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Enhancing Digital Competencies through Information Technology Courses: An Experimental Study in Science Education

This white paper provides a summary of the work from:

Hebebci, M. T., & Crompton, H. (2023). How IT Course Improves Digital Competencies: An Experimental Study in Science Education. Journal of Teacher Education and Lifelong Learning, 5(2), 466–476. https://doi.org/10.51535/tell.1280449

Research Author Bios

Dr. Mustafa Hebebci is an instructor at Necmettin Erbakan University. Dr. Helen Crompton is a Professor of Instructional Technology in the Department of STEM and Professional Studies, and the Executive Director of the Research Institute for Digital Innovation in Learning at ODUGlobal at ODU.

Overview

In today's rapidly evolving digital landscape, possessing robust digital competencies is essential for both personal and professional development. Recognizing this, educational systems worldwide have integrated digital skills into their core curricula to prepare individuals for the demands of the 21st century. Pre-service teachers play a pivotal role in shaping future generations, making it imperative for them to develop strong digital competencies. This study examines the impact of an "Information Technologies in Science Education" course on enhancing the digital skills of pre-service science teachers.

Purpose of Research

The primary objective of this research was to evaluate the effectiveness of a targeted IT course in improving the digital competencies of pre-service science teachers. The study addressed the following research questions:

1. Does participation in an IT course specifically designed for science education significantly enhance the digital competencies of pre-service teachers?

2. What specific areas of digital competency show the most improvement following the course?

3. How can the findings inform the integration of digital technologies into teacher education programs?

Method

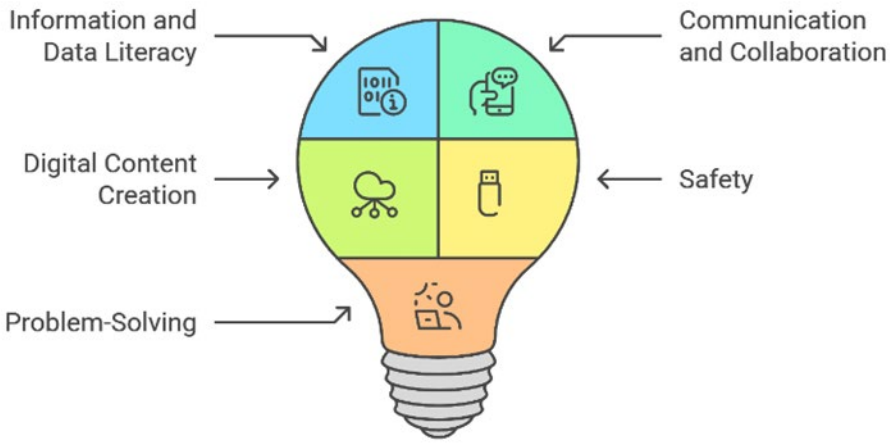
The study employed a one-group pre-test post-test experimental design to assess the impact of the IT course on participants' digital competencies. A total of 60 pre-service science teachers enrolled in the course participated in the study. The "Digital Competence Scale" was utilized to measure participants'

competencies before and after the course. Data was analyzed using paired sample t-tests to determine the significance of changes in competency levels.

Findings and Discussion

The results of the study indicated that the IT course had a significant impact on the development of digital competencies among pre-service teachers. These competencies included Information and Data Literacy, Communication and Collaboration, Digital Content Creation, Safety and Problem Solving.

Figure 1. Digital Competencies



When considering the specific digital competencies, significance was found in favor of the post-test in all competencies except problem solving. A further explanation of the increase in competencies is listed below.

Information and Data Literacy

Participants demonstrated improved abilities in identifying, locating, retrieving, storing, organizing, and analyzing digital information. This competency is crucial for effective research and evidence-based teaching practices.

Communication and Collaboration

There was a marked increase in participants' proficiency in communicating in digital environments, sharing resources through online tools, and collaborating effectively using digital technologies. These skills are essential for fostering interactive and engaging learning experiences.

Digital Content Creation

The course significantly enhanced participants' skills in creating and editing new content (e.g., text, images, videos), integrating and re-elaborating existing content, and understanding how to apply intellectual property rights and licenses. Such competencies enable teachers to develop customized educational materials that cater to diverse student needs.

Safety

Participants showed increased awareness and knowledge of protecting devices, personal data, privacy, and understanding digital identity management. This competency is vital for maintaining a secure digital teaching and learning environment.

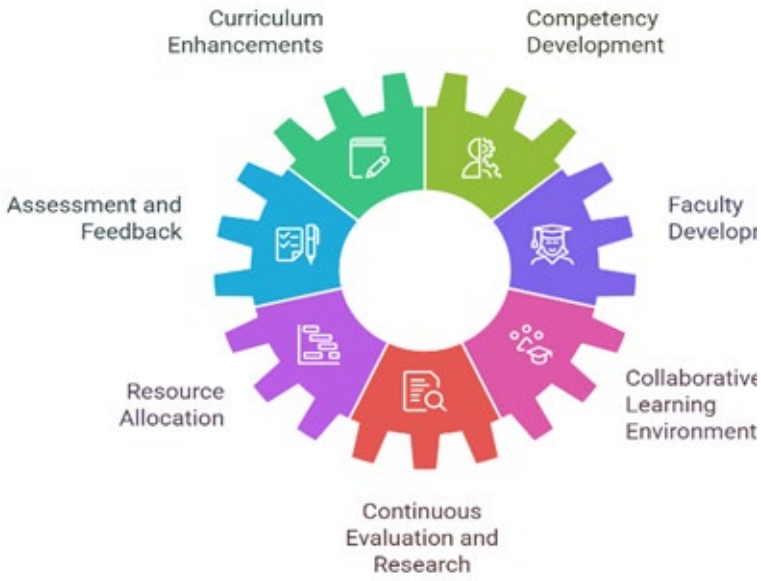
Problem-Solving

The course improved participants' abilities to identify digital needs and resources, make informed decisions about digital tools, and solve conceptual problems through digital means. These skills are critical for adapting to new educational technologies and methodologies.

Implications for Teacher Education Programs

The findings of this study have implications for teacher education programs in the following areas: curriculum enhancements, comprehensive competency development, assessment and feedback, faculty development, resource allocation, collaborative learning environments, continuous evaluation and research.

Figure 2. Implications for Teacher Education programs



Curriculum Enhancement

Integrating IT courses that align with recognized digital competency frameworks can systematically enhance pre-service teachers' digital skills. Consider adopting or adapting such frameworks to structure course content effectively.

Comprehensive Competency Development

Emphasizing all areas of digital competency—information literacy, communication, content creation, safety, and problem-solving—ensures that future educators are well-prepared to navigate and utilize digital technologies in diverse educational settings.

Assessment and Feedback

Implementing pre-test and post-test assessments can help in measuring the effectiveness of courses and provide feedback for continuous improvement. Such assessments also allow students to recognize their growth areas and build confidence in their digital abilities.

Faculty Development

Providing professional development opportunities for faculty to stay updated with the latest digital tools and teaching methodologies can enhance the overall quality of teacher education programs. Faculty equipped with current digital competencies can better mentor and model effective technology integration for pre-service teachers.

Resource Allocation

Investing in up-to-date digital tools and resources, including software, hardware, and access to online platforms, is essential. Ensuring that both faculty and students have access to these resources can facilitate hands-on learning experiences that are critical for developing digital competencies.

Collaborative Learning Environments

Encouraging collaborative projects that require the use of digital tools can help pre-service teachers develop communication and teamwork skills in digital contexts. Such experiences mirror real-world educational settings where collaboration is often mediated through technology.

Continuous Evaluation and Research

Engaging in ongoing research to evaluate the effectiveness of IT courses and staying informed about emerging digital competencies can help universities maintain the relevance and rigor of its teacher education programs. Publishing findings and participating in academic discourse can also contribute to the broader educational community's understanding of digital competency development.

Conclusions

The study highlights the critical role of targeted IT courses in enhancing the digital competencies of pre-service teachers. By aligning course content with established frameworks, teacher education programs can ensure comprehensive and measurable improvements in digital skills. The findings emphasize the need for a holistic approach to digital competency development, encompassing curriculum design, faculty training, resource allocation, and continuous evaluation.

References

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