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RESEARCH ARTICLE

Tutorials and mobile learning in higher education: Enhancing and accessibility

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Abstract: This comprehensive paper delves into two vital facets of contemporary higher education. The first segment investigates the transformative force of mobile learning (m-learning), elucidating its far-reaching impact on the educational landscape. Offering unprecedented flexibility and accessibility, m-learning redefines the dynamics between students and educators. The exploration navigates through potential benefits, challenges, and broader implications, providing a nuanced understanding of the evolving landscape of higher education in the digital age. The second segment focuses on the impact of active teaching in a first-year class at the National Engineering School of Carthage (ENICarthage) in Tunisia. Active teaching, recognized for engaging students in the learning process, is scrutinized for its effectiveness in enhancing theoretical understanding and graded assignment performance. This research introduces a dynamic dimension by incorporating mobile learning and tutorials as integral components of active teaching strategies. With its technological leverage, mobile learning aims to enhance student engagement, while advanced tutorials feature simulation functionality for an immersive learning experience. Through statistical analysis, the paper contributes to a nuanced comprehension of the positive influence of active teaching on academic achievements, offering practical insights into the application of active teaching methods and their potential benefits for enhancing student learning outcomes. This synthesis thus presents a holistic view of the dynamic interplay between mobile learning and active teaching in shaping the contemporary higher education landscape.

Keywords: tutorials, mobile learning, industrial automation, higher education, OOPP

1 Introduction

Active teaching encompasses various classroom practices that actively engage students in higher-order thinking activities, emphasizing analysis and evaluation over the passive reception of information (Abbsi et al., 2018). The past decade has witnessed a growing recognition of the pivotal role of active pedagogies and their benefits in teaching various subjects (Tinng et al., 2021; Shahnnia et al., 2016). Rooted in the belief that students learn most effectively when actively involved in the learning process, as opposed to passive listening to lectures, active teaching has positively affected learning outcomes. Despite this evidence, many educators have yet to integrate active pedagogies into their teaching practices fully. Recognizing humans' social nature and their innate desire for attention (Lakoua et al., 2022), it becomes imperative to establish a more suitable arrangement system (balti et al., 2023).

The realm of education faces numerous challenges (Zhao et al., 2018; Srihi et al., 2018; Gang-bin et al., 2011; Korroleva et al., 2018), including meeting diverse demands, adapting to rapid changes, increasing student enrollment, addressing persistent expertise deficit, aligning educational devices with market needs, enhancing overall expertise levels, and fostering positive student attitudes and satisfaction (Balti et al., 2021). Active learning, with its numerous benefits, offers a promising solution to these challenges:

(1) Increased engagement: Actively involved students are likelier to stay engaged in learning.

(2) Improved comprehension: Active participation enhances students' understanding of the material.

(3) Increased retention: Actively engaged students are more likely to retain learned material.

Developed critical thinking skills: Active learning fosters the development of critical thinking skills.

While active learning poses challenges for educators, its rewards are significant. Active learning strategies can lead to more effective learning and prolonged material retention. Tutorials

and mobile learning emerge as potent tools to augment active teaching. Tutorials offer step-by-step instruction across diverse topics, while mobile learning facilitates on-the-go learning experiences.

This paper delves into the Active Tutorials course conducted within the mechatronics engineering program at ENICarthage, Tunisia. It also presents a comprehensive student evaluation of the tutorial course, providing valuable feedback for ongoing enhancements. The subsequent sections of this paper are organized as follows: Section 2 outlines the specifications of project management tutorials, incorporating Oriented Objectives Project Planning (OOPP). In Section 3, the methodology of mobile learning platforms and active teaching is presented as a powerful combination. Moving on to Section 4, the findings of the evaluation on student satisfaction at ENICarthage are discussed, and Section 5 concludes by summarizing key insights and outcomes.

2 Mobile learning platforms and active teaching: A powerful combination

Mobile technology has revolutionized education, and mobile learning platforms are at the forefront of this change. Platforms like Moodle, Canvas, and edX offer flexible access to online courses and learning materials, while apps like Khan Academy and Duolingo provide engaging, bite-sized lessons on various subjects. These platforms are not just passive learning tools; they can be effectively combined with active teaching strategies to create a dynamic and engaging learning environment.

Active teaching methods like flipped classrooms, group discussions, and problem-based learning shift the focus from passive content consumption to active participation and application. Mobile learning platforms can seamlessly integrate with these strategies. For instance, flipped classrooms can utilize mobile apps for pre-class video lectures and quizzes, while group discussions can be facilitated through collaborative features on learning platforms. Mobile tutorials can support problem-based learning by providing real-world examples and interactive exercises (Papadakis et al., 2023).

The benefits of this combined approach are numerous. Mobile learning offers flexibility and accessibility, allowing students to learn at their own pace and revisit materials as needed (Lampropoulos, 2023). Tutorials and interactive elements within platforms enhance engagement and cater to diverse learning styles. Additionally, mobile learning can bridge the gap between theory and practice by providing real-world applications and immediate feedback, increasing retention and understanding (Melissourgaki, 2022).

In summary, mobile learning platforms are not just tools for delivering content; they are powerful assets for active teaching strategies. By integrating these platforms with techniques that encourage participation, application, and collaboration, educators can create a genuinely engaging and practical learning experience for their students.

3 Approach for Designing Tutorials with a Mobile Learning Emphasis

Tutorials serve as instructional tools offering step-by-step guidance for task completion or grasping new concepts. They find utility across various settings, such as classrooms, online platforms, or self-paced learning formats, providing a valuable avenue for active teaching. This section outlines a methodological approach to developing project management tutorials, emphasizing a structured analysis methodology (Lakhoua et al., 2021).

3.1 Presentation of the OOPP method

The proposed methodological approach centres around utilizing the Objectives Oriented Project Planning (OOPP) method, also recognized as the Logical Framework Approach (LFA). Widely employed in planning, designing, and managing projects and programs, OOPP has gained prominence, especially in international development contexts (Lakhoua, 2014; Lakoua, 2012). (see Figure 1)

The benefits of adopting the OOPP method include:

(1) Clarity and Structure: Offers a clear framework for effective planning and decision-making.

(2) Shared Understanding: Facilitates communication and collaboration among stakeholders

involved in the project.

(3) Focus on Results: Emphasizes the achievement of measurable objectives, ensuring a goal-oriented approach.

(4) Adaptability: Allows adjustments based on ongoing monitoring and evaluation findings, promoting flexibility.

(5) Accountability: Promotes transparency and a sense of responsibility regarding project outcomes.

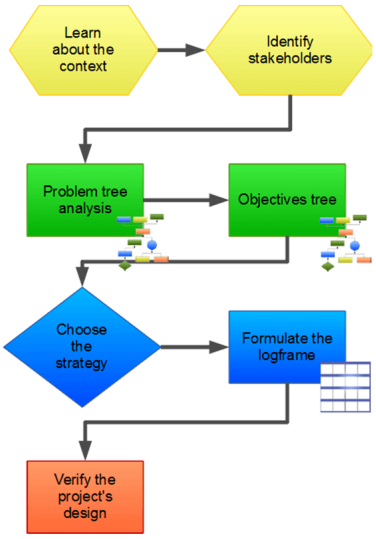

Figure 1 Project design with the logical framework approach

In light of the mobile learning emphasis, this approach aligns with the evolving educational landscape by considering the benefits of technology-enhanced learning experiences. By incorporating mobile learning principles into the tutorial development process, students can engage with educational content at their own pace, fostering a dynamic and interactive learning environment (Lakhoua et al., 2022).

3.2 Influences of project management tutorials

Figure 2 illustrates the evolution of the objectives tree for project management tutorials. This phase involves structuring an integrated and predetermined configuration or adapting and organizing the tutorial development according to a predefined plan (Ponzzanelli et al., 2018).

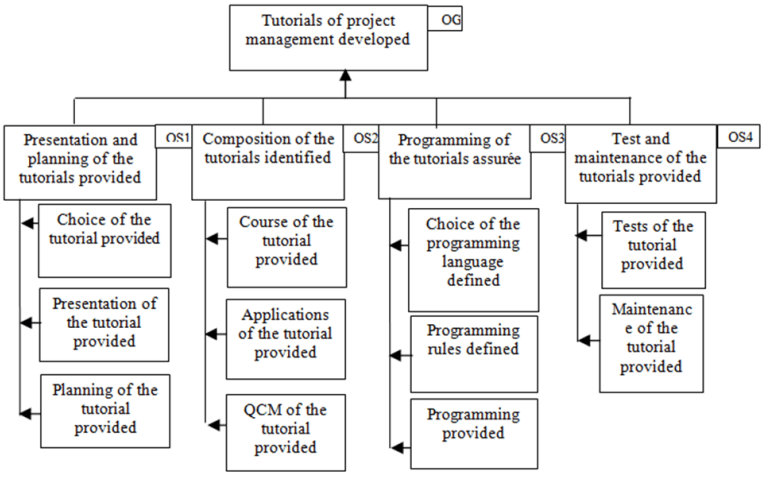

Figure 2 Tree of the objectives of the tutorials of project management

This study focuses on developing numerous tutorials within the project management education domain. Beyond the traditional formats of books or lectures, these tutorials are designed to be interactive and detailed. Their objective is to impart knowledge through practical exercises, providing information that aids in accomplishing specific tasks. Figure 2 visually outlines the objectives for the proposed project management tutorials, emphasizing the multifaceted impacts they aim to achieve.

Embracing a mobile learning approach, these tutorials are designed to accommodate the evolving preferences of learners who seek flexible and interactive educational experiences (Rotanova et al., 2018). Incorporating mobile learning principles ensures accessibility and adaptability, allowing students to engage with the tutorial content according to their pace and preferences, thereby creating an enriched and personalized learning environment (Tinng et al., 2021).

4 Evaluation and discoveries

In active teaching, the judicious utilization of tutorials and mobile learning is instrumental. These tools serve as valuable assets, enabling students to engage with educational content at their own pace, aligning with their unique learning styles, and fostering the development of critical thinking skills (Ji-chan et al., 2018).

The efficacy of tutorials and mobile learning lies in their ability to provide a personalized learning experience. Educators can harness these tools creatively to transcend conventional teaching methods. By encouraging innovative thinking and exploring unconventional approaches, teachers can discover myriad ways to leverage tutorials and mobile learning, elevating the effectiveness of active teaching strategies (Jurayev, 2023).

Incorporating a mobile learning approach further enhances the adaptability and accessibility of educational content. This ensures that students have the flexibility to engage with tutorials at their convenience, promoting a dynamic and personalized learning environment that goes beyond traditional boundaries. By exploring inventive methods, teachers can unlock the full potential of tutorials and mobile learning, optimizing the impact of active teaching practices.

Traditional systems, characterized by a more significant number of learners, often result in diminished student focus and limited opportunities for interaction. In contrast, tutorial classes featuring smaller groups foster increased engagement and facilitate discussions around lecture content. These tutorial sessions are commonly dedicated to resolving exercises, encouraging a more interactive and participatory learning experience.

Within the mechatronic program, all courses undergo evaluation after each semester. This section delves into the impact of tutorials, focusing on the subsequent analysis and discussion of their effects. Primarily, student satisfaction is assessed through official evaluations conducted by ENICarthage.

Student satisfaction and total scores were compared between two periods: before tutorial development (2019-2020) and after (2020-2021). Throughout both academic years, students consistently lauded the tutorial activities as ”well-designed and fairly practical.”

Table 1 provides a glimpse of sample Satisfaction Survey Questions from students, while Figure 3 presents the satisfaction levels in percentage terms. The findings from these evaluations shed light on the positive impact of tutorials on student satisfaction, emphasizing their perceived practicality and effectiveness in enhancing the learning experience.

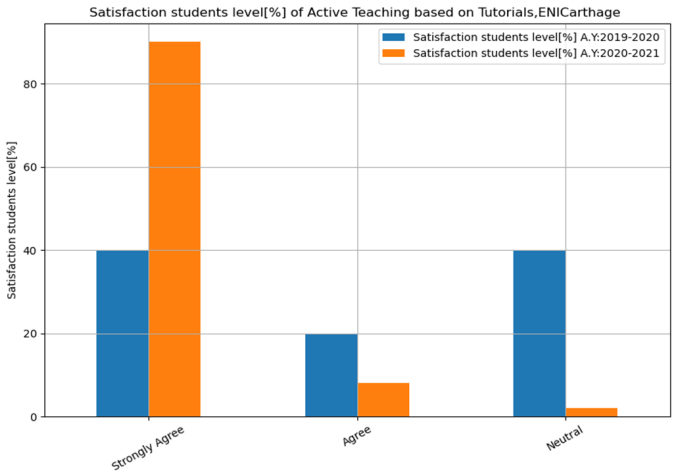

Figure 3 Satisfaction students level [%] of active teaching based on tutorials, ENICarthage

Incorporating a mobile learning approach into these tutorial sessions further amplifies their effectiveness by providing students greater flexibility and accessibility. As we delve into the

nuanced aspects of student feedback, it becomes evident that tutorials' interactive and practical nature significantly contributes to an enriched and engaging learning environment.

Table 1 Survey questions and satisfaction students level (%)

Satisfaction Survey Questions		Level of satisfaction		
		Strongly Agree	Agree	Neutral
1- Did you attend the totality workshop of active tutorials? (Yes: agree or No: Neutral)			X	
2- Rate your overall level of satisfaction with active tutorials.		X		
3- Overall, how did this year's active tutorials compare to last year's?		X		
4- The active training tutorials helped build my capacity to respond to the needs of industry systems.			X	
5- The active training tutorials increased my knowledge of Mechatronics and programmable logic controllers.		X		
6- The training increased my understanding of the critical issues related to engineering working with active tutorials.				X
7- The training improved my presentation skills in factory automation.		X		
Satisfaction students' level [%]	Satisfaction of students level [%] after the development of the active tutorials, Academic years 2019-2020 and 2020-2021.	90%	8%	2%
	Satisfaction of students level [%] before the development of the active tutorials, Academic years 2017-2018 and 2018-2019.	40%	20%	40%

5 Conclusion

This study aims to share insights derived from our experiences in higher education, wherein we implemented innovative pedagogical methods—specifically, active tutorials and mobile learning—to enhance the educational process. A distinctive feature of these tutorials is their carefully crafted content, achieved through a systematic approach that leverages planning by objectives based on the Objectives Oriented Project Planning (OOPP) method.

Integration of tutorials and mobile learning emerges as a potent strategy for fostering an active learning environment and promoting student engagement (Tülübaş et al., 2023). Through a comprehensive analysis of outcomes and valuable feedback from students, we observe a notable increase in efficiency and motivation resulting from these methods. Students appreciate the interactive teaching methodologies and feel actively involved in shaping the course content. A significant aspect of our tutorials involves conducting portions in small groups, transforming students from passive recipients into active participants.

This study on active teaching centred on tutorials and mobile learning lays the groundwork for ongoing efforts to broaden the analysis and modelling of teaching techniques. Our overarching aim is to explore and extend the application of structured methods, seeking a comprehensive understanding of their impact on education. Our goal remains steadfast as we refine our approach—cultivating an enriching and dynamic learning experience for students with active participation and continuous improvement in teaching methodologies.

Our approach's critical, unique contribution lies in emphasizing interactive teaching methodologies, particularly within small-group settings. This not only accommodates diverse learning styles but also promotes inclusivity. A student's reflection is an illustrative example: "Being part of a small group made me feel seen and heard, fostering a sense of community that positively impacted my learning experience."

Acknowledging these contributions, we recognize the imperative to elevate the novelty of our research. To achieve this, we plan to undertake a more nuanced analysis of student performance metrics and attitudinal changes over an extended period. This long-term perspective aims to uncover trends and patterns that contribute to a deeper understanding of the sustained impact of our teaching methods.

Looking ahead, we commit to intensifying our analytical perspective in discussing results and refining our approach from a broader standpoint. By incorporating diverse perspectives, including those from students with varying academic backgrounds and cultural contexts, we aspire to ensure the applicability and effectiveness of our methods across a broader spectrum. This commitment reflects our dedication to advancing pedagogical practices and creating an inclusive educational environment that aligns with the evolving needs of students.

Ethics declaration

The authors declare that the study was approved by the National Engineering School of Carthage (EniCarthage), University of Carthage, Tunisia.

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Conflicts of interest

The authors have declared no potential conflicts of interest regarding the research, writing and/or publication of this article, research, writing and/or publication of this article.

Availability of data

The corresponding author will provide the information supporting the study's conclusions upon a reasonable request.

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