Kashihara, A. et al. (Eds.) (2024). Proceedings of the 32nd International Conference on Computers in Education. Asia-Pacific Society for Computers in Education

Determinants of ICT Competency Among Public School Teachers in Bukidnon

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Abstract: ICT (Information and Communication Technology) competency is crucial for teachers to create interactive and effective learning environments. However, there are still areas that face challenges such as limited resources, inadequate training, and poor infrastructure. This study, conducted among 1,275 public school teachers in Bukidnon, explored factors influencing ICT competency using the DigiCompEdu Questionnaire, a tool for measuring digital skills. The findings revealed that higher educational attainment is linked to increased ICT proficiency, while more years of teaching experience correlated negatively. Gender and time spent using technology showed minimal impact on overall digital literacy. These results highlight the need for targeted professional development programs and infrastructure improvements. Schools must provide teachers with the necessary support and training to effectively integrate ICT into education. Additionally, policymakers should focus on developing strategies to enhance ICT integration in similar contexts.

Keywords: e-literacy, ICT competency, Bukidnon education, educational technology, 21st-century skills

1. Introduction

The integration of Information and Communication Technology (ICT) into the education sector has also been viewed as an essential component of increasing the quality of teaching and learning. As technology advances, teachers must build and maintain strong ICT competences for student involvement, engagement in interactive learning environments, and educating students for digital citizenship. This calls for understanding factors influencing teachers' ICT competency in public schools in Bukidnon to facilitate targeted policy measures designed at improving ICT integration in education.

There are several challenges that make it difficult for teachers to make effective use of digital technology despite its huge significance in education. Such obstacles include differing levels of e-literacy on the part of educators' inadequate availability of technology tools as well as lack of due process training among many others. Several works have pointed out various factors like educational attainment, years of experience as a teacher and institutional support which determine these competencies. However, very few research studies have been done on the public-school teachers in Bukidnon.

The present study aims to find key determinants that bring about the competence of public-school teachers in Bukidnon in utilizing ICT by answering the following research questions:

RQ1. What is the current level of ICT competency among public school teachers in Bukidnon?

RQ2. How do educational attainment and years of teaching experience influence ICT competency levels among these teachers?

RQ3. What is the relationship between gender and ICT competency levels in this context?

RQ4. How does the amount of time devoted to using technology in the classroom affect teachers' ICT competency levels?

2. Challenges and Opportunities in ICT Integration for Education

The integration of Information and Communication Technology (ICT) into education is essential for improving teaching and learning, particularly in developing regions. While global initiatives promote ICT competency among educators, localized challenges—such as those found in Bukidnon—continue due to insufficient resources, training, and infrastructure.

ICT competence has become a cornerstone of modern education, with the potential to greatly enhance learning environments. However, many educators, especially in resource-poor areas, lack the digital literacy and support necessary to integrate technology effectively into their classrooms (Hero et al., 2021). Addressing this gap requires targeted training programs tailored to educators' needs, particularly in areas with limited ICT infrastructure (INTEF, 2017). The rapid advancement of technology further emphasizes the need for frameworks that help educators maintain and expand their digital skills (García-Delgado et al., 2023). Despite the benefits of ICT, numerous barriers hinder its implementation, including inadequate training and poor infrastructure (Del Mundo, 2022; Ibasco et al., 2023). The COVID-19 pandemic exacerbated these issues, revealing gaps in teachers' readiness for online learning (Barnes et al., 2023). In areas like Region XII of the Philippines, where digital adoption is relatively high, systemic issues related to resource allocation persist (Bacsarpa, 2023). Overcoming these challenges requires scalable and strategic solutions tailored to specific regional contexts.

Moreover, educational attainment is often linked to greater ICT proficiency, but experience alone does not guarantee digital competence. Veteran teachers, those with higher years of experience, may struggle with new technologies, highlighting the importance of continuous professional development (CPD) that keeps pace with technological advancements (Economou, 2023). Instructional leadership is key in providing educators with the knowledge and support needed to integrate ICT effectively (Noceto, 2022). CPD plays a vital role in maintaining ICT expertise among educators, but access to such opportunities is limited in resource-poor areas (Alayan, 2022). CPD programs are most effective when they are participatory and context-specific, addressing the unique challenges faced by teachers in different locations (Tayaban, 2022). For example, the preparedness of teachers in Bambang I District for blended learning demonstrates the need for hands-on training tailored to their educational contexts (Ibasco et al., 2023).

Other factors include gender, infrastructure, and policy. Gender disparities in ICT competency also remain a challenge. Female educators often lag behind their male counterparts in digital skills due to broader societal and cultural factors (Nueva, 2019; Larawan et al., 2023). Addressing these disparities requires the development of gender-sensitive strategies to ensure equal opportunities for professional growth. Infrastructure reliability is critical to successful ICT integration. Resource limitations, such as access to high-speed internet and modern hardware, particularly in rural areas like Bukidnon, hinder the full use of ICT in education (Lagos & Nabos, 2023; Lopez et al., 2023). These disparities must be addressed to ensure equitable access to the benefits of digital technology in all educational settings. Effective policy and institutional support are also crucial for ICT integration. While national programs exist, their impact is often reduced by a lack of regional focus (Joint Research Centre, 2023). Involving local stakeholders in policy development and implementation can ensure that efforts are contextually relevant and meet the specific needs of underserved communities (Salvador & Lopez, 2023).

The link between teacher ICT competency and student outcomes is well-established. Teachers proficient in ICT can better engage students, foster creativity, and improve academic performance (Hero et al., 2021). However, the impact of ICT on student achievement often depends on factors such as resource availability and institutional support (Aguirre et al., 2022). Proper use of ICT in the classroom enhances learning experiences and develops critical thinking and problem-solving skills, essential for success in the digital age (Lopez et al., 2023).

While progress has been made in recognizing the importance of ICT in education, significant challenges remain. These include integration issues, gender disparities, and a lack of continuous professional development. Addressing these challenges requires a combination of focused research, new policy initiatives, and ongoing investment in teacher development, ultimately creating more equitable education systems.

3. Data Collection

The respondents for this study were public school teachers from various schools in Bukidnon. A purposive sampling technique was used through coordination with the Department of Education Bukidnon. Questions focused on the ICT competencies present in six domains: professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and facilitating learners' digital competency. The questions were rated on a Likert scale from 1 to 5. Average ICT competency was computed for each teacher from their ICT Competency score. The questionnaire was administered online, with the help and assurance of DepEd Bukidnon, to ensure wide participation of the target population. The classification of the ICT competency was based on the DigCompEdu framework, enabling international comparison. This classification was fine-tuned after a review of existing studies on ICT competencies in education. The framework’s structured approach is highly effective for both self-assessment and professional development, addressing the challenges of 21st-century education by aligning teacher competencies with evolving technological demands (Caena & Redecker, 2019). Additionally, Haşlaman, Uslu, and Mumcu (2024) demonstrated its practical application, highlighting its capacity to provide detailed feedback on educators' strengths and areas for improvement, thus guiding targeted professional development.

Informed consent was obtained from all participants prior to their participation in the survey. The confidentiality and anonymity of the participants were ensured by assigning unique codes to each respondent and securely storing the data. Participants were informed of their right to withdraw from the study at any time without any consequences.

4. Findings

The study included 1,275 public school teachers from Bukidnon, comprising 189 male teachers and 1,086 female teachers. The significant gender disparity, with a higher number of female teachers, provides a context for understanding the overall ICT competency levels.

Teachers were categorized based on their ICT competency scores: 12% of the respondents were at the Basic Level (1.0 - 2.0), struggling with ICT integration; the majority (68%) were at the Intermediate Level (2.1 - 3.5), showing regular but moderate use of digital tools; and a smaller group (20%) was at the Advanced Level (3.6 - 5.0), proficient in integrating ICT into their teaching practices. These findings support the need for targeted professional development, particularly for those at the Intermediate level, as highlighted by previous studies (Aguirre et al., 2022; Garcia-Delgado et al., 2023; Salvador & Lopez, 2023). This analysis answers *RQ1*, indicating the necessity for school-based interventions to address disparities in ICT competency.

The data shows that the largest group of teachers (35%) has between 6-10 years of teaching experience, followed by those with 0-5 years of experience (32%). Years of teaching experience showed a negative correlation with ICT competency, indicating that more experienced teachers might struggle to maintain high levels of ICT competency. Specifically, for each additional year of teaching, a teacher's ICT competency level decreases slightly by 0.0137 points. This suggests that more experienced teachers tend to have marginally lower ICT skills, but the effect is minimal. The years of teaching experience only explains a small portion (2.6%) of the variance in ICT competency levels. This indicates that other factors, such as access to training, resources, and support, likely play a more significant role in enhancing teachers' ICT skills. Therefore, to effectively improve ICT competency among teachers, it is crucial to consider a broader range of influences beyond just teaching experience. This also suggests a need for continuous professional development for all teachers, regardless of their experience level.

In terms of educational attainment, 65% of the respondents have a bachelor's degree while only 31% completed a master's degree and the remaining 4% have PhD and Post Doctorate qualifications. Higher educational attainment is positively correlated with higher ICT competency levels, with teachers holding advanced degrees demonstrating greater proficiency in ICT skills. These findings address *RQ2*, emphasizing the importance of supporting teachers in pursuing further education and providing ongoing training.

Regarding gender differences, the study found a statistically significant but small difference, with female teachers scoring an average of 0.1203 units lower in ICT competency compared to their male counterparts. Although this difference is significant, it only explains a small fraction of the variance in ICT competency (R-squared = 0.003), suggesting other factors play a more substantial role. This aligns with findings by Larawan et al. (2023) and Paciente (2023), highlighting persistent gender disparities in ICT skills. These results answer *RQ3*, confirming that gender differences exist, but they are not the dominant factor influencing ICT competency.

For *RQ4*, almost all teachers (99%) reported 'very high' use of technology indicating 7-8 hours of use. There was a positive trend showing that more time spent on technology could lead to higher ICT competency, but the relationship was not statistically significant. Specifically, ICT competency levels increased by an average of 0.1427 points for each level of increased time, with a base level of 2.4016 when minimal time was used. However, the low R-squared value (0.003) indicates that time spent using technology accounts for only a small fraction (0.3%) of the differences in ICT competency levels. These findings suggest that simply increasing the time devoted to technology does not guarantee significant improvements in ICT competency. Instead, the quality and effective use of ICT tools are more important in enhancing digital skills. This finding answers *RQ4*, emphasizing that while time spent on technology is valuable, it must be paired with effective integration strategies and training to maximize its benefits in education.

The results align with the perspectives of Aguirre et al. (2022), who highlighted that the effectiveness of technology in the classroom depends more on its quality of use rather than the duration. This also supports the recommendation by Garcia-Delgado et al. (2023) for targeted professional development programs focusing on the effective integration of technology to ensure meaningful impacts on teaching practices and student outcomes.

Teachers were also asked about the favorability of their working conditions for ICT use. The favorability levels were categorized into very high, high, moderate, and low. More than half of the teachers (56%) reported 'very high' and 'high' favorability, indicating supportive working conditions for ICT use. Favorable working conditions were identified as an enabler for ICT use, although their direct impact on ICT competency levels was minimal compared to other factors. This highlights the importance of comprehensive support systems and resources to facilitate effective ICT integration suggesting that while supportive environments are crucial, other factors such as professional development and educational attainment play a more significant role in determining ICT competency levels.

5. Conclusion

This study reveals that higher educational attainment significantly enhances ICT competency among public school teachers in Bukidnon, while more years of teaching experience tend to correlate negatively. Gender and time spent using technology show minimal impact on digital proficiency, emphasizing the need for targeted professional development, particularly for experienced teachers. The findings underscore the importance of integrating ICT competency training into pre-service teacher education programs to ensure that new teachers enter the profession with strong digital skills. Additionally, while favorable working conditions support ICT use, they are not sufficient on their own, highlighting the need for comprehensive support through ongoing training and improved infrastructure. By focusing on these areas, educational stakeholders can enhance ICT integration, ultimately leading to better educational outcomes. Future research should explore the long-term effects of professional development on ICT competency and consider additional factors influencing digital skills to further inform policy and practice.

While the study provides valuable insights into the ICT competency of teachers in Bukidnon, it is not without limitations. The reliance on self-reported data may introduce bias, as participants may overestimate or underestimate their ICT skills. Nevertheless, this work contributes to the existing body of knowledge on ICT competency by providing specific insights into the experiences of public-school teachers in Bukidnon. Second, the findings can inform policymakers and educational leaders in designing targeted professional development programs and resource allocation strategies to support teachers' ICT skills. Lastly, understanding the barriers and enablers to ICT integration can help in creating a more conducive environment for effective teaching and learning, ultimately benefiting the students.

Acknowledgments

The authors express their gratitude to Central Mindanao University for supporting and funding the study, to the dedicated public-school teachers who invested their time in completing the survey questionnaires, and to the Department of Education Division of Bukidnon for their assistance in facilitating the data collection process.

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