Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 4, 3072-3081
2025
Publisher: Learning Gate
DOI: 10.55214/25768484.v9i4.6728

Pre-service teachers' use of educational applications during work-integrated learning in south African primary schools

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Abstract: Mobile technology has evolved and become accessible to classroom learning. Responding to digitalization in higher education institutions, using educational applications has become inevitable and crucial to prepare students for a dynamic world in which technology takes center stage. The 2015 university disruptions caused by the #FeesMustFall protests and the recent outbreak of Covid-19 shed light on the need to strengthen technological educational systems. This paper uses the Technology Acceptance Model as a theoretical lens to explore pre-service teachers' use of educational apps during their teaching practicum, referred to as work-integrated learning (WIL). The study is placed within an interpretive paradigm and is qualitative in nature. Data were collected through interviews with nine pre-service teachers doing WIL in three primary schools and analyzed thematically. The study makes a significant contribution to the scholarship of digital transformation in teacher education programs. Furthermore, it ascertains the possibilities and challenges of increased digital transformation affordances in teaching–learning strategies and pre-service teachers' classroom practices during WIL.

Keywords: *Educational applications, Mentor teachers, Pre-service teachers, Work-integrated learning.*

1. Introduction

Mobile technology has evolved and become accessible to classroom learning around the globe. Due to growing technological change, investment in technological devices to ensure access is visible in higher institutions of learning [1]. Research has also shown motivation and engagement in student learning experiences because mobile technology grants them access to content and communication from various locations. In addition, students have access to advanced structures such as computer labs, digitalized library systems, learning management systems, and stable Internet [2]. The rapid changes and fast developments in society [3] brought opportunities to strengthen digitalization in higher institutions of learning to keep pace with the demanding trends of transformation.

Digital transformation is an inevitable change of technology adoption and acceptance [4]. Within the education sector, this transformation process involves a shift from traditional instructional practices to digitalized learner-centered-driven learning. Thus, digital transformation brings positive changes such as accessibility and inclusion, personalized learning, and engagement [5]. Various aspects of digital transformation in education have been investigated in basic and higher education institutions. Amongst these are hybrid teaching and an integration of information and communication technology (ICT), where different forms of technological devices are used in the process of teaching. The requirements for digitalizing education in South Africa are clearly spelled out in policies governing this evolving transformation, such as the White Paper on e-Education for basic education. However, research on ICT in education posits challenges that accompany digitalization despite the clear governmental policies [6]. Challenges cut across lack of resources, lack of technical skills and knowledge, and contextual challenges such as attitudes and beliefs on the use of ICT to teach [7]. Therefore, the digitalization of education remains complex yet necessary for effective quality education.

History: Received: 6 February 2025; Revised: 9 April 2025; Accepted: 15 April 2025; Published: 30 April 2025
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To respond to digitalization in higher education institutions, educational applications or apps have become crucial to prepare students for the dynamic world in which technology has taken center stage. These transformation movements advance daily, and it is remarkable that institutions of higher learning act to make sense of these changes and then implement them for the benefit of students [8]. Given the opportunities brought by digitalization, the holistic transformation agenda depends on deliverables where students are equipped with digital competencies as part of their graduate attributes and can utilize these skills in their working environment [9]. Thus, adaptation of new realities as well as cultural change that challenges attitudes, actions, and values shared by stakeholders to enable various types of learning all shape the future of society.

Globally, digitalization of education differs from country to country, where some countries seem to be advanced, while others, specifically developing countries, still struggle to explore this transformation agenda. For instance, mobile technology is widely acknowledged as a tool for learning in schools Falloon [10]. Badia, et al. [11] postulated that how teachers perceive technology in education has an instructional benefit to learners. While digital technologies may transform learning processes and systems, it is imperative to ensure that they are utilized in a way that enhances quality education. Some of the initiatives toward digital education include learning management systems, open educational resources, computer-aided instruction, and mobile learning.

Policies on digitalization are clear in higher institutions of learning and the impact of mobile technology to enhance learning has been extensively studied. In the South African context, university disruptions caused by the 2015 #FeesMustFall movement, and the recent Covid-19 pandemic shed light on the need to strengthen technological educational systems [12, 13]. These abrupt disruptions needed urgent intervention to ensure necessary measures are put in place to cover learning losses. The use of digital devices became a useful didactic resource to conducive educational interaction [14]. The question of whether university programs equip students with the necessary digital skills to respond to the work environment is an area of concern. Not only are these skills necessary, but mobile devices and educational apps are accessible and becoming cheaper [15]. Hence the need to establish policy in place vis-à-vis students' ability to apply the knowledge and skills in the work environment.

Teacher preparation on the use of educational apps is critical toward the digital transformation in higher institutions of learning. Kanyane [16] argued that digital transformation enables optimal work from anywhere to maximize productivity in the advancement of the academic project and to produce global competitive graduates who are relevant locally. While this is the case, there seems to be misalignment in preparing teachers, which then compromises the transformation agenda. For instance, unclear strategy for digital transformation in schools hampers technological initiatives [17]. What needs to be investigated is transferring skills acquired to real work situations. Therefore, this study focuses on pre-service teachers' use of educational apps during their WIL.

Educational apps are embraced and accessible within and outside the school context. Research has indicated that educational apps are becoming an integral part of children's cognitive development due to the support they offer during the learning journey [18] and convenient opportunities they provide for learning. Generally, the development prospects of educational apps are good [19]. Thus, the rapid development of educational apps undoubtedly provides convenient opportunities for learning. While access to technological devices and connectivity is spreading quickly in developed countries, access to technology in ways that are relevant and practical in developing countries is not spreading anywhere near as quick. For example, educational apps have become extremely popular in developed countries but remain a topic of debate due to the benefits and challenges they present [20]. While educational apps have the potential to improve education outcomes in developing countries, contextual factors such as content quality, available and appropriate infrastructure, and capacity of skilled teachers in digital technology need to be considered [21]. This might affect the use of educational apps for teaching, as it requires stable Internet and electricity. It is against this background that this study sought to determine pre-service teacher experiences on the use of educational apps during their teaching practice or WIL.

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ISSN: 2576-8484
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For the purpose of this study, WIL entails time where students are placed in schools to do teaching practice. Therefore, in this study, WIL is used and not teaching practice.

2. Problem Statement

Use of iPads or tablets in the classrooms is promoted in the United States, the United Kingdom, and in Middle East countries, but it remains a challenge in Asia and Africa [22, 23]. Google has recently launched Google Apps Supporting Programs for the University of Ghana to promote the usage of Google products in the field of education. The most used electronic device for classroom is the iPad, together with an educational app used by teachers and lecturers to make the classroom active and the students attentive. There are many mobile educational apps that can be used by educators to promote work and play in the classroom [24]. This means that teachers make use of apps, the Internet, and computers to teach in the classroom, which makes teaching and learning more interactive, collaborative and replaces the conventional chalkboard. This study sought to explore pre-service teachers' experiences in the use of educational apps during WIL in primary schools. Several studies in African countries have focused on the use and integration of ICT in teaching and learning [25-27] yet too little is known about the use of educational apps due to limited research on the phenomenon. Hence, this study intended to establish the extent to which pre-service teachers (given the digital transformation agenda in higher education) use the skills acquired in class in their teaching. Considering the rapid increase of and access to educational apps, and response to digitalization movements in higher institutions of learning, it becomes imperative to establish students' readiness for fieldwork. To contribute to the scholarship, the study was anchored by the following questions:

- What opportunities and challenges do pre-service teachers encounter when using educational apps during work-integrated learning?
- To what extent do teacher programs demonstrate success (and challenges) in digital transformation?

3. Rationale for the Study

This study is part of a research project called *Digital Transformation in the Teacher Education Program*. The goal of the project is to promote digitalization amongst a group of teacher educators by creating a community of practice as a platform for sharing knowledge and emerging practices. The project intends to enhance networking, small group discussion, and digital transformation. The initial phase of the project involved supplying the participants with a tablet to adjust teaching and learning processes to the new realities and challenges of using technology in ways that prepare pre-service teachers and maximize their readiness for a reshaped workplace. Therefore, this study focused on pre-service teachers' experiences in the use of educational apps during their WIL as one of the objectives of the project.

4. Theoretical Framework

This study used the technology acceptance model (TAM) as theoretical lens to explore the experiences of pre-service teachers in the use of educational apps during WIL. The TAM provides an explanation of the determinants of computer acceptance to explain user behavior across a range of end-user computing technologies [28]. Subsequently, the theory examines factors influencing pre-service teachers to adopt and integrate ICT, in this case educational apps in teaching and learning [28, 29]. This theory was relevant for this study to provide an understanding of the extent to which pre-service teachers use educational apps to teach. The theory was basically used to address pre-service teachers' acceptance or rejection of ICT and how their acceptance is influenced by technological characteristics across perceptions and their attitudes toward ICT [28]. Within the context of this study, pre-service teachers' beliefs, attitudes, and intentions are critical factors in the use of educational apps as an aspect of ICT in teaching and learning.

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5. Methodology

This study focused on Intermediate Phase (grades 4 – 6) final year students. These pre-service teachers were allocated for WIL evaluation and were engaged in the use of educational apps throughout their four-year Bachelor of Education (BEd) program. For the purposes of this study, evaluations were suitable to establish the extent to which final year students are able to put theory into practice. During school visits for evaluation, pre-service teachers were briefed on the intents of the study and nine showed willingness to participate in the study. The initial intention was to observe student-teachers' classroom practices, followed by an interview to obtain insights into their experiences.

This qualitative study was placed within an interpretive paradigm to interact with pre-service teachers to construct meaning from different perspectives [30]. An exploratory case study was employed to gain in-depth insight into pre-service teachers' experiences on the use of educational apps to teach [31]. Participants were selected both purposively and conveniently. Purposive selection was done as they were final year students who were exposed to the use of educational apps to teach through the curriculum in their BEd program [32]. Convenient selection was done as these were student-teachers allocated to the WIL evaluations [32]. Data were collected through focus groups and semi-structured interviews [33]. Focus group interviews explored the challenges and possibilities participants encountered on the use of educational apps. In addition, semi-structured individual interviews were conducted with student leaders to establish their experiences on the use of educational apps during WIL. It is worth noting that while students choose schools for WIL, the teaching practice unit approves schools within a specific radius from campus and with a minimum of three students per school. Therefore, student leaders are selected to serve as mediators between other pre-service teachers, school-based mentor teachers, and university lecturers/evaluators. Thematic analysis was used to identify, analyze, and report themes that emerged from the data generated [34].

As mentioned, this paper falls under the umbrella project on digitalization of education. Ethics guidelines were adhered to, and ethics approval was obtained from the General Human Research Ethics Committee of the university under study. In addition, permission to conduct the study was sought from the same institution. Participation was voluntary and participants signed consent forms to ensure confidentiality and protection from harm [33]. To protect the identity of the participating pre-service teachers and schools that formed part of the study, they were codenamed (A, B, and C for schools, FG for participants who took part in the focus group, and SL for the student leaders).

6. Delimitations of the Study

The study focused on the pre-service teachers' experiences in the use of educational apps during WIL in primary schools. The target was final year pre-service teachers assigned to the first researcher as an educator for evaluations. These participants were deemed information-rich participants because they had been exposed to educational apps through different modules throughout their BEd program in the previous three years of their study. Based on a limited sample of participants, conclusions made are applicable to the context under study and not to all South African schools. More studies may be conducted on this phenomenon, particularly in well-resourced schools where Internet is accessible and available to all stakeholders.

7. Findings

The popularity of educational apps has grown significantly over the years. However, accessibility of these educative apps in all South African public schools remains a challenge. This is due to the lack of resources in schools and loadshedding that in many instances constrain the stability of the Internet as well as the ability to teach using educational apps. The latter speaks to teacher education programs on how pre-service teachers are prepared for the real-world digital situation. Nonetheless, its influence and enhancement on interactive classroom learning may not be ignored [35]. Data analysis yielded three major findings. First, prior to data collection, it was determined that the three schools under study were

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ISSN: 2576-8484
Vol. 9, No. 4: 3072-3081, 2025
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not ready to implement digitalized education. Second, pre-service teachers had low confidence in the use of educational apps. Third, the disjuncture between basic and higher education as far as WIL is concerning.

The three schools in which the students were based to conduct their WIL were not ready to integrate technology in teaching and learning in terms of access to resources. Intriguingly, the schools had Wi-Fi and laptops, but teachers and learners were denied access for various reasons. For instance, teachers used the Internet for personal reasons, while learners were affected by the school policy on no cellphones which was also visible from the school sign boards at the entrance and some of devices such as overhead projectors together with speakers were locked in school strong room for safety purposes. This was a critical finding for this study prior to data collection, as it affected the methodology of the study.

7.1. Readiness of Pre-Service Teachers versus Fieldwork Readiness for Implementation

Participants in this study agreed that they were ready in terms of using educational apps in the classroom. This was evident from educational apps such as Google Classroom and Kahoot! that were downloaded on their mobile devices. The three schools that formed part of the study had inaccessible Internet due to different reasons. School A had electricity, but the classrooms were not technology friendly. The school had only one overheard projector that was locked away in a strongroom. This device was only used in staff meetings in some instances. The SL in School A had this to say:

I have educational apps on my phone, but to connect the overhead projector takes time because that also means I must bring my own laptop because the school uses a desktop computer stationed in the admin building. It is quite a daunting exercise, because we change periods; the time I am done connecting, it will be the next period.

It is evident from the above assertion that the use of educational apps to teach is complex as the working environment is not ready for societal demands. This digital division has implications on teaching and learning as it deprives learners of the opportunity to experience engaging lessons. It cannot be ignored that learners, particularly in primary schools, are fascinated by modern technology [36] in this case educational apps. Another essential finding regarding school readiness is the limited or no access of teachers to Wi-Fi within the school premises. When probed, participating pre-service teachers pointed out that the Wi-Fi could only be accessed by administrators and the school management team. Teachers' personal computers and mobile devices were not connected to the school Wi-Fi. In addition, materials were downloaded from desktop computers, which then made it a challenge to use educational apps in the classroom context. The following narrative came forth in the focus group:

Electricity is there, Wi-Fi is there, but teachers don't have access to the school Wi-Fi … apparently teachers don't really use it accurately. We use the varsity Wi-Fi because we stay on campus; we would bring my laptop and at least make learners have a feel, but data is expensive. (FG: School C)

Participants communicated that while educational apps may improve lesson delivery, encourage active participation, and portray real-life situations, digital division in public schools remains a challenge. Institutional and infrastructural factors cause barriers to adoption and integration of ICT during teaching and learning. This finding is consistent with that of Japhet and Usman [26] who hinted that the lack of access to technological tools is a barrier to the use of ICT in teaching and learning. Teachers' lack of expertise in the use and integration of technology is a prevalent problem in many classrooms [26]. The pre-service teachers who participated in this study possessed the necessary expertise and were ready for implementation. This implies that contextual factors vary and that the success of digitalized education in schools depends on consideration and mitigation of these challenges.

Another essential finding emerged from discussions with the pre-service teachers as they highlighted that the selection of relevant educational apps may be useful to improve learners' comprehension skills, providing proof of their readiness to implement. This is what was said:

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 4: 3072-3081, 2025
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Some of the educational apps are not really educational, so it is also critical to select relevant apps that match with learners' age. Learners in primary school are fascinated by games and cartoons, so Google Classroom is so relevant because it can be adjusted to suit different needs of learners. (FG: School B)

The pre-service teachers perceived educational apps such as Kahoot! and Google Classrooms as valuable tools to promote learner engagement. It is also apparent from the literature that children may learn from well-designed educational apps [37]. While the pre-service teachers' responses were based on abstract rather than practical experience, it can be concluded that educational apps may help learners understand the content better in an interactive manner. The data generated from this study unravel implicit and explicit assumptions about the nature and purpose of educational apps. Therefore, considerable effort is required to avail resources for learning affordances.

Pre-Service Teachers' Confidence in the Use of Educational Apps to Teach

Participant comments within this theme revealed enablers and constraints on the application of skills (using educational apps) acquired in higher institutions of learning. Participants highlighted confidence in using rather than teaching with the technology. Thus, they themselves were able to play around on the educational apps but were not sure if they could use the apps to teach learners adequately, as they had planned to do during WIL. When probed, participants highlighted that:

I was looking forward to use some of the educational apps in my class, but now I'm not sure if I will be able to teach learners …. I am certain given an opportunity, I would share what I know with learners. (FG: School C)

We used Google Classroom in one of my lectures and I saw it was interesting. And it can be contextualized according to learners' needs, but here there are no tools to use, I was hoping to explore this when I do fieldwork. (SL: School C)

The assertions above indicate the pre-service teachers' willingness to implement technology in the classroom, but that situational factors prevented them from doing so. Several studies under the umbrella of technology in education highlight lack of skills and resources. In this case, schools were resourced but teachers denied access. On the other hand, in their study on the impact of the lack of ICT resources on teaching and learning, Munje and Jita [27] highlighted the availability of a laboratory with dysfunctional computers in one school. This indicates that the lack of resources may not necessarily be the only hindrance, but also situational factors such as misuse, management, and maintenance of available resources. The pre-service teachers in this study were skilled and had knowledge, but in their view, they might lack confidence to implement it because they did not get an opportunity to use educational apps to teach. This had implications for their competence in putting theory into practice because they intended to use WIL for trial and error in preparation for their employment.

As seen from the data collected from participants in the study, confidence in using educational apps is influenced by the availability and accessibility of resources in schools where they are doing their WIL. In the article on preparing pre-service teachers to guide and support learning in South African schools, Van Der Merwe [38] reported on the need to infuse competencies for a fast-changing world as valuable to enrich their teaching. Participants' prior technological experience gained through training had influenced their ability to implement technology in their teaching.

7.2. Bridging the Gap between Basic and Higher Education on Digital Transformation

Regarding the gap between the Department of Basic Education and the Department of Higher Education and Training in South Africa in terms of preparedness for digital transformation. the institution under study digitalization implementation document stipulates its choice to "accelerate its digitization through development of a comprehensive digitalization implementation plan". This entails higher institutions of learning have clear plan of preparing students for real-world demands. Subsequently, participants of this study indicated that they were well prepared throughout the four-year education program on the use of educational apps to teach. However, the realities found in schools hinted on the gap between basic and higher education. When probed on this gap, one participant had this to say:

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 4: 3072-3081, 2025
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While I don't doubt, I would have done well using the apps to teach NS (Natural Sciences) … so the skills will eventually go in vain. I'm imagining a situation where I get a job in a school with similar challenges or even worse, no resources at all …. This is a problem because we can't practice what we were taught. (SL: School B)

In line with the above excerpt, the focus group discussion unraveled the following:

But the challenge now is what is happening in schools and universities does not match at all …. I mean, we have access to a lot of apps, we have Wi-Fi, but schools [where] we will practice do not have such privileges. I think this is why schools are not doing well technological-wise. But here, it's sad because it's misuse of resources that led to lack of access … we just hope they at some point find other ways to monitor rather than limiting resources that would bring a difference. (FG: School C).

At (name of the university removed), there are apps that are blocked for access, like dating apps … (laughs); so, they may block some of the apps, like Facebook, because they say teachers use the Internet for social media. (FG: School A)

The excerpt above portrays educational gaps identified between two educational sectors. This discrepancy points to inequalities in the education sector, which then compromises quality education. This is consistent with Jayaprakash and Chandar [23] report that several universities around the globe use educational apps in and outside classrooms. They further highlighted challenges such as cost and monitoring difficulties that schools should consider before bringing educational apps into the classroom. This is a critical aspect to consider, as data in the study also showed that schools banned teachers from using the Internet as they were to focus on personal rather than educative purposes.

8. Discussion of Findings

This section presents a discussion of the findings according to the research questions.

- What opportunities and challenges do pre-service teachers encounter when using educational apps during work-integrated learning?

In terms of opportunities and challenges, this study views pre-service teachers as relevant agents of change toward effective digital transformation in schools. These students are trained in technology and understand the dynamics of using technology in the classroom. The pre-service teachers who participated in this study agreed that educational apps create opportunities for learners to engage in interactive lessons, for collaborative learning, and for pathways to new ways of learning. This is consistent with Domingo and Garganté [39] who found that teachers using relevant apps perceive the significant impact of mobile technology in creating new ways of learning.

However, participants also highlighted challenges they encountered during the time spent in schools for practical teaching. Challenges ranged between inaccessibility and limited, and in some instances lack of, technological resources. Research has shown that the lack of resources in schools is a major hindrance for successful teaching and learning. Within the context of this study, lack of resources was a minor factor, wherein resources were available but not accessible. Participants highlighted that this was due to misuse of the available resources. For instance, teachers used the school Internet for personal use and sometimes did not attend class. This finding is interesting in that while literature points out the lack of resources, in some schools, resources are available but not taken care of, which leads to access being denied to the disadvantage of learners. In addition, participants mentioned it was difficult for them to request access to the Internet as they were not permanent staff members of the school.

The TAM has two diverse constructs, namely perceived usefulness and perceived ease of use, that directly affect attitudes toward a target system and indirectly affect actual system use [28]. In the case of this study, perceived use of educational apps was directly affected by situational factors. This had implications on the actual system use, which could have eased learning processes, according to participants. From a WIL perspective in the field of education, the use of educational apps would be a success toward digital transformation, especially because these are groups of students who were trained in a digitalization age.

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ISSN: 2576-8484
Vol. 9, No. 4: 3072-3081, 2025
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- To what extent do teacher programs demonstrate success (and challenges) in digital transformation?

The data generated from this study indicate success by teacher education programs on digital transformation. Despite inconveniences on the ground in response to digitalized education, participating pre-service teachers' attitudes demonstrate their ability to use educational apps to teach. In this study, several success indicators were identified, such as apps available on pre-service teachers' mobile devices, how these teachers communicated and related to the apps, and how they linked through demonstration the apps to content during interviews. This was regarded as an acceptance measure of ICT integration which was satisfactory. Subsequently, the attitudes of participating pre-service teachers were favorable for the use of ICT in the teaching and learning process.

9. Implications

From the analysis of data, this study showed that the use of educational apps by pre-service teachers to teach in primary schools is possible yet complex due to situational factors. The overall findings of this study give an indication that pre-service teachers value educational apps for their potential to create an exciting and conducive learning atmosphere and their relevance to the transformation of education. This is in line with literature on mobile learning which indicate that educational apps encourage self-regulated computer-mediated learning experiences [40]. However, situational factors in the three primary schools in this study hinted challenges that hinder a digitalized classroom. What stood out in this study was that the schools were not ready for implementation, rather than the teachers lacking ICT skills and knowledge, as is the case in many instances. Pre-service teachers were therefore prepared to use educational apps to teach. This is a positive indication on students' preparation for the evolving digital fieldwork, but a negative indication of their ability to implement this knowledge.

10. Conclusion and Recommendations

The current study investigated pre-service teachers' experiences on the use of educational apps to teach in primary schools. As already mentioned, the implications of this study are positioned within debates of digital transformation, particularly the use of educational apps to teach. This was done to benchmark the extent to which education programs prepare students for the fieldwork in response to the growing demand on digitalization. Findings reveal that educational apps have the potential to enhance interactive lessons. However, lack of resources, particularly inaccessible Internet connection, deprives learners of opportunities to engage in meaningful learning. It was discovered in the study that the gap between basic and higher education in terms of preparing teachers has implications on the quality of education in schools. The inequalities in public schools regarding resources prohibit demonstration of success (and flaws) on the digital transformation agenda in institutions of higher learning. Therefore, this study suggests the need for efforts to be made toward securing accessible, stable Internet connectivity. What needs to be strengthened in this case is management of access to the Internet for educative purposes. For instances, some apps, such as social media, may be blocked from the server, rather than denying access to all. This safety measure may ensure that the Internet serves its intended educative purpose on the school premises.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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ISSN: 2576-8484
Vol. 9, No. 4: 3072-3081, 2025
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ISSN: 2576-8484
Vol. 9, No. 4: 3072-3081, 2025
DOI: 10.55214/25768484.v9i4.6728

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Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 4: 3072-3081, 2025
DOI: 10.55214/25768484.v9i4.6728