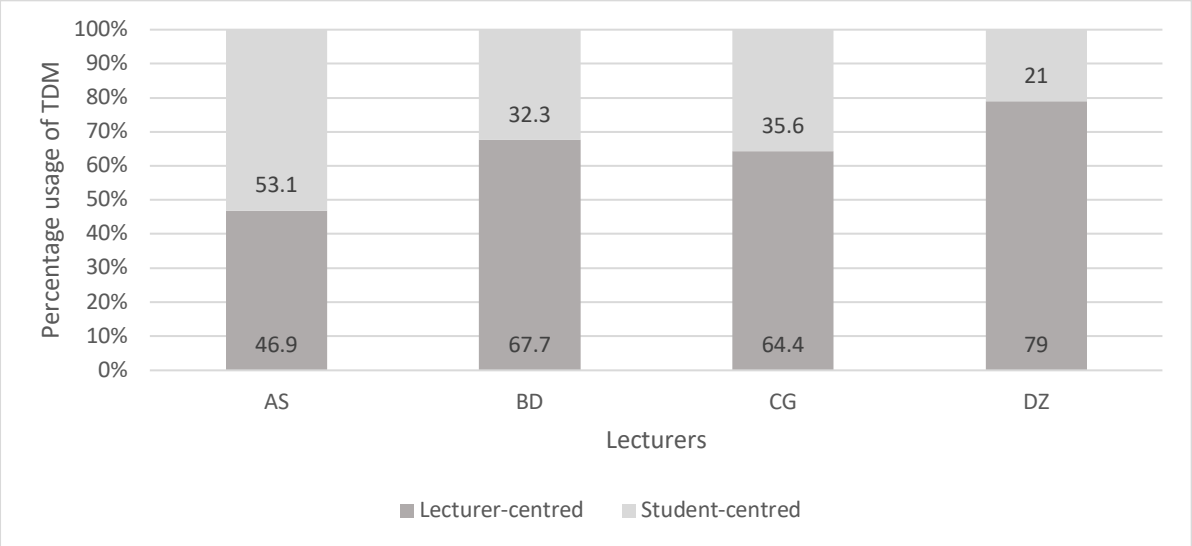


Table 2 shows the percentage value of each TDM used by the lecturers. The data shows that not all the TDMs were used by the lecturers, in particular the student-centred TDMs. Most notable are the TDMs representing, explaining, constructing, requesting, and challenging, all of which invite or encourage the students to present, participate, justify or evaluate their reasonings or their classmates' reasonings. This significant absence of the student-centred TDM revealed the extent to which the classroom communication was very lecturer-centred across the two disciplines.

Table 2
Percentage of TDM Contained in the Lecturers' Classroom Communication

		Lecturer percentage of total utterances (%)			
		AS	BD	CG	DZ
Lecturer-centred	Evaluating	1	1.8	7.7	2.4
	Forecasting	0	4.4	0	2.3
	Linking	0	3.2	0	7.4
	Real - worlding	0	2.2	16.3	14.3
	Sharing	45.9	56.1	40.4	52.6
Student-centred	Generative	40.6	26.2	15.9	20.2
	Clarifying	1.1	0	2.9	0.8
	Checking -in	10.4	4.9	2.9	0
	Connecting	1	1.2	1.4	0
	Contextualising	0	1	12.5	0
	Representing	0	0	0	0
	Explaining	0	0	0	0
	Constructing	0	0	0	0
	Requesting	0	0	0	0
	Challenging	0	0	0	0

Lecturer-Centred TDM

Figure 2 shows the graphical representation of the lecturer-centred TDM in the lecturers' classroom communication. The results revealed that the highest percentage of TDM contained in all four lecturers' classroom communication was sharing, averaging 49%. This TDM is the lecturer sharing information related to the subject matter and providing a solution or answers to any questions posed. The second TDM that featured in all the lecturers' recorded communication was evaluation albeit at different degrees with lecturer CG having the highest usage at 7.7% in comparison to the others who used the marker on average two per cent over the observation period. This code is categorised as a lecturer-centred TDM as it is in response to students' utterances as elicited by the lecturers. Real-worlding where the lecturer related ideas to current knowledge or personal experiences were only seen in three of the lecturers (averaging 8.2%). Similarly, the other TDMs such as forecasting and linking were uttered by only two of the lecturers, DZ (2.3% & 7.4%) and BD (4.4% & 3.2%).

Figure 2
The Division of Lecturer-Centred TDMs Used by the Participants

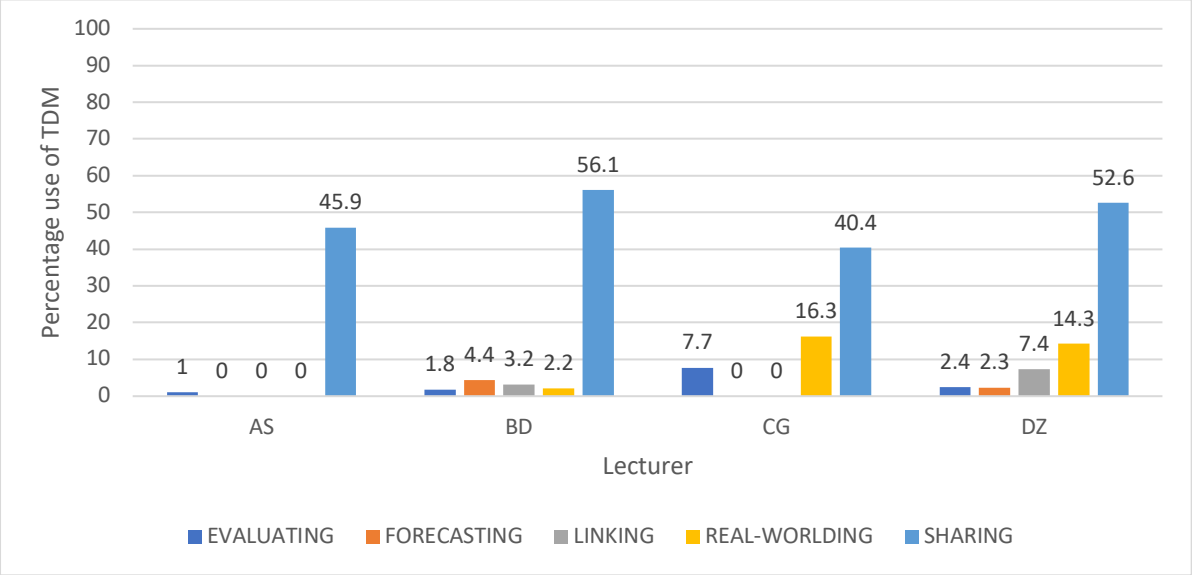


Table 3 shows excerpts of lecturers' discourse to illustrate the CDOP codes as identified from the recorded classroom communication.

Table 3
Excerpts of the Different Lecturer-Centred TDMs Uttered by the Lecturers

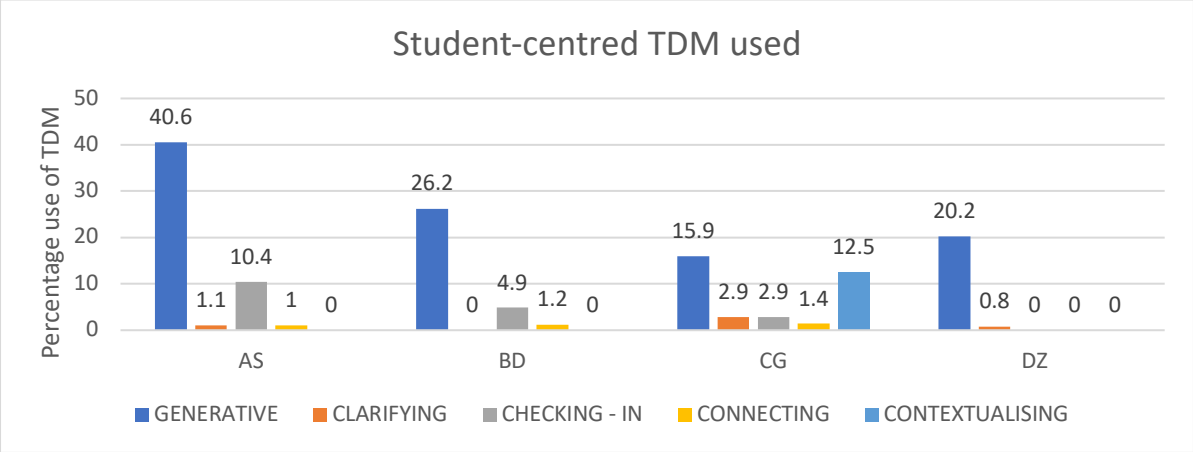
Lecturer-centred TDM	Lecturer	Utterances
Sharing	AS	So instead of using X and Y to define the position of a particle, we can use the. The polar coordinate system, which is basically instead of having X&Y we are going to define it using the radius of a curvature radius of a circle.
Real-worlding	CG	Ok, so you remember Sony Ericsson, before it was just Sony and it was just Ericsson. Then they combined they were one of the top (sic) after Samsung.
Evaluating	BD	L: So, which side is strongest? S: Side B? L: Yes exactly!
Linking	DZ	Ok, this brings me back to what we learnt in our micro-econ section to do with special and different services…copy tax, payroll tax…remember? This is a continuation
Forecasting	DZ	So, now we focus more on the local level of business and in a few weeks we will move on to more on a federal level and the country level and we can look at the differences, and you can determine.

Student-Centred Utterances

Student-centred TDMs comprise 10 codes which reflect utterances by the students in response to initiation from a lecturer. However as mentioned, only a small number of these TDM codes were used collectively by the lecturers during the observations (generative, clarifying,

checking-in, connecting, and contextualising). Figure 3 shows the graphical representation of the TDMs in the lecturers' classroom communication. As can be seen in Figure 3, the most used TDM code is generative, (averaging 26%) where the students recall basic facts, concepts, or related information as asked by the lecturer (Kranzfelder et al., 2019).

Figure 3
The Division of Student-Centred TDMs Used by the Participants



It should also be noted that within the student-centred TDM codes the generative code is in fact the most featured TDM for all the lecturers but second (AS: 40.6%, BD: 26.2%, and DZ: 20.2%) third overall (CG: 15.9%) during their classes. With regards to the other TDM codes, however, not all five were present in the lecturers' utterances. Lecturer CG and BD were missing the TDM codes contextualising and clarifying respectively from their classroom communication, whereas lecturer DZ did not have TDM codes checking in and connecting in their classroom communication. The lack of student-centred TDM codes in their communication supports the notion that the classes are very much lecturer-centred.

Table 4
Excerpts of the Different Student-Centred TDMs Uttered by the Lecturers

Student-centred TDM	Lecturer	Utterances
Generative	AS	Ok, this is your UΘ. So, what would we do next?
Clarifying	DZ	S: Tax L: Ok, but you need to be specific, what kind of tax?
Checking in	BD	So far are we good?
Connecting	CG	Remember Sony? Ok so, what about that is applicable here?
Contextualising	CG	Ok, lets focus on Brunei first and look at franchises, how many do we have in Brunei?

Discussion

Lecturer-Centred

Given that the classes observed were lectures, it would come as no surprise as sharing information or "story-telling" is seen to be the most successful method of teaching large groups large amounts of information (Schmidt et al., 2015). This was supported by Kranzfelder and colleagues (2020), who in their research on STEM lecturers' classroom discourse found code sharing to have been more frequently used at an average of 75%. However, Rakhimov and colleagues (2020) stated that lectures should be modernised to include discussions and general interactive communication among all parties involved.

Indeed, the mass sharing of information as a method of teaching in has long been considered a safe and more reliable way of disseminating knowledge consistently, especially to larger classes. In this study though, only the engineering classes had a large number of students (N=44 and 32), whereas the classes in the School of Business had a comparatively smaller number of students (N=9 and 11). This negates research conducted by Trigwell and Prosser (2014) which concluded that the size of a class should not determine the teaching approach, nor should it affect the ability of the lecturer to offer more of a varied and interactive approach (Trigwell & Prosser, 2014). Implementing such an approach can result in a more dynamic lesson, leading to an increase in knowledge retention and academic achievement.

In addition to this, the presence of the TDM evaluation in all the lecturers' vernacular is an indication of the lecturers' attempts to create a dialogue in the class. So, it does seem to be indicative of interaction between the lecturer and the students, however, the lower values illustrate the lack of feedback or responses the students are giving the lecturers in return. An example of this can be seen in the exchange in table 3 which showcases one of the instances of the TDM evaluating being used where lecturer BD initiated the class with a question (generative), the students responded accordingly, and their response was then accepted by the lecturer (evaluate). As seen from the exchange, although there is initiation made by the lecturer, the type of question asked does not encourage a comprehensive reply. Similarly, with the engineering lecturers, the questions asked were of basic types that do not require much analysis or critical thinking.

This clearly shows the importance of lecturer-centred training in areas of classroom communication and the development of skills related to the promotion of exploratory talk or dialogic strategies which would then pave the way for university lecturers to be more than just methods of disseminating large volumes of theory or information (Garcia-Carrion et al., 2020). This corresponds with Hardman (2016) who determined that instructional classroom interactions coupled with ineffective questioning techniques can reduce the need for any direct engagement between the lecture and the students. Further noting that educators need to move beyond known-information questions or recitation questions and use more information-seeking questions or referential questions which can elicit "genuine communication" which in turn can lead to the core goal of the class – learning.

When the two disciplines are further compared, it can be seen that the business lecturers' classroom communication contained a higher percentage of the TDM real-worlding (14.3% and 16.3%) unlike the engineering lecturers where only one lecturer's communication contained real-worlding and a much smaller percentage (2.2%). In the case of lecturer CG, real-worlding code is the second most frequently used code during the classes. Real-worlding

requires the lecturer to refer to shared public knowledge along with the lecturers' and the students' personal experiences (Kranzfelder et al., 2019), likely as a way to create linkages between students' current knowledge and the taught material. Schmidt et al., (2015) believed that using pre-conceived ideas or current known ideas and linking them to the subject matter stimulate the knowledge formation of the brain. This was supported by Pimentel and McNeill (2013) who discovered that the use of correct elicitation methods and allowing the students to respond accordingly can be one of the ways to break the monotony of lecturer-centred discourse.

The very minimal use of the TDM real-worlding in engineering classes can be explained due to the nature of the subject. The engineering modules observed were mathematics and physics related and in addition to this, the students were in level two of their studies. This meant the lecturers would have some difficulty in providing a reference to the module as it was a highly theoretical module featuring calculations and measurements. Whereas the business modules were more relatable to real-life situations as it incorporates real business corporations and situational events within the module. This can nonetheless be modified by the lecturer having a pre-conceived strategic plan to incorporate activities that encourages classroom participation through collaborative or interactive means (Balwant & Doon, 2021).

Student-Centred

The generative code refers to the lecturers' elicitation of the students on basic facts, concepts, or related information (Kranzfelder et al., 2019) and serves to kickstart the discussion in the classroom. However, given that the percentage use of the TDM code does reveal that the lecturers' attempts were not fully utilised. This can be further illustrated in Table 5 which shows the full extended generative utterance by lecturer AS initially detailed in Table 4. In Table 5, lecturer AS repeatedly questioned the class since there was no discernible response each time.

Table 5
Extended Extract of Utterance by Lecturer AS

Line	Lecturer	Utterance
85	AS	Ok, this is your UΘ. So, what would we do next?
86	AS	We have to prove the unit vector, right? (2s)
87	AS	Ok let's group them together here, so we have the r value here.
88	AS	What about this here? (2s)
89	AS	Ok, this is your UΘ. So, if we add the two values what will we get? It's going to be your acceleration. am I right? (3s)
90	AS	Alright, so we now have your acceleration, So, we add this value here and what do you notice? (1s)
91	AS	not your acceleration, but your? (2s) radial acceleration.

This passivity from the students is theorised to be a learned response cultivated by repeated experience of having their responses or feedback dismissed in lecturer-centred classrooms (Lak et al., 2017). This is generally a long-term effect and something students have adopted over a period of years based on their own classroom experience growing up. Abdul and colleagues (2020) confirmed that students will tend to simulate their lecturers' teaching approaches and classroom behaviour. Therefore, passive students exist because the lecturer allows them to exist without any attempt at breaking the educational mould that the students are used to.

On the surface, the data indicated that there is a degree of elicitation from the lecturer, denoting that classroom participation is present although to a very small degree. From the results, the TDM checking-in is seen to be used more by the engineering lecturers than the business lecturers. The TDM code checking-in was also used by all lecturers involved though at different frequencies, with it being the second most used TDM by lecturer AS at 25.9% compared to the others who all checked in at less than 5% of their overall observed lessons. This exchange between the lecturer and students is characterized by Sinclair and Coulthard (1975) as IRF (Initiation-Response-feedback) and is commonly recognised as a lecturer-centred approach, but as argued by others, the "feedback" part of the interaction can be used as a pedagogical tool to promote discussion and expand the dialogue between the lecturer and students. In this study, the TDM checking-in is designated a student-centred TDM as it is utterances where the lecturer asks the students if they have any questions or require clarification, (Kranzfelder et al., 2019), in these classrooms the opportunity is not always seized by the students who instead remain silent or nods in response to signal agreement or understanding. Using strategic evaluative feedback or effective follow-up questioning techniques that encourage an elaborative response can increase not only the opportunities for discussion but also open up new opportunities for learning (Garcia-Carrion et al., 2020; Howe et al., 2019). The results do certainly pinpoint the notion that the lecturers observed are not fully applying ideal techniques relating to these teaching approaches and so having more awareness of this can help towards achieving meaningful participation in the classrooms.

Recommendations

The research has highlighted a number of items where further exploration would be beneficial. This paper lacks a comprehensive investigation into the lecturers' full communication with the students. In particular, there was no observational insight into the communicative patterns of the lecturers during the class, specifically regarding their opening remarks, delivery and conclusive statements in the class. Insight into the lecturers' full communication patterns can help determine the weaknesses in the communicative teaching approach. Willemsen et al., (2018) theorised that applying a more open and welcoming discourse from the start of the class and continuing by maintaining such strategies throughout the class to encourage participation. Therefore, future research may want to include these elements in the analysis and look for any commonalities in the lecturers' speech patterns when teaching and how it encourages feedback from the students.

Another area for exploration can be the addition of analysis into the non-verbal communication utilised by the lecturers. Non-verbal communication and behaviour can play an important role in the overall teaching and instructional communicative process. Sztejnberg and Jasiński (2019) found that the use of eye contact and facial expression was deemed significant by students in reinforcing any classroom communication. Thus, adding this particular aspect may provide more depth into the reasons behind the lecturers' utterances and their relationship to learning.

Conclusion

This paper seeks to investigate the types of discourse used by lecturers along with any differences that may be observed between those teaching different programmes in the university. From the study, it was clear that all the lecturers were observed to use very teacher-centric approaches unlike those envisioned by the university. While there were certainly attempts by the lecturers to use student-centred TDMs, the ensuing responses from the students

were minimal and passive. It became apparent here that the lecturers were not using effective questioning techniques which would have allowed for the IRF-like exchange structure to evolve into more of a dialogical discussion. This further suggests that lecturers need to be aware of how language use can affect classroom dynamics. Thus, the continued use of CDOP as a tool to explore and investigate TDMs across the university can be beneficial for the development of a framework to improve classroom communication and encourage a more dynamic and dialogical-based teaching and learning environment.

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WhatsApp Remote Reading Recovery: Using Mobile Technology to Promote Literacy during COVID-19

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Abstract

School closures because of the COVID-19 pandemic affected over a billion young people worldwide and presented a threat to long-term learning, particularly for public school students in low socioeconomic situations. This article offers quasi-experimental evidence on a low-cost strategy for distance learning applied in the Republic of Panama to minimize the negative consequences of the pandemic on public elementary school children's reading levels. We conducted a 12-week intervention that utilized mobile phone technology and dissemination of reading material through WhatsApp, a cross-platform messaging freeware service, to maintain and improve children's reading levels during the pandemic school shutdown. The objective was to determine the feasibility of using WhatsApp as a digital tool to facilitate education and inform evolving practice and policy responses. Results among 292 students between the second and sixth grades indicated overall mean gains of up to 10.3% in the number of words read per minute, with statistically significant improvements overall and higher gains among the second and third grades. In addition, the adoption rate was high, with a reported average of 84% completion of the daily readings. The results of this low-tech intervention have immediate and longer-term implications for using mobile technology as a supplemental or complementary learning tool, especially for developing regions and during school closures or school vacations.

Keywords: EdTech, evaluation research, literacy

The COVID-19 pandemic closed schools and negatively affected learning for 1.6 billion young people, over 90 percent of the worldwide student population, threatening long-term education outcomes for a generation of learners (United Nations, 2020). School closure is associated with widespread learning loss (Andrabi, Daniels & Das, 2020; Angrist et al., 2020; Jaume & Willén, 2019; Slade et al., 2017). Moreover, this interruption at critical schooling stages, such as when children learn to read, can negatively affect outcomes and contribute to higher dropout rates and reduced productivity. Translated into economic terms, the World Bank projects that the educational interruption caused by COVID-19 could represent a global financial cost of up to $10 trillion (Azevedo et al., 2020).

The effects of school closures can be particularly devastating for students from low-socioeconomic situations without access to resources that facilitate learning from home. Many governments and schools around the world have turned toward technology as the most expedient means to providing distance learning, yet those without adequate access to information and communications technology (ICT) are at a distinct disadvantage (Angrist et al., 2020; Azevedo et al., 2020, Save Our Future, 2020). Adequate access is of critical concern in developing regions where much of the population often lacks ICT infrastructure and where COVID-19 has exacerbated existing educational inequalities (Azevedo et al., 2020; Save Our Future, 2020; United Nations, 2020).

COVID-19 has made more visible not only the digital divide within and between countries but also how these technological differences disproportionately impact developing countries and poor communities. Given this scenario, the most effective national responses to the COVID-19 education crisis must include a range of high- and low-tech measures to propel instruction delivery and reach as many families as possible. Successful distance learning strategies rely on multiple delivery approaches and will vary according to the conditions associated with each context (Save Our Future, 2020; Angrist et al., 2020).

This article presents evidence of a low-tech strategy applied in the Republic of Panama designed and implemented to minimize the negative consequences of the pandemic on public primary school children's reading levels. Thus, we examined the results from a 12-week distance learning intervention that utilized mobile phone technology to promote the maintenance and improvement of children's reading levels during the pandemic school shutdown.

Literature Review

Literacy in Panama

Panama's national standardized test, the *Crecer* evaluation, which annually measures learning outcomes in third graders through five performance levels, shows that roughly half of public school third graders test at low or very low literacy levels (MEDUCA, 2018). These data also reveal considerable achievement gaps. Third graders in private schools obtain significantly higher scores than their public counterparts. Similar results in regional UNESCO-led evaluations highlight outcomes below the averages for much of Latin America and the Caribbean (UNESCO, 2016). These pre-pandemic statistics highlight inequities between Panama's public and private school systems and reflect relative underperformance in the public schools. With prolonged absence from school, the risk is that students' attainment levels will further diminish across a range of academic outcomes (Carroll, 2010; Gottfried, 2014).

The combination of pervasive underperformance and school closures because of the pandemic became a concern for elementary school literacy. Moreover, since learning in other subjects at all levels is linked to early reading comprehension, setbacks at this stage will likely affect future learning negatively in multiple ways (Cunningham & Stanovich, 1997; National Institute for Literacy, 2008). Thus, for Panamanian public school students, the COVID-19 crisis threatens an entire cohort's learning possibilities.

COVID-19 and Education: Worldwide and in Panama

The coronavirus pandemic disrupted education systems in almost every country, forcing most schools to close for extended periods and jeopardizing education outcomes for over a billion learners of all ages and over 100 million students in Latin America and the Caribbean alone (UNESCO, 2020). This situation has intensified the global education crisis, pushing an already precarious situation to the brink of catastrophe. Even before COVID-19, international organizations had documented the extent of global educational inequities and how disproportionate opportunities for quality learning keep large blocks of young people from reaching their potential and participating productively in the global economy (Education Commission, 2016; Psacharopoulos & Patrinos, 2018; Save Our Future, 2020; UNESCO, 2016). For example, half of the children in low- and middle-income countries are not learning to read correctly by age 10 (Save Our Future, 2020). Furthermore, less than 25 percent of children in low-income countries and only 50 percent in lower and middle-income countries complete secondary education (Education Commission, 2016). Nearly 90 percent of the world's school-aged children live in low- and middle-income countries; thus, this inequity lays the foundation for a skills gap that will negatively affect economic growth and have far-reaching social repercussions (Education Commission, 2016).

The COVID-19 crisis worsened these pre-existing disparities. The learning losses may extend beyond this generation, reversing decades of educational progress. The UN estimates that nearly 24 million additional children and youth may drop out or be unable to access school because of the pandemic's economic impact alone (United Nations, 2020).

The Republic of Panama, a small country in Central America with a population of approximately four million, has just over 400,000 registered primary school students, 87% in its public system (INEC, 2017). The pandemic forced a strict national quarantine and school closure beginning in March 2020. The Panamanian school year runs from March to December, which resulted in most students attending school in 2020 for only a few days when the new school year began before the COVID-19 shutdown.

The government announced an official return to class starting July 20, 2020, but all activity shifted to distance learning, which continued through 2021. Panamanian schools encountered numerous obstacles in their struggle to return to classroom learning and led global lists of nations with the most consecutive days out of school (De Hoyos & Saavedra, 2021; Svenson, 2021). Before the outbreak of COVID-19, Panama did not have broad-based remote learning platforms or academic content prepared for home delivery via the Internet, TV, or radio. Since the second half of 2020, Panama's Ministry of Education, or MEDUCA for its acronym in Spanish, implemented radio, TV, and internet-based programming, as well as conducted numerous training to bring its teachers up to date with educational technology (EdTech) (MEDUCA, 2020).

Nevertheless, the fact that many public system students and teachers in Panama (and the rest of Latin America) did not have adequate access to or experience with using advanced ICT (Saez, 2020) complicated distance learning. Additionally, many families had little access to supplemental learning materials or programs in their homes, compounding pandemic education difficulties. Given the circumstances of prolonged school absence and limited learning opportunities, these students risk considerable academic setbacks (MEDUCA, 2020), especially regarding reading skills, as these skills form the base for subsequent learning (Cunningham & Stanovich, 1997; National Institute for Literacy, 2008).

Distance Education, Technology, and Equity Implications

Digital technology offers many possibilities for education (Yang, Kuo, Ji, & McTigue, 2018), and Panama's MEDUCA worked to build more technology-assisted learning into its system because of the pandemic (MEDUCA, 2020). However, a family's ability to utilize this depends on its access to connectivity. Many do not have access to a fixed Internet connection, computer, or even electricity. Only an estimated 40% of public-school students have access to the Internet at home, and less than 30% have a computer (INEC, 2017).

Although Internet access is limited in many parts of the country, mobile connections are more extensive. 100% of Panamanians report cellular phone ownership (indicating that some have more than one), and 62% report some Internet use (Kemp, 2020). This coverage varies considerably by region; the indigenous territories and other areas far removed from urban centers are among the most disadvantaged concerning cellular accessibility (De Leon, 2020; INEC, 2017). Nevertheless, most Panamanian families in the public school system have at least one mobile phone and some type of access to the Internet, even if it is intermittent.

In early 2020, there were 2.4 million social media users in Panama, an increase of 9.0% over 2019 (Kemp, 2020). Most Panamanian social media users also have access to WhatsApp, a free instant message application that operates across multiple platforms to transfer text and multimedia material (Dichter y Neira, 2015). The accessibility of this ubiquitous, potentially inexpensive, user-friendly platform has made WhatsApp a convenient for learning and messaging. Research is beginning to signal its success as an educational tool.

An exploratory qualitative study conducted in Israel with high school teachers found WhatsApp class groups helpful in communicating with students, creating a sense of belonging, promoting dialogue, and using and sharing a learning platform (Bouhnik & Deshen, 2014). It is helpful for studies to explore student perceptions regarding the use of WhatsApp, as successful adoption for educational interventions would depend mainly on students' willingness to use and enjoyment of using such a platform. In India, a controlled trial used WhatsApp to improve children's English reading and comprehension skills in grades 4 through 7 across 50 rural government schools in the Bundi district (Voluntary Services Overseas (VSO)/Pratham Foundation, 2015). Pratham Foundation's (2015) study serves as a precursor to show that WhatsApp works as a learning tool for small children. Also in India, a comparative study showed that fourth-semester medical school students who studied pathology via WhatsApp, as opposed to didactic lectures, achieved higher average scores on post-test assessments (Gon & Rawekar, 2017).

During the COVID-19 pandemic, WhatsApp demonstrated potential as a supplementary instructional vehicle for students at all levels. In addition, it garnered the interest of educators

in developing countries because it offers a relatively low-tech, low-cost means for delivering digital learning to a large portion of the school-age population.

WhatsApp as an Educational Tool

Research documents the positive effects of reading interventions over vacation periods when children, especially low-income students, are out of school for consecutive months with few opportunities to reinforce reading skills (Allington et al., 2010; Beach et al., 2018). In addition, research has also shown how mobile technology is a feasible alternative for delivering reading material to children, particularly those living in rural areas or lacking educational and technological resources (Sung et al., 2015; Kim, Miranda, & Olaciregui, 2008). Combining these two proven concepts to promote continued reading among primary school students during out-of-school periods through widely available mobile technology became a significant challenge during COVID-19. This challenge prompted the design of mobile literacy programming utilizing cell phones and the WhatsApp messaging platform to address the reading dilemma during the pandemic school closure.

WhatsApp is a familiar vehicle used by most households and Panamanian teachers to communicate with parents. A routine learning opportunity occurred within an already known and comfortable digital system by adding a reading delivery element to this communication. This ease-of-use aspect would increase the likelihood of adoption and application of the learning opportunity as it did not require learners or facilitators to confront the navigation of complexities associated with new platforms or applications (Plutino, Borthwick, & Corradini 2019). This study sought to determine the feasibility of using WhatsApp as a digital tool to facilitate education through an educational intervention of daily delivery of readings by WhatsApp to students in elementary school. The goal was for students to maintain (or expand) their reading skills during school closure.

Using input from other programs that demonstrated positive results (Bouhnik & Deshen, 2014; Gon & Rawekar, 2017; Voluntary Services Overseas (VSO)/Pratham Foundation, 2015), this intervention targeted elementary school students in the public system (grades 2-6) who were able to read and had access, through their families, to a mobile phone and a WhatsApp account. The hypothesis was that by establishing a daily reading habit, these students could sustain (or possibly expand) existing abilities and avoid reading setbacks due to prolonged classroom absence. The project delivered grade-appropriate digital stories through parent-teacher WhatsApp groups to 292 students to stimulate daily reading during the COVID-19 quarantine. Intervention pre- and post-tests measured students' reading levels and evaluated rate, fluency, and comprehension. These tests were also conducted remotely via WhatsApp.

The main research question guiding the study was: can WhatsApp be utilized effectively as an EdTech tool to maintain or increase reading levels in elementary school children? The specific questions were:

1. Did a reading intervention through WhatsApp significantly improve words read per minute (WRPM)?
2. Did a reading intervention through WhatsApp lead to a more substantial improvement in lower elementary grades (2-3) than in students in higher elementary grades (4-6)?
3. Were levels of take-up achieved through a reading intervention delivered through WhatsApp?

Method

Design

The study was quasi-experimental, with a single sample of participants who received the WhatsApp Remote Reading Recovery intervention, evaluated through a pre-test before the intervention began, a post-test one at week seven, and a post-test two at week 12. During the first seven weeks of the intervention, which took place between May and June of 2020, the public school system was not offering courses in any format, meaning most students in the country were not receiving formal educational instruction. During weeks 8 to 12 of the intervention, the public school system started offering online courses. The study measures were speed, through the count of words read per minute (WRPM). Another measure for this study was the level of adoption, or take-up, self-reported by parents to teachers to confirm that the child had completed the daily reading. Teachers used spreadsheets (manual or digital) to keep track of adoption levels.

Teachers were responsible for sending out the PDF files via WhatsApp with the daily readings to the parent or caretaker of each student participating in the project. Furthermore, teachers collected data by recording WhatsApp video calls and using pre-existing benchmark readings with word count rubrics to measure WRPM. Once the data were collected, tabulated, cleaned, and checked, researchers conducted the statistical analyses.

Ethics

This study was reviewed and approved by the Ethics Committee at Quality Leadership University. In addition, all participants' guardians provided digital written informed consent through WhatsApp.

Participants

Study participants were elementary school students in the public school system from second to sixth grade. Teachers contacted the students' parents via WhatsApp, invited them and their children to participate in the study, and obtained parental consent.

The sample of 292 (grades 2-6) was composed of 47% male (n=138) and 53% female students (n=154). Distribution among the grades and geographic regions studied is depicted in tables 1 and 2, respectively. The distribution of participants by educational region shows that most participants were within the metropolitan area of Panama (Panama Center, West, North, and San Miguelito) and accounted for 76% of study participants. Despite recruitment efforts, teachers and students from indigenous communities did not participate in the intervention. Nine out of sixteen educational regions in Panama participated in this study.

Table 1
Distribution of Participants by Grade

Grade	%	n
Second	30	88
Third	13	37
Fourth	22	63
Fifth	19	56
Sixth	16	48

Table 2
Distribution of Participants by Educational Region

Region	%	n
Bocas del Toro	1.5	4
Chiriqui	2	5
Cocle	12	35
Colon	1.5	4
Panama Center	22	64
Panama Norte	6	18
Panama West	27	79
San Miguelito	21	61
Veraguas	7	21

Procedure

In April 2020, Panama's Centro de Investigación Educativa (Center for Education Research, CIEDU), ProEd Foundation, and Quality Leadership University (QLU) came together to design and implement the WhatsApp Remote Reading Recovery project. MEDUCA and a corps of 60 volunteer public school teachers supported this initiative, maintaining contact with students and their families throughout the onset of the pandemic and the closure of schools. The project was also the focus of an official MEDUCA COVID-19 teacher-training program. The teacher training, project fieldwork, and evaluation research were implemented from April to August 2020 to produce results to inform MEDUCA decision-making related to supplemental digital literacy support and contingency planning for potential future education disruptions.

The first phase of this project involved recruiting, training, and coaching MEDUCA primary school teachers to implement the intervention. Teachers had the opportunity to take a certificate course in action research within MEDUCA's teacher training program, which included an applied component that required teachers to be field implementers of the project. The teacher-training portion lasted approximately 80 hours, including synchronous instruction, discussions, small group coaching, and follow-up sessions. As an incentive to follow through with the requirements of this project, teachers received a certificate of participation and points toward the Panamanian point-based promotion system for public school teachers. Teachers participated from regions around the country in the teacher development program and used WhatsApp to send their students daily readings over 12 weeks for a total of 60 readings.

Teachers committed to sending each student one reading per weekday during the intervention. Teacher training included courses on literacy assessment, daily reading distribution and pre/post-test materials, WhatsApp broadcast group setup, communications design for parents, and data registration. All volunteer teachers also participated in monthly workshops and weekly coaching sessions to maintain implementation fidelity. Teachers monitored daily take-up of the intervention by logging delivery, receipt, and completion of the readings. Researchers used these data to measure take-up levels of the readings as a percentage of the total content delivered throughout the intervention. Teachers also video-recorded students' pre- and post-test words read per minute through WhatsApp. Six researchers coached the teachers and took notes during each follow-up session to provide qualitative data to complement the analysis. The discussion of results contains observations that occurred during these sessions.

The second phase of this project involved taking the data from the video recordings of all students' pre- and post-test readings and quantifying it to assess WRPM. We stored all video data in a cloud drive. Five additional teachers who had received previous literacy training through the ProEd Foundation but did not take part directly in the first phase of the project implementation received training as evaluators to process the data recorded.

Data Analysis Techniques

We used Statistical Package for the Social Sciences (SPSS) to analyze the data. An inspection of boxplots revealed five outliers in the data; however, outliers were kept as part of the sample. Words read per minute for each time point was normally distributed, as assessed by the Shapiro-Wilks test ($p>0.05$). Mauchly's test of sphericity indicated that the assumption of sphericity had not been violated, $\chi^2(2)=0.898$, $p=0.638$. We conducted a one-way repeated measures analysis of variance (ANOVA) to determine whether there were statistically significant differences in WPRM throughout the 12-week reading intervention. Afterward, we conducted a Bonferroni post hoc test to determine whether there were statistically significant differences in WRPM between the different time points.

Results

This section presents the results of the implemented intervention designed and implemented, which aimed to minimize the pandemic's negative consequences on public primary school children's reading levels.

Overall, with the five grades combined, the results indicated a statistically significant gain in WRPM over time $F(2,582)=52.16$, $p<0.001$, partial $\eta^2=0.15$, with WRPM increasing from week 0 (M=81.51, SD=1.84) to week 7 (M=95.18, SD=1.91), and then slightly decreasing in week 12 (M=89.89, SD=1.88). The mean WRPM was 81.5, with a reported increase at the end of the 12 weeks to 89.9, representing a 10.3% increase. However, the mean WRPM at week 7 was 95.2, representing a 16.8% increase at the midpoint of the intervention. Post-hoc tests revealed a statistically significant increase in WRPM from week 0 to week 7 (M=13.67 WRPM, 95% CI [10.34, 17.0], $p<0.0005$), and from week 0 to week 12 (M=8.38 WRPM, 95% CI [5.21, 11.55], $p<0.0005$), despite a statistically significant decrease in WRPM that occurred from week 7 to week 12 (M=-5.29 WRPM, 95% CI [-2.03, -8.54], $p<0.0005$). The intervention elicited significant gains, including an effect size of partial $\eta^2=0.15$, which indicated a large effect according to SPSS rules of thumb (SPSS, 2022).

The lower elementary grade group comprised 125 second and third-grade participants. Upon a closer look at this group, WPRM was statistically significantly different at the different time points during the intervention for the lower elementary grade group, $F(1.864, 231.084)=75.099$, $p<0.001$, partial $\eta^2=0.377$. The effect size for the lower elementary group is larger than that for the overall group. In addition, post hoc tests revealed a statistically significant increase in WRPM from week 0 to week 7 (M=20.944 WRPM, 95% CI [16.218, 25.670], $p<0.001$), and from week 0 to week 12 (M=15.496 WRPM, 95% CI [11.089, 19.903], $p<0.001$), despite a statistically significant decrease in WRPM that occurred from week 7 to week 12 (M=-5.448 WRPM, 95% CI [-9.163, -1.733], $p=0.002$). This group started with significant gains, which decreased in the second half of the intervention, but resulted in a significant general increase.

The upper elementary grade group was comprised of 167 fourth, fifth, and sixth-grade participants. For this group, WPRM was statistically significantly different at the different time points during the intervention for the upper elementary grade group, $F(1.915, 317.870)=9.727$, $p<0.001$, partial $\eta^2=0.055$. Post-hoc tests revealed a statistically significant increase in WRPM from week 0 to week 7 (M=8.222 WRPM, 95% CI [3.825, 12.618], $p<0.001$), an increase that was not statistically significant from week 0 to week 12 (M=3.054 WRPM, 95% CI [-1.179, 7.286], $p=0.246$), and a statistically significant decrease in WRPM that occurred from week 7 to week 12 (M=-5.168 WRPM, 95% CI [-10.175, -1.179], $p=0.041$). This means that this group started with significant gains, which decreased in the second half of the intervention, and resulted in a general increase that was not significant. However, SPSS rules of thumb indicate that a partial eta squared of .055 is equivalent to a small to medium effect (SPSS, 2022).

Another measure tabulated for this study was the rate of adoption, or take-up, where we used available data from a sample of 187 students in second and fourth grade and found that, on average, students completed 84% of the daily readings or an average of 51 of a total of 60 readings. This means that most students regularly completed the daily readings and assigned tasks.

Inter-Rater Agreement

We ran inter-rater agreement tests to ensure evaluative uniformity and assessment fidelity for a randomly selected sample portion. Inter-rater agreement is a critical – and often overlooked – component affecting assessment fidelity; thus, incorporating high inter-rater agreement within the research design is vital for ensuring data integrity (Reed, Cummings, Schaper &

Biancarosa, 2014). Therefore, we implemented the following process to determine the degree of inter-rater agreement:

1. Groups of students were assigned to the five evaluators. Each video was evaluated by one of the evaluators, and a group of students was randomly selected to be assessed by a second evaluator to obtain the degree of inter-rater agreement. The second randomized evaluation was conducted for 74 of the 292 students, or approximately 25% of the sample.
2. Each evaluator calculated the total WPRM for the pre-test, post-test one, and post-test two.
3. The results of the records chosen for inter-rater agreement were added to a separate table. Each teacher's record was placed side by side, with an additional column marked "difference" to measure the difference noted in the result by evaluator.
4. Differences greater than three words per minute were considered "not in agreement" and marked in red.
5. Only the WRPM within the three-word difference was considered for the calculation of inter-rater agreement.

We obtained an overall inter-rater agreement of 82% in WRPM. Typically, inter-rater agreement of 80% and above is in the acceptable range (McHugh, 2012).

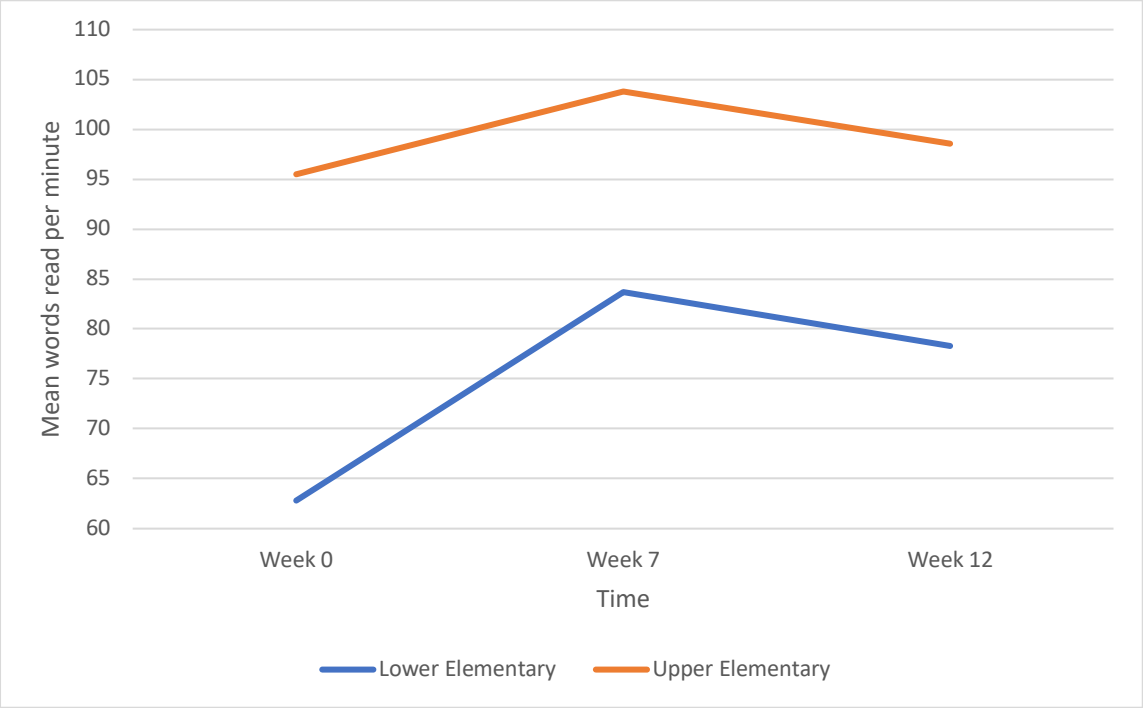
Discussion

The initial aim of this project was to stem reading loss, which seemed inevitable for many students given the prolonged classroom absences caused by the COVID-19 pandemic, particularly for those in the early stages of solidifying their reading skills. However, the gains we observed with processing the data far surpassed this aim and provided positive empirical data in support of the EdTech potential for mobile literacy interventions, especially in developing regions. The results also contained more nuanced implications for specific grade levels.

Figure 1 presents a visual depiction of mean WRPM over time for lower elementary and upper elementary groups. The figure also demonstrates how the lower elementary group had a steeper increase between week 0 and week 7, compared to the upper elementary group, making up for the slight decline that both groups experienced from week 7 to week 12, allowing for the overall increase from week 0 to week 12 to be significant. Possible explanations for this backslide in the final weeks of the project leading up to post-test 2 include the following:

a. The "reopening" of classes in July 2020 via distance education channeled student attention toward multiple subjects.
b. The use of slightly higher-level readings for post-test 2.
c. Pandemic-related stress and fatigue in connection with the reopening of classes in July 2020, a situation for which no one was adequately prepared and which caused additional stress for teachers, parents, and students.
d. The 12-week length of the intervention, with daily readings Monday through Friday, entailed a total of 60 readings, which may have been excessive for some students.

Figure 1
Mean Words Read per Minute over Time for Lower Elementary and Upper Elementary Groups



Results suggested that the gains associated with the mobile reading intervention significantly impacted the younger students in early primary. It is also important to note that the intervention effect was much higher for the lower elementary grade group (partial η^2=0.377) than for the upper elementary grade group (partial η^2=0.055). This is consistent with other studies that have noted how gains in basic skills acquisition are likely to happen more quickly in lower grades (LoGerfo, Nichols & Reardon, 2006).

These findings are especially noteworthy given the recently released NWEA data on the effects of COVID-19 on students in the early elementary years (Kuhfeld & Lewis, 2022). This NWEA research shows how first- and second-grade student achievement at the end of 2021–22 was lower compared to pre-pandemic reading trends by 6 to 7 percentile points and how this learning loss was greater than that of students in grades 3-5. The study also demonstrates how high school students were disproportionately impacted, with reading losses often double those of their counterparts in low-poverty schools. Suppose mobile literacy interventions such as WhatsApp Remote Reading Recovery can be quickly implemented in times of crisis and school closure. In that case, it may be possible to reduce early-grade reading losses, even in typically marginalized areas, which continue to impact achievement beyond the crisis period.

Likewise, the relatively high percentage of take-up – an average of 84% completion of the daily readings – coupled with the high retention rates noted for teachers and families throughout the 12-week project bodes well for this intervention's future applicability. This measure is crucial to international organizations interested in the gains obtained through reading interventions and the probability that participants will follow through with the

intervention to determine the feasibility for broader application in the future (McKenzie, 2011; 2019).

Relative to previous research conducted with the utilization of WhatsApp in a learning context (Bouhnik & Deshen, 2014; VSO/Pratham Foundation, 2015) and given the take-up statistics achieved in this study, this research reinforces the value of the WhatsApp platform as a viable vehicle for content delivery due to teachers,' families' and students' familiarity with and willingness to adopt WhatsApp for educational purposes beyond simple messaging. Additionally, this research builds on prior evidence for WhatsApp's utility in promoting language and literacy outcomes (VSO/Pratham Foundation, 2015). Finally, it echoes the conclusions of other pandemic studies that present positive results with WhatsApp use for advancing literacy in developing country primary school scenarios (Chai & Bin Rasi, 2021; UNGEI, 2022).

Follow-up sessions with teachers provided insights which we highlight below:

a. Familiarity with the user-friendly WhatsApp platform appeared helpful for maintaining participation throughout the intervention for teachers, parents, and students.
b. Many teachers who had access to a computer in their homes used the WhatsApp desktop version and reported ease of navigation.
c. The utilization of high-quality international-standard digital materials was essential to the project. It helped children view reading as a diversion instead of a homework assignment and propelled participant take-up.
d. The literature recommends that establishing a daily reading habit is instrumental to achieving more significant literacy gains throughout the intervention (Cullinan, 2000).
e. The WhatsApp-aided literacy promotion methods used in this project relied upon a triangulation of teacher-family-student relationships conducive to supporting literacy gains.
f. The flexibility of the WhatsApp platform facilitates its utilization in combination with other distance learning strategies, including radio, television, and internet instruction delivery.
g. One of the biggest obstacles to project implementation was the cost of data plans. For example, though WhatsApp is a cost-free application, its usage requires access to a cellular signal and a data plan. Telecommunications companies united to reduce data costs during the pandemic (Mi Diario, 2020). Still, implementation was reportedly uneven and inconsistent, often leaving poorer families without resources to invest in continued data access, especially in cases of suspended employment. Moreover, homes in remote areas (particularly the indigenous territories) often do not have immediate or constant access to cellular signals.

Implications

A survey conducted by UNICEF Panama in June 2021 showed that almost 70% of low-income household children participating in distance education during the COVID-19 pandemic were doing so via mobile phone, and most on a device they shared with other family members. The survey also noted that online learning is not accessible in most indigenous and many rural communities in Panama due to a lack of signal (UNICEF, 2021). These figures reiterate the importance of the work presented in this article. Mobile learning is possible for most Panamanian schoolchildren – if they have the connectivity. The same is

true for students in almost every country throughout the world. Thus, mobile education has been a topic of increasing discussion, even pre-pandemic, mainly because of its potential for developing regions (West & Chew, 2014).

This project emphasized how the realization of mobile technology's potential for education gain is intrinsically tied to three critical issues. The first is *connectivity*, which depends directly on access to a signal, the Internet, and a mobile electronic device. To mitigate these obstacles and move toward more and better signal coverage as well as an increase in the number of mobile devices available per family, most countries and school districts will likely need to pursue effective public-private partnerships with signal providers, mobile device manufacturers, and other key actors. The second critical issue affecting the implementation of mobile tech education programming is *capacity*. Teachers, students, and often students' families must be familiar with and comfortable using mobile devices and the corresponding software and platforms involved. This usually requires some capacity development activity (training, coaching, mentoring, or a combination of these) to enhance all participants' knowledge and skill sets, without which meaningful commitment over the long term is difficult to achieve. The third critical issue for implementation is quality course *content*, regarding both didactic materials and pedagogy. Instruction based on exciting and engaging materials and teaching methods has a much better chance of delivering real learning opportunities. These elements – connectivity, capacity, and content – individually and in combination, can make or break a given mobile EdTech intervention.

Since mobile technology offers the most ubiquitous modality available worldwide for propelling remote learning, its potential for leveling the educational playing field is enormous. Future directions should seek to enable and encourage possibilities to explore this realm in literacy and other academic areas. Advancing mobile learning to the point that it begins to level the educational playing field, nationally and internationally, will require enormous effort and dedication of resources from multiple sources.

Conclusion

We hope this study will inform the school system, government, private sector, and general public in Panama regarding the potential for and obstacles to propelling literacy gains through low-tech, low-cost distance learning options that utilize mobile technology. This knowledge is helpful for and applicable to crises such as COVID-19, but it also has implications for situations beyond the current pandemic. For example, school closures occur during annual school holidays, other public health crises, and natural disasters or weather-related shocks, among other disturbances. At such times, instructional methods to substitute in-person instructional delivery are needed. Mobile learning is a valuable tool, and the procedures detailed in this project are easily adaptable across various circumstances. In addition, they may add value as complements for supplemental coursework design when schools are open during the regular academic year.

The results also signal promise for digitally supported distance education tools that can be used in less technologically connected communities. This type of instruction offers multiple benefits. For example, it educates students on a given topic (literacy, in the case of this project); it trains teachers and students to utilize familiar digital devices and platforms for innovative educational purposes; it makes it possible for less technologically connected schools and households to tap into some of the more sophisticated digital learning content currently being developed throughout the world.

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