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The Impact of School Infrastructure on Professional Learning Community and Teaching Practices: A Systematic Literature Review Framework for Maldivian Schools

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ABSTRACT

Literature shows a clear impact of the schools' physical environment on the professional learning community and teaching practices. As Maldives' quality of education depicts a decline, the paper intends to examine the influence of school infrastructure on the professional learning community (PLC) and teaching practices. A systematic literature review was done on articles between 2018 – 2020. A descriptive analysis and thematic analysis were followed by a framework to comprehend the impact of school infrastructure on PLC and teaching practices. The integrated framework may be used by policymakers and school leaders to create a positive learning environment through a standard infrastructure and improve Maldives' teaching practices. The paper may be examined later to collect empirical evidence to support the study.

1. Introduction

The school's infrastructure is an area where the policymakers, planners, and principals always wrestle to meet the standards to facilitate the educational processes best (Victorian School Building Authority, 2020). The infrastructure or the physical conditions holds all the designs, facilities, and amenities that

create a supportive environment for students' academic journeys in schools (Kamau et al., 2020). The topic has gained constant attention, through extensive literature base, over the decades (Victorian School Building Authority, 2020; Kamau et al., 2020; Akash, 2018; Deppeler and Aikens, 2020; Barrett et al., 2019). However, the influence of infrastructure on professional learning communities is an under explored area (Victorian School Building Authority, 2020; Kamau et al., 2020; Akash, 2018; Deppeler and Aikens, 2020; Barrett et al., 2019). Researches revealed that poor infrastructure significantly affects the learning and development of teachers (Deppeler and Aikens, 2020). Therefore, this has been recognized as a significant area that need further exploration.

The literature also indicated poor school infrastructure in some Asian countries, which requires careful and meaningful upgrading to improve the standard of teaching practices (UNICEF, 2018). Research by the Ministry of Education (2020) in the Maldives summarized that 26% of the schools are disadvantaged in physical facilities where they lack important resource rooms such as libraries, staff rooms, laboratories, and lack of proper hygiene infrastructure and clean drinking water. Ministry of Education (2019), highlighted the disparity in resource allocation between the Maldives' capital city and other islands. Researches also revealed that underprivileged schools showed under rated teaching activities, and poor academic performances (UNICEF, 2018).

The impact of school infrastructure on teaching practices is still an unexplored area in the Maldives with a handful of literature available (Ministry of Education, 2019). The association of school infrastructure, PLC, and teaching practices requires attention globally. Therefore, the study aims to present a theoretical overview, to address the gap and illuminate the impact that school infrastructure may have on PLC and teaching practices in Maldives. It could help policymakers and school leaders understand the impact of school infrastructure on PLC and teaching practices.

2. Method

A Systematic Literature Review (SLR) was carried out to examine the relationship between the factors; school infrastructure, professional learning community, and the teaching practices. According to Mengista et al. (2019), the transparent methodology and integrated literature of SLR makes it a powerful form of research which synthesizes a holistic view of the concept. The information from papers were charted and coded based on descriptive analysis and thematic content analysis. The information was then cross-tabulated under separate categories to explore emergent patterns. An integrated framework was then proposed based on the information gained from the research papers examined.

3. Literature Review

The Systematic Literature Review (SLR) paper identified relevant information about the impact of school infrastructure on PLC and the teaching practices, in the context of all other studies. A framework, as shown below in Table.1, was created to ensure transparency, high-quality process, and minimize bias (Treiblmaier et al., 2020).

Table 1: Framework for Systematic Literature Review

Steps	Outcomes	Methods
Protocol Search	Study Scope	Pre, Primary and Secondary Schools
	Search Strategy	Searching String included key terms “School Infrastructure and Professional Learning Community” OR “School Infrastructure and Teaching Practices” OR “School Infrastructure, Professional Learning Community and Teaching Practices” OR “Professional Learning Community and Teaching Practices.”
	Searched Studies	Search databases Research Gate, Springer Links, Google Scholars
Appraisal	Selecting Studies	Inclusion and exclusion criteria
	Quality Assessment	Quality criteria
Synthesis	Extract data	An extraction template with the author, published year, research methodology, types of publication, study focused country, contribution to the investigation factors, outcome, identified gaps was prepared.
	Categorize data	Iterative definition
Analysis	Data Analysis	Descriptive statistics and thematic analysis
	Results and Discussion	The trend, gap, and results comparison Integrated Framework
	Conclusion	The framework derived would assist in answering the research questions on how infrastructure can support PLC and teaching practices in the Maldives

Source: Adapted from Kraus et al. (2020) and Mengista et al. (2019)

Protocol Search

Protocol search covered the study scope, search strategy, and searched studies. The research scope was decided based on the PICOC framework, which consisted of population, intervention, comparison, outcome, and context (Mengista et al., 2019). The population included articles based on primary, and secondary school teaching levels. The intervention included consideration of school infrastructure. The comparison group consisted of articles reporting the difference in physical conditions and their impact on PLC and teaching. The study outcomes focused 8 parameters which are listed down in the extraction table 3. Hence, the refined objective for this SLR was to examine the impact of school infrastructure on PLC and teaching practices in the Maldives. A research question was framed to guide the review;

1. *How can the school infrastructure impact the professional learning communities and the teaching practices in the Maldives?*

The search strategy followed a search string with critical terms related to the concept, as highlighted in table 1, above. The publications were accessed from

three primary online databases; Research Gate, Springer Links, Google Scholars, for articles between 2018 to 2020 and included journals, e-books, conference proceedings, and project reports limited to the English language. Google Scholars was mainly used as an additional basis for cross-checking articles and getting access to full texts of papers and identifying the gray literature (Treiblmaier et al., 2020). The searching for publications was finalized on 15th September 2020.

Appraisal

The literature search resulted in a total of 1500 articles from three central databases. The papers were appraised based on the inclusion and exclusion criteria illustrated below, in table.2.

Table 2: *Inclusion and Exclusion Criteria*

Criteria	Decision
The key terms existed in the title, abstract, or in keyword sections.	Included
The paper was published in a peer-reviewed journal	Included
The article was written in English language	Included
The report presented evidence on the impact of school infrastructure on PLC and teaching quality	Included
The paper addressed at least one of the three variables	Included
Was a duplicated paper	Excluded
The full texts are not accessible	Excluded
Did not meet the period	Excluded

Source: Adapted from Kraus et al. (2020) and Mengista et al. (2019)

The title, abstract, and keywords were reviewed for identifying the papers. The screening was done by reading the title and abstract and deciding on the topics' relevance. After the screening, 1300 articles were excluded from the review. In the eligibility phase, the content was analyzed by reading the full texts. The process excluded 190 duplicated papers, those outside the time-span, and those that did not allow access to full text, lacked factors under investigation and lacked enough evidence to show the impact of the variables on each other. Hence, 15 articles deemed essential for the systematic literature review were retained for further processes, as illustrated by the four-phase flow chart in Figure.1.

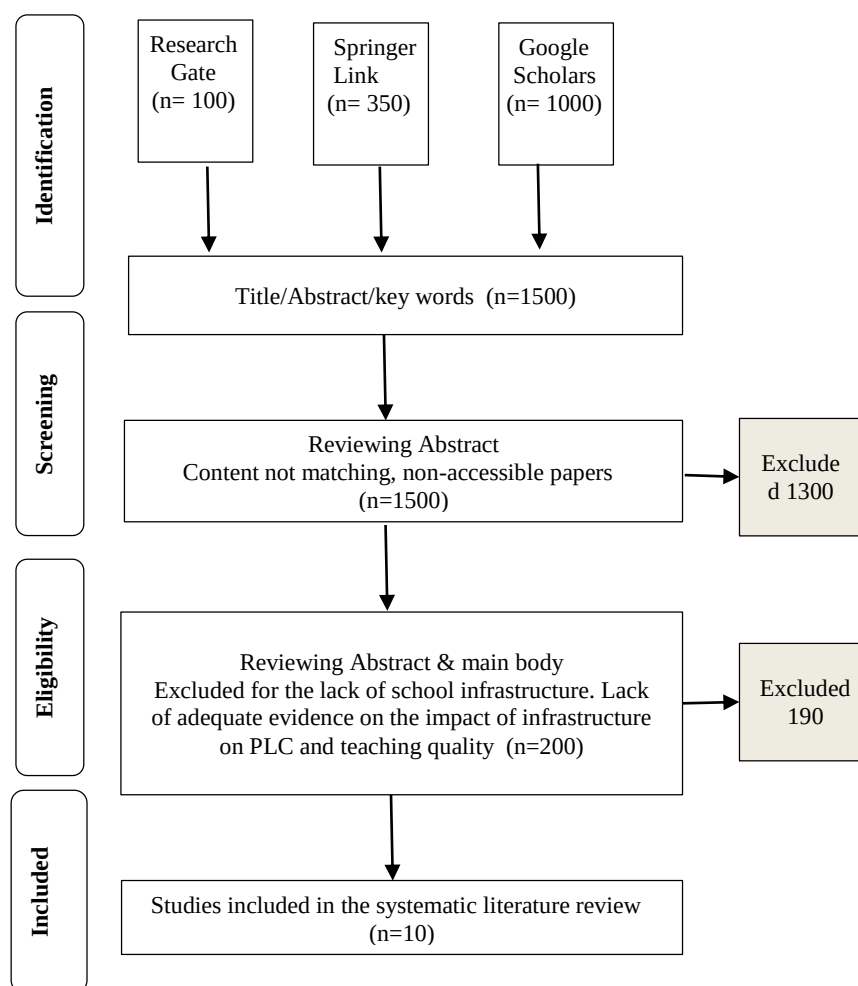


Figure 1: The four-phased flow chart showing the article screening and inclusion process for SLR

Source: Adapted from Kraus et al. (2020) and Mengista et al. (2019)

Synthesis

After that, the selected articles were critically analyzed and relevant data were extracted and categorized before including them at synthesis level. Coding criteria were prepared with specific factors; author, published year, research methodology, types of publication, study focused country, contribution to the investigation factors, outcome, identified gaps. An extraction template was created with the eight parameters, and the data from each article was separately filled up, as shown in the table. 3.

Analysis

The useful information was extracted with the help of descriptive statistics, and thematic analysis. The descriptive statistics included analysis of the publication

distribution over the years, publication types, analysis methodology used, and contributing to the factors under investigation

Table 3: Information Extraction Table

Category	Paper 1	Paper 2	Paper 3	Paper 4	Paper 5	Paper 6	Paper 7	Paper 8	Paper 9	Paper 10
Author	Joanne Deppeler & Kathleen Aikens	Peter Barrett, Alberto Treves, Tigran Shmis, Diego Ambasz, and Maria Ustinova	Department of Education and Training	Donna Hannaway	Maria D. Aygerinou and Sophia Moros	Tess Martin and Ian Thomson	Kay Oddone, Hilary Hughes, and Mandy Lupton	Jennifer Feldman	Pamela Woolner, Ulrike Thomas, Lucy Tiplady	Vivi Kurnia Herviani, Yuliyati, Budiyanto
Published Year	2020	2019	2020	2019	2020	2018	2019	2020	2018	2019
Study Focused Country	Australia	America	Australia	South Africa	America	Australia	Australia	South Africa	England	Indonesia
Types of Publication	Project Report	Book	Book	Journal Article	Journal Article	Journal Article	Journal Article	Journal Article	Journal Article	Conference Paper
Research Methodology	Systematic Literature Review	Systematic Literature Review	Case Study	Qualitative Analysis	Case Study	Case Study	Qualitative	Literature Review	Case Study	Quantitative
Contribution to variable under investigation	Infrastructure - Teaching Practice	Infrastructure - Teaching Practice	PLC - Teaching Practice	Infrastructure - PLC - Teaching Practice	Infrastructure - PLC - Teaching Practice	PLC - Teaching Practice (infrastructure limited)	Infrastructure - PLC	PLC - Teaching Practice (infrastructure limited)	Infrastructure - PLC - Teaching Practice	Infrastructure - Teaching Practice
Identified Gaps	1. How to create innovative physical structure is limited 2. Physical conditions related to teacher learning is limited 3. How infrastructure can promote PLC characteristics is not highlighted	1. Physical conditions related to PLC is limited 2. Relation of PLC to teaching practices is limited 3. Only direct relation of infrastructure with teaching practices were discussed	1. No relation of physical conditions to teacher PLC discussed 2. Physical condition was related to teaching practices and student learning	Technology component of infrastructure was only discussed	Technology component of infrastructure was only discussed	Role of Infrastructure was limited	Relation of Infrastructure and professional learning to teaching practices is not discussed	Relation of Infrastructure to professional learning discussion is limited	Discussion limited to only few examples of physical conditions to PLC and teaching practices	Only direct relation of infrastructure with teaching practices were discussed

Outcome	1. School buildings need to be more open, flexible, innovative - portable classrooms, experimental spaces, technology-rich environment - can empower student participations, greater sense of community	evidence of holistic space & educational technology on student learning, improving teaching pedagogy with safe & healthy learning space, classroom characteristics & sizes were discussed	1. Multiple learning settings & spaces, suitable furniture to include all, access to ICT, sports fields, drinking water, proper toilets - how it promotes human connectedness, participation, contribution and engagement of community, safety and security, aesthetically pleasing facilities, --- empower students, intellectual engagement and self-awareness	Interrelation between technological and pedagogical content knowledge - financial resources, technology infrastructure, better access to devices, sustainability - teacher planning & preparation, stimulate collaboration between stakeholders, support the curriculum, teacher development, learning materials, school management, supervision, teamwork, production of knowledge, communication between educators and students, achievement of results, growth in higher order thinking and problem-solving	Professional learning under pandemic-Supportive Infrastructure & Digital Applications - Support Network & Connectedness, Educator Preparation, e-Learning, Flexibility, collaboration, Remote Learning Strategies, Community of Inquiry Approach, Community of Practice, Fostering Interaction, Just-in-Time Professional Development, Personalized Professional Learning, Community, Home-School Connection, Building Resilience during pandemic, Research-Based Design, Self-Study	PLC - school-based and collaborative learning, continuous professional development, ongoing, job-embedded, needs-based workshops, train the trainer, gain knowledge and skills - improve teacher preparedness, projects, portfolios, mentoring, collaborative lesson planning, co-teaching, and peer learning, study groups, use of ICT	PLN model - social technologies, learning resources, online profile - networked learning, individuals & groups work together, context-based, socially constructed & self-determined, learning is driven autonomously, diversity & interactivity, equitable and accessible, co-construct knowledge and understanding, shared purposes & mutual interests, update and refresh knowledge, advice and further support, offer and receive feedback, gained greater self-confidence, collaborate across geographic and temporal boundaries	PLC - social practice theory - beliefs, attitudes, and values cultivated within social practice, on-going collective practice, shared and collaborative, similar conditions, - teachers are carriers or performers of beliefs, attitudes, and values, repeated practices can become implicit rules - the social setting where professional practice takes place are schools - needs to be aligned	PLC - physical school environment - facilitate social practices -eg; England school - gardening program - deeply embedded change into pedagogy and culture, embedded in physical space, continuous training, collaborative practices, on-going, mutually dependent, curriculum coherence - extremely successful - change at a structural, cultural and individual level	PLC - Inclusive Education - Facilities and infrastructure simplify and expedite the process of education / land, building, equipment, school furniture, learning tool, space resources, learning materials - accessible for all learners - independence, safety and autonomy for all
	2. physical conditions should allow ongoing and authentic collaboration, shared values, experiential, build trust and skills, problem solving - can reshape teaching practices									

Source: Developed from the Literature

4. Results and Discussions

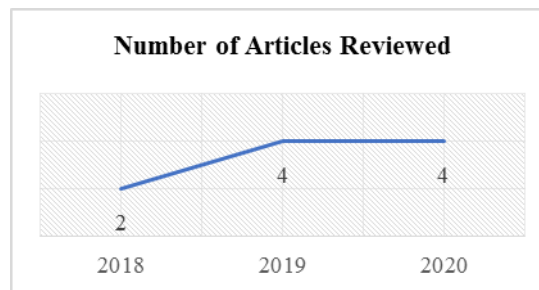


Figure 2: The Graph Showing the Number of Articles Accessed Over the Three Years

Source: Developed from the Literature Review

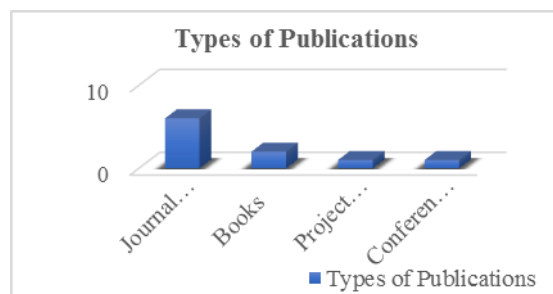


Figure 3: The Graph Showing the Types of Publications Accessed

Source: Developed from the Literature Review

Descriptive Analysis

According to Mahimuang (2018), PLC is a concept that is still evolving with new perspectives and dimensions added to the growing literature. Therefore, the literature search was limited from 2018 to 2020. The graph in the figure.2 below, shows the spread of the publications over the three years. As the trend shows, only two papers were accessed in 2018, whereas four articles were accessed in 2019 and 2020, consecutively. Therefore, the infrastructure's relevance and interest concerning PLC and teaching practices are shown to be inclining slowly and steadily.

The graph in the figure.3 represents the types of publications included in the review. As illustrated by the chart, the association of school infrastructure with PLC and teaching practice seemed to be gaining interest among researchers. The maximum number of publications were journals, and all were peer-reviewed ones. The result implies that the authentic writings that had passed through formal academic processes are also increasing under this domain.

Figure.4 below represents the research methodology used in the papers reviewed. According to the graph, 40% of the publications have adopted a case study method, 30% were systematic literature reviews, 20% used qualitative analysis, and only 10% have used quantitative analysis methods. Systematic literature review, case study method, and qualitative methods are mostly used

to get in-depth knowledge about concepts and topics (Flick, 2018). Based on the results, it can be said that the authors and researchers find the integrated effect of these three factors as a new concept and are still trying to get a deeper understanding of their impact on each other

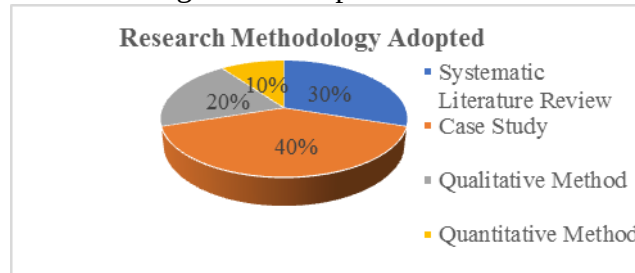


Figure 4: The Graph Showing the Research Methodology Adopted

Source: Developed from the Literature Review

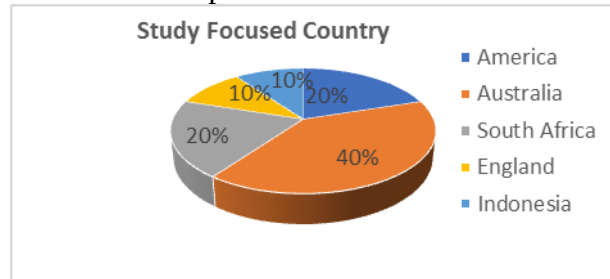


Figure 5: The Graph Showing the Study Focused Area

Source: Developed from the Literature Review

According to the figure.5, 40% of the publications were based on Australia, 20% were from America and South Africa, and 10% were from England and Indonesia. In general, it could be said that 90% of the publications included in the review process were from western countries, whereas only 10% was contributed from an Asian country. This result came in consensus with the various researchers who claim that PLC related models and theories are more famous in western countries than the Asian region (Herviani et al., 2019).

A content analysis of the selected papers' contribution to the investigation factors showed that only 3 articles related the three factors; school infrastructure, PLC, and teaching practices. While 3 reports displayed PLC and their influence on teaching practices, another three papers directly linked the school infrastructure to teaching practices. Only one article compared the two variables; school infrastructure and PLC, separately. The result concludes that there is greater scope to examine the role of infrastructure on PLC and teaching practices.

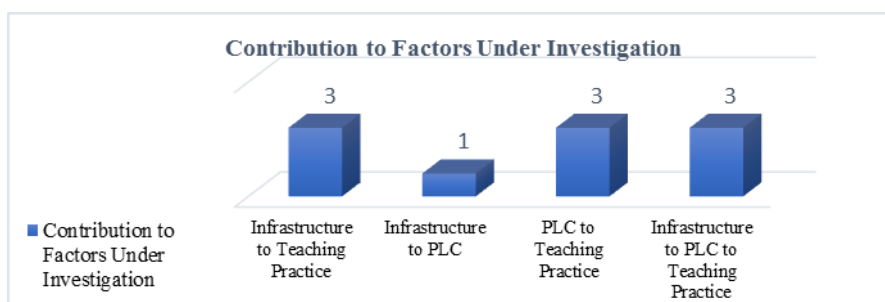


Figure 6: The Graph Showing the Contribution of the Paper to the Factors Under Investigation

Source: Developed from the Literature Review

Thematic Analysis

After thorough content analysis of the ten publications in the review process, four main themes were derived, as illustrated in the chart below;

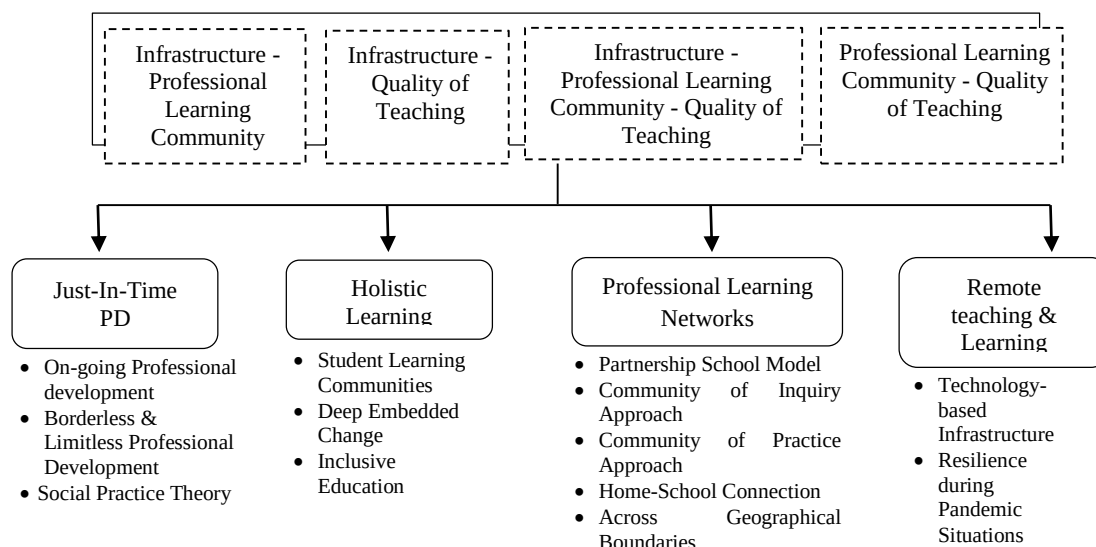


Figure 7: Chart representing the main themes derived from the content

Source: Developed from Literature Review

Just-in-Time Professional Development

The just-in-time PD approach boasted of passing on the right information in the right place at the right time (Ferdig, 2020). The method opens knowledge opportunities to teachers, wherever and whenever they desire (Ferdig, 2020). The world is changing rapidly, and new knowledge is created every day (Woolner et al., 2018). In such an arena, knowledge distribution and acquiring should also be fast, on-going, and authentic (Woolner et al., 2018). Deppeler and Aikens (2020), supported the argument and stated that the physical environment of a school should be an 'educational hub' where knowledge is openly available and easily accessible. For instance, updated and resourceful libraries, fully - equipped computer and science laboratories would help the teachers prepare for the lesson and collect the latest updates regarding the content areas (Barrett, 2017). Availability of responsive technology, such as

intranet and internet facilities, digital tools, electrical outlets in staff rooms, classrooms, and in the school premises, would make the process of learning more comfortable and contended for teachers (Barrett et al., 2019). The design and the layout of the school building, classrooms, corridors, and the school as a whole, should enable teacher collaboration and team learning (Martin and Thomson, 2018). Such facilities keep the teachers connected at all times, and may facilitate co-teaching, discussion, experimenting, and inquiring curriculum content (Ferdig, 2020).

Feldman (2020), attempted to understand the usefulness of professional learning communities through the lens of social practice theory. She argued that beliefs, attitudes, and behavior can be cultivated and modified through social practices where the repeatedly performed behavior and practices gets embedded in the culture and becomes the explicit rules (Feldman, 2020). In this sense, the on-going learning practices may cultivate a culture and reshape the teaching and learning practices (Ferdig, 2020). However, Barrett (2017), argued that the social settings in which the learning or practices occurs are the schools and the physical conditions of schools should be built and designed to stimulate professional learning and professional teaching practices.

Holistic Learning for Students

The physical environment is known as the ‘third teacher’ in a school, which can either stimulate or hinder the teaching and learning processes (Shmisdiego et al., 2019). Hence, it requires careful planning and execution to build up meaningful structures to support the students’ learning from every corner of the schools (Kamau et al., 2020). The dimension, layout, and interior design must promote desirable social interaction, professional communication and motivation among students (Azar et al., 2019). The new-generation students look for open, flexible, and comfortable spaces that promote a continuum of education and recreation (Katsantonis, 2020). The research claimed that the corridors, outdoor learning corners, and the school premises designed to promote informal discussions and educational games, create a broad range of learning experiences, and improve academic performances (Deppeler and Aikens, 2020).

The space and facilities in a school must create environments that ensure equitable use by all students (Deppeler and Aikens, 2020). Literature also believed that physical conditions must cater to students' physical, cognitive, socio-emotional, and sensory abilities (Victorian School Building Authority, 2020). According to the ergonomic principles, prudently designed resources and facilities are believed to exert a powerful influence on the education system (Nalanda International School, 2020). According to Barrett (2018), well-designed classrooms influenced 16% of the learning outcomes of students. Shmisdiego et al. (2019), raised the psychological angle and argued that physical-sensory elements in classrooms, such as light, color, sound, and space, are significant to minimize students' and teachers' stress levels and maximize lessons' effectiveness. Kapur (2019), added to this matter and said that properly ventilated classrooms with a cooling and heating equipment provision are

adequate to keep the students concentrated and intact in the lessons. The research also highlighted special adjustments such as ramps integrated with stairs, adjustable benches, rooms for aides, and flexible spaces are essential features of schools in order to accommodate physically challenged students and those with various abilities (Herviani, 2019). Research by Shmisdiego et al. (2019), identified playgrounds as essential in conducting leisure and recreational activities, sport festivals, competitions, training sessions, or events. These activities, not only, develop students' sports but also stimulate their minds, foster creativity, and create a culture of learning (Kapur, 2019). Woolner et al. (2020), shared an extremely successful example of a gardening program, from an England school, which showed how holistic learning can occur when teaching practices are deeply embedded into the school's structural and organizational culture. The example explained how the alignment of vision, mission, school activities, the curriculum, training programs, school rules and teacher schedules with the program resulted in meaningful and holistic teaching and learning (Woolner et al., 2020).

Professional Learning Networks (PLN)

The Partnership School Model is a concept under the professional learning network, where groups of teachers work together as a team towards the same goal (Oddone et al., 2019). Different schools adapt to this concept at different levels (Katsantonis, 2020). Some schools prefer teachers teaching similar subjects to form small learning groups or communities where they discuss the queries related to the topics such as curriculum depth and interpreting complex strands (Martin and Thomson, 2018). The activities may be limited to simple knowledge discussions or extend themselves to more complex and meaningful learning (Katsantonis, 2020). The community of inquiry is one similar networking group where a group of teachers delegate subject areas or topics or common subject related concerns among themselves, inquire and research to collect detail information, and share them among the team (Ferdig, 2020; Al Aqad, 2018; Al Aqad, 2017; Al Aqad et al., 2017; Azar and Adnan, 2020; Hashim et al., 2016). Some groups use sharing platforms such as conferences or seminars to come together as a learning team (Katsantonis, 2020; Al Aqad, 2017; Al Aqad et al., 2017; Azar and Adnan, 2020; Hashim et al., 2016). The community of practice also forms groups of teachers or practitioners to share their learning experiences or practices through video lessons, demonstrations, learning materials, teaching aids, and or discussion of best practices (Kamau et al., 2020). The professional learning networks can support the teachers and their professional work, despite the geographical boundaries, limitations of space, and time (Katsantonis, 2020).

The learning networks may also connect teachers and parents to discuss and guide each other on improving the teaching and learning processes (Nalanda International School, 2020). This home-school partnership would strengthen the bond between teachers and parents, which is regarded as a positive effect on the students (Kamau et al., 2020). The professional learning networks greatly impact teachers' work by reducing their workload, teacher isolation, and

attrition (Katsantonis, 2020). However, it requires a carefully designed technology-rich infrastructure to connect to the world outside the schools and work effectively (Nalanda International School, 2020).

Remote Teaching and Learning

Technology-based infrastructure or digitalization is a concept that had been advocated by several researchers over the decades (Treiblmaier et al., 2020). However, the current pandemic situation has made the remote teaching and learning a necessity of existing period (Frolova et al., 2019). All the regular teaching and learning activities, such as delivering lessons, doing assessments, clearing doubts and queries, marking attendance, are all carried out via virtual classrooms (Ferdig, 2020; Azar et al., 2019). Besides, essential meetings, functions, and ceremonies are also conducted out virtually (Treiblmaier et al., 2020). Moreover, any teacher training programs such as webinars, social media collaboration, and interaction through educational websites have become everyday practices (Treiblmaier et al., 2020).

However, some schools, especially in developing countries, are still struggling with this form of teaching and learning (Treiblmaier et al., 2020). Amongst the main challenges are the lack of adequate digital equipment and tools, digital applications, internet availability and speed, and user unawareness (Ferdig, 2020). Therefore, Covid-19, though a severe virus, came as an impactful teacher who made the school leaders and educators realize the importance of technological infrastructure and digitalization in teachers' professional learning and the teaching and learning of students (Ferdig, 2020).

The limited amount of publication with the three factors under investigation, school infrastructure, PLC, and teaching practices, implies that this is an area with ample scope to explore further and understand the association of the factors with each other. Hence, the key components in the 10 articles reviewed, were compiled to develop an integrated framework to answers the research question.

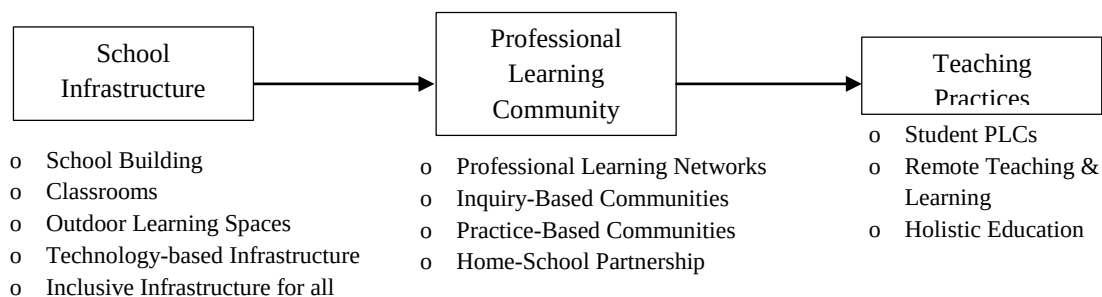


Figure 8: The Conceptual Framework Showing the Impact of School Infrastructure on the Quality of Education

Source: Developed from the Literature Reviewed

5. Conclusion

The paper constructed a conceptual framework on the impact of schools' infrastructure on the teaching practices, based on the literature. The research on the area depicted disparity and inadequacy in resource allocations in Maldives schools, which lead to inappropriate infrastructure. Therefore, the study explored the current literature and offered a framework to understand the dimensions of infrastructure that influence professional learning communities and enhance teaching practices. The lack of existing theories and models integrating the three areas, school infrastructure, PLC, and teaching practices, could limit the study in getting a comprehensive understanding of the topic. Most researchers focused on specific parts of the framework, and therefore, the components from different researches had to be compiled to get a meaningful framework.

The review paper would yield several theoretical and practical implications. The paper provided vital themes and methods which discussed new ideas and applications from a holistic view, to contribute to the existing literature. Hence, the study could be a path for future studies and research in the field, especially in the Maldivian context where literature is scarce. Besides, the integrated framework enlightened the facilitators and barriers in the association with school infrastructure, PLC, and teaching practices. The enlightenment could improve the existing models and theories in the field. The integrated framework may assist the policymakers and school leaders to make new policies and amend the existing systems. This study would allow the school leaders and educators to adopt this framework and plan the design and layout, and establish the facilities, tools, and equipment to enhance the teaching and learning processes.

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