Digital Transformation in Coastal Educational Settings: A Case Study of Administrators and Teachers Readiness in Bachok, Kelantan

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ABSTRACT

Digitalization is now an essential component of teaching and learning. The integration of digital technologies enhances accessibility, engagement, flexibility, efficiency, and collaboration among educational stakeholders. This study explores how digitalization in education is perceived and experienced by teachers and administrators of coastal schools in Bachok, Kelantan, one of the country's districts with the highest poverty rates. The objective of the study is to explore how digitalization occurs in coastal schools. Using a case study design framed by Constructivist Grounded Theory and Gunnsberg Digital Transformation Model as the framework the research involved 13 participants who are school administrators and teachers. Data were collected through semi-structured interviews and document analysis. The data were analysed using open, axial, and selective coding. The findings of the study revealed that issues related to teachers' pedagogical skills and structure are main obstacles to the process. Thus, not many changes take place in the process of teaching and learning. The study concludes with recommendations for future research on educational digitalization in similar socio-economic settings.

Keywords: Digitalization, Grounded Theory, Coastal Schools, Administrators, Teachers

INTRODUCTION

Digitalization in education is an inevitable and continuous process that requires ongoing evaluation and refinement to enhance educational quality (Alenezi et al., 2023; Mhlongo et al., 2023, Frolova et al., 2020; Schmidt & Tang, 2020).In schools, digitalization is mainly shaped by school leadership, with leaders' perceptions strongly influencing how effectively digital technologies are integrated into teaching and learning (Reis & Andersson, 2024). Successful digitalization process also depends on enabling conditions such as infrastructure, teacher readiness, and technological literacy. Reviews of smart education initiatives also show that emerging technologies such as the Internet of Thing (IoT) can enhance learning, if they are thoughtfully implemented (Badshah et al., 2023). At the same time, research on professional development models demonstrates that scaling digital reforms requires structured approaches that support teachers throughout the process (El-Hamamsy et al., 2023). The process of digitalization in education is both unavoidable and central to improving educational quality, but its success depends on strategic planning, continuous improvement, and holistic institutional support.

A study on challenges of digitalization of education in eastern Europe by Simakhova, Artyukhov and Shmarlouskaya (2022) reveals six major areas of challenges.

1.Teachers who are not well trained

2.Lack of digital competence among managers of institutions

3.Institutions not having adequate equipment to practice digitalization of education.

4.Poor internet connectivity

5.Institutions not having enough computers or tablets to engage in the digitizing process.

6.Institutions not having adequate support in terms of workshops or related training.

The study concludes that if these six challenges are not solved, the process of digitalization of education will not succeed. Quite similar, a study done in Indonesia shows that teachers are not competent and not fully ready to engage in digitalization yet as they still require more formal training (Champa, Rochsantiningsih & Kristiana, 201

Despite the challenges, it also found that the process of digitalization increases the engagement of teachers and students with more active sharing of information (Rastogi, 2019; Qualter, 2024). In India, a study by Hans and Crasta (2019) reveals that digitalization of education also reduces cost of infrastructure in education as it requires less classrooms and buildings, promotes hybrid approach to learning, encourages students-centred learning and opens opportunities for students to learn while fulfilling other commitments. This would then offer more rooms for distance learning and open online courses, and online communication. In Sweden, the digitalization of education has brought about three positive major changes to education system. Firstly, changes in pedagogy which become more flexible and effective, secondly, positive changes in the management of the schools and thirdly, changes in the way support systems are offered to teachers and students (Lindqvist & Pettersson, 2019). In Finland, digitalization of education involves drastic changes to four domains of education: schooling days, pedagogy of teaching, collaborative learning involving teachers and administrators and students. Digitalization of education has brought many positive impacts to an education system. (Korhonen, 2021). Besides the positive impacts to education, digitalisation in education also promotes sharing of knowledge, encourages explorations of digital technologies in learning, ventures into practices of video sharing and actively promotes online learning (Seethal & Menaka, 2019). All the findings above show that digitalization of education has impacted the system and its stakeholders in many ways.

In Malaysia, there is a growing number of studies on the process of digitalization of education. A study on trainee teachers shows that, the trainee teachers are ready for digitalization of education (Ghazali, 2020). As trainee teachers are mainly in their 19's and 20's, representing younger generations, obviously digitalization is not much of a challenge to them due to the kind of exposure that they get. However, during Coronavirus disease from 2019 to 2020, generally the process of online learning in Malaysia did not run that smoothly. The stressful experiences were due to limited interactions with teachers due to poor internet and limited gadgets. Thus, students did not get proper guidance from teachers during online classes (Badiozaman, 2023). While existing studies largely focus on connectivity and device limitations faced by rural and low-income students in Malaysia, less attention has been given to how digitalisation reshapes teaching and learning practices themselves. This limited understanding of pedagogical and experiential adaptation highlights a significant gap in current digital education research. The research aims to explore and analyse the process of digitalization as experienced and perceived by those directly involved and affected by the process in the coastal schools within the Education District of Bachok, Kelantan. The findings of this study offer important insights into the human and organisational dimensions of educational digitalisation in underrepresented contexts.

The objective of the research is to explore how the process of digitalization of education takes place in coastal schools in Bachok Kelantan as experienced by school administrators and teachers. This study uses a grounded theory approach which would enable the researcher to understand new phenomena been studied.

Glaser and Strauss (2009) assert that inquiries in a Grounded Theory approach, are mainly made to understand the social and psychological elements in different fields. Later, it would lead to discoveries and understanding of new phenomena. In this context, how administrators and teachers in coastal schools experience the process of digitalization

LITERATURE REVIEW

Digitalization of Education in Malaysia

Currently the process of digitalization of education in Malaysia is guided by the Malaysia Education Blueprint (2013-2025). In Transformation 7 of MEB (2013-2025) the process of digitalization of education is highlighted as one of the focuses (Shan, Yunus, Mohamad, 2016). Thus, all levels of educational institutions in Malaysia need to align to the process of digitalization of education based on different frameworks designed to direct and smoothen the process. However, studies have shown that the challenges of the process of digitalization vary at different levels.

At the school level, several studies have examined the digitalization process within Malaysian educational settings. Syafiqah and Zamri (2025) investigated the role of school administrators in driving digital transformation, while Kaleena and Harwati (2025) explored teachers' experiences with digitalization in rural schools. Research on teachers' readiness for digital adoption has also been conducted by Felisca and Sofwan (2024) and by Fadhilahanim et al. (2023). However, there remains a noticeable gap in the literature, as few studies have focused specifically on how teachers in coastal areas experience the digitalization of education.

School Administrators

School administrators occupy a pivotal role in overseeing the daily management of schools and ensuring the effective implementation of policies issued by the Ministry of Education, as well as State and District Education Departments. The examples of different tiers of teachers in schools are shown in the figure below.

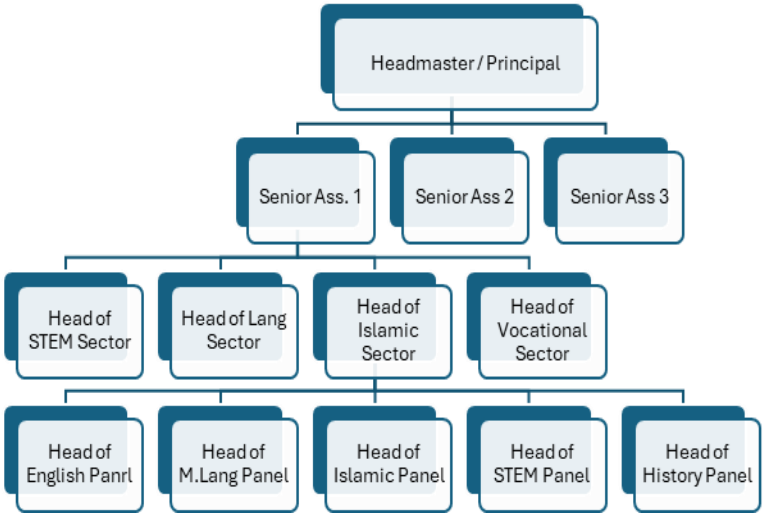


Figure 1: Different Tiers of Teachers in a school.

At the secondary level, leadership is typically headed by a principal, while primary schools are led by a headmaster. These leaders, together with senior assistants are responsible for academic affairs, student affairs, and co-curricular activities, constitute the first tier of administration. This tier is primarily responsible for strategic planning, policy execution, and overall institutional direction.

The second tier, commonly referred to as middle management, comprises senior teachers who oversee broad academic domains, such as Social Sciences and Science, Technology, Engineering, and Mathematics (STEM). Positioned between top leadership and classroom teachers, these middle managers play a critical mediating role by translating institutional policies into subject-specific strategies and coordinating instructional practices across departments.

The third tier consists of subject panel heads who manage individual subject areas, including English, Malay Language, and History. Their responsibilities often involve curriculum coordination, instructional supervision, peer support, and monitoring subject-level performance. As instructional leaders at the departmental level, they are directly engaged in classroom implementation and teacher development.

Within the context of educational digitalization, this tiered leadership structure significantly influences the extent and effectiveness of implementation. While top-tier administrators establish institutional priorities and allocate resources, middle managers facilitate coordination and professional development, and panel heads oversee the practical integration of digital tools into classroom instruction. The distribution of leadership responsibilities across these tiers therefore determines how digitalization policies are interpreted, operationalized, and sustained within schools. Studies by Subban et al. (2020) and Hamzah et al. (2021) have examined how school administrators in Malaysia respond to the digitalization of education.

The study by Subban et al. (2020) emphasizes the critical role of school leadership in successfully driving digitalization in schools. It identifies five key strategies employed by the principal. First, digitalization is embedded within the school's overarching vision, making it a core institutional priority. Second, the principal adopts a delegative leadership style, distributing tasks and responsibilities to middle managers to accelerate implementation and reduce bureaucratic delays. Third, decision making authority is shared with key personnel, such as the e-Learning (BESTARI) coordinator, enabling faster and more effective programme execution. Fourth, systematic monitoring and supervision involving assistant leaders ensure collective accountability and sustained progress. Finally, the principal fosters a strong spirit of teamwork to support collaboration in navigating the challenges of digital transformation. Overall, the study underscores that proactive and supportive school leadership significantly influences teachers' engagement and the successful implementation of digitalization initiatives.

Hamzah et al. (2021) found that both principals and teachers in Hulu Langat, Selangor, demonstrated high levels of digital competency, with a moderate correlation between principals' digital leadership and teachers' digital teaching practices. The study also emphasized that principals' ability to plan and organize digital initiatives significantly contributes to sustaining effective teaching and enhancing students' academic achievement during the pandemic. This highlights administrators as key catalysts in promoting and strengthening digital practices in schools.

Similarly, Lopez et al. (2022) revealed that school administrators, especially in indigenous school contexts play multifaceted roles in implementing digitalization policies. Their experiences revolved around three major themes: fulfilling leadership responsibilities, navigating obstacles and challenges, and adopting strategic approaches to facilitate digital transformation. Importantly, beyond policy implementation, effective leadership in indigenous schools requires contextual sensitivity. Understanding students' cultural backgrounds, socio-economic conditions, and lived realities enables administrators to manage initiatives more effectively. Together, these findings reinforce that successful digitalization depends not only on technical competence but also on strategic leadership, contextual awareness, and responsive school management. Building on previous research, this study aims to examine how administrators in coastal schools perceive, respond to, and experience the process of educational digitalization.

School Teachers

Numerous studies have explored how teachers in Malaysia respond to the digitalization of education, including research by Zainal and Zainuddin (2020), Clement and Yunus (2021), Sahrir et al. (2021), and Ke and AlSaqqaf (2022). Among these, the study by Zainal and Zainuddin (2020) is particularly noteworthy, as it examines various digitalization policies introduced by the Ministry of Education and their impact on schools and stakeholders. The researchers found that several factors hindered teachers from integrating e-learning into their teaching practices, including a lack of confidence in adopting digital approaches, limited understanding of smart learning concepts, insufficient ICT knowledge, and inadequate skills to facilitate creative and critical classroom discussions. The findings indicate that even among teachers in Smart Schools, not all possess the confidence and necessary skills to effectively implement e-learning in the teaching and learning process. Therefore, it is important to explore how teachers in other school contexts perceive and experience the process of digitalization. Clement and Yunus (2021) examined how English teachers in Limbang, Sarawak experienced digitalization during the COVID-19 pandemic. Their study found that teachers generally responded positively to the shift toward digital education. The second component of the research assessed teachers' digital competence, with the results summarized in Table 1 based on their responses

Table 1: Teachers' Digital Competence

Teachers' Competency	High	Average	Low
Technological Literacy	18%	22%	60%
Practicing Technology in the classroom	4.0%	42%	54%
Familiarity with Digitalization in classrooms	0%	88%	12%

Source: Clement and Yunus, (2021)

As shown in the table above, although teachers demonstrate positive attitudes toward e-learning, the data concerning their competence in the digitalization of education reveal less favourable outcomes. A substantial proportion of teachers lack adequate technological knowledge, with more than 60% classified at a low level of competency. Consequently, the proportion of teachers who actively integrate technology into classroom practice remains minimal (4%). Furthermore, none of the respondents reported possessing a high level of experience or familiarity with the implementation of digitalization in classroom settings. Overall, the findings indicate that despite rural teachers' positive attitudes toward educational digitalization, limited digital competencies significantly constrain their ability to implement it effectively in practice.

A related investigation by Ke and AlSaqqaf (2022) explored English teachers' readiness for educational digitalization during the COVID-19 pandemic in Sabah. Their findings revealed that, although teachers possessed adequate digital competence to engage with technological tools, they were not psychologically prepared for the pedagogical transition required by digitalized instruction. Moreover, insufficient access to appropriate digital teaching materials further constrained effective implementation.

A notable divergence between the two studies concerns teachers' levels of digital competence. While the present study indicates generally low levels of digital competency among teachers, Ke and AlSaqqaf (2022) reported comparatively higher levels of technical readiness. This discrepancy may be explained by contextual differences, particularly geographical location. The participants in the present study were English teachers from Limbang, a predominantly rural area, whereas Ke and AlSaqqaf's respondents were based in Kota Kinabalu, an urban center in Sabah. Urban schools typically benefit from stronger technological infrastructure, greater institutional support, and increased exposure to digital resources, which may contribute to higher levels of competency and preparedness.

These findings reinforce the argument that geographical context plays a pivotal role in shaping both teachers' readiness and their capacity to implement digitalization initiatives. Variations in infrastructure, professional development opportunities, administrative support, and socio-economic conditions appear to influence the extent to which digital transformation can be effectively realized. Thus, teachers' readiness for digitalization cannot be examined in isolation from the broader contextual environment in which they operate.

Coastal Communities

Although existing studies have acknowledged the importance of contextual factors, limited scholarly attention has been directed toward schools located in coastal communities. Such settings often experience distinctive challenges, including geographical isolation, uneven technological access, limited connectivity, and socio-economic constraints. These factors may create unique patterns of digital adoption that differ from those observed in rural inland or urban contexts. The limited empirical focus on coastal schools therefore represents a significant research gap. Addressing this gap is essential to developing a more nuanced and context-sensitive understanding of digitalization in education, as well as to informing policies and interventions that are responsive to the specific needs of coastal communities

METHODOLOGY

This study employs a qualitative case study design informed by an interpretivist paradigm. The interpretivist lens facilitates an in-depth understanding of how individuals construct meaning within their specific social and

cultural contexts. Guided by this perspective, the study explores how administrators and teachers in coastal schools in Bachok experience and interpret the process of educational digitalization.

The study is further informed by a Grounded Theory approach (Glaser & Strauss, 2009), whereby theory is inductively derived from systematically analysed data. Through iterative data collection and analysis, categories and themes emerged from participants' narratives, enabling the development of contextually grounded conceptual insights.

The central research question guiding this inquiry is: How do administrators and teachers in coastal schools experience the process of educational digitalization? A qualitative approach is particularly suited to this investigation, as it allows for an in-depth exploration of complex, context-dependent experiences while foregrounding the influence of social, historical, and institutional factors. In this study, the coastal school context constitutes a critical lens through which digitalization processes are understood

Three main methods are used to gather data for this study.

(i) Focus Group Discussions

(ii) Individual Interviews

(iii) Document analysis

Issues concerning the implementation and challenges of educational digitalization were initially explored through focus group discussions and subsequently triangulated using individual interviews and document analysis. A. figure below illustrates the process of triangulation of the study.

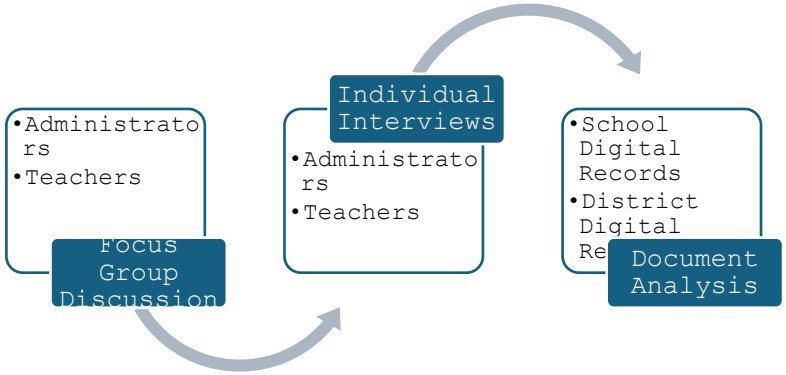


Figure 2: The Triangulation Process

The participants were school administrators and teachers from four coastal schools in Bachok, Kelantan. They were purposively selected due to their direct involvement in and firsthand experience with digitalization initiatives, enabling a comprehensive understanding of the phenomenon under investigation. The profile of the participants is presented in Table 2.

Table 2: Backgrounds of the participants

No.	**Pseudonym**	**Background**
1	Suraya	• A Coastal School Administrator • 52 years old (Primary School)
2	Darus	• A Coastal School Administrator • 58 years old (Primary School)
3	Asri	• A Coastal School Administrator

		● 53 years old (Primary School)
4	Rosli	● A Coastal School Administrator ● 56 years old (Secondary School)
5	Rosma	● A Coastal School Teacher ● 56 years old (Primary School)
6	Yusmini	● A Coastal School Teacher ● 54 years old (Primary School)
7	Fadli	● A Coastal School Teacher ● 48 years old (Primary School)
8	Azmira	● A Coastal School Teacher ● 51 years old (Primary School)
9	Tarmizi	●A Coastal School Teacher ● 56 years old (Primary School)
10	Nora	● A Coastal School Teacher ● 53 years old (Primary School)
11	Ruby	● A Coastal School Teacher ● 45 years old (Primary School)
12	Azean	● A Coastal School Teacher ● 50 years old (Secondary School)
13	Aman	● A Coastal School Teacher ● 44 years old (Secondary School)

Thirteen participants from four coastal schools participated in the study.

The focus group discussions and individual interview questions were guided by the six dimensions of Gunsberg's (2018) Digital Transformation Model (DTM). This framework was selected over other models due to its capacity to clearly capture and represent participants' experiences of the digitalization process. The six dimensions of the DTM are summarized in Table 3 below.

Table 3: Six dimensions of ACE DT Model

Dimensions	Details
Leadership and Management	How can leaders and managers catalyse digital transformation?
Innovation	How innovation propels the digital transformation process?
Strategy	How are strategies used to facilitate the digital transformation process?
Culture	How culture of any organization assists in digital transformation

Learning and Change	How can learning and change being affected by digital transformation?
Structure	How does the structure of an organization influence digital transformation?

Source: (Gunsberg, Callow, Ryan, Suthers, Baker & Richardson, 2018)

Finally, the data from the interview sessions were analysed through three stages of coding: open coding, selective coding, and theoretical coding. Theoretical coding facilitated the development of the key themes identified in the study. The coding process is illustrated in Figure 3.

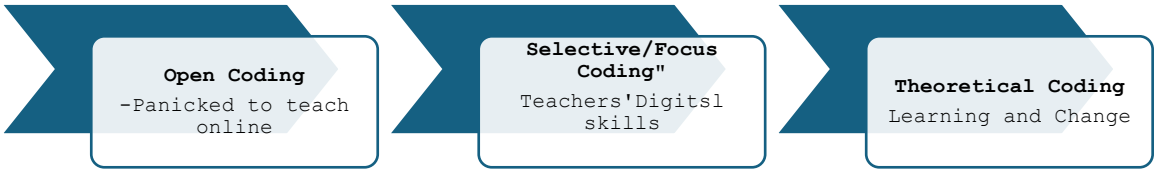


Figure 3: The Coding Process

FINDINGS

This section discusses the findings of the study. The results show that out of six dimensions, two dimensions which impact both teachers and administrators the most are learning and change and structure.

Learning and Change

The findings of the study show that both coastal school administrators and teachers experienced the process of digitalization in their own unique ways. In this study two issues under the dimension of learning and change are mostly related to teachers

1. Teachers' Skills and Training

2. Emotional and Cognitive Readiness

These two issues are very much related. They are experienced by the teachers in the implementation of digitalization process in schools. The figure below illustrates the process. The overlapping of the two dimensions -teachers' digital skills together with training that they get, and their emotional and cognitive readiness suggests that there is a clear connection between these two issues and they influence each other.

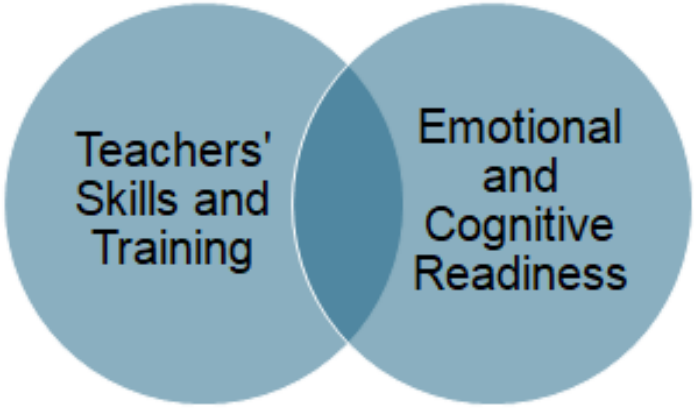


Figure 5: Learning and Change in Coastal Schools

The findings of the study suggest that teachers are the group which was mostly affected by the process of digitalization. Teachers are supposed to be the facilitators of the process, but they do not have the skills to do that. Cikgu Tarmizi from SK Tepi Pantai confessed.

I am one of the teachers in SK Tepi Pantai who are not competent in this (digital technology). When we needed to conduct online classes during the pandemic, I panicked, I did not know what to do [Tarmizi: A Coastal School Teacher]

Another teacher, Cikgu Rosma, said:

I have been teaching for almost 30 years. But digital technology is something that I obviously not good at at all. Young teachers are much much better. [Rosma: A Coastal School Teacher]

Documents obtained from the Bachok District Education Office on the use of DELIMa (Digital Educational Learning Initiative Malaysia) by coastal schoolteachers triangulated and validated the insights provided by the participants. The document supported the earlier findings, indicating that the digital ID system was not fully utilized by teachers. As shown in Table 6 the level of engagement with DELIMa remained limited, reinforcing teachers' claims that digitalization practices were not yet fully integrated into their teaching routines.

Table 6: Coastal schoolteachers use of DELIMa

Schools	Teachers	Active Users	Percentage
SK Pantai Lama	47	39	82%
SK Tepi Pantai	55	28	50%
SK Pantai Lama	46	26	56%
SMK P.Panjang	33	15	45%

Source: District Education of Bachok

Different words and phrases were used to describe digital skills of coastal schoolteachers. This is summarized in the table below.

Table 7 Teachers' Digital Skills

Administrators	Teachers
Lacking skills, not well trained, digital illiterate, not skillful, no knowledge and skills, not good in digital.	Not competent, not familiar, no skills, no experience

Both teachers from primary and secondary schools admitted that they do not have digital skills to facilitate the process of digitalization in schools. However, some teachers expressed their confidence that with the right training they can improve their digital skills. Teachers also expressed that they are not cognitively ready for digitalization. Furthermore, their experiences practicing digitalization added to their emotional challenges as teachers. Table 8 summarized expressions they used to describe teachers' emotional readiness.

Table 8: Teachers' Emotional Readiness

Nightmares, stressful, frustrated, angry, disappointed, boring, distracted, troubled, had to redo tasks, disappointed but kept on hoping, took a lot of time, very slow, loading and then disappeared, disconnected repeatedly.

The insights shared by the participants under the theme of learning and change have provided meaningful input to answer the research question. They talked about their experiences and how the process had affected them in many ways.

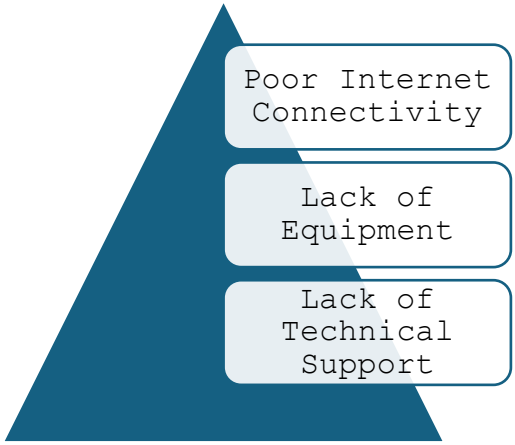
While most coastal schoolteachers reported low digital competence and emotional stress, some demonstrated remarkable resilience and initiative. For example, Cikgu Aman described proactively facilitating digital learning despite these challenges:

I was willing to take risks. I told the students that next week we would learn using smartphones. I wrote a letter to the school to seek permission and informed parents through the class WhatsApp group. During the lesson, I guided them to explore various online resources… They were very excited, and I felt happy. [Aman: Coastal School Teacher]

This example illustrates how individual resilience can help overcome contextual limitations, enabling teachers to creatively implement digitalization even in constrained settings. Recognizing and supporting teachers like Cikgu Aman through formal mechanisms, such as the Malaysian Education Blueprint, could institutionalize effective practices and provide mentorship opportunities for colleagues who face digital challenges. Additionally, partnerships with international organizations such as UNESCO or UNICEF could align local efforts with global initiatives aimed at promoting equitable access to digital education.

By linking individual teacher practices to policy frameworks and international programs, the study highlights how grassroots innovation contributes to addressing disparities in digitalization. This situates research within broader debates on equity, access, and digital learning, demonstrating that teacher agency is both a practical and policy relevant pathway for advancing educational digitalization in coastal and underserved communities

Structure



Insights given by the teachers and schools administrators of coastal schools on structure are related to three challenges as shown in Figure 2

Figure 2: Three Challenges

Cikgu Suraya, the headmaster of SK Pulau Satu. She confessed:

We used the module and WhatsApp only… we do not to use Google Meet or Google Classroom. Parents here do not have the access …… we just did our best, ..and that is our aim...here in terms of online learning we rely a lot on WhatsApp. [Suraya: A Coastal School Administrator]

Cikgu Darus from SK Tepi Pantai said:

Internet (connectivity) is surely an issue here. Like chips more (biscuits), sometimes its available, but most of the time, we don't have it. It causes many problems for us…trying to settle all the administrative matters, what more to use for teaching. [Darus: A Coastal School Administrator]

A coastal schoolteacher, Cikgu Rosma shared her experience:

Apart from not having enough gadgets, weak internet (connectivity) is also a problem here. Sometime during peak hours, there was no internet at all. That's why as GB (headmaster) explained earlier, during the PKP (Restricted Movement), this school opted for an offline approach like printing modules to be taken by coastal school parents and later used by our pupils. [Rosma: A Coastal School Teacher]

Both teachers and school administrators claimed that poor internet connectivity is one of the major challenges. The Table below illustrates this.

Table 9: Expressions describing poor internet connectivity

Administrators	Weak internet, most of the time not available, poor internet, not stable, at times no internet at all,
Teachers	Not strong, poor internet, internet is slow, loading forever, disconnected, poor connectivity, line is not reliable, mostly weak,

Table 10 and Table 11 show words and expressions from administrators and teachers describing limited equipment and limited technical support.

Table 10: Expressions describing limited equipment

Administrators	Tablets shared, not enough even for a class, we have less than 20 PCs, old computer labs,
Teachers	Laptops not enough for a class, not familiar with online-no laptops at home, they must share, share phones, we have less than 10 laptops, limited.

Table 11: Expressions describing lack of technical support

Administrators	Who to fix old system (in computer labs)? I wish we get trained technicians in school,
Teachers	It takes time for support (technicians) to arrive in schools, pupils' moods are affected, Teachers in schools who assist have no technical backgrounds.

The findings from this study, viewed through the Gunsberg Digital Transformation Model, highlight structure as a critical determinant shaping stakeholders' experiences of digitalization in coastal schools. Participants consistently pointed to poor internet connectivity, limited equipment, and insufficient technical support as structural barriers that constrained their engagement with the process of digitalization. These issues directly influenced how stakeholders experienced the digitalization process, often resulting in frustration, disrupted teaching and learning routines, and uneven access to digital opportunities. At the same time, the structural challenges had tangible effect**s** on stakeholders, shaping their perceptions of digital transformation as burdensome rather than empowering, and heightening concerns about equity and sustainability. Thus, structural constraints not only framed the overall digitalization journey but also significantly impacted the emotional, professional, and practical realities of those involved.

However, Coastal school teachers and administrators exhibit remarkable resilience and creativity in navigating digitalization despite infrastructural limitations. Cikgu Aman proactively engaged students with smartphones and online resources, while Cikgu Suraya, headmaster of SK Pulau Satu, adapted by using modules and WhatsApp to maintain learning continuity. These cases highlight that effective digitalization depends on adaptive leadership, resourcefulness, and agency rather than technology alone. Recognizing such practices through the Malaysian Education Blueprint and international initiatives (UNESCO, UNICEF) can promote knowledge sharing and equitable access, situating local experiences within global debates on digital education and equity.

DISCUSSION

The findings of the study show that both teachers and administrators at coastal schools have experienced the process of digitalization in their own unique ways. While teachers faced practical, technical and emotional struggle, administrators faced challenges in terms of strategic and managerial challenges.

Teachers

The study proves that dimension of learning and change which is part of Gunnsberg' Digital Transformation Model (DTM), is very relevant. The two core issues are teachers' digital skills and training and their emotional and cognitive readiness in facing digitalization process.

Across the interviews, teachers consistently reported limited competence in using digital technologies, describing themselves as *"not competent," "not familiar," "no experience,"* and *"not good in digital."* These

descriptions were mirrored in administrators' assessments, who labelled teachers as *"lacking skills," "not well trained,"* and *"digitally illiterate."* Such expressions reveal a substantial skills gap that inhibits teachers' capacity to function as facilitators of digital learning.

The documentary evidence retrieved from the District Education Office further validates these accounts. Patterns of usage on the DELIMa platform indicate uneven engagement among teachers, with active user rates ranging from 45% to 82%. These figures confirm that digitalization has not yet been effectively normalized within teachers' professional routines. The misalignment between expected digital pedagogical practices and teachers' actual levels of digital engagement suggests that capacity-building efforts remain insufficient, particularly in underserved coastal contexts. This is what the study highlights as emotional and cognitive readiness of teachers.

Participants also reported experiencing the digitalization process as emotionally demanding. Descriptions such as *"stressful," "frustrated," "angry," "disappointed,"* and *"nightmares"* illustrate the extent to which teachers perceived digital tasks as burdensome. These emotional responses stem not only from insufficient skills but also from the cognitive load associated with learning new technologies under pressing circumstances. This combination of limited digital competence and heightened emotional strain indicates that teachers of coastal schools were not cognitively ready to embrace digital transformation. In line with prior studies examining teachers' technology adoption, emotional readiness plays a significant role in determining the success of digital integration. The findings here reinforce the argument that digitalization efforts must attend to human readiness, not merely technological readiness.

Collectively, these insights prove that teachers of coastal schools were among the most affected stakeholders in the digitalization journey, experiencing both professional and emotional disruptions. Their accounts offer valuable evidence for understanding how the Learning and Change dimension operates in resource-constrained environments.

School Administrators

The issue of structure was highlighted by both administrators and teachers. It was found to be a critical determinant shaping the experiences during digital transformation in coastal schools. Participants identified three interconnected structural challenges which are poor internet connectivity, limited equipment, and inadequate technical support which collectively impeded the implementation of digitalization initiatives.

Both teachers and school administrators frequently emphasized poor and unstable internet connectivity, using expressions such as *"weak internet," "loading forever," "disconnected,"* and *"not available most of the time."* These accounts illustrate persistent infrastructural constraints that compromised the reliability of digital platforms and hindered meaningful engagement with online teaching and administrative duties.

Insufficient internet access fundamentally limited the types of digital tools schools could adopt. As one headmaster explained, schools relied heavily on WhatsApp and printed modules instead of platforms such as Google Classroom or Google Meet due to parents' restricted access to devices and connectivity. This reliance on low-bandwidth tools reflects systemic inequities that shape the digital capacities of coastal communities.

Teachers and administrators also highlighted equipment shortages, noting that laptops, tablets, and functioning computer labs were insufficient to support consistent digital practice. Phrases such as *"not enough for a class," "old computer labs,"* and *"shared devices"* point to material deficits that prevented students and teachers from effectively utilizing digital resources. These limitations reinforce findings from prior research showing that hardware accessibility remains a primary determinant of digital readiness in rural and coastal educational settings. The absence of timely and specialized technical support further compounded implementation challenges. Administrators remarked that they lacked trained technicians capable of maintaining outdated systems, while teachers noted delays in receiving technical assistance. As a result, digital disruptions affected instructional continuity and contributed to declines in student motivation.

CONCLUSION

This study explored the process of digitalization in coastal schools within the Education District of Bachok, Kelantan, focusing on the experiences of teachers and administrators. Findings indicate that stakeholders face substantial challenges, particularly related to infrastructure, access to technology, and capacity building, with

significant emotional, social, and economic implications. Despite exposure to digital initiatives, meaningful transformation in teaching and learning has not occurred as intended, highlighting a gap between digital adoption and effective pedagogical change.

Individual agency and resilience were evident in overcoming these constraints. Cikgu Aman described taking proactive steps to engage students with digital tools, securing school permission, and guiding them through online resources: Similarly, Cikgu Suraya, the headmaster of SK Pulau Satu, adapted creatively by relying on modules and WhatsApp to maintain learning continuity:

These examples illustrate that effective digitalization in under-resourced schools depends not solely on advanced technology but on adaptive leadership, creativity, and the ability to maximize available resources. Teachers and administrators exercised agency within contextual constraints, demonstrating the importance of context sensitive strategies in sustaining learning outcomes.

Structural barriers such as poor connectivity, limited equipment, and inadequate technical support also shaped perceptions and experiences of digitalization. These constraints limited the development of higher order dimensions of the Digital Transformation Model (DTM), particularly innovation and strategic planning, which were less evident in the data. Consistent with literature on the rural digital divide, these findings highlight that infrastructural deficits not only restrict technology adoption but also shape the emotional, professional, and pedagogical realities of coastal school stakeholders.

Future research could expand these findings to other coastal areas, allowing comparative analyses that capture regional variations in digital adoption and challenges. Methodologically, mixed-method approaches could integrate qualitative insights with quantitative measures of digital adoption and learning outcomes, providing a more holistic understanding of educational digitalization in Malaysia.

Finally, the study offers actionable recommendations for policymakers and practitioners. Targeted interventions in teacher training, infrastructure development, and leadership capacity building could enhance digital competence, improve access to technology, and support adaptive teaching strategies. Recognizing and formalizing the innovative practices of teachers and administrators like Cikgu Aman and Cikgu Suraya within the Malaysian Education Blueprint, as well as exploring collaboration with international organizations such as UNESCO or UNICEF, could help bridge the gap between policy intentions and classroom realities. Such measures would promote equitable, context sensitive digitalization and ensure that technology adoption translates into meaningful pedagogical change in under-resourced coastal schools

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