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"Current Issues, Trends, and New Ideas in Education"

M-Learning and Experiential Learning in Vocational Education

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Abstract

The aim of our research was to investigate the impact of the use of mobile devices in mobile technology (MT)-enabled experiential learning (EL). *Methods/Analysis:* The basis of the research was an experiment. Quantitative data included pretest and post-test results of two groups of students (ELs and regular education students). Qualitative data consisted of individual analysis of a final questionnaire composed of 37 items, some of which were open-ended. A 5-point Likert scale was used for evaluation, and some questions were open-ended. *Findings:* The results showed that the average knowledge gained in the EL group's post-test increased compared to the regular class. We found that after the photographing/note-taking phase, students with the ability to use mobile devices generally lost interest in further observation. We also found that both groups had great difficulty in the question design and comparison sections, in finding answers to the prepared questions. *Novelty/Improvement:* it became apparent that the teaching process needed to be modified. The photo-taking phase should be done after close observation so that the sensory experience is not replaced by mobile devices. The comparison phase did not show a significant result in any of the observed viewpoints and can be omitted. The sensory experience, sound recording, requires some modifications, more effectively applied in the classroom environment, as ambient noise was a problem in the teaching process.

Keywords:

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M-Learning;
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Experiential Learning;
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1- Introduction

The rapid advancement of science and technology has positioned the development of mobile technologies and artificial intelligence (AI) as a major focus within educational systems worldwide, emphasizing the need to cultivate relevant skills and competencies [1]. Experiential Learning Theory (ELT), which has been extensively applied in education and practice for over 35 years, supports this aim. According to Albort-Morant, employing experiential learning strategies enhances students' comprehension of theoretical concepts and leads to superior academic performance [2]. Additionally, Holik highlights that students possess varied learning styles and research demonstrates their preference for engaging in experiential learning (EL) activities that involve direct experiences to enhance their knowledge [3]. ELT, rooted in the foundational work of Kurt Lewin, John Dewey, and other influential theorists [4, 5], offers a comprehensive framework for dynamic learning. This approach characterizes learning as a continuous process that incorporates four key contexts shaped by situational needs. A distinctive feature of EL is the creative tension between different learning models [6]. The core of this learning model is a cycle consisting of four interrelated stages: experience, reflection, conceptualization, and action. These stages collectively foster deeper understanding and practical application [7, 8].

Incorporating mobile technology into inquiry-based learning, combined with lectures, self-directed study, collaborative activities, and game-based learning, is more effective than traditional methods in informal learning

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environments [9]. Gan and Balakrishnan (2014) explored factors influencing mobile learning adoption and its impact on improving teacher-student interactions during lessons [10]. The growing use of mobile phones for educational purposes facilitates seamless information sharing between teachers and students [11]. Advancements in ICT have led digital devices to become more compact, mobile, and interactive, introducing new opportunities for innovative, experiential learning in classrooms. Consequently, mobile learning can be seen as the evolution of e-learning, bridging the gap between real and virtual educational experiences [12].

It provides unrestricted access to information, allowing students to make personal choices and take responsibility for their learning. This approach fosters active, independent, and interactive learning that supports both personal and social development. Mobile learning shifts students from passively receiving information to actively directing their own learning, enhancing their sense of autonomy and self-realization. Naismith and Corlett (2006) identify five key factors that impact successful active learning through mobile technologies:

- ***Access to Technology***: Mobile devices should be accessible anytime and anywhere.
- ***Ownership***: Learners should either own their devices or have access to borrowed ones that they can use as their own.
- ***Connectivity***: Reliable wireless or mobile network connections are crucial.
- ***Integration***: Mobile learning should be integrated into the curriculum and connected to students' daily experiences.
- ***Institutional Support***: While the primary advantage of mobile technologies is their ability to give learners control over their learning, successful implementation also requires adequate support from the educational institution [13].

Experiential learning is inherently an autonomous process of acquiring knowledge from past experiences and applying it to new situations. Moreover, it is applicable in many disciplines. Kabilan Krishnasamy's study looks at the process in peacekeeping, where the experiential learning of troop-contributing countries is particularly unique [14]. If we look at similar research in the field using experiential learning or the application of modern technology, for example, Liao et al. (2024) combine experiential learning with artificial intelligence and project-based learning [15], using elements of augmented reality and virtual reality (AR/VR) in their experiment. A phenomenological study and a team of authors around Rodriguez et al. (2024) have explored the Kolby cycle of experiential teaching, applying it to university educators to reflect on their expertise, the importance of engaged experiences and new knowledge [16].

In summary, previous significant literature on ELT has mainly shed light on areas other than general education of technical subjects and outside the Slovak context and mode of education. Therefore, more attention should be paid to research on experiential learning using ICT in the teaching of technical subjects in secondary vocational schools. While the effectiveness of implementing experiential learning requires the committed participation of pupils, attracting pupils within an experiential classroom learning approach can be a challenge as it may not be easy for pupils to recognise, immerse and reflect on new experiences. In order to bridge the above gaps, increase pupil engagement, motivation to learn and improve their learning experience, ICT has been embedded in experiential learning in this proposed pedagogical approach, incorporating an element of collaboration in an innovative and skilful way. The strategy of asking students to solve a problem by proposing new questions about the issue expresses an approach to learning that could motivate students to experience, consolidate and reflect towards their learning.

1-1- M-learning

Incorporating mobile devices like phones and tablets into the learning process is known as M-learning (Mobile learning) [17]. M-learning, a subset of e-learning, leverages mobile devices, but its significance transcends the technology itself — it's fundamentally about the mobility and flexibility these devices offer to learners. This connection between M-learning and experiential learning resonates particularly well with younger students who are accustomed to and fond of mobile technology.

M-learning emphasizes enhancing teachers' competencies in two main areas:

- ***Technological Proficiency***: Teachers must understand how to effectively use mobile devices, as neglecting this aspect may lead to underutilizing the devices' potential.
- ***Didactic Knowledge***: Teachers need a solid grasp of the curriculum's instructional content, as focusing solely on technology could render M-learning merely motivational without impacting learning outcomes.

Additionally, game-based mobile learning combines two powerful trends: the increasing use of mobile devices and the growing popularity of educational games, which foster deep learning. The authenticity and contextual relevance of such learning activities provide teachers with effective tools [13].

Despite its advantages, there are certain barriers that hinder the widespread adoption of M-learning. The cost of advanced mobile devices and online connectivity can deter students, while underdeveloped pedagogical strategies for

M-learning can discourage teachers from incorporating it into their teaching. While these factors pose challenges, the goal of mobile learning is to increase its relevance by expanding learning methods and creating a more flexible, accessible, and effective process for sharing knowledge. Importantly, M-learning is designed to complement, not replace, traditional teaching methods [17].

2- Applying Mobile Technologies in Experiential Learning

The declining student interest in engineering science is attributed to content- and test-driven curricula, coupled with pedagogies that overlook students' interests and needs [18]. Given that technical vocational subjects are from the category of "subject that loves and hates," which evoke strong feelings in students [19, 20], there is an urgent need to rejuvenate technology education through pedagogical approaches that not only promote students' deep learning and problem-solving skills, but just as importantly, their affective engagement with science [21].

Scientific theories propose modern pedagogical approaches and strategies to enhance students' learning and boost their motivation. One such approach is experiential learning, which enables students to gain deeper understanding and reflection through guided experiences. When integrated with ICT and mobile technologies, experiential learning creates opportunities to explore its potential for enhancing motivation among vocational secondary school students. Mobile devices and ICT offer immediate learning opportunities and feedback, as shown by studies indicating their effectiveness in outdoor learning and field trips [22, 23]. These technologies are becoming increasingly popular in classrooms.

In this context, we connected ICT and mobile devices with experiential learning. Mobile technologies offer instant recording, note-taking, and are equipped with cameras and audio recording features. They provide computing power and wireless connectivity, making learning immediate, authentic, accessible, efficient, and convenient [24, 25].

Mobile technologies serve multiple roles, with the following key functions highlighted [22]:

- ***Capturing Real-Time Information***: Mobile devices allow learners to gather information whenever and wherever it's needed, supporting the learning process with readily accessible materials. This functionality helps learners stay focused and navigate topics effectively, preventing them from deviating from their learning goals.
- ***Enabling Quick-Access Interfaces***: Mobile devices offer features for note-taking, photography, and audio/video recording. These tools help students stay organized and focused even outside the traditional classroom environment. However, the challenge lies in whether students can recognize, implement, and maximize this knowledge both indoors and outdoors within the framework of experiential learning.

2-1- Design and Implementation of Experiential Learning Activities

Our aim was to explore learners' perceptions of mobile technology features and their impact on the learning process. To achieve this, we established two key objectives:

- To conduct an experiment using ICT and mobile devices in the learning process.
- To compare knowledge acquisition between two groups of secondary school students - one using mobile devices during learning and the other not using them.

We developed a learning process and teaching strategies using mobile technologies to support learning during instruction in an ICT equipped laboratory environment. The laboratory is one of the most modern in the university, well-equipped with high-speed internet. The teaching approach was based on experiential learning practices in teaching programming and was structured into six stages (Figure 1):

- ***Photographing/recording knowledge***: students captured lecture content through photographs to document key visual information. The lecture took place at the college in a special laboratory with high-quality computers. One group recorded the content by taking photographs. The other group could only use traditional lecture content notetaking.
- ***Sensory experience***: this phase focused on using multiple senses, such as sight and hearing, to reinforce sensory impressions. Pupils using mobile devices were able to use all available options such as recording videos, sounds and other sensory stimuli. The second group again used only hearing, sight and the ability to scribble, jot down notes.
- ***Further observation***: students deepened their understanding of specific topics through close observation. When they needed more information, the first group of students found mobile devices facilitated access to online learning resources. The second group could only use materials supplied by the teacher.
- ***Refined questions***: students were asked thought-provoking questions to encourage analysis and critical thinking. They presented their answers based on the data collected, distinguishing between correct and incorrect observations and updating their records accordingly.

- ***Question generation***: The first group used mobile devices to conveniently orally record their questions, thus promoting cognitive restructuring and deeper conceptual understanding. The second group had only traditional options, pen, paper, and teaching materials.
- ***Final report***: Upon returning to the classroom, students compiled their findings into a final report in which the first supine integrated photographs, voice memos, questions, and observations. The second group compiled their notes. The goal of this step was to help students organize the knowledge they had gained and consolidate abstract ideas into a comprehensive understanding.

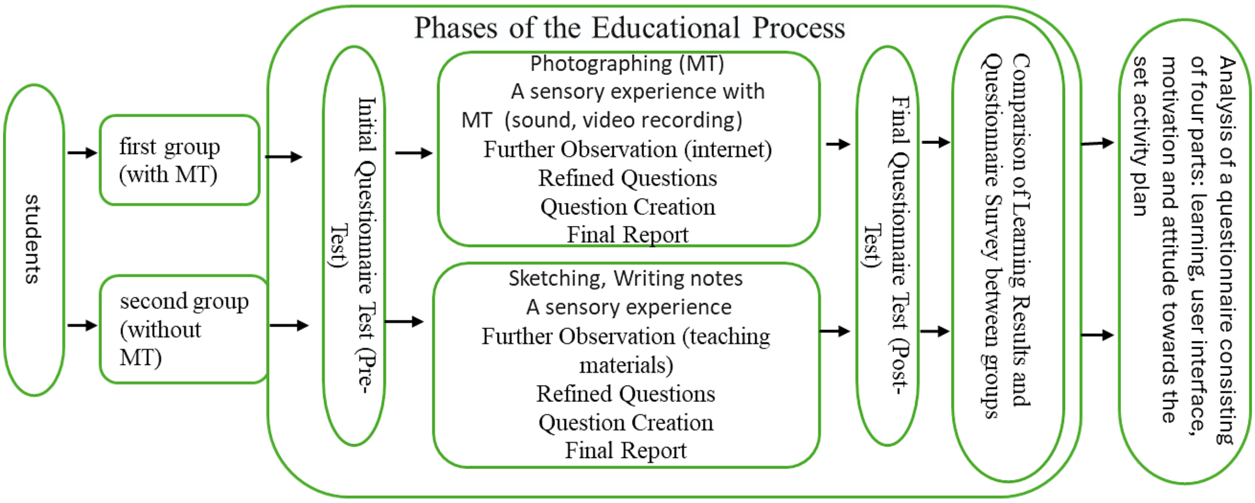

Figure 1. The process of the experiment

Supplementary data can be found in the DTI College library under the title: *Creating and Using Didactically Effective Modules to Develop the Creativity of Engineering Students.*

The goal was to create knowledge through experiential learning focused on two main phases: generating questions and synthesizing the findings into a final report. During the questioning phase, students practiced thinking about unclear aspects and formulating relevant questions. In the final report, they synthesized their findings into a coherent understanding of the topic [26].

2-2- Research Methodology

The research aimed to test the hypothesis that mobile technology enhances knowledge creation beyond traditional methods, such as pen and paper. The experiment involved two third-year high school classes: an experimental group of 26 students using mobile devices and a control group of 23 students relying on traditional tools.

The instructional control took place in the following phases:

- ***Pre-test:*** They had already debriefed the content once in the traditional teaching.
- ***Post-test:*** After all activities, both groups completed a post-test identical to the pretest (see Appendix I).
- ***The final reports*** were analyzed by categorizing the sentences into two categories: knowledge gained directly in the learning process (e.g., from lecture or notes) and new knowledge gained from external sources or deeper understanding.
- ***The post-experiment questionnaire*** contained 37 items to assess students' attitudes towards experiential learning and the integration of ICT and mobile technologies and several open questions about students' attitudes towards the educational process in general and to assistive technology in particular. It was divided into four parts: learning, user interface, motivation and attitude towards the activity plan. A 5-point Likert scale was used for the responses (5 being strong agreement, 1 being strong disagreement). The questionnaire included 30 items common to both groups and an additional seven items specific to the experimental group to capture their experiences with the technology. The goal of the experiment was to assess whether the use of mobile devices positively impacted knowledge creation and student engagement compared to traditional learning methods.

2-3- Results

The experiment investigated the level of knowledge acquisition using mobile technology in experiential learning by comparing two different classes. We used a 10-question test to test the acquired knowledge of both groups. Both groups were on the same level in terms of knowledge at the beginning, after the assessment of the Pre-test, as the statistics show. The test had 10 questions and different answer forms (one correct answer, multiple correct answers), eventually there is a part of code and answer in the test, which will be seen in the output (see Appendix I).

Both groups received the same tutorial lecture, no rivalry was created between the groups and as mentioned several times the test showed that prior knowledge was at the same level.

No significant difference was found when analysing the Pre-test, i.e. the knowledge acquired so far. We analysed the Pre-test, the average of the test results of two independent sets. To use a *t*-test to compare the means of two independent sets whose sample size is less than 30, we first had to test the equality (inequality) of the variances of the independent sets using the *F*-test (Table 1). As a result, the sets did not show equality of variances ($F < F$ Critical, reject H_0- equality of variances, *P*-value < α, α = 0.05), so we used the *t*-test to compare the means of two independent sets using the inequality of variances t-test (Table 2).

Table 1. F-test result for the Pre-test phase of both groups

Pre-test		
F-Test Two-Sample for Variances		
	Variable 1	***Variable 2***
Mean	3.115384615	3.173913
Variance	1.146153846	3.241107
Observations	26	23
df	25	22
F	0.353630394	
P(F<=f) one-tail	0,006753494	
F Critical one-tail	from 0.4407	

Table 2. Result of t-test for the Pre-test phase of both groups

Pre-test		
t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	***Variable 2***
Mean	3.115384615	3.173913
Variance	1.146153846	3.241107
Observations	26	23
Hypothesized Mean Difference	0	
df	35	
t Stat	-0.136075639	
P(T<=t) one-tail	0.446270579	
t Critical one-tail	1.689572458	
P(T<=t) two-tail	0.892541157	
t Critical two-tail	2.030107928	

When comparing the mean scores, as expected, the analysis showed no significant differences at the beginning of the experiment when comparing the means of the Pre-tests of the two groups (*t Stat* = -0.13608, *P* > α, α = 0.05) (Table 2).

The effect of educational attainment is shown in Table 3, confirmed by comparing the means of the results obtained in the posttest, using an independent-sets *t*-test with inequality of variances. The analysis showed significant differences between the two groups (Table 3), as confirmed by both the *t*Stat and the *P*-value (if *P*-value < α, α = 0.05, we reject the null hypothesis, which represents equality of means, and confirm the alternative hypothesis, the assumption of an increase in post-test scores).

Table 3. Effects of learning outcomes for both groups

	first group (with MT)		**second group (without MT)**			
	Mean	**St.dev.**	**Mean**	**St.dev.**	***t* Stat**	***P*-value**
Pre-test	3.12	1.07	3.17	1.80	-0.14	0.45
Post-test	6.77	0.99	6.04	1.66	2.23	0.04
n	26		23			

So far, we have only compared groups to each other. When comparing the knowledge gained in both groups by the system for the same individuals, the difference of the average in the Pretest and Posttest after the process of experiential learning using a paired t - test, a significant improvement of the first group was confirmed, which clearly points to the clearly positive impact of the use of mobile technologies. Alternative hypothesis predicted an improvement in the results of students in the group using mobile technologies (one-sided test $t\ Stat < -t_{1-\alpha;n-1}$; where $-t_{1-\alpha;n-1}$ is the quantile of the Student's distribution with n-1 degrees of freedom; first group: $t\ Stat$ = -16.4974; second group: $t\ Stat$ = -7.2804) (see Table 4). Interestingly, the findings also show that the second group improved, although the first group experimental more significantly.

Table 4. Comparison of paired t-test results for both groups

First group (with MT) t-Test: PairedTwo Sample for Means			Second group (without MT) t-Test: Paired Two Sample for Means		
	Variable 1	**Variable 2**		**Variable 1**	**Variable 2**
Mean	3.115385	6.769230769	Mean	3.173913043	6.043478
Variance	1.146154	0.984615385	Variance	3.241106719	2.770751
Observations	26	26	Observations	23	23
Pearson Correlation	0.402603		Pearson Correlation	0.406901446	
Hypothesized Mean Difference	0		Hypothesized Mean Difference	0	
df	25		df	22	
t Stat	-16.49743		t Stat	-7.280413778	
P(T<=t) one-tail	3E-15		P(T<=t) one-tail	1.36023E-07	
t Critical one-tail	1.708141		t Critical one-tail	1.717144374	
P(T<=t) two-tail	6E-15		P(T<=t) two-tail	2.72045E-07	
t Critical two-tail	2.059539		t Critical two-tail	2.073873068	

In order to investigate how students created knowledge during experiential learning, we further analyzed the final reports of all students from the experimental and control groups. Each sentence in the final reports was considered a unit of analysis and was classified into one of two categories: - acquired knowledge - created knowledge. As an experiential learning activity, the acquisition of knowledge was only one of the objectives. In order to explore how the students built knowledge in experiential learning, the following we analyzed the final reports of the two classes. The results (see Figure 3) showed that in terms of the number of descriptions already given in the related materials, there was a significant difference between the two classes there were no differences. However, in terms of the number of newly created descriptions during the experiential learning process, students with MT created more knowledge than students without MT. That is, the learner did discoveries in more detail when using the photography technique using MT during the experiential learning, it forced the students to think and create cognitive schemas and reach refined and deep conceptual understanding . Based on the exemplary information outcome, we can argue that mobile technologies have the potential to support experiential learning in a very productive way.

The results (see Figure 2) showed that, while in terms of the number of knowledges already mentioned in the related materials, there was no significant difference between the two classes (t Stat = 0.07; P-value = 0.85), in terms of the number of newly - acquired knowledge during the experiential learning process, students who also used mobile technologies created more knowledge.

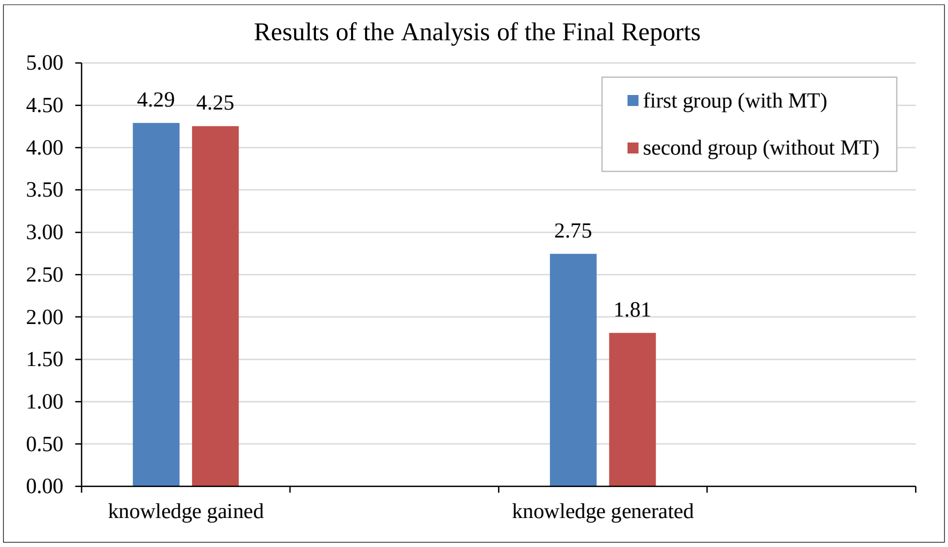

Figure 2. Results of the analysis of the final reports

Mobile technology enables students to access learning materials and networks in real time. According to the survey, 63% of students found these materials beneficial for learning, even in laboratory settings outside the school environment, where the stimulating context further enhanced their engagement. Additionally, these technologies proved particularly valuable during the abstract conceptualization phase, aiding students in developing abstract ideas. Features such as capturing images, scanning documents, recording audio, and touchscreen typing provided flexibility, significantly enriching the overall learning experience. According to the questionnaire results, students recognized photography as a tool for more effective learning. Compared to traditional notetaking, photography offered four key advantages:

1. ***Speed***: Taking photographs allows for quick recording of information, enabling students to capture and review observations rapidly.
2. ***Manipulation***: Digital images can be edited and enhanced to generate meaningful insights.
3. ***Storage and Management***: Photos are easy to store and organize, allowing students to revisit topics after leaving the external learning environment or after a period of time.
4. ***Accessibility***: Not all students can clearly or accurately capture notes manually, making photographs a valuable alternative (see Table 5).

Table 5. Comparison of the results of the questionnaire section for both groups

	First group (with MT)		Second group (without MT)			
	Mean	**St.dev.**	**Mean**	**St.dev.**	***t* Stat**	***P*-value**
Guided by questions in an experiential learning process outside the classroom. I feel better	4.650	0.580	3.960	0.900	-3.320	0.003
The use of modern teaching methods increases my interest in teaching outside the classroom	4.570	0.540	3.960	1.040	-2.400	0.003
Asking interesting questions in the observation phase increases my interest in learning	4.180	0.810	3.710	1.120	-2.060	0.025
Interesting questions helped me to focus the essential parts during the observation	4.330	0.750	4.070	1.060	-0.710	0.060
Interesting questions in the observation phase prepared me better for the phase of creating my own questions	4.000	0.820	3.860	1.020	-0.640	0.065
Different features (shooting/drawing. typing; audio recording/no option; creating questions) make learning more attractive	4.410	0.870	3.950	0.810	-2.450	0.003
Various functions (shooting/drawing. typing; audio recording/no option; creating questions) make the learning process more efficient	4.330	0.810	3.880	0.960	-2.080	0.025
	4.353		3.913			

These benefits underscore the effectiveness of mobile technologies in improving learning outcomes and making abstract concepts more accessible to students.

The phase in which students were asked questions garnered a notably positive response from those using mobile devices. Respondents highlighted that the ability to quickly locate answers in their materials or online significantly enhanced their learning experience, whereas the control group found this process more challenging. Furthermore, traditional note-taking places higher demands on students' attention and increases cognitive load. As a result, photography emerged as an essential tool to support students during experiential learning and help them maintain focus. However, the convenience and speed of taking photos can also introduce distractions during observation.

Most students reported that audio recording was quicker and easier than handwriting, and many appreciated this feature, noting that it facilitated their learning. Sound recording allowed students to formulate more questions and discover solutions more rapidly, particularly during abstract conceptualization (with an average of 2.38 questions generated by the mobile-enabled group compared to 1.63 by the non-mobile group). This functionality also fostered greater creativity in question design, though some students expressed that they found audio recording inconvenient.

The questionnaire results specifically addressed the questions posed during the comparison phase, as well as the experiential learning process and the use of various aids (see Table 5). Both groups were asked about the effectiveness of learning stimuli, whether obtained from mobile devices or through teacher-prepared materials. The results revealed significant differences between the two classes. On a 5-point Likert scale, students using mobile devices averaged a score of 4.35, while those without mobile access averaged only 3.91 (see Table 5). Students with mobile devices also scored higher on most items. Items 1 and 2 indicated that mobile-enabled students were more motivated than those in the control group. Furthermore, items 3, 4, and 5 (Table 5) demonstrated that using mobile devices for note-taking saved time, especially during the stages of preparing answers and generating new questions, leading to improved knowledge acquisition.

The final results highlighted that mobile device features significantly enhance students' motivation and learning. Both classrooms implemented the experiential learning modules—photography, sensory experience, further observation, comparison, question design, and final report—in a similar manner. In a questionnaire, students were asked to choose from four options regarding which of the six phases they found most enjoyable, most frustrating, liked, or disliked (see Table 6). The responses offered valuable insights into the benefits, challenges, and best practices associated with mobile-enabled experiential learning.

Table 6. **Results of the assessment of the experiential learning modules by both classes**

Phases of research	They found most enjoyable (%)		They found most frustrating (%)		They liked (%)		They disliked (%)	
	first group (with MT)	second group (without MT)	first group (with MT)	second group (without MT)	first group (with MT)	second group (without MT)	first group (with MT)	second group (without MT)
Photography/drawing writing	57.5	36.8	7.2	43.8	77.1	40.3	3.1	34.9
Sensory experience	0	20.3	12.4	7.9	3.8	18.6	22.1	4.1
Other observation	3.2	6.4	18.6	6.8	0	7.9	17.6	4.4
Comparison	6.8	6.2	3.4	10.2	3.9	8.9	14.3	4.3
Designing questions	16.3	3.2	40.1	18.2	10.8	18.6	21.3	27.2
Final report	16.2	27.1	18.3	13.1	4.4	5.7	21.6	25.1

In both classes, students liked the first phase of recording the lecture by taking photographs or writing down or plotting algorithms. Interestingly, in the second stage focused on sensory experiences, students in the experimental group did not find the activities particularly helpful or enjoyable, despite having the option to use mobile devices for recording audio or capturing videos. Conversely, students using traditional pen and paper, who struggled initially with notetaking, found the experience relatively engaging, despite initially disliking the challenging task of taking notes. This observation suggests that to maintain students' interest during the sensory experience phase, it might be beneficial to adjust the sequence of the modules. For instance, placing activities like photographing, sketching, and writing after the sensory experience stage could enhance engagement. Additionally, we discovered that students without access to mobile devices had a complicated relationship with traditional note-taking and drawing. This is evident as 43,8% of these students reported frustration during this stage (see Figure 3), highlighting an ideal opportunity to integrate technology to support experiential learning.

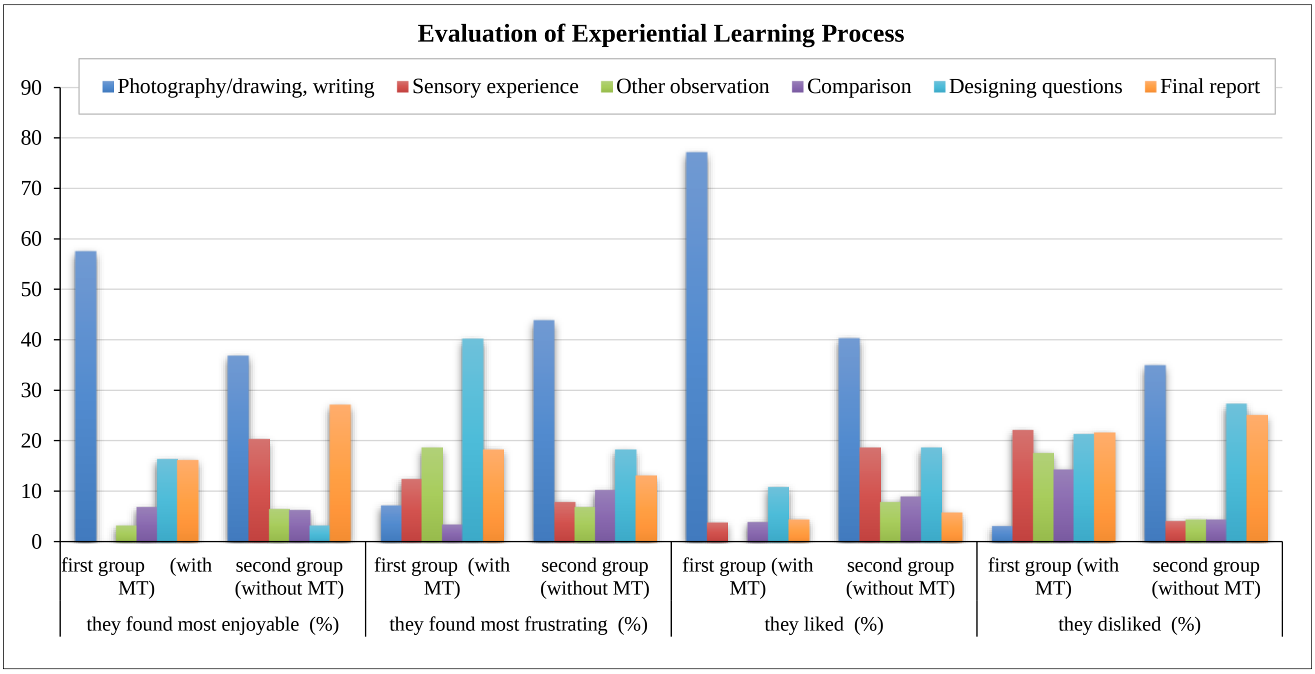

Figure 3. **Results of the analysis of the final reports**

The photography feature, in particular, gave students a more comprehensive perspective. However, students with access to mobile devices faced different challenges, such as finding the audio recording aspect of the module frustrating. This frustration appeared to stem from several issues, such as:

- ***Frequent mistakes***: "I made several mistakes and had to repeat it multiple times."
- ***Background noise***: "There were so many classmates nearby that I ended up speaking too loudly, which made it difficult for them to hear me."

- ***Difficulty crafting questions***: "I spent a considerable amount of time trying to formulate a good question."
- ***Discomfort with recordings***: "My voice sounded strange when recorded."

These findings suggest that while mobile technologies can mitigate certain challenges, they also introduce new complexities that require careful consideration and integration into the learning process

3- Discussion

Our analysis reveals that, in terms of knowledge creation, students with access to mobile technology significantly outperformed those in the control group without it. However, it is crucial to recognize that knowledge acquisition alone should not be regarded as the sole measure of experiential learning effectiveness.

Regarding the progression through the six phases, we observed that after the photography phase, students with mobile device access generally showed a decline in interest during the further observation stage. They also faced challenges in designing questions and struggled to find answers to prepared questions during the comparison section. While the initial photo-taking activity motivated students to observe, our findings suggest that the note-taking process was more effective in sustaining motivation during the exploration phase. The experiment revealed that students appreciated the use of photography at the start of their experiential learning, but this enthusiasm was not solely due to the technology; it stemmed from the interaction between the technology and the thoughtfully designed pedagogical process that enhanced the learning experience. It became clear that the photography phase should follow close observation to ensure that the sensory experience is not overshadowed by mobile devices, thereby preserving the authentic nature of learning. We ourselves were surprised by the results of this phase, but we are already preparing further experimental studies where we will change the order of the phases, for example. We will also try to include and maintain attention with other learning technologies such as multimedia games, virtual reality or escape room. Additionally, the findings indicate that the sensory experience, particularly sound recording, requires adjustments for more effective implementation in a classroom environment due to issues with ambient noise. In this context, two key factors must be considered for the experiment. First, the motivational influence of new technologies may impact the results, although this effect might be short-lived. As previously mentioned, the comparison phase, which featured prepared questions rather than engaging ones, did not yield the desired results in either group, as shown in the results (Table 6), indicating that this phase failed to produce significant outcomes across the studied angles. Second, providing students with complex or confusing questions during the matching phase may have hindered some from successfully completing the survey, leading to incorrect conclusions. In this experiment, we later presented corrected statements and a brief conclusion during the comparison phase. However, the impact of this phase, particularly with its many difficult and misleading questions intended to "trap" students, warrants further investigation.

To enhance the use of mobile devices and facilitate data processing, while also improving teachers' oversight of student work and analysing final projects, we propose the development of a module system. This could be integrated into existing platforms like Socrative or Kahoot or developed as a standalone system with various modules. The primary goal of this module system is to support experiential learning for both teachers and students. For teachers, the modules would offer interfaces to create and monitor student work. Through an authoring interface, educators could design questions and learning materials tailored to their subjects. This functionality would enable teachers to develop their own questions or entire quizzes and create resources that assist individual students in problem-solving while answering quiz questions. Additionally, a monitoring interface would give teachers a comprehensive view of student learning in the classroom, allowing them to assess learning outcomes and track students' progress effectively. This capability would also enable teachers to provide immediate support to students who are struggling. For students, the module system would allow them to submit their questions and demonstrate their understanding of the quizzes created by teachers. Students would engage with the questions and quizzes to identify the subject matter or uncover specific learning objectives. Moreover, they would have the opportunity to evaluate their learning progress against that of their peers through real-time information sharing.

4- Conclusion

The use of mobile devices has become an integral part of everyday life, particularly among young people. Our analysis indicates that, in terms of knowledge construction, students utilizing mobile technologies achieved significantly better results compared to those in the control class who did not have access to such devices. The data obtained revealed difficulties in the educational impact on the pupils in the experimental group, such as the reduced motivation of pupils to further observe after the photography phase, great difficulties in the design of questions, as well as in the comparison part, in finding answers to the prepared questions. The photography mechanism seemed to motivate pupils to observe initially, but the findings suggest that the sketching process-maintained motivation in the exploration phase in a more productive way. The experiment showed that pupils perceived photography well at the beginning of experiential learning, but this was not related to the technology itself, it was the interplay between the technology and the prepared pedagogical process that provided opportunities for better experiential learning.

It became apparent that the photography phase should take place after close observation so that the sensory experience was not replaced by mobile devices, thus neglecting the authentic nature of the learning experience. The findings also suggest that sensory experience, the audio recording, requires some corrections applied more effectively in the classroom environment as ambient noise was an issue.

Based on a pedagogical and didactic approach in which experiential learning strategies were applied and the use of mobile assignments, it is possible to demonstrate a feasible way of conducting experiential learning within a regular classroom in the case of teaching in an outdoor environment. This approach facilitated learners to assimilate and apply the experiences in the four stages of Kolb's learning cycle. Due to its flexibility, this approach is suitable for classes of different sizes. If mobile devices are used, with some modifications, this approach can be applied, to practice experiential learning and increase students' motivation to learn and engage in non-technical subjects.

5- Declarations

5-1- Author Contributions

Conceptualization, I.D.L. and J.H.; methodology, I.D.L. and J.H.; software, L.Ž.; validation, I.D.L. and J.H.; formal analysis, I.D.L.; investigation, L.Ž.; resources, I.D.L. and L.Ž; data curation, P.B.; writing—original draft preparation, I.D.L.; writing—review and editing, I.D.L.; visualization, L.Ž. and P.B.; supervision, I.D.L.; project administration, I.D.L.; funding acquisition, J.H. All authors have read and agreed to the published version of the manuscript.

5-2- Data Availability Statement

The data presented in this study are available in the article.

5-3- Funding and Acknowledgments

The contribution was created within a project 020UCM-4/2022 - Adaptive platform for statistical literacy development.

5-4- Institutional Review Board Statement

Not applicable.

5-5- Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

5-6- Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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Appendix I

Programming Basics:

Pre-test: Programming basics.
Post-test: Programming basics.

Name:
Classroom:

1. The beginning of the program section, which describes the types of variables used, defines the keyword:

a) program; b) var; c) start; d) write.

2. Of the proposed headings, this is incorrect:

a) programsumma;
b) programsumma _ chisel;
c) programchisla;
d) programsumma.

3. To enter data in a programming language use the keyword:

a) VAR; b) READ; c) START; d) WRITE.

4. Strengthening the number calculates the function:

a)SQRT (X); b) SQR (X); c) ABS (X); d) INT (X).

5. The final value of variable X as a result of the following actions:

X:=2;
Y:=0;
X:= (Y+X)*5-2+X

will be equal to:

a) 0; b) 2; c) 8; d) 10.

6. In this fragment of the programme:

program errors;
start
writeln(' errors no ');
*writeln ('5*5=',25);*
end .

considered a mistake:

a) incorrect programme name;
b) the absence of a variable;
c) undefined variable name;
d) writing a counting expression.

7. As a result of the programme:

program class;
Start
writeln(45/(12-3));
writeln(' class *');*
end.

on the screen we will see

a) 5 classes; c) about 5 classes;
b) 9 classes; d) about 9 classes.

8. One-dimensional field values are set using a loop:

for i :=1 to 5 do BUT [i]:= 2+ i ;

As a result, the value of B will be equal to:

a) 9; b) 8; c) 7; d) 6.

9. As a result of executing a program fragment:

for i:=1 to 10 start
if a[i]>0, then a[i]:=a[i]/3
otherwise a[i]:=2;
end;

the following happens:

a) the positive values of the array elements are tripled and the negative values are replaced by 2;
b) the positive values of the array elements are reduced by a factor of three and the negative values are replaced by 2;
c) the negative values of the array elements are doubled and the positive values are replaced by 3;
d) the negative values of the array elements are halved and the positive values are replaced by 3.

10. As a result of executing a program fragment

writeln(' New field');
for i:=1 to 20 readln(a[i]);
end.

the following happens:

a) a new field is created;
b a new field is printed;
c) only indices will be printed;
d) only indices will be created.