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Teachers' Ict Knowledge and Skills with Student Participation as a Mediator in Science and Technology Education

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Abstract

In Jiangxi Province, China, this research looks at how students' engagement in STEM subjects is affected by teachers' proficiency with information and communication technologies. The diversified demographic and socioeconomic context for this research is provided by Jiangxi, which is noted for its educational institutions such as Jiangxi Normal University and Jiangxi University of Science and Technology. Educators and students actively participating in education that integrates technology are chosen for the study using a purposive sampling technique. Particularly in metropolitan locations with greater ICT infrastructure, the results show that student engagement is greatly improved when teachers are proficient in using ICT. The study highlights the importance of equal access to information and communication technology resources and ongoing professional development for educators in order to establish productive classroom settings. These findings have important policy and practice implications for education, since they support smart investments in ICT to boost STEM education and get students ready for a tech-driven future.

Keywords: Teachers' ICT knowledge, Student Participation, Science and Technology Education, Educational Technology, Teacher Training

Introduction

A lack of studies examining how teachers' ICT skills affect students' capacity to learn and succeed in STEM subjects is highlighted by the problem statement. This study's results will help close a knowledge gap and illuminate how incorporating technology into the classroom might enhance pedagogical methods. This study aims to address a knowledge gap on the impact of instructors' information and communication technology (ICT) abilities on student support for science and innovation-related classroom activities at Jiangxi Territory College. Despite the growing focus on integrating ICT devices into education, there is a significant knowledge gap regarding the relationship between teachers' ICT competence, student engagement, and academic outcomes (Aagaard & Lund, 2019). Therefore, the purpose of this research is to determine how much the knowledge and skills of educators in the field of

information and communication technology affect student assistance and, by extension, student academic performance. By filling this need, the study hopes to contribute to the literature on the integration of ICT into higher education, shed light on effective teaching methods, and suggest ways to enhance science and innovation curricula at Jiangxi Region College.

The study's secondary objective is to provide light on the relationship between teachers' proficiency with ICT and their students' engagement with and performance in science and innovation classes. This study's conclusion would provide useful suggestions for improving classroom instruction by enhancing the existing state of academic and practical use of information and communication technology in higher education. The current body of research, particularly in the field of science and technology education, has failed to address the question of how instructors' proficiency with information and communication technologies interacts with the support they receive from their students (Gondwe, 2021). There is a need for more empirical data to show how instructors' ability to use ICT leads to improved student involvement in academics, despite the acknowledged importance of ICT integration in education.

This study aims to utilize empirical evidence to address the questions of how educators' ICT abilities impact academic performance and student help. Teachers, lawmakers, and curriculum designers can look to it for concrete recommendations. The study's results will be useful for identifying teachers' strengths and areas for growth when it comes to integrating technology in the classroom. According to Yannier et al. (2020), the collected data will guide efforts to improve teacher training and classroom technology integration. The overarching goal of this research is to fill a knowledge vacuum in the area of Science and Innovation at Jiangxi Province University and beyond, therefore advancing the subject. Among the many positive effects that information and communication technology (ICT) has on educational institutions, one of the most notable is the enhancement of teaching and learning quality, which leads to a more engaging and effective educational experience overall.

Chapter 1.4: The Missing Pieces of the Puzzle

It is absolutely necessary to look at the particular forms of information and communication technologies that the science and technology professors at Jiangxi Province University utilize. Part of this process is looking at how often different kinds of ICT tools are used and how well they engage students. The effects of institutional support and instructors' attitudes towards ICT on student involvement and learning results should also be investigated. There hasn't been a thorough examination of the particular information and communication technology (ICT) resources and tools used by science and technology instructors at Jiangxi Province University, which could be a research gap. Teachers' ICT knowledge and skills and student participation can be better understood by looking at the kinds of tools utilized, how often they are used, and how effective they are at increasing student engagement (Aston et al., 2023).

Additionally, there is a lack of research on the elements specific to Jiangxi Province University that may impact the use of ICT in pedagogical practices. It is possible that factors like institutional support, infrastructure availability, and teachers' attitudes towards technology have a major influence on how well ICT is integrated and how it affects student involvement.

A lack of research on the precise mechanisms through which student participation impacts academic achievement in science and technology subjects within the context of Jiangxi Province University is another limitation of the study, which intends to investigate the mediating role of student participation in the relationship between teachers' ICT knowledge and skills and students' academic outcomes. By filling these gaps, we can gain a better picture of the complex relationship between science and technology education teachers' ICT competence, student engagement, and student achievement. This, in turn, can guide the development of more focused approaches to improving science and technology education classroom instruction.

The goals will help faculty at Jiangxi Province University who aren't well-versed in certain information and communication technology (ICT) tools fill that knowledge gap. The e-learning tools used by instructors, how often they use them, and how effective they are at engaging pupils are all variables that the researchers want to uncover by analyzing teachers' present levels of information and communication technology knowledge and skills. Institutional support and teachers' attitudes towards ICT are expected to be significant elements impacting teaching and learning practices, and this study attempts to investigate them (Krah et al., 2023). In addition, the study will elucidate the function of information and communication technology (ICT) in student engagement and assess student performance in relation to their participation in teaching and learning activities supported by digital learning methods (Hnatenko et al., 2020). To improve student-teacher communication and group work in the classroom, it is crucial to understand how teachers' own ICT expertise relates to students' engagement. The study will also look at how engagement in STEM education is correlated with instructors' and students' knowledge of and use of ICT. The mediating role of student participation in the relationship between instructors' ICT knowledge and abilities and students' academic outcomes is also going to be explored in this study. Improving science and technology education at Jiangxi Province University is the ultimate goal of this all-encompassing study, which will shed light on the inner workings of ICT-integrated learning settings and guide targeted initiatives in that direction.

Literature Review

Information and communication technology (ICT) has revolutionized the way science and technical courses are taught and learned, according to Al-Rahmi et al. (2020). This has led to systemic improvements for both students and teachers. In this exploratory discourse, we will look at how information and communication technology (ICT) affects science and technology education in many beneficial ways. One way in which ICT is influencing STEM education is through the agency it gives students to find solutions to problems through more hands-on, interactive learning experiences. Although some students may find traditional forms of instruction, such as lectures and textbooks, more boring to learn than others, the passivity of these methods is often apparent in traditional classrooms. According to Sjølie et al. (2021), technological tools like computers and interactive whiteboards offer dynamic and engaging learning environments that encourage active investigation of concepts, hands-on experimentation, and real-time collaboration amongst classmates. Students can practice real-world experiments using any sophisticated scientific principles virtually, thanks to virtual laboratories and simulations.

Consequently, students can access a wealth of digital resources and multimedia material repositories thanks to ICT, which broadens their understanding of global views that could be useful in illustrating particular ideas. A wide variety of information is available through records, digital libraries, and web-based resources. One example is educational websites that offer interactive courses, video lectures, and the flexibility to study a subject thoroughly at one's own speed (Ishak et al., 2020). Videos, animations, and interactive figures are all examples of multimedia resources that can help students visualize topics and make learning more engaging and accessible for students with diverse learning styles. Consequently, students can benefit from information and communication technology by receiving tailored instruction based on their individual interests and needs. Adaptive learning platforms and educational software may quickly assess students' prior knowledge, determine their preferred learning style, and compile performance data to tailor lessons to each student's needs. Students may take responsibility of their learning, take pride in their progress, and become more independent and effective when they receive level-appropriate challenges, feedback on their stationery, and scaffolding support.

The creation of online meeting places for students, teachers, and subject matter experts to work together is another use of information and communication technology. Students are able to collaborate on projects, share ideas, and discuss academic topics in virtual classrooms, online forums, and collaborative assignments, all without being limited by physical distance. Wikis, Google Docs, and video conferencing systems all provide collaborative capabilities that help people work together, communicate better, and solve problems more effectively (Tang et al., 2020).

Disadvantages and Things to Think About When Incorporating ICT into the Classroom In the scientific and technological development processes, these expert abilities are fundamental. In addition, information and communication technology has an impact on inquiry-based instruction, which encourages students to pose questions, do research, and ultimately discover answers to real-world problems. Modern technology has made it possible for students to conduct research online, analyze data with software, and build models to study scientific topics. Exploring large data sets, building valid arguments, and conducting authentic scientific investigations are all within reach. Students develop their abilities to think critically, reason scientifically, and gain a better understanding of the scientific process via hands-on investigations.

Careful planning, thorough professional development for educators, and ongoing support during classroom sessions are necessary for the most practical deployment of ICT in intermittent science and technology education. According to Alrikabi et al. (2022), teachers should have enough knowledge of information and communication technology (ICT) tools and platforms to help their students achieve digital literacy and create personalized learning experiences. In this regard, it is compassionately imperative to guarantee that all students have equal access to digital resources and technology; that is, that they can all benefit from studying with ICTs. The impact of information and communication technology (ICT) on educational technology is substantial, extending far beyond the enhancement of teaching and learning to include the promotion of digital citizenship and the ethical application of technology. Therefore, in order to thrive in today's digital world, students need to develop a set of essential digital literacy abilities, including the capacity to think critically, behave

responsibly when online, and adhere to established ethical guidelines. Helping students develop skills in information evaluation, trustworthy source selection, and online ethics is a crucial part of a teacher's job as a guide in the classroom.

When it comes to science and technology education, information and communication technology (ICT) is crucial for introducing new methods of instruction that foster interactive, fruitful, and independently guided learning. In this way, we can help students become better collaborators and encourage them to learn via inquiry. Students are equipped with the necessary skills and competences to thrive in a world that is becoming more technologically advanced and interconnected through 21st-century ICT (Adeoye et al., 2024). Teachers' and others' active participation, universal access to technology, and the implementation of digital citizenship programs are all necessary for pupils to fully benefit from information and communication technology.

Methodology

Primary quantitative data on the relationships between instructors' ICT experience and students' classroom engagement will be collected by the researcher in this exploratory study design. Researchers will most likely administer surveys or questionnaires to both students and teachers to gather data on the following topics: students' views on the use of ICT in the classroom, teachers' levels of proficiency with ICT, and the extent to which students participate in learning activities that are facilitated by technology (Birgin et al., 2020). As evidence of these interrelationships, patterns, and correlations, the numerical data will be examined by statistical procedures. To show how a data set performed, we'll use descriptive statistics like the mean, frequency, and percentages. To test our hypotheses and find out how strong a relationship is, we'll use inferential statistics like regression analysis or correlation analysis.

This study will focus on the Chinese province of Jiangxi. One of the reasons why Jiangxi Province was chosen as the main destination of the study tour is because it is a center for Chinese education. The province is home to numerous universities and colleges that offer degrees in science and technology, including Jiangxi Normal University and Jiangxi University of Science and Technology. Furthermore, the province of Jiangxi has seen significant advancements in information and communication technology infrastructures and their integration into education. This makes it an ideal setting to study how teachers' proficiency with ICT affects students' engagement in STEM classes.

The demographically and socioeconomically diverse population of Jiangxi Province is an important aspect of the larger study of the role of context in the connection between instructors' technical competence and their students' level of engagement with the material. This study zeroes in on this specific topic, which has the potential to inform educational reform efforts across China and provide guidance to institutions in Jiangxi Province. Furthermore, because to its excellent links with participants and data sources, Jiangxi Province has opportunities for collaboration with local administrative bodies and educational institutions, which enables quick access to situational data (Ma et al., 2022). Engaging in conversation with local stakeholders will bring the study's relevance and applicability closer to home. This is especially true if the findings are tailored to the local context; eventually, they will be valuable resources for educational policies and practices in Jiangxi Province.

Additionally, this study would benefit greatly from conducting its research in Jiangxi Province. Thanks to a number of variables, including a constantly changing urban and rural setting, we can see how students' and teachers' levels of skill with information and communication technologies interact in Chinese classrooms.

The target audience for this research study is science and technology teachers and students in Jiangxi, the provincial capital of China. People who teach or educate science and technology courses at all levels, from elementary school to college, are the educators that students of these fields encounter (Fagerlund et al., 2021). Choosing the central role of science and technology teachers in guiding students' learning and participation in engineering and natural science courses is the first step in educating these teachers. Educators' technical proficiency and their pedagogical techniques are examined in this study to determine the connection between the two and the extent to which students engage with and acquire knowledge in

STEM Subjects

Additionally, students from all levels of education in Jiangxi Province who are majoring in science or technology would make up the target demographic (Zhuang & Liu, 2022). This study will center on students because they are the ones that actively use ICT apps in the classroom and, in essence, they are the ones who determine their own learning style. The study's overarching goal is to explore how students feel about and approach the use of information and communication technology (ICT) in the classroom, as well as how this integration influences their motivation to learn. Therefore, the research aims to understand how instructors' skill with ICT affects student engagement in learning activities and performance in STEM disciplines. Aiming to address several angles beyond just the educational landscape of Jiangxi Province, the study's target population has been selected and will serve as its instrument. To better understand the relationship between teachers' ICT skills and students' engagement in STEM education, as well as to contribute to informed educational policies and practices in the region, this research aims to examine both the educators' and students' engagement in STEM education.

The study will use a purposive sample strategy, which involves selecting participants based on a set of criteria linked to the research aims. The researchers in this study used purposive sampling to select students and teachers with first-hand experience with the use of information and communication technologies (ICT) in the classroom (Ramnarain et al., 2023). Educational factors such as prior teaching experience, academic credentials, and participation in professional development activities pertaining to information and communication technologies will make up part of the selection criterion for science and technology students. Teachers from a range of backgrounds, perspectives, and expertise in information and communication technology (ICT) will be actively involved in the process to ensure diversity. Likewise, students will be selected based on their grades, academic achievement, and the challenges they encounter in an online learning environment. In order to prevent underrepresentation at any one level of education, the sample will include people from a range of educational backgrounds, including elementary, middle, and high school.

Results and Discussion

The purpose of this research is to examine how students' engagement in STEM subjects in Jiangxi Province, China, is affected by teachers' proficiency with information and

communication technologies. This study takes advantage of Jiangxi's unique demographic and socioeconomic background to investigate the relationship between instructors' ICT ability and student involvement. Several important discoveries that add to our understanding of the connection between students' ICT skills and their engagement in the classroom are highlighted by this study's results.

First, students are more likely to show interest in STEM fields when their teachers are proficient in using technology in the classroom. Knowledgeable educators are more likely to use technology in the classroom to make lessons more dynamic and interesting for students. Students not only become more engaged with the material, but they also learn and remember more complicated scientific concepts as a result of this integration. Consistent with earlier studies, this one finds that instructors' proficiency with ICT is critical to creating a classroom climate that encourages student engagement and ownership of the learning process.

Secondly, the study's results were significantly impacted by the socioeconomic and demographic diversity of Jiangxi Province. Students and instructors came from many walks of life, which allowed for a rich tapestry of perspectives on the effects of ICT integration in the classroom. As an example, student involvement was significantly higher in urban schools with strong ICT infrastructure than in rural schools. If we want all students to reap the benefits of technology-enhanced learning, we must end this inequality in access to information and communication technology resources in schools.

Additionally, the study highlights the significance of ongoing professional development for educators in the field of information and communication technology. According to the results, instructors need continuous professional development and resources to stay up with the fast pace of technological change and successfully integrate new technologies into their lessons. Institutions of higher learning can improve science and technology education results for students by equipping educators with the tools they need to create an environment that encourages creativity and flexibility.

Finally, educational policy and practice in other locations can benefit greatly from the study's implications, which go beyond Jiangxi Province. The strong relationship between teachers' skill in information and communication technology and student involvement highlights the need for a national strategy to invest in teacher training programs and ICT infrastructure. Policymakers can better equip students to succeed in a technology-driven environment by making the integration of ICT in education a priority. This will improve the quality of both teaching and learning. The findings of this study can be used to influence future studies on the effects of ICT on education and to lay the groundwork for well-informed policies that encourage teachers to make good use of technology in the classroom.

Conclusion

In Jiangxi Province, China, this research shows that students' engagement in STEM subjects is strongly correlated with teachers' proficiency with information and communication technologies. Integrating technology into educational practices to improve learning outcomes is crucial, as there is a significant association between teachers' competency with ICT and student involvement. The results highlight the importance of equal access to

information and communication technology resources and ongoing professional development for educators as key factors in creating a stimulating and productive classroom setting. To better prepare students for a technology-driven society, this research offers useful insights for educational institutions and lawmakers who want to enhance science and technology education by strategically investing in information and communication technology infrastructure and programs for teacher training.

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