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Abstract

We live in a wide digital world, surrounded by technology. The pace of technological change, the proliferation of mobile devices, and innovation are increasing and leading to massive changes in all aspects of our lives, including the way we teach and learn.

Many complex and difficult tasks can be performed easily and efficiently with the latest technology. It has also changed education and revolutionized the process and teaching methods. With the advent of computers in education, it has become easier for teachers to transfer knowledge and make it accessible to students. Nevertheless, the design of teaching and learning in schools and academic institutions is not sufficiently suited to the needs of the younger generation growing up with digital technology.

Mobile technology has shown great potential in a variety of educational contexts. In addition, there is an emerging research centers that shows how their students communicate with mobile devices for learning. As some of these technologies are integrated into the education sector, understanding the existing research base of smartphone education (m-learning) is an important factor for technology developers, researchers, educators, and school administrators to support student activities. Since the beginning of the COVID-19 epidemic, the education area has expanded the distance learning programs by digital technologies, mainly using m-learning devices (laptops, smartphones, tablets, applications, and software education). Mobile learning has become more effective in the education process.

This thesis emphasizes the importance of students' perceptions of mobile learning which awarded students an element of freedom of choice that encourages them to select any subject that connects them with other students and teachers. This kind of learning is performed through experiences, and it can be implemented both inside and outside of the class in different forms at any time. The traditional methods of teaching do not offer this convenience and limits their effectiveness in today's modern world.

Based on Ausubel's study of targeted education - constructivist epistemology - this study covers four aspects: teacher, student, education, and assessment, and all of them need to be included in a constructive approach toward higher levels of targeted education. This paper will further discuss what connection Ausubel's assimilation theory and meaningful learning have.

The findings of this study indicate that the greater the use of mobile learning, the higher the meaningful and collaborative learning, as the participant students learned the study material in different ways, at different times and places, and acted autonomously in their learning process. Students showed more internal motivation to work on certain tasks using their mobile devices; this shows that students' perception of mobile learning positively affects students' internal motivation and implications for some aspects of their learning.

The study concludes that mobile learning is an innovative approach that can greatly contribute to the learning process for students. It contributes to a significant learning quality that is adjusted to the teaching requirements of the 21st century for increasing the learners' motivation, autonomy, and enjoyment. Mobile devices enable learning with high accessibility between student and teacher and between student activities for learning and study materials. They also enable availability, communication, and information transfer anywhere and anytime. Mobile tools are integrated into teaching today to develop different opportunities in the learning process. With

mobile learning integrated into the teaching methodology, students can learn in a fun learning environment that makes them understand and easily perceive the material, assimilate new information, improve achievements, and experiential learning, and develop creative thinking and different learning skills; all these increase the autonomous and meaningful sense of learning among students.

Keywords: Mobile learning, Meaningful learning, Internal motivation, Experiential learning, Higher education.

I Introduction

Mobile technology has thoroughly penetrated all aspects of life, but it has been slowly used as an educational platform (Deaton et al., 2018). It is only natural that mobile learning, such as a tablet or a smartphone used as a technological device that serves us at any time and place has become an integral part of the education system which aims to graduate students. Education for optimal functioning with 21st-century skills is improving teaching and learning processes to promote the student's meaningful learning (Ciampa, 2014; Kärki et al., 2018). Due to mobile learning, educators and students can learn in ways that were impossible before. M-learning implements many functions and has portability, therefor the learner must not be connected to formal learning in class. As a result, learning becomes conceptualized in many various ways, times, and places.

Mobile learning allows teachers, and students to modify their duties and the curriculum for augmenting the m-learning potential. Researchers point out to a positive correlation between the level of effective use of mobile devices and the perception of their impact. The lecturer in the academic of the 21st century is challenged, and he should rethink novel teaching (Ciampa, 2014; Huang et al., 2010).

Meaningful learning continually develops owing to the changes in m-learning technology that has access to information anytime and anywhere, providing learning processes and communication among students and also between them and their educators. The rapid changes in the novel technologies have created many terms expressed in the keywords of m-learning, for instance: hypermedia assisted learning, mobile instruction technology, e-learning, ubiquitous computing, and handheld learning (El-Hussein & Cronje, 2010).

Mobile learning has been established in response to the need to create a significant qualitative change in the education system that changes the cultural- social and digital learning environments to become an integral part of the learning routine and a response to the complexity of the pedagogical challenge in many educational systems. Thus, the education system provides a relevant and authentic response to the young learner in terms of his language and by his worldview. The m-learning allows us a connection to the learner’s world (Deaton et al., 2018; Fazeena et al., 2012).

The use of mobile devices in teaching-learning provides a learning experience with pedagogical uniqueness that we have never encountered before. The promotion of each student's motivation, personal choice, initiative, and creativity gives the learner freedom of choice and personalization which is related to a wide range of possibilities for managing learning (Ciampa, 2014).

Studies about the impact of mobile classroom use by learners present two possible effects of using these means of mobile devices and serve the students as a substitute for the traditional notebook and as a technological framework for a personal learning environment that accompanies the student at the classroom meeting and even outside it. They enable students to be connected to learning resources from anywhere within and

outside the campus, making possible the continuity of learning processes, regardless of time and place (Barkhuus & Lecusay, 2012; Christensen et al., 2013).

I.1 Statement of Research Problem

The use of technology has made teaching and learning more enjoyable for both teachers and students. However, the use of a mobile learning platform in educational institutions is being assimilated at a slower pace. Mobile devices have been introduced into every aspect of our lives, but they are rarely integrated in higher education because some lecturers doubt or are not aware of the capabilities and benefits of integrating this learning method in the education system.

I.2 The Objectives and The Significance of the Study

This thesis deals with the integration of mobile learning by mobile devices in higher education teaching. The main purpose of the study is to examine the contributions of the mobile learning integration to the learning process among students.

The main variables explained in the study are meaningful learning and internal motivation for learning. Those variables will be mainly explained by students' perceptions towards mobile learning integration in the lessons. In addition, the thesis examines whether it is possible to increase the processes of cooperative learning, active learning, engagement, and autonomous learning among students by integrating mobile learning into teaching.

II Literature Review

Meaningful learning has been described as a very important goal of education, that should be focused on explicitly in every taught course (Jonassen & Strobel, 2006). As Jonassen et al. (2004) highlighted, it is a process that is inherently active, constructive, intentional, cooperative, and focused on authentic tasks.

Motivation is related to many different aspects of learning, including the student’s energy, values and beliefs, determination in achieving goals, and how to achieve them (Wentzel & Wigfield, 2009). The emotional aspect of learning is among its most important domains because motivation heavily affects the learning process (Vollmeyer & Rheinberg, 2006). Depending on motivation, in comparison to one another, two students may perform much better or much worse at learning some study material (Cole et al., 2004). Due to its importance, motivation has been described as the engine of this process.

II.1 Meaningful Learning

The term meaningful learning refers to knowledge and understanding in an active

process that involves exploration and discovery, interpretation and taking a position while improving previous knowledge, learning and understanding in collaborative learning while engaging in dialogue with experts and colleagues, applying analytical thinking, problem-solving, critical and creative thinking (Rossing et al., 2012; Valli et al., 2017). Meaningful learning continually develops owing to the changes in m-learning technology that has access to information anytime and anywhere, providing learning processes and communication among students and between educators and students (Bestwick & Campbell, 2010; Seiler et al., 2019). However, meaningful learning exists in many learning environments and the learners take profit from its advantages (Huang et al., 2011). Ausubel (2000) describes meaningful learning as learning that integrates new information into previously existing conceptual frameworks.

Meaningful learning, thus, involves learning of two processes that are necessary for problem-solving: problem representation when the learner creates mental representations of the elements that are included in the problem, and problem solution when the learner creates a plan for resolving the problem and then follows it (Mayer, 2002). The aspect of learning as knowledge construction is in line with the concept of meaningful learning. The view of it will be further elaborated on later, but its basis is that learners wish to give meaning to their experiences in the learning process. Thus, learning involves actively processing information through directing attention towards relevant information, organizing that information, and integrating it with previously learned material. This is different from rote learning, which only sees learning as adding new information to the previously existing (Clark & Mayer, 2012; Mayer, 2002).

Content is best learned when learning is done in a natural environment and when the learners have the chance to construct meaning and share their knowledge with others, thus actively being able to work with the information and perceive the effects that their knowledge dissemination has. This makes the learning process deeply personal, as the learner is focusing on what the material means to him, and not to the teacher (Jonassen & Strobel, 2006).

Jonassen (2013) claimed that critical thinking must be engaged to create the knowledge basis of expert systems; it means that if learners wish to acquire knowledge, they can analyze and organize their knowledge by themselves, as part of this process of knowledge acquisition.

II.2 The Relationship between Engagement and Motivation

Engagement is a concept of educational psychology that has originated through research on students with poor achievement, which had the goal of understanding what can be done to help them improve.

Motivation and engagement have enough in common that the terms are sometimes used interchangeably, without making a distinction between the two. However, as

engagement experts point out (Finn & Zimmer, 2012), there are differences between the two concepts. Motivation is based on one's internal needs, including the needs for autonomy, relatedness, and competence (Deci & Ryan, 2012). This is similar, but also significantly different from affective engagement, which is described through the process of starting with a set of behaviors and external motivations that become internalized over time. Furthermore, the concept of affected engagement is more tightly related to the school context and used only to describe a fueling force for behaviors and values related to school achievement (Finn & Zimmer, 2012).

In the literature which examined the relationship between engagement and motivation, engagement is typically seen through its cognitive (learning strategies, self-regulation), behavioral (attention to task, effort, persistence) and emotional (interest, enthusiasm, no anger or boredom) aspects (Fredricks et al., 2004). Research that utilized the SDT showed that autonomous motivation enhances behavioral, emotional (Skinner et al., 2009), and cognitive engagement, as seen through deep learning (Vansteenkiste et al., 2007).

The biggest importance of engagement in terms of motivation is that it serves as a mediator between motivation and achievement. It is the means through which a student's motivation can be utilized and reflected in his work, which is what ultimately leads to success. Engagement has even been shown to be able to improve students' motivation (Reeve & Tseng, 2011).

II.3 Mobile Learning Promotes Motivation

Mobile devices motivate students to engage in self-directed learning and stimulate their cognitive curiosity inside and outside the class (Traxler, 2018) so that they can integrate school learning with home learning.

Martin & Ertzberger, (2013) applied a new theory about the way students are motivated to learn through mobile devices. They argued that m- learning enables a variety of activities such as self-paced learning which provide instant feedback, for example, quizzes and games. Immediate feedback was used to get an authentic result. Moreover, students revealed cognitive curiosity when they were learning at their own pace, viewing and listening to videos and books on their mobile devices in such a way that gave them control over their learning aspects.

II.4 Mobile Learning Support Sharing and Collaboration

Cobcroft et al., (2006) admitted that mobile technologies can sustain learners' engagement in creative, collaborative, critical, and communicative learning activities. With the support of m-technology, students can perform investigations, discuss their issues, collaborate, and create knowledge anywhere, not only in the classroom. They can

implement these ideas by creating centered activities, collaborating, and counseling each other through apps that will function like an interactive classroom to advance the students' collaboration and their digital skills according to the curriculum (Chou et al. 2012; Luna Scott, 2015).

II.5 Mobile Learning in Higher Education

Mobile technology has become prominent in higher education and has been integrated into teaching and learning. The growing use of mobile technology in colleges nowadays includes learning activities and communication between students and their faculties (Alzaza & Yaakub, 2011). The benefits of mobile technology in the academic, social, and economic aspects have worldwide implications. UNESCO published extensive publications about the potential of mobile technology in education, including guidelines policy in this area and its implementation. These publications have unique advantages for mobile technology (Hanemann, 2014).

M-learning can be applied to higher education institutions because most students currently have mobile devices (tablets or smartphones) and many academic institutions have free access to wireless networks (Meishar-Tal & Forkosh-Baruch, 2016; Seiler et al., 2019).

II.6 Problems related to Mobile learning

Along with the use of learning support, mobile devices serve students in other matters that are incompatible with the course of the lesson (Christensen et al., 2013). The existence of these devices in class presents attractive temptations for learners. At any given moment, they can browse sites that are not related to the lesson, check and send an email, chat on social networks, and access new sites and other games and applications that distract their attention from the classroom (Gehlen-Baum & Weinberger, 2014; Wang et al., 2009). There is difficulty in performing several different cognitive actions simultaneously: listening to the lesson, reading and answering emails, or surfing the social network (Wang et al., 2009).

Generally, the devices have become more distracting than "fun" in classes where the students used them without a clear target. Therefore, educators must provide clear instructions to design activities and assignments for students. Unclear learning activities cause students to lose focus and waste their time looking for games and other issues on the internet. Such distractions should be avoided because they prevent students to focus on lectures and group discussions (Alrasheedi et al., 2015).

II.7 Questions of the Study

Can the integration of students' perception of mobile learning in teaching and learning with the help of mobile learning devices in higher education, anytime and anywhere (not necessarily in the classroom) have a positive effect on the variables - Internal motivation for learning, Meaningful learning, Experiential active learning and Cooperative learning among the college teaching students? Can it make the student more engaged in the learning process?

III Methodology

The research is based on the 'mixed method' model - quantitative and qualitative tools can be combined to deepen the understanding; these two main tools were chosen for collecting the data, making interviews and questionnaires.

III.1. The Study Sample

The data were gathered from 200 participants. Most of the sample population consists of teaching students from academic college, who answered the questionnaire. Other respondents from the sample are students from other disciplines, teachers, and high school students. Most of the students in the teaching group have experienced the mobile learning method. The demographic characteristics of the sample are presented in table 1.

As table 1 shows, most of the sample participants were women (76.5%), Jew (70.0%), and the aged 18-25 (67.5%). Most of the participants were education students (67.5%) and had 12 years of education (84.0%). Most of the participants were in their first academic year (82.5%) and the rest were in their second year (8.5%), third year (6.0%), or fourth year (3.0%). In their opinion, 1.5% of the participants had low academic achievements, 48.0% of the participants had medium academic achievements, and 50.5% of the participants had high academic achievements. 12.5% of the participants used their cellular phone for 1-2 hours on average, 42.0% of the participants used their cellular phone for 3-4 hours on average, 28.0% of the participants used their cellular phone for 5-6 hours on average and 17.5% of the participants used their cellular phone for 7+ hours in average.

Table 1 *- Frequencies for the sample's demographic characteristics*

Category	N	%
Gender		
Male	47	23.5

Category	N	%
Female	153	76.5
Sector		
Jew	140	70.0
Arab	56	28.0
Other	4	2.0
Age group		
15-17	21	10.5
18-25	135	67.5
26-35	29	14.5
36-45	15	7.5
Role		
Pupils	21	10.5
Education students	135	67.5
Students	29	14.5
Teachers	15	7.5
Years of education		
8	12	6.0
12	168	84.0
BA	19	9.5
MA	1	0.5
Academic year		
First-year	165	82.5
Second-year	17	8.5
Third-year	12	6.0
Fourth-year	6	3.0
Average hours of use of cellular phones (Hours)		
1-2	25	12.5
3-4	84	42.0
5-6	56	28.0
7+	35	17.5
Academic achievements		
Low	3	1.5
Medium	96	48.0
High	101	50.5

In a qualitative questionnaire, 30 students who have experienced this kind of learning and had at least 4 sessions of mobile learning in lessons during some courses were interviewed. To preserve the interviewees' privacy, they were informed that the interviews were intended only for academic purposes.

III.2. The Study Tools

The research uses both quantitative and qualitative research methods to collect and analyze the data. The researcher developed a questionnaire that was distributed online mainly among first-year academy students experienced with online learning and mobile devices in learning. In addition, the researcher conducted interviews with students who experienced combining mobile learning with all kinds of activities in the learning process.

The questionnaire was carried out on the Google form software and had been transferred to social networks, mainly to WhatsApp groups. A large proportion of the respondents are groups of students who have undergone several lessons with applications in various fields of study. In mobile learning, they repeated the material and memorized it individually or in groups with applications that can also be useful for education needs, such as Google apps, Kahoot, Quizlet, Padlet, and other apps.

III.3. Research Procedure

Quantitative method

In this thesis, several hypotheses are being examined relating to mobile learning integration in lessons. The way of learning through reviewing and repeating the learned material can be performed by playing, competing, or personal training via mobile devices.

In this study there is examined the effect of students' perception of mobile learning in academic teaching in terms of experiential learning, collaborative learning, and motivation for learning. In addition, meaningful learning and internal motivation for learning are affected by mobile learning, which is desirable in students' eyes and attracts them to continue studying with mobile devices.

Table 2 *- Variables and factors that make them up*

α	***SD***	***M***	**The questionnaire items included in the factor**	**The name of the factor**
0.87	1.14	4.11	15. I want to learn new things	Internal motivation for learning
	1.28	3.78	*17*. It's interesting and intriguing to me	
	1.26	3.71	*19*. This is a challenging field	

	1.21	3.75	*22*. I find great interest in the lessons learned by mobile technology	
0.93	1.16	3.81	*29*. Contributes to an easier understanding of the studied material	meaningful learning
	1.2	3.84	*30*. Helps to understand better the studied material	
	1.09	4.01	*32*. Contributes to exposing the student to additional fields	
	1.19	3.90	35. Is a convenient way to learn	
	1.17	3.77	*41*. Allows me to explore topics that interest me	
	1.21	3.78	*42*. Contributes to more meaningful learning	
0.90	1.08	4.04	*28*. Contributes to a better understanding of the material being studied	Experiential and active learning
	1.18	3.90	31. Contributes to more active learning	
	1.23	3.82	*37*. I want mobile learning to be challenging so I can learn new things	
	1.15	3.81	*40*. Gives me fun and pleasure	
0.77	1.22	3.92	*43*. Contributes to learning everywhere - inside and outside the classroom	Mobile learning
	1.29	3.73	45. Allows me to feel comfortable learning with a mobile	
	1.11	3.76	46. Mobile learning contributes to better learning from home	
	1.07	3.88	*47*. Mobile learning enables learning while playing	
	1.09	3.89	*48*. With mobile learning it is easier to practice the material	
0.91	1.26	3.83	34. Can encourage teamwork	Cooperative learning
	1.22	3.71	*38*. Allows useful group learning	
	1.22	3.84	*44*. Contributes to more collaborative learning	
			43. Contributes to learning everywhere - inside and outside the classroom	Ubiquitous learning

			46. Mobile learning contributes to better learning from home	

Qualitative method

The interviews were conducted in the interviewees' homes, in their natural and safe environment, usually at hours that were convenient for them. The interviews were recorded so that they could be used for the original quotes in the data analysis. The length of the interviews ranged from half an hour to an hour and a half. The length of the interview depended on the depth of the answers, the number of examples given for some experiences with mobile learning, and the interviewees' willingness to cooperate and reveal more details about their experience.

III.4. Research Hypotheses

Hypothesis 1: The relationship between students' perception of Mobile learning will positively predict internal motivation to learn.

Hypothesis 2: The relationship between students' perception of Mobile learning will positively predict meaningful learning.

Hypothesis 3: The relationship between students' perception of Mobile learning will positively predict cooperative learning.

Hypothesis 4: The relationship between students' perception of Mobile learning will positively predict experiential and active learning**.**

Hypothesis 5: students' perception of Mobile learning, cooperative learning, and ubiquitous learning will positively predict meaningful learning.

Hypothesis 6: students' perception of Mobile learning, cooperative learning, and ubiquitous learning will positively predict experiential and active learning.

Hypothesis 7: Experiential and active learning, Meaningful learning, and Cooperative learning will mediate the relationship between students' perception of Mobile learning and Ubiquitous learning to Internal motivation to learn

Hypothesis 8: Experiential and active learning and Cooperative learning will mediate the relationship between students' perception of Mobile learning and Ubiquitous learning to Meaningful learning**.**

III.5. Ethics

The researcher found himself struggling a lot with questions concerning the ethical aspect, such as how to ensure and protect the privacy and dignity of the interviewees throughout the research process, so that they would not be harmed by their participation.

At the beginning of the study, before the interview, the researcher made it clear to the participants that any opinion they expressed was legitimate in his eyes. He explained to them the research process and emphasized the importance of maintaining their privacy and dignity, asking them for permission to use the recordings from the interviews. Once the materials have been collected and verified that the interviewees' voices have indeed been heard and not altered when no harmful materials and data have been used outside the study or may harm their dignity, out of respect for speakers and without judging their words.

There are several ethical dilemmas faced by the researcher, for example, the researcher tried very hard not to express his views and perceptions during the interviews, and thus these effects are reduced as much as possible, so as not to harm the credibility of the study.

IV Findings

IV.1. Findings from Quantity Research

Examination of the main hypotheses between study variables

 # Hypothesis 1: Students' perception of mobile learning will positively predict Internal motivation to learn

In order to test this hypothesis, a linear regression was conducted. The dependent variable was the internal motivation to learn and the predictors were students' perception of mobile learning and the demographic variables that had correlations with internal motivation to learn.

The demographic variables that had correlations with internal motivation to learn were gender, age, and role. However, age and role had a high correlation in a chi-square test ($\chi^2(6) = 263.36$, $p < .0001$), which may cue for identity between the variables. To avoid multicollinearity in the model, only the age predictor was used.

Results show that the 3 predictors explain 24.7% of the variance in internal motivation to learn. Internal motivation to learn was positively predicted by mobile learning ($\beta = .47$, $p < .01$), participants in the ages of 18-25 y/o ($\beta = .42$, $p < .01$) and 25-45 y/o ($\beta = .32$, $p < .01$) had higher motivation to learn in comparison to the participants in the ages of 15-17 y/o. That is, the higher the mobile learning and being older than 18 y/o positively predict internal motivation to learn. Students' perception of mobile learning was,

thus, successful in predicting internal motivation to learn, even after taking into account the effect of age. Therefore, the research hypothesis was confirmed.

Table 3 *- Standardized and unstandardized coefficients for predicting internal motivation to learn*

	B	Std error	β	t	P
Mobile learning	0.51	0.07	.47	7.38	< .01
Male	-0.24	0.15	-.10	-1.59	.11
Age 18-25	0.88	0.21	.42	4.10	< .01
Age 26-45	0.78	0.23	.32	3.38	< .01

 # Hypothesis 2: Students' perception of mobile learning will positively predict Meaningful learning

In order to test the hypothesis, a linear regression was conducted. The dependent variable was meaningful learning, and the predictors were students' perception of mobile learning and the demographic variables that had correlations with meaningful learning.

None of the demographic variables were correlated to meaningful learning, therefore students' perception of mobile learning was the only one used in the model as a predictor.

Results show that mobile learning explains 53.5% of the variance of meaningful learning. Students' perception of mobile learning was a positive predictor of meaningful learning ($\beta = .73$, $p < .01$), which that means, as the students' perception of mobile learning goes up higher, the meaningful learning is higher too. Thus, this research hypothesis was confirmed.

Table 4 *- Standardized and unstandardized coefficients for predicting meaningful learning*

	B	Std error	β	t	P
Mobile learning	0.86	0.06	.73	15.17	< .01

 # Hypothesis 3: Students' perception of mobile learning will positively predict Cooperative learning

In order to test this hypothesis, a linear regression was conducted. The dependent variable was cooperative learning, and the predictors were students' perception of mobile learning and the demographic variables that had correlations with cooperative learning.

No demographic variables had correlations with cooperative learning and therefore only mobile learning was used in the model as a predictor.

Results show that mobile learning explains 35.3% of the variance of cooperative learning. Students' perception of mobile learning was a positive predictor of cooperative learning ($\beta = .60$, $p < .01$), that is, the higher the students' perception of mobile learning the higher the cooperative learning. Thus, the hypothesis was confirmed.

Table 5 *- Standardized and unstandardized coefficients for predicting cooperative learning*

	B	Std error	β	t	P
Mobile learning	0.73	0.07	.60	10.46	< .01

 # Hypothesis 4: Students' perception of mobile learning will positively predict Experiential and active learning

In order to test this hypothesis, a linear regression was conducted. The dependent variable was experiential and active learning, and the predictors were students' perception of mobile learning and the demographic variables that had correlations with experiential and active learning.

The demographic variables that had correlations with internal motivation to learn were sector and role. Therefore, the final predictors in the model were mobile learning, sector, and role.

Results show that the three predictors explained 52.0% of the variance of experiential and active learning. Mobile learning was a positive predictor of experiential and active learning ($\beta = .73$, $p < .01$). That is, the greater the students' perception of mobile learning, the greater the experiential and active learning. The remaining predictors were not significant.

This indicates that mobile learning was a significant predictor of experiential and active learning, even after taking into account the factors of sector and role. Thus, the hypothesis was confirmed.

Table 6 *- Standardized and unstandardized coefficients for predicting experiential and active learning*

	B	Std error	β	t	P
Mobile learning	0.84	0.06	.73	14.12	< .01
Pupils	-0.33	0.25	-.10	-1.30	.19
Education student	-0.20	0.20	-0.09	-0.99	.32
Students	-0.38	0.24	-.13	-1.61	.11

 # Hypothesis 5: Students' perception of mobile learning, Cooperative learning, and Ubiquitous learning will positively predict Meaningful learning.

In order to test this hypothesis, a linear regression was conducted. The dependent variable was meaningful learning, and the predictors were mobile learning, cooperative learning, ubiquitous learning, and the demographic variables that had correlations with meaningful learning.

No demographic variables had a significant correlation with meaningful learning and therefore the final model included students' perception of mobile learning and cooperative learning and ubiquitous learning as predictors.

The Results show that the three predictors explained 69.1% of the variance in meaningful learning. Mobile learning ($\beta = .39$, $p < .01$) and cooperative learning ($\beta = .49$, $p < .01$) were significant positive predictors of meaningful learning. However, ubiquitous learning was not. Namely, the higher the mobile and cooperative learning, the higher the meaningful learning. Thus, the hypothesis was partially confirmed.

Table 7 *- Standardized and unstandardized coefficients for multiple regression, predicting meaningful learning*

	B	**Std error**	**β**	**t**	**P**
Mobile learning	0.46	0.11	.39	4.10	< .01
Cooperative learning	0.47	0.05	.49	9.61	< .01
Ubiquitous learning	0.06	0.10	.06	0.63	.53

 # Hypothesis 6: Students' perception of mobile learning, Cooperative learning, and Ubiquitous learning will positively predict Experiential and active learning.

In order to assess this hypothesis, a linear regression was conducted. The dependent variable was experiential and active learning, and the predictors were mobile learning, cooperative learning, ubiquitous learning, and the demographic variables that had correlations with experiential and active learning.

The demographic variables that had a positive correlation with experiential and active learning were sector and role. Therefore, the final model included mobile learning, cooperative learning, ubiquitous learning, sector, and role as predictors.

The results show that the 5 predictors explain 68.0% of the variance in experiential and active learning. Mobile learning ($\beta = .44$, $p < .01$) and cooperative learning ($\beta = .51$, $p < .01$) were positive significant predictors. That is, the higher the students' perception of mobile learning and cooperative learning, the higher the experiential and active learning.

The rest of the variables did not significantly predict experiential and active learning. Thus, the hypothesis was partially confirmed.

Table 8 *- Standardized and unstandardized coefficients for multiple regression predicting experiential and active learning.*

	B	Std error	β	t	P
Mobile learning	0.51	0.12	.44	4.36	< .01
Cooperative learning	0.48	0.05	.51	9.66	< .01
Ubiquitous learning	-0.04	0.10	-.04	-0.36	.72
Pupils	-0.05	0.21	-.02	-0.26	.80
Education students	-0.12	0.16	-.05	-0.71	.48
Students	-0.29	0.19	-.10	-1.49	.14

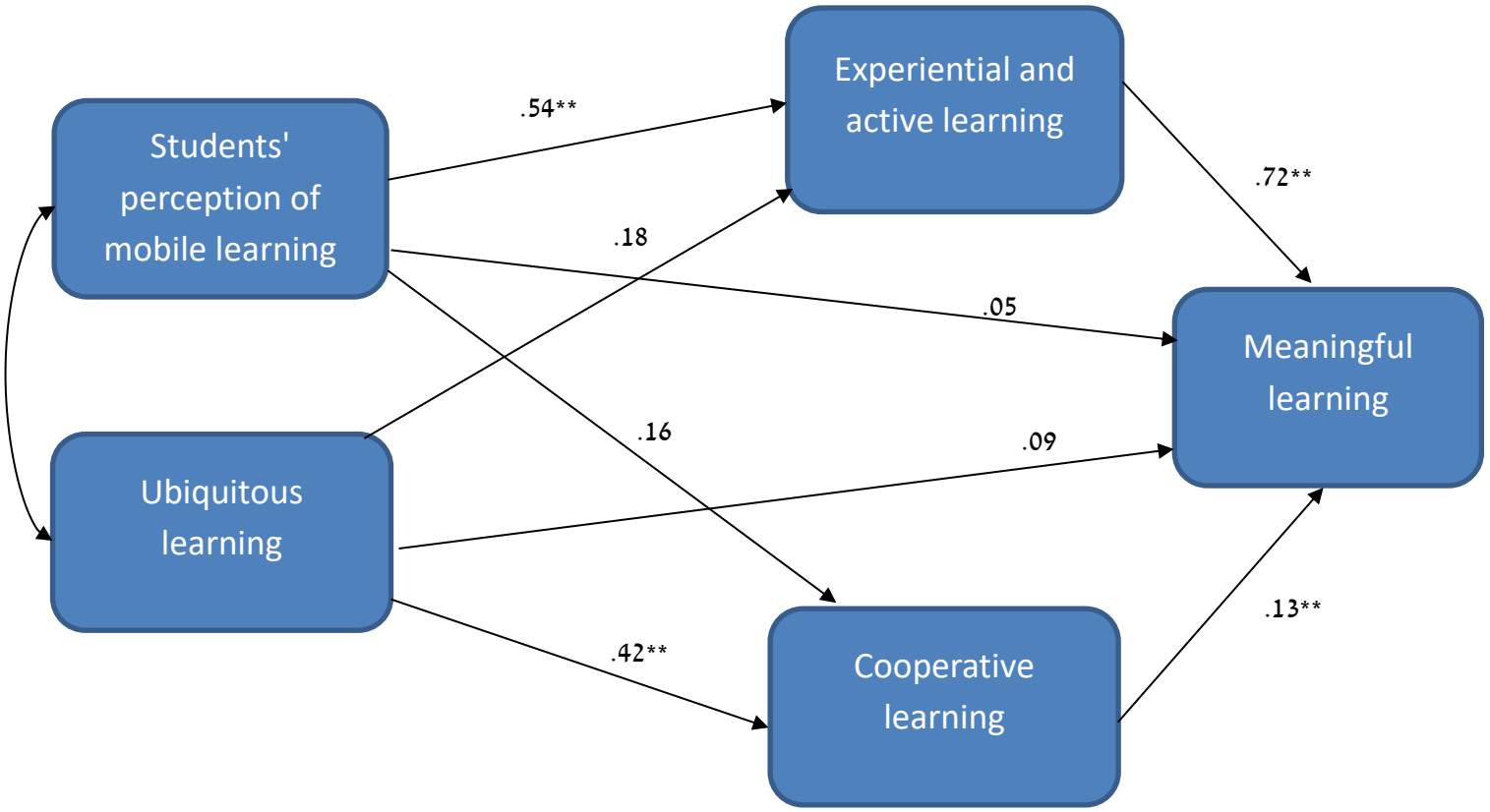
 # Hypothesis 7: Experiential and active learning and Cooperative learning will mediate the relationship between Students' perception of mobile learning and Ubiquitous learning to Meaningful learning

In order to assess the hypothesized model, Structural Equation Modeling (SEM) was performed. In order to test the research hypotheses, mobile learning and ubiquitous learning were exogenous variables; experiential, active, and cooperative learning were used as mediators and meaningful learning was the outcome tested. The model showed partially acceptable fit, $\chi 2$ (1) = 8.25, $p < .01$, CFI = 0.99, GFI = 0.98, NFI = 0.99, RMSEA = 0.19, SRMR = 0.03.

As figure 1 shows, mobile learning was a positive predictor of experiential and active learning ($\beta = .54$, $p < .01$), but not of cooperative learning ($\beta = .16$, $p = .25$) or meaningful learning ($\beta = .05$, $p = .45$). Ubiquitous learning had a positive effect on cooperative learning ($\beta = .42$, $p < .01$), but no effect on meaningful learning ($\beta = .09$, $p = .14$).

Experiential and active learning had a positive effect on meaningful learning ($\beta= .72$, $p < .01$), as well as cooperative learning ($\beta = .13$, $p < .01$).

Figure 1 - *Structural equation modeling for the relations between ubiquitous, mobile, cooperative, and meaningful learnings, and experiential and active learning.*



Note *$p < .05$, **$p < .01$

 # Hypothesis 8: Experiential and active learning, Meaningful learning, and Cooperative learning will mediate the relationship between Students' perception of mobile learning and Ubiquitous learning to Internal motivation to learn

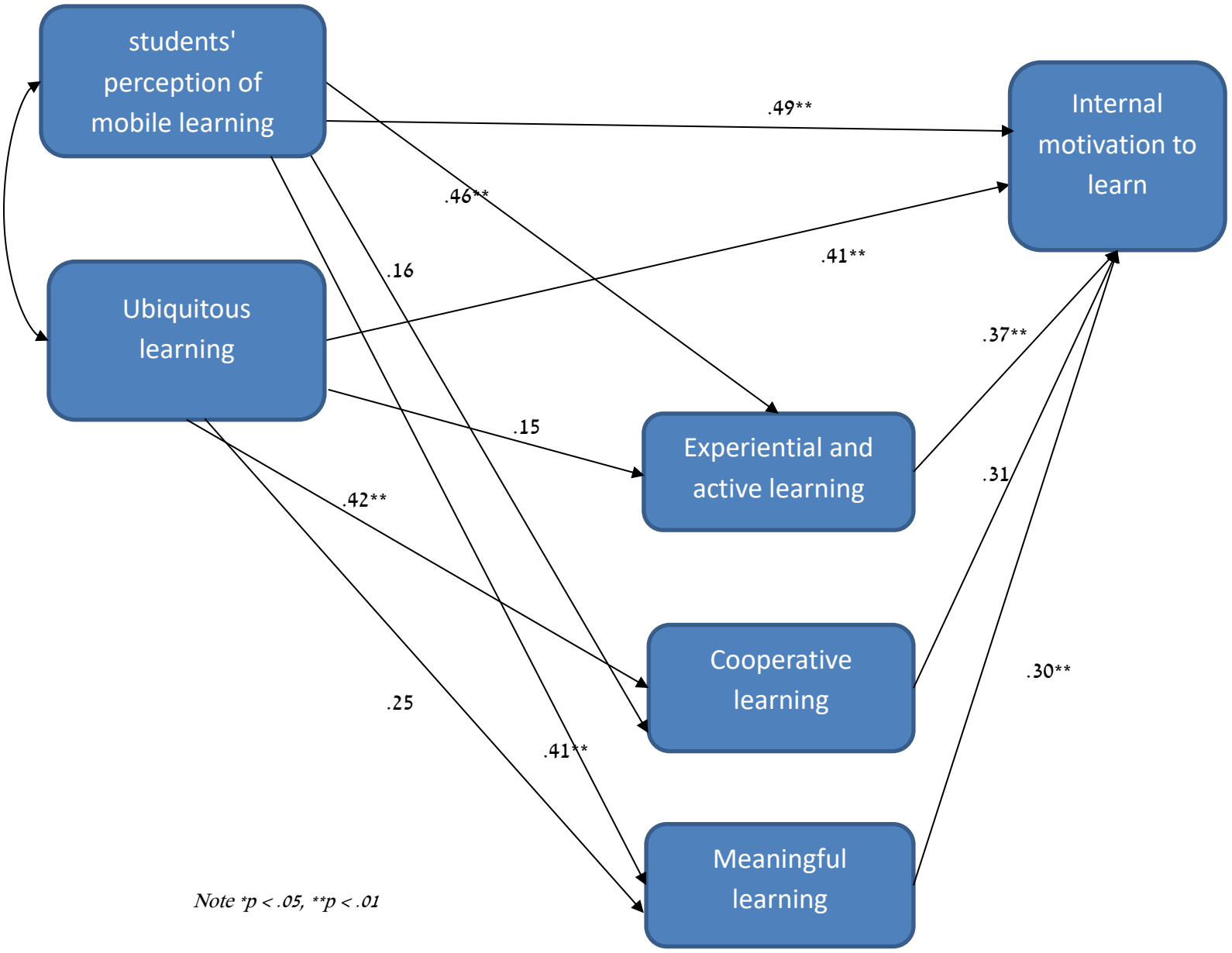
In order to assess the hypothesized model, Structural Equation Modeling (SEM) was performed. In order to test the research hypotheses, mobile learning and ubiquitous learning were exogenous variables, experiential and active learning, meaningful learning, and cooperative learning served as mediators, and internal motivation to learn was the outcome tested. The model showed partially acceptable fit, $\chi 2$ (1) = 39.62, $p < .01$, CFI = 0.97, GFI = 0.95, NFI = 0.97, RMSEA = 0.44, SRMR = 0.06.

As figure 2 shows, mobile learning had positive effects on internal motivation to learn ($\beta = -.49$, $p < .01$), experiential learning ($\beta = .46$, $p < .01$), and meaningful learning ($\beta = .41$, $p < .01$), but no significant effect with cooperative learning ($\beta = .16$, $p = .25$).

Ubiquitous learning had a positive effect on internal motivation to learn ($\beta = .41$, $p < .01$) and cooperative learning ($\beta = .41$, $p < .01$) but not significant effect on experiential and active learning ($\beta = .15$, $p = .26$) or meaningful learning ($\beta = .25$, $p = .052$).

Experiential learning had a positive effect on internal motivation to learn ($\beta = .37$, $p < .01$), along with meaningful learning ($\beta = .30$, $p < .01$). However, cooperative learning did not successfully predict internal motivation to learn, there is no significant effect between them ($\beta = .31$, $p = .17$).

Figure 2 - *Structural equation modeling for the relations between ubiquitous, mobile, cooperative, and meaningful learnings, experiential and active learning, and internal motivation to learn.*



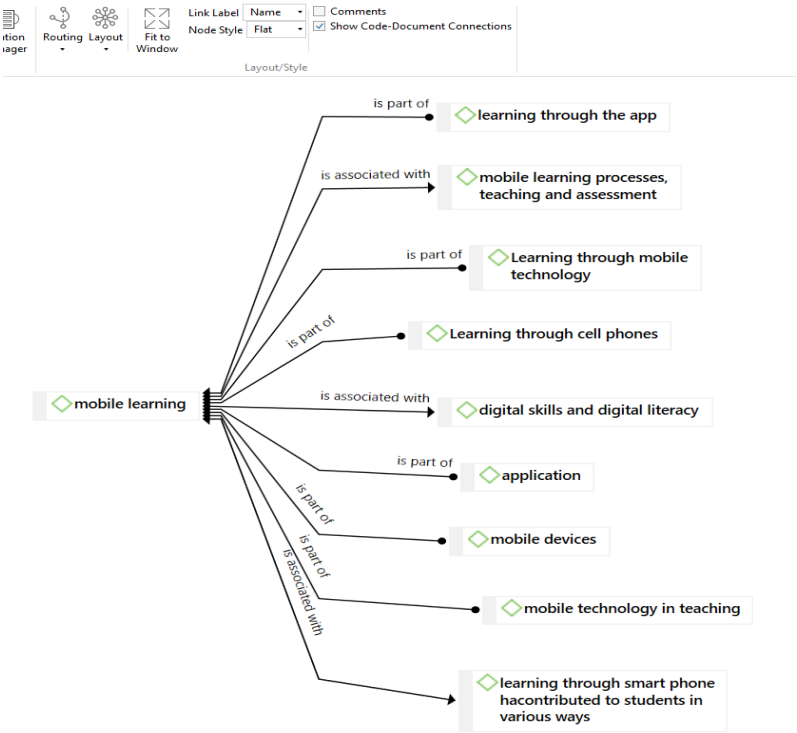
IV.2. Findings from Qualitative Research

The findings from the qualitative research have highlighted five categories relating to the integration of mobile learning which is based on Self Determination Theory (SDT) (Deci & Ryan, 2004)

1. meaningful learning - use of mobile technology to study in a more interesting way through the experience.
2. Sense of competence – students' ability to make choices and manage their learning through mobile devices.
3. Sense of connection and belonging - the need to feel belonging and connect with other students and teachers through mobile devices.
4. Sense of autonomy - students need to feel that they are in control of their own learning.
5. Distractions that arise in learning with mobile devices

As we can see from figure 3, mobile learning has important relationships with various other themes detected in the qualitative analysis. It consists of sub-themes of learning through the app, learning through mobile technology, application, and mobile technology in teaching. Furthermore, it is associated with themes such as learning through smartphones has contributed to students in various ways, digital skills and digital literacy, and mobile learning processes, teaching, and assessment.

Figure 3 – a *roadmap for mobile learning*



As can be seen in Figure 4, learning through mobile devices turns the lesson into an experimental and active one, the students feel that they can promote their learning and hence they become autonomous learners.

Figure 4 – a roadmap for experiential and active learning

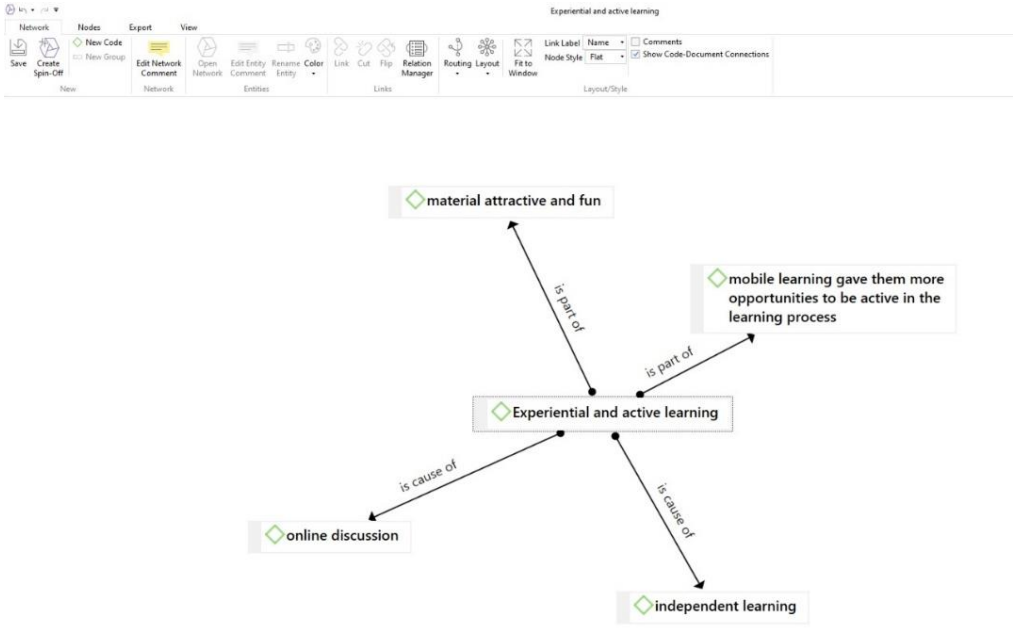
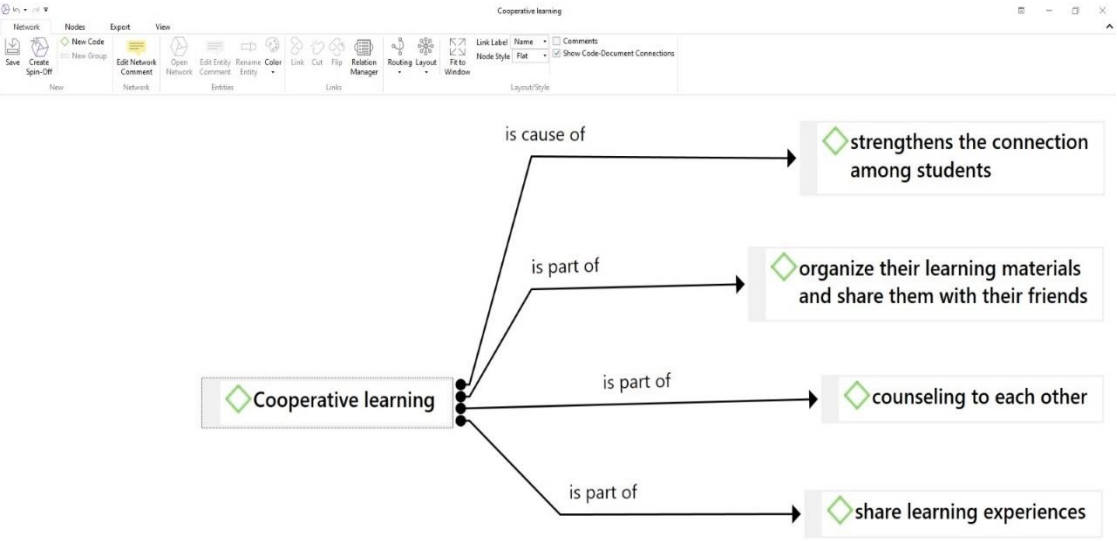


Figure 5 shows that cooperative learning contains sharing experiences and counseling among students. Those characteristics help them to feel a sense of community and belonging. Therefore, students' perception of mobile learning helped achieving the necessary prerequisites of a constructivist classroom by discussing learning materials and placing them in contexts that the students can understand (Almaiah et al., 2019). A natural extension of this view is the consideration of mobile phones by students as part of their daily reality, and therefore they use them for learning purposes. Furthermore, the less formal relationship that they achieve with teachers through the usage of mobile learning provides them with the freedom to explore and discuss topics alongside their peers.

Figure 5 – a roadmap for cooperative learning



V Discussion

When a student feels a sense of autonomy, belonging, and meaningful learning, he feels internally motivated, these findings are supported by Self Determination Theory (SDT) (Deci & Rayn, 2012).

V.1. Mobile Learning which Contributes to Experiential and Active Learning

This study found that in m-learning environments or in lessons through mobile devices, there occur more experiential, collaborative, and meaningful learning than in the traditional learning environment without mobile devices.

By introducing mobile learning in the classroom, it is possible to create many prerequisites for meaningful learning. By investigating Huang & Chiu's (2015) principles of meaningful learning, we can understand how students' perception of mobile learning affects each of them:

1. Open work.
2. Increasing students' motivation.
3. The students must learn by using sensible means in their usual environments.
4. The students' creativity should be facilitated because it leads to an improvement in their imagination and capabilities.
5. The technique of concept mapping should be utilized so that the students can understand the relationships between different concepts.

Students' perception of mobile learning affects meaningful learning through the means of collaborative learning as well, as has been additionally supported by the first mediation model. The most beneficial aspect of students' perception of mobile learning to meaningful learning through collaborative learning is ubiquitous learning. This was shown in the first mediation model and indicates that the students' ability to work on schoolwork from any place and at any time increases the possibility of their maximal collaboration. Considering this, it is important to ensure that the m-learning contribution is clear to educate students so that they are able to see the advantage over traditional learning (Stone, 2016). Effective mobile learning can and should push the boundaries of classroom space and time.

V.2. Mobile Learning and the Constructivist Classroom

The most basic idea of constructivist learning is that the learning process is not one-directional like in the traditional model of learning. The constructivist theory posits that knowledge is not transmitted but created. Knowledge is co-constructed through the interaction between the teacher and the students, as well as through the interactions amongst students. The meanings of various concepts and how they can be applied to the real world are created in this process. Thus, the students are seen as active subjects who can decide and think for themselves (Zajda, 2018).

The question is how does students' perception of mobile learning affect the classroom in this regard? We can assess this through Jonassen's (1994) practices relevant to a constructivist classroom, here are two of the practices:

1. Reality is seen in various ways - mobile learning makes it easier to propagate this aspect of constructivist theory. Since there is virtually an infinite amount of content on the internet, it is relatively easy to find various representations of reality there. Furthermore, mobile devices may be used to create content that is unique and indicative of every student's vision of the material that is being learned. It is also very important to note that co-construction and learning occur through the communication of the students' subjective visions of the world. Thus, by facilitating communication, both inside and outside of the classroom, this exchange can happen more easily and more successfully.

2. These different representations allow for the examination of the complicated nature of the world, thus avoiding banalization - mobile devices allow for the integration of various worldviews. Instead of arriving at a single and simple point, the students should take into account the nuances and the complicated nature of the world. These nuances can be successfully communicated and understood through the usage of mobile devices. Furthermore, they can be used for sharing and examining various materials, such as videos, documentaries, and recordings of events, that can help the students understand the complexity of various phenomena. The students do not have to be limited to the views of their teachers and peers but can instead take into account the views of people from all around the world.

V.3. Cultivating a Sense of Competence, Belonging, and Autonomy

Autonomy is achieved in various ways through mobile learning. Students have the freedom of choosing, in agreement with their teachers, the way in which the lecture will be approached, what type of apps will be used, where they will work when they work if they will put more work into a topic at school or at home, in which ways they will interact with their peers (through mobile devices or in person), etc. Hence, although they are certainly still limited in some ways, the freedom of choice and autonomy of students is greatly enhanced through mobile learning.

There are many ways in which this study showed that mobile learning increased the sense of competence in students. First, the learning is performed on mobile devices, which the participants know to use well. Therefore, they feel comfortable and competent doing so and that makes the other elements of the learning process easier and increases their sense of competence, as they do not fear the technology but instead feel like working with it naturally. Second, mobile technologies permit each student to get tasks and practices adjusted to their abilities in studies. This allows them to feel competent while performing tasks because these tasks are tailored to their strengths. Thus, the strong points of each student are highlighted, which makes the students more satisfied and more motivated next time when they need to work on a similar task. Their confidence and sense of ability rise and, at the same time, their abilities rise as well because they are motivated to make an effort to practice.

Through the mentioned advantages of mobile learning that lead to the propagation of the sense of competence, the actual competence of students is increased. The self-determination theory (Deci & Ryan, 2012) is mainly concerned with motivation, and it postulates that students who feel competent will be more motivated to engage in school tasks.

The need for relatedness was the last need added to the basic psychological needs theory for motivation (Ryan & Deci, 2017). There are two main ways in which mobile learning helps students achieve higher levels of this need, that were shown in this study. The first one is that the students have reported some improvement in the relationships between them and their professors who affect their intrinsically learning motivation to participate in the learning process. The second benefit of mobile learning in terms of increasing their sense of connectedness is the increased ability to communicate with other students quickly and efficiently. Furthermore, it is possible to communicate at any time and any place.

V.4. Effect of Mobile Learning on Student Engagement

There are two categories of characteristics of the learning environment that are highlighted by the student-teacher dialectic model: relationships and external events. As for the relationships,

the results of this study highlighted the students' feelings about mobile technology use; this use has improved their relationships with their professors, feeling more relaxed around them and being understood by them. This is important for the underprivileged students with poor engagement since it may arouse their care more about the learning process and see the appreciation about them by the professor. Hence, it can be understood that the results of this study indicate that the *relationships between the teacher-student* aspect of the learning environment are positively affected by mobile learning.

Furthermore, the relationship with peers' aspect is also affected positively by mobile learning. Mobile technologies make communication amongst students immensely easier. Also, this is not assured that all students will actually communicate more and form stronger relationships, it is still a positive factor. The participants in this study also noted that they felt that mobile technologies improved their communication with one another. Through better communication, which can happen at any time and any place, they are able to help one another, discuss ideas and arrive at solutions together. It can be inferred that by doing so, the students improve their mutual relationships and that mobile technologies are a big facilitator of this process.

V.5. Transformation in the Role of the Lecturers

According to the research literature, m-learning requires some transformation in the lecturer's and student's roles and academic activities. The research literature is based on the needs, experiences, and interests of the student, which is at the center and performs an active role in learning. The student can access the information any time he wants, he is responsible for his learning, learns at his own pace, creates, and shares new information. In the m-learning environment, there is a large use of personal and active learning by the learner himself. Consequently, he learns to evaluate his and other peers' learning while collaborating with them (Kukulska-Hulme, 2010).

This approach challenges the reality in most institutions of higher education, where in many cases the nature of student's engagement by the teacher and the integration of autonomy made possible that m-learning will depend on the teachers' management of the teaching-learning process, considering the teacher as that who initiates and leads the learning. The teaching is focused on the lecturer, meaning that he is the expert and the main source of knowledge. In contrast, mobile learning allows connection to any person and any source of information anytime and anywhere and thus the lecturer can serve as a facilitator of student-focused learning.

VI Conclusions

The identified main findings were about m-learning as constituting learning partially based on the learner's world where technology is part of his agenda. When the student practices learning with the help of mobile learning devices, a continuous learning process is created - learning throughout most of the day, anywhere, in which a large part of it is the learner's choice and initiative.

The introduction of mobile devices into the school is perceived by teachers as an innovative and positive change, that helps in the learning process in school, and in imparting learning skills to students. Likewise, teachers should invest in tailoring diverse digital learning activities to evoke enjoyment and raise learners' motivation. Mobile tools are incorporated into teaching today to develop various opportunities. Students learn in a fun learning environment that makes them understand the material and assimilate new information, improve achievements, social growth, motivation in learning, experiential learning, development of creative thinking and different learning skills, and increasing the sense of meaningful learning among students. This study is about taking advantage of the added value of mobile technology and the way it helps teachers and students in the learning process.

The study emphasizes the importance of using mobile communication which requires learning experience that involves participants and the way in which the teacher conducts himself in the mobile learning environment. The teacher must be familiar with the available options in this environment, its advantages, and disadvantages so that he can navigate the lesson optimally. If there is a need to demonstrate flexibility, he should know how to do it. For this to happen, teachers must be well acquainted with the pedagogical possibilities inherent in mobile learning and instruct students on how to work with them. In this way, they can get the benefit of their potential, so that they can be involved and committed to the mobile-learning process.

Students' perception of mobile learning has been shown to positively affect the internal motivation of students to learn in various ways. It helped students find learning more fun, interesting, and less annoying. Most importantly, they did not feel that it was forced on them, but rather that they had autonomy and freedom to choose what and how they will learn. This fulfilled their need for autonomy, and other aspects of mobile learning affected their needs for competence and relatedness as well. Fulfilling those needs led to an internalization of the external motivation to learn and do schoolwork. Furthermore, students' perception of mobile learning also increased their engagement, by influencing both their internal motivation and the relevant external factors. As engagement and motivation affect one another in a reciprocal way, mobile learning had both direct and indirect positive effects on both.

VI.1. Research Contribution and Recommendations

Mobile learning enhances the learning experience and increases student motivation. It is recommended that it should be used in parallel with the curriculum so that the contribution is clear to the teacher and student. This is why it is important to mediate between pedagogy and mobile devices.

Higher education institutions often lack a policy about the use of mobile technology; therefore, the lecturer should decide about it by himself. The higher education authorities also

need to invest more in the development of smarter ways of mobile learning and provide a better engaging experience to the students to improve their attention level and focus on the learning material at a distance learning between teachers and students. This can happen when the existing conventional learning material becomes transferable through mobile devices, creating and distributing more visual content, and making the learning material accessible on different devices and platforms.

VI.2. Limitation of the Current Research

The study examined several cycles of students who participated in the program, but in a future study, there should be considered an examination of combining m-learning in teaching at other colleges and universities, not necessarily colleges of education, so the findings of this study may be tested as true for other different academic institutions.

Another limitation identified in the study relates to its qualitative part which examined students' attitudes. The number of the examined students was relatively low and most of them were in their first year of study. Further research will attach great importance to maintaining larger student samples in all age groups and in all yearbooks.

References

Almaiah, M. A., Alamri, M. M., & Al-Rahmi, W. (2019). Applying the UTAUT model to explain the students' acceptance of mobile learning system in higher education. *IEEE Access*, *7*, 174673-174686.

Alrasheedi, M., Capretz, L. F., & Raza, A. (2015). A systematic review of the critical factors for success of mobile learning in higher education (university students' perspective). Journal of Educational Computing Research, 52(2), 257-276.

Alzaza, N. S., & Yaakub, A. R. (2011). Students' awareness and requirements of mobile learning services in the higher education environment. American Journal of Economics and Business Administration, 3(1):95–100. doi:10.3844/ajebasp.2011.95.100

Ausubel, D. P. (2000). The nature of meaning and meaningful learning. In *The acquisition and retention of knowledge: A cognitive view* (pp. 67-100). Springer, Dordrecht. https://doi.org/10.1007/978-94-015-9454-7_2

Barkhuus, L., & Lecusay, R. (2012). Social infrastructures as barriers and foundation for informal learning: Technology integration in an urban after-school center. *Computer Supported Cooperative Work (CSCW)*, *21*(1), 81-103.

Bestwick, A., & Campbell, J. R. (2010). Mobile learning for all. *Exceptional parent*, *40*(9), 18-20.

Chou, C. C., Block, L., & Jesness, R. (2012). A case study of mobile learning pilot project in K-12 schools. *Journal of Educational Technology Development and Exchange (JETDE)*, *5*(2), 3.

Christensen, C. M., Horn, M. B., & Staker, H. (2013). Is K-12 Blended Learning Disruptive? An Introduction to the Theory of Hybrids. *Clayton Christensen Institute for Disruptive Innovation*.

Ciampa, K. (2014). Learning in a mobile age: an investigation of student motivation. *Journal of Computer Assisted Learning*, *30*(1), 82-96.

Clark, R. C., & Mayer, R. E. (2012). *Scenario-based e-learning: Evidence-based guidelines for online workforce learning*. John Wiley & Sons.

Cobcroft, R. S., Towers, S. J., Smith, J. E., & Bruns, A. (2006). Mobile learning in review: Opportunities and challenges for learners, teachers, and institutions.

Cole, M. S., Feild, H. S., & Harris, S. G. (2004). Student learning motivation and psychological hardiness: Interactive effects on students' reactions to a management class. *Academy of Management Learning & Education*, *3*(1), 64-85.

Deaton, B., Herron, J., & Deaton, C. C. (2018). Mobile Technology and Learning. In *Handbook of Research on Human Development in the Digital Age* (pp. 87-108). IGI Global.

Deci, E. L., & Ryan, R. M. (Eds.). (2004). *Handbook of self-determination research*. University Rochester Press.

Deci, E. L., & Ryan, R. M. (2012). *Self-determination theory.* In P. A. M. Van Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology* (p. 416–436). Sage Publications Ltd. https://doi.org/10.4135/9781446249215.n21

El-Hussein, M. O. M., & Cronje, J. C. (2010). Defining mobile learning in the higher education landscape. *Journal of Educational Technology & Society*, *13*(3), 12.

Fazeena, J. F., Hewagamage, K. P., & Ekanayake, Y. (2012). Suitability of mobile learning to enhance English language learning: A survey among University of Colombo School of Computing Students. In M. Specht, M. Sharples & J. Multisilta (Eds.), Proceedings of the 11th International Conference on Mobile and Contextual Learning (pp. 197–202). Helsinki, Finland: CEUR Workshop Proceedings.

Finn, J. D., & Zimmer, K. S. (2012). Student engagement: What is it? Why does it matter?. In *Handbook of research on student engagement* (pp. 97-131). Springer, Boston, MA.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of educational research*, *74*(1), 59-109.

Hanemann, U. (2014). Harnessing the Potential of ICTs for Literacy Teaching and Learning: Effective Literacy and Numeracy Programmes Using Radio, TV, Mobile Phones, Tablets, and Computers. *UNESCO Institute for Lifelong Learning*.

Huang, J. J., Yang, S. J., Huang, Y.-M., & Hsiao, I. Y. (2010). Social learning networks: Build mobile learning networks based on collaborative services. Educational Technology & Society, 13(3):78–92.

Jonassen, D. H. (1994). Thinking technology: Toward a constructivist design model. *Educational technology*, *34*(4), 34-37.

Jonassen, D. H. (2013). designing CBI'. *Instructional Models in Computer-Based Learning Environments*, *104*, 385.

Jonassen, D., Marra, R., & Palmer, B. (2004). Epistemological development: An implicit entailment of constructivist learning environments. In *Curriculum, plans, and processes in instructional design* (pp. 89-102). Routledge.

Jonassen, D. H., & Strobel, J. (2006). Modeling for meaningful learning. In *Engaged learning with emerging technologies* (pp. 1-27). Springer, Dordrecht.

Kärki, T., Keinänen, H., Tuominen, A., Hoikkala, M., Matikainen, E., & Maijala, H. (2018). Meaningful learning with mobile devices: pre-service class teachers' experiences of mobile learning in the outdoors. *Technology, Pedagogy and Education*, *27*(2), 251-263.

Kukulska-Hulme, A. (2010) Mobile learning as a catalyst for change, Open Learning: The Journal of Open, Distance and e-Learning, 25:3, 181-85. DOI: 10.1080/ 02680513.2010.511945

Luna Scott, C. (2015). The futures of learning 2: What kind of learning for the 21st century?

Martin, F., & Ertzberger, J. (2013). Here and now mobile learning: An experimental study on the use of mobile technology. *Computers & Education*, 68, 76-85.

Meishar-Tal, H., & Forkosh-Baruch, A. (2016). How Do Faculty Members React Towards the Use of Personal Mobile Devices by Students in the Classroom?. In *EDEN Conference Proceedings* (No. 1, pp. 490-498).

Mayer, R. E. (2002). Rote versus meaningful learning. *Theory into practice*, *41*(4), 226-232.

Rossing, J. P., Miller, W., Cecil, A. K., & Stamper, S. E. (2012). iLearning: The future of higher education? Student perceptions on learning with mobile tablets.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Publications.

Valli, R., Valli, P., & Lähdesmäki, S. (2017). Meaningful Learning Experiences in the Finnish Teacher Education. Asian Journal of Education and e-Learning, 5(2), 27-35. https://doi.org/10.24203/ajeel.v5i2.4471

Vansteenkiste, M., Matos, L., Lens, W., & Soenens, B. (2007). Understanding the impact of intrinsic versus extrinsic goal framing on exercise performance: The conflicting role of task and ego involvement. *Psychology of sport and exercise*, *8*(5), 771-794.

Vollmeyer, R., & Rheinberg, F. (2006). Motivational effects on self-regulated learning with different tasks. *Educational Psychology Review*, *18*(3), 239-253.

Wentzel, K.R. and Wigfield, A. (eds) (2009) Handbook of Motivation at School. New York: Routledge.

Reeve, J., & Tseng, C. M. (2011). Agency as a fourth aspect of students' engagement during learning activities. *Contemporary Educational Psychology*, *36*(4), 257-267.

Seiler, L., Kuhnel, M., Ifenthaler, D., & Honal, A. (2019). Digital applications as smart solutions for learning and teaching at higher education institutions. In *Utilizing learning analytics to support study success* (pp. 157-174). Springer, Cham.

Traxler, J. (2018). Distance learning—Predictions and possibilities. *Education Sciences*, *8*(1), 35.

Skinner, E. A., Kindermann, T. A., & Furrer, C. J. (2009). A motivational perspective on engagement and disaffection: Conceptualization and assessment of children's behavioral and emotional participation in academic activities in the classroom. *Educational and psychological measurement*, *69*(3), 493-525.

Stone, C. W. (2016). Technology integration: A community of practice to support learning.

Wang, M., Shen, R., Novak, D., & Pan, X. (2009). The impact of mobile learning on students' learning behaviors and performance: Report from a large, blended classroom. *British Journal of Educational Technology*, *40*(4), 673-695.

Zajda, J. (2018). Effective constructivist pedagogy for quality learning in chools. *Educational Practice and Theory*, *40*(1), 67-80.