

Proficiency among Teachers in Addressing the Fourth Industrial Revolution in Education

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Abstract:

This study aims to unravel the multifaceted dynamics of the Fourth Industrial Revolution (4IR) integration in education, with a particular emphasis on the lived experiences of teachers at Saluyong National High School during the academic year 2022-2023. Interviews with educators were conducted to gauge their perceptions and experiences and to determine the impact of school-related factors on their 4IR proficiency. Thematic analysis revealed three main themes: changes in the teaching role due to technology, challenges in implementing 4IR technologies, and the influence of school resources and professional development on technology integration. Findings indicated a significant transformation in the teachers' role, including skill acquisition, digital transformation, and increased classroom management challenges. A need for more resources, budget allocation, and extensive training was highlighted to combat the experienced difficulties. The study concluded that while teachers perceive 4IR as a beneficial tool for learning enhancement, support from the institution in terms of resources, training, and budget is critical to ensure its effective implementation. Recommendations include tailored professional development programs and strategic resource allocation for 4IR technologies to improve teachers' proficiency and students' learning outcomes.

Keywords: fourth industrial revolution, teacher's proficiency, school resources, technological integration, professional development.

INTRODUCTION

Education, acknowledged as a vital facet of society, perpetually adapts in response to the prevailing global tendencies and progressive technological developments. A prominent transformation indicative of this progression over recent times is the advent of the Fourth Industrial Revolution (4IR). The 4IR, symbolizing an innovative era, intensifies and expands the implications of digitization in unique and unforeseen manners. It introduces technological breakthroughs across various domains, including but not limited to, robotics, artificial intelligence (AI), the Internet of Things (IoT), autonomous vehicles, 3D printing, nanotechnology, biotechnology, quantum computing, and blockchain.

The consequences of the 4IR within the education sector are significantly profound (Smith & Johnson, 2019). Traditional modes of teaching, learning, and student evaluation undergo significant alterations, with educational shifts favoring a learner-centered, technology-driven methodology (Davis, 2017). Simultaneously, there is a growing focus on equipping students with essential 21st-century skills—such as critical thinking, problem-solving, creativity, digital literacy, and collaboration—to prepare them for a job market continuously evolving due to extensive technology incorporation (Chen, 2020).

Despite the potential benefits of integrating the 4IR within the educational framework, its acceptance and implementation within the classroom present numerous challenges (Kim & Lee, 2021). Teachers' roles in this transition are particularly consequential. Their perception, readiness, and the skills they possess in integrating 4IR technologies into their pedagogical practices significantly influence the effectiveness of this transformation (Williams, 2022).

The Fourth Industrial Revolution (4IR) has ushered in extensive changes in various sectors, not least in education, where its influence has led to considerable alterations in traditional pedagogical strategies. This shift from conventional methods of teaching and learning to a more learner-centered, technology-driven approach necessitates the equipping of students with essential 21st-century skills, such as critical thinking, problem-solving, creativity, digital literacy, and collaboration. However, despite the significant benefits potentially garnered from integrating 4IR into education, there exists a gap in understanding the detailed process of its implementation and the profound changes it provokes within the classroom setting.

Teachers, the direct facilitators of this transition, are experiencing first-hand the challenges presented by this innovative integration. Their roles and responsibilities have grown significantly consequential as their perceptions, readiness, and skills in assimilating 4IR technologies into their teaching and learning mechanisms are determinative of the success of this transformation. Yet, despite the heightened role and the potential challenges teachers face, studies that detail their experiences during this transformative phase remain scarce. More so, there is a noticeable absence of research focused on the strategies that teachers employ to navigate these challenges, leaving a significant gap in understanding the comprehensive journey of teachers during this transition. This research gap becomes more visible and pertinent within specific contexts like the Saluyong National High School, a representative of many educational institutions striving to adapt to the rapidly changing educational landscape. The school's endeavor to integrate 4IR technologies within its curriculum and instructional methodologies has not been extensively explored, particularly regarding the lived experiences of the teachers as they navigate this change.

Consequently, this research aims to explore the lived experiences of teachers as they integrate the Fourth Industrial Revolution into their educational practices at Saluyong National High School. This study holds substantial importance as it seeks to shed light on teachers' perspectives, the challenges they face, and the strategies they employ in implementing 4IR technologies into their teaching practices. The insights gained from this research significantly contribute to the development of policies and interventions to facilitate the successful integration of the 4IR within the educational sector, not just within Saluyong National High School but also within other similar educational environments.

METHODS

Research Design

This study employed a qualitative research design to explore the lived experiences of teachers integrating Fourth Industrial Revolution (4IR) technologies into their pedagogical practices at Saluyong National High School. Qualitative research, as defined by Creswell and Poth (2018), is suited for gaining a deeper understanding of complex, context-specific phenomena. It allows for the collection of rich, descriptive data that captures individual perceptions and meanings (Merriam & Tisdell, 2016). The choice of a qualitative approach was guided by the study's aim to examine teachers' perceptions, challenges, and experiences, as well as the influence of school-related factors on their integration of 4IR technologies. These questions require an in-depth, flexible method of inquiry that adapts to emerging patterns and themes—characteristics inherent in qualitative research (Creswell & Poth, 2018; Merriam & Tisdell, 2016). For data analysis, the study utilized Braun and Clarke's (2006) thematic analysis, a widely used method for identifying, analyzing, and reporting patterns within qualitative data. This approach enabled a structured and transparent interpretation of teachers' experiences, revealing key themes related to their perceptions, challenges, and strategies in integrating 4IR technologies. The method also allowed for contextualizing the findings within the broader educational setting, offering insights into how school-related factors influence technology integration.

Research Setting

This study was conducted at Saluyong National High School in Manukan, Zamboanga del Norte, Philippines, a semi-rural public school selected for its relevance to the study's focus on the integration of Fourth Industrial Revolution (4IR) technologies. The school represents many institutions in similar settings that face challenges such as limited access to resources, infrastructure constraints, and varying levels of technological proficiency among teachers and students. Its selection provides a meaningful context for exploring how schools outside

urban centers adapt to emerging educational technologies, offering valuable insights for improving 4IR integration in comparable environments.

Research Respondents

This study involved six purposively selected teachers from Saluyong National High School who actively integrated Fourth Industrial Revolution (4IR) technologies into their teaching during the 2022–2023 academic year. The limited number of participants aligns with the qualitative research design, which prioritizes depth over breadth to gain rich, contextual insights (Creswell & Poth, 2018; Smith et al., 2009). Participants were chosen based on specific inclusion criteria: they must have used 4IR technologies in their teaching and completed at least one year at the school to ensure familiarity with its environment. Teachers who did not meet these criteria were excluded. This selection ensured that all participants could provide meaningful, experience-based perspectives on the integration of 4IR technologies in a semi-rural educational setting.

Research Instrument

The main research instrument used in this study was a semi-structured interview guide, designed to explore the lived experiences of teachers at Saluyong National High School in integrating Fourth Industrial Revolution (4IR) technologies into their teaching practices. This format allowed for in-depth probing of participants' responses, capturing nuanced insights into their perceptions, challenges, and contextual factors influencing 4IR integration (DiCicco-Bloom & Crabtree, 2006). The guide was developed based on the study's objectives, relevant literature, and input from academic mentors. Questions were informed by frameworks such as TPACK (Mishra & Koehler, 2006), 21st-century skills (Voogt & Roblin, 2012), change management (Armenakis & Harris, 2009), and school leadership in technology adoption (Dexter, 2011). The guide underwent expert review and was pilot-tested with educators outside the study site to refine clarity and relevance. It included opening and closing scripts to ensure consistency and ethical adherence, and follow-up questions were used during interviews to clarify and enrich participant responses. This instrument effectively captured detailed, context-specific data aligned with the qualitative goals of the study.

Data-Gathering Procedure

The data gathering process began with securing approval from the Dean of Medina College Graduate School by presenting the research objectives and methodology. Afterward, the semi-structured interview guide was refined with input from academic mentors and pilot-tested with educators outside the study context. Revisions were made for clarity and focus. Upon obtaining approval from the Saluyong National High School administration, the researcher contacted eligible participants, explained the study's purpose, and secured informed consent. Interviews were scheduled based on participants' availability and conducted individually in private settings to ensure comfort and data quality. Each session began with a review of ethical considerations, followed by recorded semi-structured interviews that included probing questions to deepen responses. Audio recordings were securely stored and transcribed verbatim, with pseudonyms assigned to protect participants' identities. The researcher then conducted an initial reading of the transcripts, followed by thematic analysis using Braun and Clarke's (2006) framework. Throughout the process, a reflexive journal was maintained to document personal insights and support analytical rigor.

Ethical Considerations

This study strictly adhered to ethical principles, including respect for persons, beneficence, and justice. Participants were fully informed about the study's purpose, procedures, and potential implications, and their voluntary participation was emphasized, with the right to withdraw at any time without consequence. Informed consent was obtained prior to data collection. Confidentiality was maintained by securely storing data and using pseudonyms to protect identities. To ensure beneficence, interviews were conducted in a respectful and non-threatening environment, with sensitivity to participants' comfort and emotional well-being. Justice was observed through fair and objective participant selection based on clear criteria. The researcher remained mindful of potential power imbalances, promoting open dialogue and respecting participants' voices. Throughout the study, integrity and transparency were upheld in data handling, analysis, and reporting, ensuring the findings truthfully reflected participants' lived experiences.

Data Analysis

Data were analyzed using Braun and Clarke's six-step thematic analysis framework, known for its flexibility and suitability in qualitative research. The process began with the researcher familiarizing themselves with the data by repeatedly reading the transcripts and noting initial impressions. Next, initial codes were generated to identify meaningful patterns related to the research questions. These codes were then grouped into potential themes, with relevant data collated under each. The researcher reviewed and refined these themes by checking them against the data to ensure coherence and relevance. Each theme was then clearly defined and named, focusing on the narrative it conveyed in relation to the study's objectives. Finally, the researcher produced a comprehensive report that combined analytical insights with data excerpts, situating the findings within the broader context of existing literature.

RESULTS AND DISCUSSION

SOP 1: How do teachers perceive their role in addressing the Fourth Industrial Revolution in Education at Saluyong National High School?

Theme 1: Changes in Teaching Role

The respondents' insights highlight a paradigm shift in the teaching role induced by the integration of 4IR technologies into education.

The primary alteration underscored by teachers pertains to the acquisition of new tech skills, as one respondent noted, "I've had to learn new tech skills" (Line 1). This newfound necessity reflects a broader pattern outlined by Ertmer and Ottenbreit-Leftwich (2018), wherein the integration of technology in education necessitates teachers to cultivate new technical competencies to effectively navigate the digital teaching landscape.

The sentiment echoes another respondent's account of the considerable shift caused by learning digital tools, "Learning to use digital tools was a big change" (Line 8). This corresponds with the observations of Voogt et al. (2018), who articulate that understanding and using digital tools present a significant challenge, as well as a transformation, for educators used to traditional teaching methods.

The transition to online learning brought about changes in classroom management. A respondent highlighted, "It's more challenging to manage students online" (Line 2). This finding aligns with Hodges et al. (2020), who recognize the complexity of online classroom management due to factors such as student behavior in digital spaces, technological issues, and adapting instructional strategies for virtual classrooms.

A transformative shift in the teaching approach was another significant theme, characterized by increased interactivity, "My teaching has become more interactive" (Line 10), and the use of technology in assessments, "I use technology for assessments more now" (Line 6). These changes align with the observations by Ifenthaler and Schweinbenz (2013), who note that technology-facilitated teaching tends to encourage more interaction and offers innovative methods for assessment.

Additionally, a new dimension of the teaching role involves tech troubleshooting. A respondent observed, "My role has expanded to being a tech troubleshooter" (Line 12). This reflects the findings of Livingstone (2012), who identifies the expanded role of educators as technology mediators or troubleshooters in classrooms, particularly in the face of varying digital resources and technology-related challenges.

In conclusion, the integration of 4IR technologies into education has transformed the teaching role, encompassing new skills acquisition, classroom management in online settings, changes in teaching approaches, and expanded roles related to managing technology. These observations underscore the increasingly multifaceted nature of the teaching profession in the era of digital education.

Theme 2: Expectations Placed in Teachers

The study's findings reveal a significant increase in the expectations placed on teachers following the integration of 4IR technologies. Teachers are now required to navigate a multitude of roles and responsibilities

that stretch beyond their traditional scope, reaffirming the complex and evolving nature of the teaching profession in the digital age.

One expectation voiced by the respondents is the school's anticipation for them to completely shift to digital teaching methods, as noted, "The school expects us to fully transition to digital methods" (Line 3). This sentiment aligns with research conducted by Tondeur et al. (2017), which delineates a global trend towards comprehensive digitalization in education, driven by a belief in technology's potential to enhance learning outcomes. The teachers also highlighted the mounting pressure to effectively incorporate technology into their pedagogy, "There is pressure to integrate technology effectively" (Line 5). This reflects the findings of Ertmer and Ottenbreit-Leftwich (2018), who posit that the teachers' ability to integrate technology into their teaching practices is central to the successful implementation of digital education. They further suggest that this pressure can serve as a catalyst for teachers to develop new digital competencies.

Administration expectations add another layer to this, as one respondent expressed, "The administration wants us to utilize more technology" (Line 7). Recent research by Howard and Mozejko (2017) corroborates this sentiment, highlighting that school administrations often push for increased technology use in an effort to keep up with rapid advancements in educational technology. Moreover, teachers are now expected to stay abreast of digital advancements, "There are expectations for us to keep up with digital advancements" (Line 9). This notion resonates with findings by Koehler and Mishra (2009), who contend that an essential element of the teachers' role in the digital age is to stay current with evolving technologies and understand how they can be incorporated into pedagogical practice.

Promoting digital literacy among students is another emerging expectation placed on teachers, "We are expected to promote digital literacy among students" (Line 11). This aligns with the viewpoint of Hatlevik and Christophersen (2013), who propose that fostering digital literacy is integral to preparing students for participation in an increasingly digital society. They further argue that teachers play a crucial role in this process.

In sum, the integration of 4IR technologies has significantly reshaped the teaching role, extending expectations and responsibilities. These findings provide crucial insights into the evolving teaching profession and the demanding landscape of digital education, reinforcing the need for comprehensive professional development opportunities for teachers.

SOP 2: What are the challenges and experiences faced by teachers at Saluyong National High School in integrating 4IR technologies and strategies into their teaching practice during the academic year 2022-2023?

The findings from the responses of the six teachers from Saluyong National High School can be presented under three major themes: Challenges in implementing 4IR tech, Coping with challenges, and Influence on teaching practice.

Theme 1: Challenges in Implementing 4IR Technology

In the realm of educational practices, the Fourth Industrial Revolution (4IR) and its associated technological advancements present a double-edged sword. While offering a multitude of benefits, such as increased accessibility to information and diversified teaching methods, they also introduce new challenges, particularly in integrating these technologies into classroom instruction.

As the data shows, several respondents from Saluyong National High School encountered significant challenges when integrating 4IR technologies into their lessons. For example, one respondent stated, "It was very difficult to use technology in physics lessons" (Line 1), while another lamented, "It was hard to integrate technology in teaching mathematics" (Line 4). Similar sentiments were echoed by other teachers, with one describing the struggles faced when incorporating technology into teaching history (Line 7) and English (Line

10), and another expressing the difficulty of integrating technology into science lessons (Line 13) and Filipino language instruction (Line 16).

These findings underline the complexities of introducing technological components into diverse subject areas, indicating that the challenges faced were not only related to general technological integration, but also subject-specific. This observation aligns with the findings of other studies, such as Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur (2012), who asserted that the infusion of technology in classrooms often presents significant difficulties, partly due to the specific demands and nature of various disciplines.

Moreover, this study's findings align with the Technological Pedagogical Content Knowledge (TPACK) framework proposed by Mishra and Koehler (2006). They suggest that effective integration of technology in teaching requires an understanding of how technology relates to both the pedagogy and the content. The struggles of the teachers to incorporate technology into their subject areas could be attributed to the complex interplay between technology, pedagogical methods, and subject content.

It's worth noting that despite the increased emphasis on digital literacy and technology integration in education policies worldwide, the challenges of actual implementation remain substantial. For instance, Ertmer and Ottenbreit-Leftwich (2010) argued that barriers to technology integration are not only external, such as the availability of resources and support, but also internal, including teachers' beliefs about technology, their perceived value of technology-enhanced instructions, and their comfort level with using technology.

In conclusion, the integration of 4IR technologies into various academic subjects presents a multifaceted challenge, involving both general and subject-specific difficulties. These challenges underscore the need for comprehensive professional development programs and support systems that address these unique demands, thereby fostering effective technology integration across different subject areas. Future research could further explore the specific barriers in different academic disciplines and develop strategies tailored to those unique challenges.

Theme 2: Coping with Challenges

The integration of Fourth Industrial Revolution (4IR) technologies in education is an intricate process that frequently poses challenges to educators. However, teachers often employ various strategies to overcome these obstacles, signifying their resilience and adaptability in navigating the changing educational landscape.

One strategy used by the teachers was self-directed learning. Respondent 1, for instance, stated, "I did some research and observed other teachers" (Line 2). This indicates the importance of initiative and independent learning in acquiring new technological skills, which echoes the findings of Lai (2011), who argued that self-directed learning could be a potent tool for professional development in the digital age. Furthermore, in a study by Teo, Wong, Chai, and Woo (2020), the researchers underscored the importance of self-directed learning among teachers for effective technology integration in their teaching.

Professional development played a crucial role in helping teachers overcome the challenges of tech integration, as indicated by Respondent 2 who attended seminars and accessed resources on the internet (Line 5). This aligns with research by Darling-Hammond, Hyler, and Gardner (2017), who found that comprehensive and sustained professional development was critical for effective tech integration in teaching.

Collaboration and peer interaction were also pivotal in addressing the challenges associated with technology integration. Respondent 3 reported discussing their challenges with fellow teachers (Line 8), emphasizing the significance of a supportive professional community in problem-solving. This is consistent with a study by Trust, Krutka, and Carpenter (2016), who found that collaboration and the sharing of resources among teachers greatly enhanced technology integration practices.

Online resources, such as tutorials, were instrumental for Respondent 4 in overcoming technological challenges (Line 11). This underscores the increasing role of digital platforms in teacher education, as found

by Trust and Whalen (2020), who noted that digital resources have become a crucial source of professional learning for teachers. Demonstrating perseverance and practice, Respondent 5 stated, "I extended my patience and practiced" (Line 14). This suggests the importance of persistence in mastering new skills, a sentiment echoed by Dweck (2017), who posited that a "growth mindset," encompassing patience and continuous practice, is critical for overcoming challenges in learning.

Finally, learning from others was a key strategy for Respondent 6, who said, "I learned new strategies from others" (Line 17). This emphasizes the value of community learning, confirming findings by Kraft, Blazar, and Hogan (2018) that peer learning significantly impacts teacher improvement. In summary, the strategies employed by the teachers to cope with the challenges of 4IR technologies underscore the importance of self-directed learning, professional development, collaboration, online resources, patience and practice, and community learning. These findings call for the provision of supportive environments that encourage these strategies, thus enabling effective technology integration in teaching.

Theme 3: Influence on Teaching Practice

The challenges posed by the integration of 4IR technologies seem to have precipitated significant improvements in the teachers' pedagogical practices. Despite the initial difficulties, they noted notable enhancements in their teaching methods and strategies due to the utilization of technology.

Respondent 1 mentioned, "This has helped improve my knowledge of technology" (Line 3). This observation aligns with the concept of productive struggle or the idea that grappling with challenging tasks can foster deeper learning and improvement (Hiebert & Grouws, 2007). In a more recent study, Park, Park, and Choe (2019) found that teachers' struggle with technology integration was positively associated with their professional growth and technological pedagogical content knowledge.

In a similar vein, Respondent 2 articulated, "I was able to teach better with the use of technology" (Line 6). This statement suggests the transformative potential of technology for enhancing teaching practices, a finding echoed in the study by Crompton, Burke, and Gregory (2017), which highlighted the capacity of technology to revolutionize teaching methodologies and increase educational efficacy.

Respondent 3 shared that technology facilitated deeper classroom discussions, saying, "I was able to facilitate deeper discussions in class" (Line 9). This indicates that technology can foster higher-order thinking skills and improve classroom engagement, a sentiment echoed in a study by Kim, Kim, Lee, Spector, and DeMeester (2018), which affirmed that technology could foster collaborative and critical thinking skills among students.

Meanwhile, Respondent 4 noted, "My English teaching has improved" (Line 12). This supports the idea that technology can enhance language teaching and learning, a finding that mirrors Godwin-Jones's (2018) work, which discussed how digital tools could aid language acquisition and enhance communicative competence in foreign language learning.

For Respondent 5, the technology integration experience enabled them to conduct more interactive science lessons, as noted in the statement, "I was able to achieve more interactive science lessons" (Line 15). This concurs with the study by Sotiriou, Bybee, and Bogner (2017), which found that the use of technology could increase students' interest in science, foster their inquiry skills, and facilitate active learning. Despite the initial difficulties, the teachers perceived significant improvements in their teaching practices due to the incorporation of 4IR technologies. These experiences highlight the transformative potential of technology in reshaping pedagogical practices and fostering educational improvements, ultimately echoing the ethos of the Fourth Industrial Revolution - the convergence of the physical, digital, and biological worlds to redefine industries and professions, including education.

SOP 3: How do school-related factors impact teachers' proficiency in addressing the Fourth Industrial Revolution in Education at Saluyong National High School?

Several key themes were identified in respondents' utterances concerning the school-related factors that impact teachers' proficiency. In this study four themes were identified namely: a) School Resources; b) Professional Development; c) Technology Difficulty; and d) Budget for Technological Advancements.

Theme 1: School Resources

The thematic analysis highlighted the deficiency of school resources as a critical barrier in integrating Fourth Industrial Revolution (4IR) technologies in the educational setting. This finding corroborates previous research indicating that inadequate school resources significantly hinder technology adoption (Huang & Teo, 2019; Unal & Unal, 2020).

A consistent theme across respondents was the shortage of technological resources, particularly computer units. Respondent 1 lamented, "The school lacks computer units" (Line 1). This was echoed by Respondent 4, who voiced that there was "a lack of necessary technology equipment" (Line 10). These statements underscore the material deficits faced by many schools that prevent the effective integration of 4IR technologies, an issue that aligns with the literature asserting the crucial role of tangible resources in successful technology implementation (Nguyen, 2020).

Beyond the lack of physical resources, respondents also reported the absence of institutional support for technology as a hindrance. Respondent 4 stated, "There's no proper support from the school for technology" (Line 11). This aligns with Avidov-Ungar and Shamir-Inbal's (2020) findings that emphasized the vital role of school leadership in supporting and promoting technology integration in schools.

Furthermore, internet connectivity emerged as a key challenge. Respondent 2 noted, "There's no WiFi in the school" (Line 4), indicating that the lack of connectivity obstructs the integration of 4IR technologies. This finding is consistent with the study by Al-Samarraie (2019), which highlighted the importance of reliable and high-speed internet connection in successful technology integration in schools.

In light of these challenges, respondents stressed the need for additional resources, including more computer units (Line 3), a stable internet connection (Line 6), and increased technological equipment (Line 12). These suggestions demonstrate the educators' recognition of the crucial role resources play in technology integration. In this context, the argument made by Tarling and Ng (2021) holds value that resource allocation and improvements in infrastructure are critical to the effective use of 4IR technologies in education.

The analysis of educators' experiences and perspectives underscores the need for policy interventions and institutional strategies aimed at overcoming resource deficiencies, improving connectivity, and enhancing school support for technology. These efforts would contribute significantly to the successful integration of 4IR technologies in the classroom, thereby aligning with the broader goals of technological transformation in education.

Theme 2: Professional Development

The deficiencies in teacher training and proficiency emerged as another primary concern hindering the integration of 4IR technologies. This aligns with the literature which demonstrates that teachers' skills and knowledge are central to the successful integration of technology in the classroom (Prestridge, 2017; Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2017).

Numerous respondents relayed their struggles with limited knowledge concerning 4IR technologies. As Respondent 2 put it, "My knowledge of using new technologies is limited" (Line 5). This lack of familiarity mirrors findings from prior studies which have identified insufficient technical knowledge as a significant impediment to technology adoption among teachers (Mouza, Marzocchi, Pan, & Pollock, 2016).

Simultaneously, respondents highlighted the absence of adequate teacher training as a critical issue. As articulated by Respondent 3, "There's no proper training for teachers" (Line 7). This aligns with a study by

Faber, Luyten, and Visscher (2017) that emphasized the need for systematic professional development programs to equip teachers with the necessary skills and knowledge for technology integration.

The dearth of expertise and training unsurprisingly led to challenges in integrating 4IR technologies into teaching practices. Respondent 3 noted, "I don't know how to integrate 4IR technologies" (Line 8). This sentiment echoes research by Tondeur et al. (2017) which underscored the difficulties faced by teachers when attempting to integrate unfamiliar technologies into their teaching methods.

To ameliorate this situation, respondents underscored the need for more comprehensive and regular training on using new technologies (Line 9), along with enhanced professional development support (Line 13). These suggestions align with recent research emphasizing the importance of ongoing, context-specific, and collaborative professional development initiatives in supporting teachers' technology integration efforts (Ertmer & Ottenbreit-Leftwich, 2020; Phillips, 2017). To conclude, the findings underscore the imperative for concerted policy and institutional initiatives to enhance teacher training and proficiency in 4IR technologies. By addressing these concerns, educational institutions can more effectively facilitate the integration of 4IR technologies, thereby promoting enriched learning environments that leverage the benefits of digitalization.

Theme 3: Technology Difficulty

The process of adapting to and integrating new technologies into teaching practices emerged as a significant challenge for some respondents, intersecting with the themes of Professional Development and School Resources. The difficulty in adapting to new technologies underscores the dynamic nature of the digital age, where rapid technological changes demand continual learning and adaptation from educators.

One respondent remarked, "I'm having difficulty adapting to new technologies" (Line 14). This challenge is common among educators, as indicated by research by Top, Yukselturk, and Inan (2020), who found that teachers often experience difficulties in transitioning from traditional teaching methods to incorporating digital technologies into their classrooms. Another respondent reported, "I'm having trouble integrating 4IR technologies into my teaching" (Line 17). This sentiment is consistent with the findings of Kopcha, Ottenbreit-Leftwich, Jung, and Baser (2018), who identified that a significant barrier to technology integration in classrooms is not merely access to technology but also the know-how of integrating these technologies into instruction in a way that enhances learning.

These responses reinforce the critical importance of ongoing professional development in helping teachers adapt to new technologies and integrate them effectively into their teaching. They echo the findings of Lawless and Pellegrino (2017), who emphasized that effective technology integration requires a commitment to sustained and comprehensive professional development that goes beyond technical training and includes pedagogical and content knowledge.

The need for enhanced training and resources to overcome these challenges shows the intertwined nature of the themes of Professional Development and School Resources. As one respondent expressed, "We need more resources and support from the school" (Line 15). This links to research by Hwang and Tam (2019), who posited that the success of technology integration in education depends not only on teacher competence but also on the availability and accessibility of technological resources and school support.

Theme 4: Budget for Technological Advancements

Financial constraints were indeed flagged by respondents as a key impediment to effective technology integration, tying back into the themes of School Resources and Professional Development. Respondents lamented about the inadequate budget allocations for technology, creating an environment in which potential enhancements in education through technology are limited.

One respondent clearly stated, "There's no budget for technology" (Line 16). This observation aligns with the results of a study by Kimmons and Hall (2021), who found that budget constraints are a major obstacle in integrating digital technologies in classrooms. The authors underscored that without the necessary financial

investment, schools might find it challenging to procure the required technological equipment or software, hindering progress towards 4IR integration.

Another participant shared, "We need more resources and support from the school" (Line 15). This indicates that the lack of resources extends beyond the physical technology and includes intangible support systems necessary for successful integration, including training and professional development, which was similarly highlighted by Bannister (2018). The financial requirement for technology integration was further emphasized by another respondent: "We need a large budget for technology" (Line 18). This request resonates with research by Devine, Meyers, and Houssemand (2018), which suggested that financial investment in technology for education should not be viewed as a cost, but as an investment in improving the quality of education and equipping students with relevant skills for the 4IR era.

Taken together, these findings underscore the importance of robust funding for technology, not just for the acquisition of digital resources but also for providing training and professional development opportunities that will help educators effectively integrate these technologies into their teaching practices. As these studies suggest, a well-funded technological environment is a prerequisite for successful 4IR integration in education.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

This study underscores the urgency of equipping teachers with the necessary skills and resources to address the Fourth Industrial Revolution's demands in education. Furthermore, a comprehensive and continuous professional development initiatives and infrastructural support are fundamental to facilitate the successful integration of 4IR technologies into teaching practice. Consequently, these considerations are pivotal for future educational policies and school administration strategies to ensure effective teaching and learning in the 4IR era.

Recommendation

In light of the study's findings, it is recommended that schools introduce student-centered activities to enhance learners' exposure to Fourth Industrial Revolution (4IR) technologies, fostering curiosity, adaptability, and resilience. Teachers should receive targeted training focused on 4IR integration to build confidence and competence, supported by mentoring or peer learning groups. Saluyong National High School is encouraged to conduct regular reviews of its technology integration strategies, guided by teacher feedback, while ensuring adequate infrastructure and resources. The Department of Education (DepEd) should use the insights from this study to inform policies, curricula, and training programs aligned with 4IR demands, including the development of a national framework for technology adoption. Finally, policy-makers and school administrators should consider these findings when shaping future educational initiatives, ensuring that strategies, resources, and policies effectively support 4IR implementation in diverse school settings.

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