(RESEARCH ARTICLE)

Check for updates

Investigating the influence of 5G technology on educators teaching practices

Clarice Pillos Rutor [1], Jhonna Antalan Villegas [1, *], Rita Quizon Figueroa [1], Jerilyn Mahilom Cuizon [1] and Joven Aguinaldo Tolentino [2]

[1] College of Education, Tarlac Agricultural University, Philippines.
[2] College of Engineering and Technology, Tarlac Agricultural University, Philippines.

Abstract

This study delves into the application of 5G in the educational sector as a means of enhancing the teaching practice by engaging students. The main concern of the study is to educate the teachers in Tarlac, Philippines, not only about privacy and security issues but also about infrastructure development, and ensuring that they will be able to grasp the benefits of the technological era. Utilizing a quantitative framework, this study will involve 350 secondary school educators in both junior and senior high school levels which were chosen through stratified random sampling. It involves gathering the 5G technology knowledge along with the perceived implications and the problems that come with it by learning. The joint participation includes educators, administrators, parents, and students, when confronted with this issue may eliminate many kinds of defenses and is most likely to lead to the implementation of some initiatives.

This article explores how the 5th generation technology affects learning styles of teachers. It examines the interplay between 5G's abilities and teaching techniques, in-service training, as well as learners' participation and results. The study investigates how tutors adjust to and incorporates 5G into their pedagogy, the difficulties and what should be consider to be advantages for student engagement and scholarship. The research utilizes questionnaires, interviews, and case studies to illustrate both the opportunities and problems that come with 5G adoption in schools.

Keywords: 5g technology; Educators; Teaching practices; Professional development; Student engagement; Learning outcomes; Implementation challenges

1. Introduction

The impact of 5G technology on educators as an area for investigation reveals a significant evolution in the field of mobile technology. 5G delivers multi-Gbps speeds, ultra-low latency, improved reliability and large network capacity to revolutionize communication in various sectors. In education, the influence of 5G is remarkable as it allows for real-time data analysis in personalized learning experiences. The researchers seeks to explore how 5G affects teaching models employed by teachers and students' involvement in the lessons which can be adjusted dynamically thereby promoting individual academic progress. Similarly, 5G enables better video calling experience, making virtual reality based learning possible through AR and VR technologies and also facilitating immediate understanding of Big Data that supports mental health care (Meraj et al., 2015). New research shows that e-learning has been successful due to 5G networks. This surpasses geographical boundaries with global access to virtual classrooms, educational apps and live-streamed lectures reaching out millions around the world at once. It also helps address different learners' needs, promote inclusivity while enhancing student outcomes and engagement (Xuel et al., 2021).

However, despite its potential, there are challenges connected with the application of this technology in higher education that researchers need to examine carefully. This includes digital inequality; privacy issues; security

* Corresponding author: Jhonna Villegas

dimensions as well as continuous professional development requirements. Addressing these issues is crucial for effectively leveraging 5G in education (Mao et al., 2021).

The purpose of this research is to evaluate how 5G affects teachers in order to extend the conversation on technology integration in education. This study seeks to establish ways by which opportunities, challenges and impacts of its adoption can be identified with a view of making it possible for educators, policymakers and stakeholders to put them into practice. With its findings, the study intends to help shape further research and push the educational industry towards more innovative and all-encompassing policies.

2. Review of Related Literature and Studies

A recent study of teacher demographics vis-à-vis technology in education pays most attention to the levels at which teachers operates. Kulaksız and Toran (2022) on the other hand explore the preparation needs and competencies of preservice teachers across different educational levels. The effects of technology integration in various subjects are very different. Peciuliauskiene et al. (2022) point out the disparities in ICT self-efficacy and digital skills development among teachers of science, mathematics, and those teaching humanities subjects. The gaps between public and private schools concerning access to, as well as use of technology are profound as highlighted by J-PAL North America (2019) and are likely to influence academic performance according to school type. Reports from MIT News (2022) and others discuss educators' acquaintance with new technologies such as 5G network, their readiness for applying them in teaching practices and, finally, need for continuous professional training regarding digital competences is one more prevalent issue that was addressed by many researchers; IJETHE is one of them who suggested having an organized training course for educators so that they can make use of advanced technologies including 5G network system. The UNESCO (2023) report on technology in education brings to light many advantages that come with better internet connectivity like improved access to resources and interactive learning opportunities. Many researchers talk about how technology can greatly affect students' engagement and learning outcomes, it is mostly done through application of various technologies into the educational process such as personalized and interactive learning. MIT News (2022) gives support for technology improving student learning experiences. There are plenty of issues related to privacy and security in regard to educational technology, some of the major ones being raised by the UNESCO (2023) report and other studies are data privacy and digital learning environment security concerns among educators. Common challenges including infrastructure constraints, costs, and pushback against innovation are well documented, such as J-PAL North America (2019) describing real-world barriers in implementing technology solutions. The role of 5G in education is expected to be transformational with prospects of more personalized, immersive learning environments and collaboration on a larger scale. These future scenarios and their implications for teaching, learning strategies are examined in the International Journal of Educational Technology in Higher Education (2022).

2.1. Conceptual Framework

The conceptual framework for investigating the influence of 5G technology on educators' teaching practices encompasses key components that are essential for a comprehensive analysis. These include.
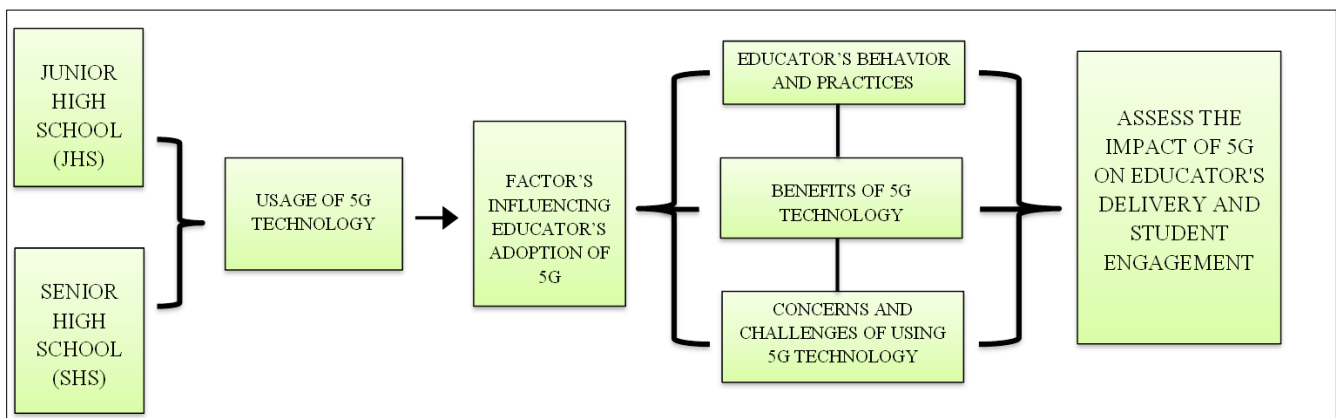
Figure 1 Conceptual Framework for Investigating the Influence of 5G Technology on Educators' Teaching Practices**.**

Factors influencing adoption are compatibility with existing practice; relative advantage; complexity; observability. This structure makes it possible for an organized investigation that provides insights along with recommendations supporting successful uptake of 5G in education.

3. Methods of Study and Sources of Data

This study uses a quantitative research design to systematically measure and analyse the impact of 5G technologies on educators. It aims to quantify educators' perceptions, experiences, and the influence of 5G on teaching practices by collecting numerical data. A stratified random sampling method will ensure a representative sample from diverse educational institutions, including Junior and Senior High Schools, stratified by educational levels, subject areas, and geographic locations. The study targets 350 junior and senior high school educators in Tarlac. A sample of 50 respondents, representing 14.3% of the total population, will provide a balanced view of 5G technology's impact on teaching.

A survey questionnaire, adapted from related studies and refined for this research, will gather quantitative data on educators' familiarity with 5G technology, its perceived impact on teaching practices, and associated challenges and opportunities. The survey will include Likert scale items, multiple-choice questions, and demographic information. A pilot test with a small group of educators will precede full-scale implementation to ensure the survey's clarity, relevance, and effectiveness. Feedback from the pilot will further refine the survey. The survey will be distributed electronically using Fynzo Survey App to selected educators with clear instructions and a reasonable response period to encourage high participation and minimize non-response bias. The collected data will be statistically analysed using comparative analysis to identify patterns, relationships, and associations. Results will be presented with appropriate statistical measures and visual representations, such as table chart.

Ethical considerations, including informed consent and ensuring participants' confidentiality and anonymity, will be prioritized. The research will adhere to ethical guidelines and regulations for human subjects. Findings will be disseminated through academic publications, contributing to the existing knowledge base on 5G technology's influence on educators. This dissemination will ensure that research outcomes reach relevant stakeholders and inform decision-making in educational contexts.

4. Results and Discussion

This study seeks to investigate how 5G technology impacts educators' teaching methods, covering aspects like their knowledge of 5G, training received on its integration, perceived advantages, concerns, and obstacles. By analysing survey responses, the study aims to understand educators' attitudes and preferences towards incorporating 5G into teaching. The findings from this exploration are as follows:

Table 1 Demographic Characteristics and Perceptions of Educators Regarding 5G Technology.

		Results	Percentage (%)
1.	Educational Level	Junior High School	78
		Senior High School	22
2.	Subject Areas Specialization	English	44
		Mathematics	24
		Filipino	12
		Others	20
3.	Affiliation with Educational Institutions	Public School	46
		Private School	54
4.	Familiarity with 5G Technology	Very familiar	66
		Somewhat familiar	26
		Not familiar at all	8

5.	Training on Integrating 5g Technology	Yes	74
		No	26
6.	Perceived Benefits of 5G Technology	Enhanced connectivity and speed	62
		Greater opportunities for interactive learning	20
		Improved access to online resources	18
7.	Impact on Student Engagement and Learning Outcome	Positive	76
		Neutral	16
		Negative	8
8.	Privacy and Security Concerns	Major concerns	36
		Some concerns	46
		No concerns	18
9.	Concerns and Challenges	Infrastructure limitations	42
		Cost of implementation	36
		Resistance to change from stakeholders	22
10.	Future of Education with 5G Technology	More personalized and immersive learning experiences	56
		Greater connectivity and collaboration among educators and students	42
		Minimal change in the overall educational landscape	2

This result includes the respondents' educational level which the majority (78%) primarily teach or work in junior high, with the remaining (22%) in senior high. Regarding subject areas, a significant portion of respondents specialize in English (44%), followed by Mathematics (24%), and Filipino (12%). The affiliation with educational institutions is evenly split, with 46% affiliated with public schools and 54% with private schools. The majority of respondents (66%) express a high level of familiarity with 5G technology and its potential applications in education, which indicates a readiness to embrace technological advancements in the educational setting.

Furthermore, the high percentage (74%) of respondents who have received training or professional development on integrating 5G technology into their teaching practices. The primary benefit perceived by the respondents in incorporating 5G technology in educational settings is enhanced connectivity and speed (62%), followed by greater opportunities for interactive learning (20%) and improved access to online resources (18%).

Notably, the overwhelmingly positive perception (76%) of the impact of 5G technology on student engagement and learning outcomes suggests a strong belief in the potential of 5G technology to enhance the educational experience. It is important to acknowledge the concerns expressed by educators regarding the privacy and security implications (22%) and the challenges foreseen in implementing 5G technology, such as infrastructure limitations (42%) and the cost of implementation (36%).

A noteworthy finding is that 36% of participants harbour significant apprehensions about the privacy and security implications associated with the use of 5G technology in educational environments, while 46% have moderate concerns, and 18% report no concerns. This underscores the substantial level of unease among respondents regarding privacy and security.

Looking ahead, the respondents envision the future of education with the widespread adoption of 5G technology as featuring more personalized and immersive learning experiences (56%), indicating a shift towards a more dynamic and engaging educational landscape.

5. Conclusion

This concludes the survey with seventy-eight percent (27%) respondents are Junior High School (JHS) teachers while twenty-two percent (22%) are Senior High School teachers and the majority specialized in English (44%), Mathematics (24%) and Filipino (12%). They were divided between public school (46%) and private schools (54%). Majority, which stands at 66%, knows about 5G technology with 74% of them having been trained on its use. The top advantages include improved connectivity at 62% interactive learning at 20% as well as enhanced resource access at 18% with an additional belief by 76% that students will have better engagement and outcomes through it. However, concerns about privacy (22%), infrastructure (42%), and costs (36%) remain, with 36% having significant privacy concerns. Looking ahead, 56% percent anticipate that this will facilitate more personalized and immersive learning using the fifth generation technology.

In conclusion, educators are ready to adopt 5G as a result of their positive attitude towards its potential for enhancing education. Nonetheless, addressing privacy issues, about infrastructure problems and resistance to change is essential to maximize its benefits. A strategic approach needs to be taken into account when integrating 5G technology in education, stressing prior action to exploit its transformative influence.

Recommendation

To successfully integrate 5G technology in education, it is crucial to address educators' concerns about privacy and security. Providing clear guidelines, training, and resources on data protection and cyber security can alleviate these worries. Infrastructure limitations, especially in areas with poor connectivity, should be addressed through investments in development and upgrades to ensure seamless 5G integration in schools. Educational institutions should offer financial assistance for implementation costs and professional development opportunities to support educators. Engaging stakeholders—educators, administrators, parents, and students in the decision-making process is vital for overcoming resistance to change and ensuring the successful adoption of 5G technology. Continuous monitoring and evaluation of 5G's impact on student engagement, learning outcomes, and overall educational practices are essential to identify areas for improvement and guide future decisions. Recommendations include addressing privacy concerns, investing in infrastructure, providing implementation support, promoting stakeholder engagement, and monitoring impacts to inform decision-making. These steps aim to facilitate the successful integration and utilization of 5G technology in educational settings.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] International Journal of Computer Science and Information Technologies 6(3), 2545-2551. Retrieved from https://scholar.google.com/.

[2] International Journal of Educational Technology Research 14(2), 102-115.

[3] Jianting Xue, Yuanyuan Mao. (2021). Research on the impact of 5G technology on teaching behaviour. Retrieved from https://scholar.google.com/.

[4] J-PAL North America. (2019). What 126 Studies Tell Us About Education Technology Impact. Retrieved from https://news.mit.edu/2019/mit-jpal-what-126-studies-tell-us-about-education-technology-impact-0226.

[5] Kulaksız, Y., & Toran, M. (2022). Understanding Pre-service Teachers' Competencies and Training Needs Across Different Educational Levels. Education and Technology Quarterly, 36, 102-115.

[6] Meraj, M., & Kumar, S. (2015). Evolution of mobile wireless technology from 0G to 5G.

[7] MIT News. (2022). What 126 studies say about education technology. Retrieved from [https://news.mit.edu/2019/mit-jpal-what-126-studies-tell-us-about-education-technology-impact-

0226](https://news.mit.edu/2019/mit-jpal-what-126-studies-tell-us-about-education-technology-impact-0226).

[8] Peciuliauskiene, A. (2022). Differences in ICT Self-Efficacy and Digital Skills Development Across Disciplines. Journal of Educational Technology Research, 14(2), 102-115.

[9] The International Journal of Educational Technology in Higher Education. (2022). How does technology challenge teacher education. Retrieved from https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-022-00375-1.

[10] UNESCO. (2023). Technology in Education. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000387743#:~:text=URL%3A%20https%3A%2F%2Funesdoc.unesco.org%2Fark%3A%2F48223%2Fpf0000387743%0AVisible%3A%200%25.

Appendix A

Questionnaire

Name:_____   Date:_____

Occupation:_____

1. Which level of education do you primarily teach or work in?

- Junior High
- Senior High

2. In what fields are you specialized as a teacher mainly?

- Mathematics
- Science
- English
- Social Studies
- Filipino
- TLE
- Physical Education
- Values Education
- Other

3. What kind of educational organization is attached to your name?

- Public School
- Private School

4. How familiar are you concerning 5G technology as well as its potential applications in teaching?

- Very familiar
- Somewhat familiar
- Not familiar at all

5. Have you undergone any training or professional development on incorporating 5G technology into your pedagogical techniques?

- Yes
- No

6. From the subsequent options provided, how would you tell the top merit of integrating 5G technology into classrooms?

- Enhanced connectivity and speed
- Improved access to online resources
- Greater opportunities for interactive learning

7. Can you describe how much impact does 5G have on student engagement compared to learning outcomes?

- Very positive
- Neutral
- Negative

8. What concerns might occur regarding using 5G for privacy and security reasons across educational institutions?

- Major concerns
- Some concerns
- No concerns

9. Select which obstacles would entail bringing 5G into an educational institution.

- Infrastructure limitations
- Cost of implementation
- Resistance to change from stakeholders

10. How do you see education's future when having such widespread adoption of 5g technology?

- More personalized and immersive learning experiences
- Greater connectivity and collaboration among educators and students
- Minimal change in the overall educational landscape