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A Systematic Review of Leadership Strategies for Enhanced Technology Usage Among Teachers in Secondary Schools

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Abstract

Despite the inestimable benefits of technology use in the 21st century, there is still an apparent digital divide in technology use based on gender in all spheres of life**.** The onus of this study is to systematically review relevant strategies adopted by secondary school leaders to achieve enhanced technology acceptance and usage, especially among female teachers. Also, to determine its implications for education leadership and management. With the aid of the PRISMA protocol, 499 articles identified were painstakingly analysed. These articles were obtained from Scopus and Web of Science Digital bases. Only 20 articles that fulfilled the relevance and quality eligibility criteria were included in the review for analysis. It was found that there was a paucity of studies on leadership strategies adopted by secondary school principals to enhance technology usage among teachers in secondary schools. Similarly, eight leadership strategies were identified as the common ones among secondary school principals to integrate and enhance technology usage in their various schools globally. This study uniquely assembled various exemplified strategies for technology integration, which will likely be helpful for school leaders who are yet to successfully integrate technology usage into the hearts of teachers in their various schools.

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Introduction

Technology has permeated all the spheres of human endeavours. Technology usage is when humans apply technology in any form to achieve their objectives. The use of information and communication technologies like the internet, whiteboards, tablets, computers and data projectors and many more has, therefore, become ubiquitous (Sanusi et al., 2023). It is used in socio-political, health, and educational activities among others. This is the more reason why the terms Internet of Things and digitalisation are commonly used to describe the use of technology in the 21st century. The school business environment globally is becoming more complex, demanding tremendous input from educational personnel (Oluoch, 2016). Apparently, teachers in Africa cannot be exempted from the benefits of technology (Sanusi et al., 2023).

Despite the numerous advantages embedded in the technology, especially in the academic setting, Purnomo et al. (2023) noted that the acceptability of its usage among members of all organisations has been marked as a significant challenge. Most especially in the African continent, there are challenges of inadequate digital knowledge, inadequate infrastructure and lackadaisical attitude (Munje & Jita, 2020). USAID report has also established that there is still a conspicuous gap among human beings in its acceptability and usage based on gender (USAID, 2023). The situation is more

pronounced in the education sector than in other sectors. It has been found that teachers are more parochial regarding technology acceptance and usage, especially in secondary schools on the African continent. Many teachers complained that they do not have access to ICT training in their various workplaces (Adewale et al., 2022; Gómez-Trigueros & Yáñez de Aldecoa, 2021). The implication is that the attainment of the 21st-century educational agenda and the sustainable development goal of equality will remain a mirage. It is, therefore, essential to quest for an everlasting solution to endear the hearts of teachers to technology acceptance and usage, especially in their day-to-day teaching and learning activities.

Leaders play a vital role in the actualisation of organisational objectives. As such, the role of school principals as school leaders in their various schools in terms of technology acceptance must be considered (Chen, 2013; Taylor, 2019). Principals as instructional leaders must be aware of the importance of technology and devise means and strategies to sell the idea to their subordinates and endear their hearts to it. Ghavifekr and Wong (2022) reiterate that principals must use the best methods to stimulate teachers and learners to use technology in schools. Hence, the onus of this study is to systematically review relevant strategies adopted by secondary school leaders to achieve enhanced technology acceptance and usage among female teachers especially. The identification of these strategies will provide a catalogue of ideas for school leaders to choose from. In view of this, the following research questions are raised:

i) What are the demographic components of the included studies?
ii) What strategies are used by school leaders to enhance technology acceptance and usage among teachers in secondary schools?

Methodology

This study adopted a systematic literature review method to retrieve and analyse earlier empirical studies (Ikhsan et al., 2021). The essence was to use the retrieved information to answer the research questions raised in this study. The researcher prepared a review protocol containing inclusion and exclusion parameters, search strategy, quality assessment, and data extraction. Using the PRISMA guidelines (Adewale & Potokri, 2023; Page et al., 2021), methodical identification and examination of articles was done.

Search Strategy

The researcher developed search strategy using Boolean operators and search terms to quest for relevant and appropriate literature for review. The combination of the Boolean operators (OR, AND) and the search terms (Leadership strategy, school principal, technology integration and teacher) gave birth to the following:

- SCOPUS: “leadership practice*” OR “school principals’ strategy*” AND “technology integration” AND “teacher*”
- WEB OF SCIENCE: “leadership practice*” OR “strategy*” AND “technology integration” AND “teacher*”

The strategy was used to explore the two databases (Scopus and Web of Science). The reason for choosing the databases used is that the articles indexed in them are of high quality. Using the PRISMA flow chart, the record of the flow of retrieved articles was kept for transparency, accountability and accuracy.

Table 1
Inclusion and Exclusion Criteria

Parameter	Inclusion	Exclusion
Leadership strategies	Focus on enhancing technology usage.	Studies that do not specifically address technology usage among female teachers were excluded.
Gender	Studies must involve both genders as participants (male and) female teachers as the primary participants	Studies focusing solely on only one gender among teachers was excluded.
School level	The research must focus on technology usage within the context of secondary schools.	Studies conducted on primary schools and higher institutions were excluded.
Publication	Only peer-reviewed journal articles	Conference proceedings, theses, and unpublished reports, dissertations were excluded.
Language	Studies published in English	Studies published in languages other than English
Timeline	The studies must have been published between 2010 and January 2024	Studies published prior to January 1st 2010
Research design	All types of study designs, including qualitative, quantitative, and mixed study	Literature review

Data Collection

In this stage, relevant literature is searched and collected for relevant information. It is a critical stage in the systematic literature review where helpful information is sourced from the existing literature (Maheshwari, 2021). To actualise this, two databases (Scopus and Web of Science) were searched meticulously to collect different literature on leadership strategies for enhanced technology usage among teachers in secondary school. Furthermore, the researcher prepared a Microsoft Excel spreadsheet based on the variables of interest in this study to obtain relevant information from the included study.

Quality Assessment

The appraisal of the quality of the identified research articles for the review was done using the Mixed Method Assessment Tool (MMAT) (Matsuda et al., 2021) . MMAT for systematic reviews offers several strengths that enhance the rigour through the rating of the review articles (Sukadari et al., 2023) and comprehensiveness of the review process. It allows for the integration of diverse types of evidence, including both

quantitative and qualitative data (Hong et al., 2018). This integration enables a more holistic understanding of the research topic by capturing various perspectives, experiences, and outcomes. By incorporating multiple methods, the review can address complex research questions that may require insights from quantitative measurements and qualitative interpretations, thereby enriching the depth and breadth of the evidence base. MMAT promotes methodological flexibility and adaptability (Matsuda et al., 2021). MMAT recognises the diverse nature of research designs, methodologies, and paradigms across disciplines and fields of study. This flexibility allows reviewers to tailor the assessment criteria to the specific characteristics and requirements of the studies included in the systematic review, ensuring that the evaluation process remains contextually relevant and sensitive to the nuances of the research topic. Moreover, the tool can accommodate variations in data quality, study designs, and methodological rigour, enabling a nuanced appraisal of each study's strengths and limitations. Despite its strengths, integrating diverse types of evidence requires careful consideration of methodological compatibilities, theoretical frameworks, and analytical approaches, which can be challenging to navigate.

Method of Data Analysis

The researcher carefully analysed the data in this systematic review by following a clear, step-by-step approach. He began by gathering potential studies from two well-known academic databases, Scopus and Web of Science. Then removed duplicate papers and those that didn't fit his focus and closely examined the studies, and through careful evaluation, selected high-quality articles that met all his specific requirements for inclusion.

To ensure these studies were trustworthy, the researcher used the Mixed Methods Appraisal Tool (MMAT), a respected method for checking research quality. They then organized key details – such as leadership strategies, participant demographics, and study results – into a structured spreadsheet. From there, he looked for common patterns and grouped the findings into major themes. This thorough process not only helped him draw meaningful conclusions but also made his work transparent and reliable for other educators and researchers to learn from.

Ethical Considerations

This study is a systematic review of readily available research outcomes from research articles in databases. However, all the included studies were duly acknowledged and appropriately referenced. Hence, no special ethical issue was addressed.

Results

This section presents the findings of the systematic review, addressing the study's central objective: to identify leadership strategies that enhance technology adoption among secondary school teachers, with particular attention to gender-inclusive approaches. The results section details the findings, supported by tables and figures to illustrate patterns across the reviewed studies.

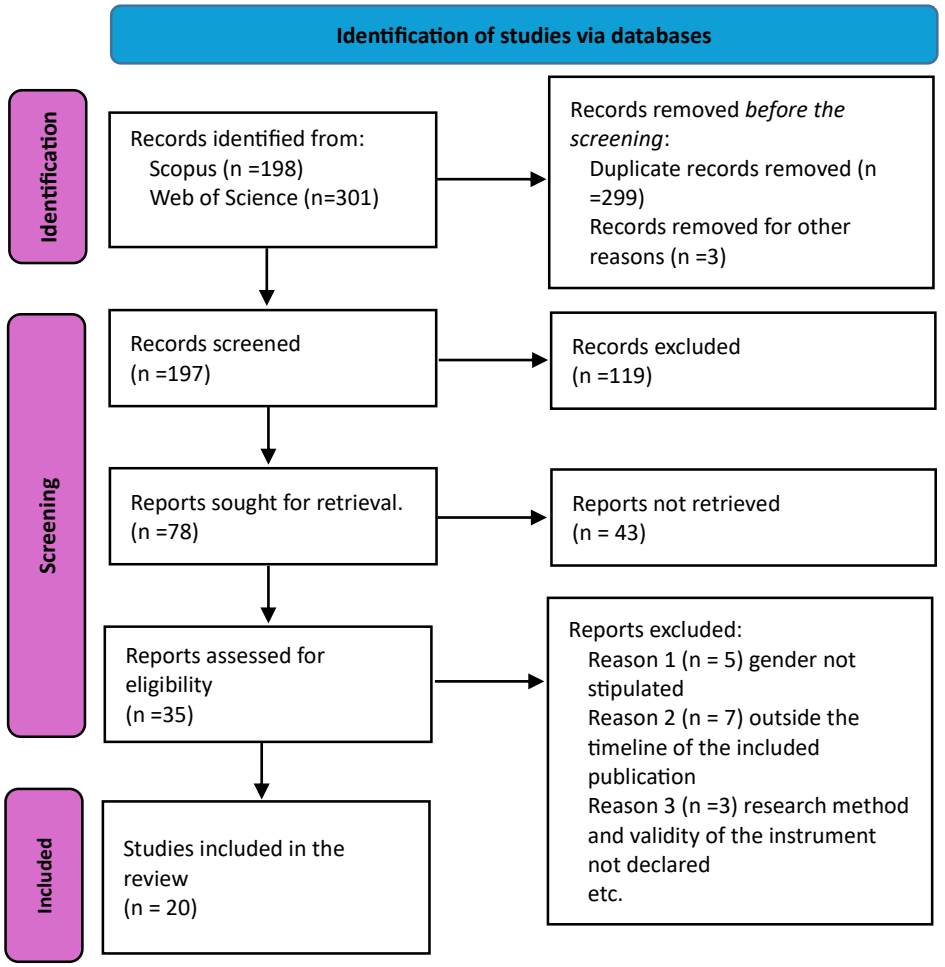

Figure 1: Flow chart for the included studies
Source: Adapted from Page et al. (2021)

The PRISMA flow chart in Fig. 1 indicates how the chosen databases were searched. It indicated that 499 were obtained from two databases (Scopus =198 and Web of Science = 301). Thereafter, 302 records were removed due to duplication, which presupposes that only 197 records were screened. Furthermore, 119 records were excluded for failing the test of inclusion criteria set for the systematic review. Similarly, 78 reports were sought for retrieval; meanwhile, 43 reports were not retrieved. Thereafter, 35 reports were assessed for eligibility, clinging tenaciously to the inclusion and exclusion parameters. This effort resulted in the exclusion of 15 reports due to reasons including participant gender not being mentioned and lack of validity. A total of 20 articles that satisfactorily fulfilled the inclusion and exclusion conditions were included in the study for further analysis and to answer the research questions. The PRISMA flowchart gives the researcher a visual representation of the rigorous selection process.

Research Question 1: What are the demographic components of the included studies?

Table 2

Included Studies Characteristics

S/N	Authors and year	Method	Country	Sample	Gender
1	Thannimalai and Raman (2018)	Quantitative	State of Kedah Malaysia	645 teachers	Mixed
2	Afshari et al. (2012)	Quantitative	Tehran, Iran	320 principals	Mixed
3	Baharuldin et al. (2019)	Quantitative	Pahang, Malaysia	530 teachers	Mixed
4	Claro et al. (2017)	Mixed method	Chile	38 teachers 53 principals	Mixed
5	Vermeulen et al. (2017)	Quantitative	Netherland	544 teachers	Mixed
6	Lindqvist (2019)	Mixed method	Umea, Sweden	1409 teachers	Mixed
7	Alajmi (2022)	Quantitative	Kuwait	404 teachers 113 principals	Mixed
8	Karakose et al. (2021)	Qualitative	Turkey	89 teachers	Mixed
9	Schmitz et al. (2023)	Quantitative	Switzerland	2248 teachers	Mixed
10	Hamzah et al. (2010)	Quantitative	Malaysia	63 administrators/ principals	Mixed
11	Reis-andersson (2023)	Qualitative	Sweden	32 IT strategists	Mixed
12	Gürfidan and Koç (2016)	Quantitative	Turkey	396 teachers	Mixed
13	Emeterio and Arias-oliva (2020)	Quantitative	Spain	142 principals	Mixed
14	Ilomäki and Lakkala (2019)	Mixed study	Finland	57 principals and teachers	Mixed
15	Sterrett and (Richardson (2020)	Qualitative	USA	12 principals	Mixed
16	Chen (2013)	Quantitative	Singapore	2043 teachers	Mixed
17	Asante and Novak (2023)	quantitative	Ghana	197 teachers	Mixed
18	Rasdiana et al. (2024)	Quantitative	Indonesia	428 teachers	Mixed
19	Reis-Andersson (2024)	Mixed	Sweden	157 school leaders	Mixed
20	Preston et al. (2015)	Qualitative	Canada	11 school leaders	Mixed

Table 2 presents a comprehensive overview of the characteristics of the studies included in the review. All the included studies have mixed gender distribution with nine of the total included studies involving the secondary principals while the remaining 11 studies having teachers as participants. In addition, only two studies have samples that are above 1000 participant while other studies have less than 1000 participant. Similarly, the studies adopted three research designs including quantitative, qualitative, and mixed methods.

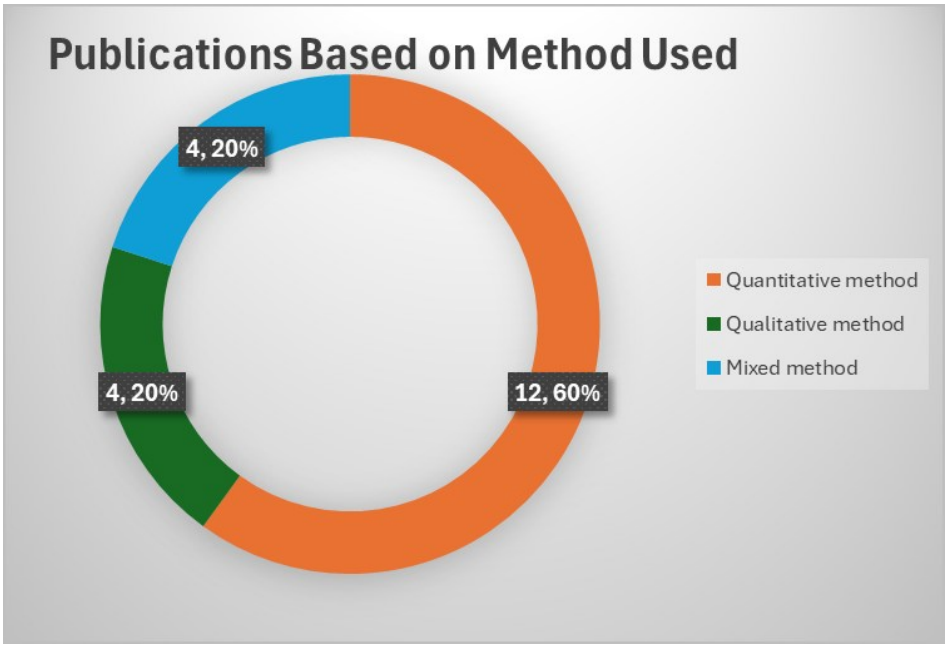

Figure 2: Publications distribution based on the method used

Figure 2 presents the distribution of the research design method used to conduct the included studies in this systematic review. The outcome indicated that 12 articles, which represent 60% of the distribution, used quantitative research design, while the articles used qualitative research design were 4 (20%). Similarly, studies that used mixed method, which is the combination of both quantitative and qualitative research designs, were 4 (20%).

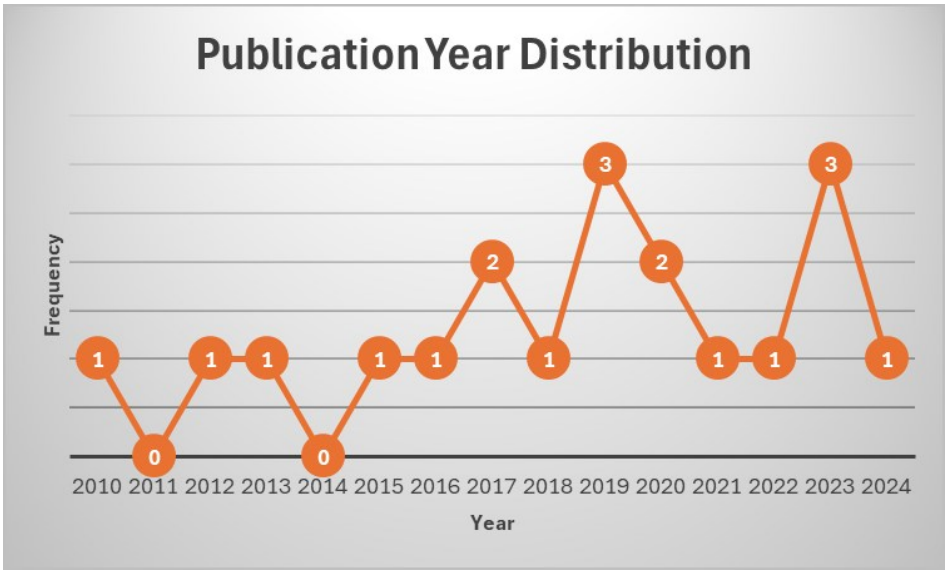

Figure 3: Year of Publication

Figure 3 reveals the frequency distribution of included research articles by year of publication. The data revealed some fluctuation in the number of publications over the years. From 2010 to 2014, there seems to be minimal research on the leadership strategies adopted by secondary school principals on technology integration, with only sporadic publications. However, from 2015 onwards, there is a noticeable increase in research output, with different numbers of publications each year.

The upward trend in research output starting from 2015 indicated a growing interest or recognition of the role of leadership in technology integration within the academic community. The peak in 2019, with three publications, suggested a particularly active period, possibly driven by emerging developments, funding opportunities, the COVID-19 pandemic and shifts in research priorities.

The subsequent years show a somewhat fluctuating pattern, with peaks and troughs in the number of publications. While there is a slight dip in 2021 and 2024 compared to the preceding years, it is worth noting that even in these years, there is still a steady flow of research output, indicating sustained interest in the subject matter.

Table 3
Research Country Affiliation

Countries	Number of Articles	Percentage
Malaysia	3	15%
Iran	1	5%
Chile	1	5%
Netherland	1	5%
Sweden	3	15%
Kuwait	1	5%
Turkey	2	10%
Switzerland	1	5%
Spain	1	5%
Finland	1	5%
USA	1	5%
Singapore	1	5%
Ghana	1	5%
Indonesia	1	5%
Canada	1	5%

Table 3 presents the distribution of the included studies according to the countries where they were conducted. The table reveals that a diverse range of countries contributed to the research, with Malaysia and Sweden leading the pack with 15% each. This suggests a significant involvement of research outcomes on technology integration from these two countries. Furthermore, Turkey follows closely behind with 10% representation. The rest of the countries each contributed 5% of the total articles, indicating a diverse spread of research interests across various regions. The presence of multiple countries, including Iran, Chile, Netherlands, Kuwait, Turkey, Switzerland, Spain, Finland, USA, Singapore, Ghana, Indonesia, and Canada, further emphasises the global nature of the research.

Research Question 2: What are the strategies used by school leaders to enhance technology acceptance and usage among teachers in secondary schools?

Table 4 reveals the included studies and their extracted corresponding strategies adopted by secondary school principals to enhance teacher technology integration and usage. All the identified strategies were further grouped into eight themes. including visionary leadership, teacher training, and resource availability.

Table 4

Strategies Used by School Leaders to Enhance Technology Acceptance and Usage Among Teachers in Secondary Schools

S/N	Authors	Year of publication	Leadership strategies
1	Thannimalai & Raman	2018	1) Digital age learning 2) digital citizenship 3) systemic improvement 4) excellence in professional development practice
2	Afshari et al.	2012	1) Computer training 2) Transformational leadership a) Individualised consideration b) Intellectual simulation c) Inspirational motivation d) Idealised influence (behaviour) 3) Computer use a) Instructional use b) Administrative use
3	Baharuldin et al.	2019	1) Adequate time for ICT skills development 2) Freedom to use the acquired skills in teaching.
4	Claro et al.	2017	1) Support to use it 2) Training
5	Vermeulen et al.	2017	1) ICT infrastructure provision 2) Transformational leadership vision
6	Lindqvist	2019	1) Introduction of a new method of working 2) Sharing and collaboration 3) Creating a supportive environment for teachers to test tools 4) Role modelling 5) Showing digital competence for teachers
7	Alajmi	2022	1) Visionary leadership 2) Excellence in professional practice 3) Systemic improvement 4) Digital learning culture 5) Digital citizenship

Cont …

Table 4 (continued)

S/N	Authors	Year of publication	Leadership strategies
8	Karakose et al.	2021	1) Digital technology usage 2) Support for digital transformation. 3) Support for Professional development. 4) Support for digital learning culture. 5) Digital leadership skills
9	Schmitz et al.	2023	1) Teachers' belief 2) Teachers' digital skill 3) Digital infrastructure 4) Pedagogy of using digital technologies
10	Hamzah et al.	2010	1) Shared vision 2) Learning and Vision 3) Productivity and professional development practice
11	Reis-andersson	2023	1) Support of school digital technologies by IT strategists 2) Changing working methods in schools using digital technologies
12	Gürfidan & Koç	2016	1) Support services 2) School culture
13	Emeterio & Arias-oliva	2020	1) Increased level of motivation in the classroom 2) Improved competence learning 3) Technical support for teachers
14	(Ilomäki & Lakkala	2019	1) shared vision of using digital technology 2) networking 3) pedagogical and technological training supports.
15	Sterrett & Richardson	2020	digital professional learning network
16	Chen	2013	1) Develop ICT goal. 2) communicating ICT goals 3) coordinate curriculum to support the use of ICT. 4) Supervise ICT-based instruction. 5) Promote ICT-based professional development. 6) Provision of incentives for teachers to use ICT.

Cont …

Table 4 (continued)

S/N	Authors	Year of publication	Leadership strategies
17	Asante & Novak	2023	1) staff development and training 2) technology and infrastructural supports 3) evaluation and research 4) interpersonal and communication skills
18	Rasdiana et al.	2024	1) Instructional supervision 2) Teachers' development
19	Reis-Andersson	2024	1) Collaboration 2) Shared culture
20	Preston et al.	2015	1) Sharing of skills 2) Building technological confidence

Theme 1: Leadership and Vision

Evidence from the reviewed literature indicates that leaders who have successfully integrated technology have achieved that through setting a clear vision and transformational leadership style. A transformational leader is characterised by inspiration, influence, and consideration for the individual (Vermeulen et al., 2017). School leaders achieve this through the development of ICT goals, communication of the goals and curriculum coordination to support the use of ICT (Chen, 2013). Inspirational motivation fosters enthusiasm and commitment among teachers to learn, unlearn, and relearn information and communication technologies skills, while idealised influence sets an example for desired behaviour towards technology use (Afshari et al., 2012). Teachers' unique needs and concerns are addressed through individualised consideration of technology integration. All these are operationalised by a visionary leader who provides a roadmap for digital transformation, articulating clear goals and direction. With a shared vision, teachers are able to collaborate and align individual efforts towards the common objective of enhanced technology use in classrooms.

Theme 2: Professional Development Programmes

Teachers' professional development is an essential strategy adopted by school principals to enhance teachers' skills and make them stay abreast of technological advancement (Thannimalai & Raman, 2018; Asante & Novak, 2023). This strategy has excellently been adopted by school leaders globally to integrate technology into secondary education. This involved promotion of ICT-based training (Chen, 2013) and other relevant training that improves teaching efficacy and student outcomes. The training encompasses practices that promote productivity, reflective learning, and continuous improvement in the use and integration of ICT (Afshari et al., 2012; Hamzah et al., 2010). Many school principals give support for professional development by providing resources, time, and incentives (Chen, 2013), which provide a culture of lifelong learning among teachers to achieve the school goal of technology integration.

Theme 3: Digital Learning Culture

Among the leadership strategies adopted by school principals is the building of a digital learning culture (Reis-Andersson, 2024). This involves creating an environment where technology is seamlessly integrated into teaching and learning practices. This is done by nurturing teachers' beliefs in the transformative power of technology and building their confidence to use digital tools effectively (Preston et al., 2015). Collaboration and sharing of best practices among educators are essential components of a thriving digital learning culture (Ilomäki & Lakkala, 2019; Thannimalai & Raman, 2018). Networking opportunities through digital professional learning networks provided by school leaders facilitate knowledge exchange and professional growth among teachers (Lindqvist, 2019; Sterrett & Richardson, 2020). A shared culture of innovation and experimentation encourages risk-taking and exploration of new pedagogical approaches.

Theme 4: Infrastructure and Resources

As a way of enhancing technology usage, school principals are leveraging reliable ICT, such as hardware, software, and connectivity, to support teaching and learning activities (Vermeulen et al., 2017). Digital infrastructure provided by school leaders is not limited to physical components but also encompasses policies and procedures that govern their usage (Schmitz et al., 2023). Providing technical support and incentives for teachers to utilise ICT effectively is essential for overcoming obstacles and promoting widespread adoption. Allocation of resources is being strategically done to align with school priorities and objectives.

Theme 5: Pedagogy and Instruction

Effective pedagogical technology integration involves aligning digital tools with instructional goals and methods. School principals, as instructional leaders, are leading their teachers to understand ways and manners they can leverage technology to enhance teaching and learning experiences (Schmitz et al., 2023; Rasdiana et al., 2024). Instructional support, among which are training and supervision, and digital leadership help teachers develop the necessary skills and confidence to integrate technology into their lessons (Baharuldin et al., 2019; Lindqvist, 2019). Pedagogical training supports teachers in designing engaging and interactive learning experiences that leverage digital resources effectively (Claro et al., 2017). Aligning the curriculum to support ICT usage ensures that technology is integrated seamlessly into teaching and learning practices.

Theme 6: Systemic Improvement and Evaluation

A holistic approach that addresses different parts of educational practices, policies, and structures is a systemic improvement strategy (Alajmi, 2022). For enhanced technology usage among teachers, school leaders are developing people, organisations, and instructional practices to adapt to technological advancements and changing educational needs (Thannimalai & Raman, 2018). School heads also conduct periodic evaluations of the impact of technology integration initiatives and inform future decision-making. The assessment measures outcomes at multiple levels, including student achievement, teacher efficacy, excellence in professional practices (Alajmi, 2022) and institutional effectiveness.

Theme 7: Digital Citizenship and Responsibility

It has also been found from the reviewed articles that school principals promote digital citizenship and responsible use of technology for safe, ethical, and responsible behaviour among teachers and students. Digital citizenship education equips learners and teachers with the knowledge, skills, and attitudes to navigate the digital world responsibly (Karakose et al., 2021). It encompasses topics such as online safety, digital literacy, and ethical use of information (Thannimalai & Raman, 2018). Providing freedom to use acquired skills in teaching empowers teachers to innovate and experiment with new technologies.

Theme 8: Support Services for Teachers

It has also been found that school leaders made provision for technical and non-technical support services for teachers who are either new to the integration of ICT in their teaching activities or those who are having some difficulties with its usage (Emeterio & Arias-oliva, 2020; Ilomäki & Lakkala, 2019; Gürfidan & Koç, 2016). This support is provided by information technologist strategists who were employed for that purpose (Reis-andersson, 2023). Many schools have support service departments, which are purposely constituted by the school authority to hearken to the call of any teacher who may be in need of one assistance or the other. The consequence of this strategy is improved competence and motivation in the classroom, not only on the part of the teachers but also on the part of the students.

Discussion

The primary purpose of this systematic review was to determine leadership strategies adopted by secondary school principals to enhance teachers' use of technology in their teaching and learning activities.

The systematic review incorporated 20 studies that met the stringent inclusion criteria, revealing several noteworthy demographic patterns. Geographically, the research spanned 15 countries, with Malaysia and Sweden emerging as the most prolific contributors, each accounting for 15% of the included studies (Thannimalai & Raman, 2018; Lindqvist, 2019; Reis-Andersson, 2024). This disproportionate representation suggests that these nations have prioritized research on educational technology leadership, potentially due to national digital education policies or stronger academic infrastructure. Other regions, including Chile, the Netherlands, and Ghana, were represented by single studies (Claro et al., 2017; Vermeulen et al., 2017; Asante & Novak, 2023), indicating significant gaps in research from developing contexts where technology integration challenges may be more pronounced (Munje & Jita, 2020).

Methodologically, quantitative approaches dominated (60% of studies), focusing on measurable outcomes such as teachers' technology adoption rates and leadership effectiveness (Afshari et al., 2012; Chen, 2013). Qualitative (20%) and mixed-methods studies (20%) provided richer narratives about implementation challenges and contextual factors (Karakose et al., 2021; Preston et al., 2015), but their limited inclusion points to a potential oversight of socio-cultural dimensions in technology integration research. The participant demographics showed a balanced inclusion of both teachers and principals, with sample sizes varying from small qualitative cohorts (e.g., 11 principals in Preston et al., 2015) to large-scale surveys (e.g., 2,248 teachers in Schmitz

et al., 2023). This diversity in sample composition allowed for both macro-level trends and micro-level insights, though the predominance of mixed-gender studies may have obscured gender-specific barriers highlighted in broader literature (Gómez-Trigueros & Yáñez de Aldecoa, 2021).

Temporally, publication frequency increased post-2015, peaking in 2019, likely driven by global digitalization trends and the pre-pandemic push for 21st-century learning skills (Sanusi et al., 2023). However, the small final sample (n=20) underscores a critical gap: despite the ubiquity of technology in education, empirical studies specifically examining leadership strategies for teacher adoption remain scarce, particularly in low-resource settings. This paucity limits the generalizability of findings and calls for more targeted research in underrepresented regions.

The analysis of the available literature showed that there is a paucity of studies specifically addressing the strategies employed by school leaders to enhance and motivate teachers to integrate technology in their teaching and learning endeavours. Nevertheless, in the twenty included studies in this review, a substantial number of strategies adopted by school principals was identified and grouped under eight different themes. It was noted that ICT goal setting and communication of the goals with the teachers remain a vibrant strategy for integrating and enhancing technology use by secondary school teachers. The ICT goals can be actualised with the willing power of a transformational leader (Vermeulen et al., 2017). The study has also revealed the efficacy of professional development programmes of ICT for teachers, the instilling of a digital learning culture, and the provision of infrastructure and other ICT resources required for successful integration in school teaching and learning endeavours. This finding is in congruence with (Chen, 2013; Preston et al., 2015; Reis-Andersson, 2024; Thannimalai & Raman, 2018; Vermeulen et al., 2017), who reiterated the importance of leaders' ICT vision for their schools, providing and maintaining ICT facilities and domesticating digital learning culture among teachers and students in secondary school make it easier for teachers to see the use of information and communication technologies as a responsibility that must be adequately discharged. This presupposes that where there is a well-communicated, clear digital vision, using it will become teachers' way of life. It should be emphasised that teachers' constant use of digital knowledge is also dependent on the availability of ICT infrastructure in the schools for the users and the continuous professional development of teachers' knowledge of ICT.

The systematic review identified eight key leadership strategies that secondary school principals employ to enhance technology integration among teachers. Visionary and transformational leadership emerged as foundational, with principals who articulated clear ICT goals and provided individualized support achieving greater teacher motivation (Afshari et al., 2012; Vermeulen et al., 2017). However, this approach's effectiveness depended on organizational culture and systemic buy-in (Ilomäki & Lakkala, 2019). Professional development programs proved crucial for building teacher competence and confidence, particularly when incorporating hands-on training and peer collaboration (Asante & Novak, 2023; Thannimalai & Raman, 2018), though accessibility remained challenging in resource-constrained settings (Adewale et al., 2022).

Successful principals cultivated digital learning cultures that normalized technology use through role modelling and collaborative practices (Lindqvist, 2019; Reis-Andersson, 2024). While reliable infrastructure was essential, its impact was maximized

when combined with pedagogical alignment and strategic vision (Schmitz et al., 2023; Alajmi, 2022). Instructional leadership that connected technology to curriculum goals through supervision and feedback loops showed particular promise (Chen, 2013; Rasdiana et al., 2024). Systemic evaluation processes enabled schools to adapt and improve their technology initiatives over time (Thannimalai & Raman, 2018), while attention to digital citizenship addressed ethical dimensions of technology use (Karakose et al., 2021). Comprehensive support systems, including technical assistance and mentoring, proved vital for overcoming implementation barriers (Emeterio & Arias-oliva, 2020), though their availability varied significantly across contexts. These interconnected strategies highlight the multifaceted nature of technology leadership, where vision, training, culture, resources, and support must work in concert to drive meaningful adoption.

Furthermore, this study also found instructional leadership, systemic improvement and evaluation, digital citizenship and responsibility, and provision of technical support for teachers to be critical complementary strategies that work synergistically with visionary and transformational leadership approaches. These additional components address the practical implementation challenges, ethical considerations, and ongoing sustainability of technology integration efforts in secondary schools.

The reviewed studies (Alajmi, 2022; Baharuldin et al., 2019; Claro et al., 2017; Karakose et al., 2021; Lindqvist, 2019; Thannimalai & Raman, 2018) indicated that it is easier to integrate technology where the school principal, as an instructional leader, provides a digital leadership role and evaluates the whole school system to enhance digital technology use. This implies that school leaders need to endear technology use to the hearts of teachers by providing necessary support for teachers. When this is available, confidence and a sense of responsibility are entrenched in the psyche of teachers, who are the primary target for onward dissemination of the knowledge among themselves and their students.

Implications for Education Leadership and Management

The systematic review has indicated a significant role of visionary leadership in driving technology integration in secondary schools. It implies that leaders who articulate a clear vision for digital transformation and embody transformational leadership can effectively inspire and guide teachers toward meaningful technology integration by fostering a shared sense of purpose, providing individualized support, and creating an environment conducive to innovation and continuous learning. This approach not only enhances teachers' confidence and competence in using technology but also ensures alignment between digital initiatives and broader educational goals, ultimately leading to sustainable adoption and improved teaching and learning outcomes. Leaders who wish to enhance technology usage among teachers should set ICT goals, communicate them effectively, offer individualised support and foster enthusiasm and commitment among teachers.

It also implies that school principals play a role in facilitating teachers' professional development to keep them abreast of technological advancements. This, therefore, requires a proactive promotion of ICT-based training and providing resources and incentives to cultivate a culture of lifelong learning among teachers. This investment

in professional development enhances teaching efficacy and students' outcomes, serving as a cornerstone for successful technology integration in secondary education.

Furthermore, the outcome of the review is that school leaders must provide reliable ICT infrastructure and policies indicating procedures governing technology usage. In other words, school leaders must provide technical assistance and strategically allocate resources that align with school priorities. Above all, the review also underscores school leaders' instructional leadership role in guiding teachers in aligning digital tools with instructional goals and techniques, facilitating pedagogical technological integration in education.

Conclusion

Having meticulously reviewed relevant articles, it has been established that secondary school principals have devised strategies grouped under eight themes to enhance technology integration and usage among teachers globally. However, it was found that more empirical studies need to be conducted to determine more useful strategies and address the paucity of literature on the subject matter.

Limitations and Direction for Future Research

In spite of the far-reaching implications for educational leadership and management practices discussed in this study, a few limitations are identified. First and foremost, the technology usage enhanced strategies among teachers are limited to secondary schools. Similarly, the number of articles included for review was very small. This might affect the extent of generalisation of the finding. Based on this, further research should extend the literature search to other databases to increase the number of studies included in similar research in the future. Similarly, more empirical research should be conducted on leadership strategies adopted for technology integration and endearing teachers to use it in teaching and learning activities.

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