

SIGNIFICANT AND RELEVANT FACTORS THAT CAN AFFECT THE
SUSTAINABILITY OF MOBILE LEARNING

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SIGNIFICANT AND RELEVANT FACTORS THAT CAN AFFECT THE
SUSTAINABILITY OF MOBILE LEARNING

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Abstract

Abide Coşkun Setirek, “Significant and Relevant Factors that Can Affect the Sustainability of Mobile Learning”

Educational leaders are concerned about whether m-learning initiatives can address current educational needs and intent of m-learning, have potential to be adopted by users, maintain a certain condition indefinitely or make progress and adapt to possible changes or not. This study aims to facilitate and promote future empirical research with not only specifying the current status of m-learning, but also investigating and improving factors affecting m-learning sustainability. The literature was reviewed about current sustainability factors, educational needs, adoption, success factors, limitations and challenges, and potential changes and risk of mobile learning projects. The following critical sustainability issues were identified and discussed: technological, developmental, pedagogical, assessment, psychological, social, legal & ethical, organizational & institutional and financial issues. In addition to literature, investigations were made in order to obtain additional sustainability factors. One investigation was based on formal interviews conducted with 11 heads of distance education centers and lecturers from seven universities. Another investigation was made for understanding the significance of these factors on m-learning sustainability. This investigation was based on a survey research conducted with lecturers and students from universities which have m-learning facilities and m-learning staff from management, system and support, content development and design, and assessment units. The results were evaluated and analyzed, and a conceptual model for m-learning sustainability was developed. The paper concludes that it was observed that some m-learning sustainability factors are critically

important and many m-learning initiatives disregard these factors. The study may provide guidelines to m-learning initiatives for a sustainable mobile learning.

Özet

Abide Coşkun Setirek, “Mobil Öğrenmenin Sürdürülebilirliğini Etkileyebilecek
Önemli ve İlgili Faktörler”

Eğitim liderleri m-öğrenme girişimlerinin şu anki eğitim ihtiyaçlarını karşılayabilip karşılayamadığı, kullanıcılar tarafından benimsenme potansiyeline sahip olup olmadığı, belirli bir durumu süresiz olarak koruyabilir veya ilerleme kaydedebilir olup olmadığı ve olası değişikliklere adapte olabilir olup olmadığı konuları hakkında endişe duymaktadırlar. Bu çalışma mobil öğrenmenin şu anki benimsenme durumunu belirleyerek ve mobil öğrenmenin sürdürülebilirliğini etkileyen faktörleri sorgulayıp geliştirerek, gelecek deneysel çalışmaları kolaylaştırmayı ve desteklemeyi amaçlamaktadır. Bu çalışmada mobil öğrenme projelerinin şu anki sürdürülebilirlik faktörleri, eğitim ihtiyaçları, benimsenmesi, başarı faktörleri, kısıtlamaları ve zorlukları ve olası değişiklikler ve riskleri hakkında literatür taraması yapılmış ve aşağıda verilen sürdürülebilirlik konuları belirlenmiş ve tartışılmıştır: teknolojik, pedagojik, geliştirme, finansal, organizasyonel ve kurumsal, yasal ve etik, sosyal, psikolojik ve değerlendirme. Literatüre ek olarak, ilave sürdürülebilirlik faktörlerini elde edebilmek için araştırmalar yapıldı. Araştırmaların biri, çeşitli yenilikçi m-öğrenme stratejilerini uygulayan 7 üniversiteden 11 uzaktan eğitim merkezi müdürü ve eğitimcisi ile yapılan yapısal görüşmeye dayanmaktadır. Bir diğer araştırma da, bu faktörlerin mobil öğrenme sürdürülebilirliği üzerindeki önemini anlamak için yapılmıştır. Bu araştırma mobil öğrenme imkanı sağlayan üniversitelerin uzaktan eğitim veren eğitimcilerine, uzaktan eğitim alan öğrencilerine, uzaktan eğitim merkezlerinin sistem ve destek, içerik geliştirme ve tasarım ve yönetim birimleri çalışanlarına uygulanan bir anket araştırmasına dayanmaktadır. Sonuçlar

değerlendirilmiş, analiz edilmiş ve m-öğrenmenin sürdürülebilirliği için bir model geliştirilmiştir. Araştırma sonunda bazı mobil öğrenme sürdürülebilirlik faktörlerinin kritik düzeyde önemli olduğu, ancak birçok m-öğrenme girişimlerinin bu faktörleri göz ettiği gözlemlenmiştir. Bu çalışmanın m-öğrenme girişimlerine sürdürülebilir bir mobil öğrenme için rehberlik sağlayabileceği düşünülmektedir.

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PREFACE

This study is an evolution of our previous study “Significant developmental factors that can be affect the sustainability of mobile learning” which was presented in “Word Conference on Educational Science 2014” in Malta and will be published in Procedia Social and Behavioral Sciences Journal. As noted in assumption of the previous study, in addition to developmental issues, many m-learning sustainability issues were also identified and discussed: technological, developmental, pedagogical, assessment, psychological, social, legal & ethical, organizational & institutional and financial. Furthermore, another assumption was carried out in this study with increasing the number of sample size. On the other hand, as distinct from previous study, another investigation was made with 11 experts in order to obtain additional sustainability factors. The investigation was based on formal structural interviews. Lastly in this study, the factor analyses are used for grouping the items into categories.

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CHAPTER 1

INTRODUCTION

In the last ten years, mobile devices usage is increasing throughout the world and many educational institutions are using advantages of the mobile devices as part of mobile learning. “Intersection of online learning and mobile computing—called mobile learning—holds the promise of offering frequent, integral access to applications that support learning anywhere, anytime” (William, 2003). M-learning is any form of learning delivered to students anytime and anywhere through mobile devices (Wang et al., 2009). Some mobile devices used in m-learning can be listed as mobile device, like cellular phones, Personal Digital Assistants (PDA), smartphones, tablet PC etc. (Andronico et al., 2003). While in 2007, the generation of laptop and tablet PCs cannot be named as mobile devices (Traxler, 2007), currently many researcher state that laptop and tablet PCs are also carried around as a part of life. For example, Kalinić and Arsovski (2009) stated that laptop computers and notebooks can be also considered as mobile devices in narrow sense, which usually have small screen and keyboard and are pocket-sized. Some mobile device usage for instructional activities are downloading and sharing document, collaborating on projects, reviewing coursework, preparing for exams, showcasing their work, sharing project results, reading (listening to) audio books, recording information, presenting projects; conducting research, saving their work, submitting work to the instructor etc. (Corbeil and Valdes-Corbeil, 2007).

Even if mobile devices usage in educational institutions is increasing throughout the world, m-learning is still in its infancy (Muyinda, 2007). Wingkvist

(2009) stated that, research results indicate that few of efforts have produced any lasting outcomes. High dropout rate in online courses is problem (Sulcic and Sulcic, 2007) and many e-learning initiatives fail (Stepanyan, Littlejohn & Margaryan, 2010). Wingkvist argued that it is evident that the initiatives are faced with inherently complex settings and that the outcomes might not live up to their promises; will not be adopted, hence, will not become sustainable. On the other hand, literature review shows that sustainability of mobile learning depends on not only adoption of mobile learning but also educational needs, success factors, limitations and challenges, and changes and risk of mobile learning projects.

This study aims both specifying the current status of m-learning, and identifying factors affect m-learning sustainability which helps to improve future empirical research.

The study may provide guidelines to assist m-learning initiatives (boards of education, educators, policy makers and m-learning staffs) in sustaining an effective mobile learning. Universities and other m-learning initiatives must meet the increasing demand for m-learning with sustainable education policy. In addition to m-learning initiatives, students and families can also benefit from these significant m-learning sustainability factors for assessing the m-learning initiatives and making decision.

This study seeks to answer the similar central research questions investigated by Timpone (2012). The original questions concerning educational technology are modified and the following guiding questions were used in this research study: What are the significant and relevant factors that can affect the sustainability of mobile learning? What does the statistical evidence suggest about how the significant and

relevant factors affect the sustainability of mobile learning? What is the current situation of the sustainability of m-learning at universities in Turkey?

The term ‘sustainability’ can be interpreted from a number of different viewpoints. Sustainability was defined by Eckersley (1998) as “the ability to continue an activity or a certain condition indefinitely”. Sustainability of education focuses on the implementation of sustainable forms of ‘successful’ practice through educational development, leadership and innovation (Davies & West-Burnham, 2003).

In the context of e-learning, Robertson (2008) interpreted sustainable e-learning as “e-learning that has become normative in meeting the needs of the present and future”. Sustainability is “the property of e-learning practice that evidently addresses current educational needs and accommodates continuous adaptation to change, without outrunning its resource base or receding in effectiveness” (Stepanyan, Littlejohn & Margaryan, 2010). On the other hand, in Gunn’s (2010) study, an e-learning initiative is considered sustainable when all three of these conditions are met:

- *A learning design involving information and communications technology has been developed and implemented within a course or courses of study. It has been through a proof-of-concept stage and has been judged, on the basis of evidence produced, to be beneficial to teaching and learning.*
- *The e-learning concept, design, system or resources have proven potential to be adopted, and possibly adapted, for use beyond the original development environment.*
- *Maintenance, use and further development of the e-learning concept, design, system or resources do not remain dependent on one or a few individuals who*

created them, to the extent that, if their involvement ceased, future prospects would not be compromised.

On the basis of research, four abilities which define the sustainability of m-learning were specified in our study:

- ability to address current educational needs and intent of m-learning
- ability to have potential to be adopted by users
- ability to maintain a certain condition indefinitely or make progress
- ability to adapt to possible changes

This study assumed that the respondents responded accurately to the survey about the current m-learning status of their initiative. The study also assumed that institutions are accurate representatives in terms of mobile learning initiative, according to their statements about m-learning facilities.

CHAPTER 2

LITERATURE REVIEW

Educational Technology Sustainability Factors

With technology started to use in education intensively, research on educational technology sustainability factors also started to make because of rapid technology development. Romano (2005) specified 10 educational technology sustainability factors in his study: Leadership, Funding, Professional Development, Technical Support, Assessments, Technology Integration, Digital Content, Equitable Access to Technology, Connectivity and Communication/Shared Practices. Timpone (2008) and Lee (2010) also investigated the Romano's 10 educational technology sustainability factors and their alignment. Phipps & Merisotis (2000) also identified some benchmarks for success in Internet-Based distance education. These are Institutional Support, Course Development, Teaching/Learning Process, Course Structure, Student Support, Faculty Support and Evaluation and Assessment

E-Learning Sustainability Factors

Educational leaders struggled also with e-learning sustainability factors. Many authors have argued these difficulties arise because the creation, utilization and support of e-learning facilities require a balancing of tensions between technical, organizational and pedagogical considerations (Marshall & Geoff Mitchell, 2002). Some researchers handled similar factors for e-learning sustainability. For example, Trentin (2007) investigated pedagogical, professional, sociocultural, informal,

content, organizational, economical, technological approaches. Stansfield and his colleagues (2009) studied on the sustainability issues: organizational, technological, pedagogical, student/user, financial and consolidation issues. On the other hand, Attwell (2007) focused on five aspects of e-learning sustainability. These are learning platforms and learning software, institutional responses to the use of e-learning, e-learning materials development, pedagogic approaches, and teacher and trainers skills. Sun and her colleagues (2006) studied on thirteen factors under the six dimensions which are Learner Dimension, Instructor Dimension, Design Dimension, Environmental Dimension, Technology Dimension and Course Dimension.

M-Learning Sustainability Factors

There is not more research about sustainability of mobile learning but some abilities which define the sustainability of m-learning were specified in our study and we can research in the light of this definition.

- ability to address current educational needs and intent of m-learning
- ability to have potential to be adopted by users
- ability to maintain a certain condition indefinitely or make progress
- ability to adapt to possible changes

Researchers have studied about educational needs, adoption, success factors, limitations and challenges, and changes and risk of mobile learning projects.

Requirements

Firstly, there are some requirements for sustainable mobile learning in order to be able to address current educational needs and intent of m-learning. Casany and her colleagues (2012) specified some requirements for m-learning projects sustainability. These requirements are changes in the traditional practices of educational institutions, motivation to change technology, time for customizing and adapting materials and content to different types of devices or platforms, budget for hardware and Internet connections, consolidation, and content and services for different sociocultural realities. The existence and application of mobile hardware and networking technology is a necessary component for the existence of m-Learning (Caudill, 2007).

Al-Bahadili and his colleagues (2011) studied on learner's requirements for successful m-learning and specified as identification of learner's needs, structuring of the pedagogical material, enhancement of the m-learning environment, motivation for learner participation, tutorials, collaborative mechanisms, supporting tools and combination of learning processes. Papanikolaou and Mavromoustakos (2006) also studied on learners' requirements these are identification of learners' needs, structuring of the pedagogical material, enhancement of the m-learning environment, motivation for student participation, the ability of solving student questions and problems, collaborative mechanisms, supporting tools and combination of learning processes.

Adoption

Secondly, sustainable m-learning should be able to have potential to be adopted by users. Zurita and Nussbaum (2004) emphasized some factors that essential for the

adoption of the project such as interactivity, coordination, negotiation and communication, organization of material, mobility, and motivation and collaboration. Liu (2008) studied on an adoption model for mobile learning. His research model includes such issues: social influence, facilitating conditions, self-management of learning, performance expectancy, effort expectancy, mobility, self-efficacy, attainment value, and perceived enjoyment. Lu and Viehland (2008) made investigation on factors influencing the adoption of mobile learning and self-efficacy, perceived usefulness, subjective norm, attitude, perceived ease of use, and perceived financial resources were accepted as reasons for adoption of m-learning. Chong *et al.* (2011) studied on the adoption of m-learning in Malaysia and the results show that perceived ease of use, perceived usefulness, quality of services and cultural aspects affect the adoption of m-learning significantly and positively.

Success factors, limitations and challenges

Thirdly, a successful project can maintain a certain condition or make progress therefore success factors are essential for m-learning sustainability. Cochrane and his colleagues (2009) explored some m-learning success factors: the level of pedagogical integration of the technology into the course criteria and assessment, the level of lecturer modeling of the pedagogical use of the tools, the use of regular formative feedback from both lecturers and student peers, appropriate choice of mobile devices and software, and technological and pedagogical support. Papanikolaou and Mavromoustakos (2006) handled the issues as critical success factors for the development of mobile learning applications such as understanding of characteristics, peculiarities and constraints of the various mobile devices and

technologies to be used in m-learning, learners' needs and requirements and examination of the quality components which are usability, functionality, reliability, efficiency, maintainability and portability. According to Bates and Poole (2003), the appropriateness of the technology for students, ease of use and reliability, costs, teaching and learning approaches, interactivity, organizational issues, novelty and speed are important factors.

In addition to success factors, limitations and challenges are also essential for maintaining a certain condition or progress. Al-Bahadili and his colleagues (2011) specified some constraints for mobile device such as software constraints, hardware constraints and network constraints. According to Alzaza and Yaakub (2011), the cost of transaction, slow data exchange with networks and concerns over confidentiality of personal information are important limitations. Georgiev and his colleagues (2006) also handled three types of constraints such are technological challenges, development challenges and pedagogical challenges. Shudong and Higgins (2005) examined the limitations of mobile phone learning from technical, psychological and pedagogical viewpoints. Berge and Kearsley (2003) studied about the sustainability of distance training and received a wide variety of responses to the question "What are the biggest obstacles or issues associated with sustaining e-learning in your organization at present, and in the past if different?". Such issues were specified:

- *time and costs associated with the development of e-learning;*
- *demonstrating return on investment for e-learning;*
- *formalizing the processes associated with e-learning;*
- *keeping up with rapid changes in technology;*
- *finding and retaining e-learning staff;*

- *identifying what training needs can best be met by e-learning;*
- *creating and maintaining interest in e-learning;*
- *providing the technical support needed;*
- *misconceptions about e-learning that result in underuse or overuse;*
- *budget and/or resource limitations;*
- *inadequate bandwidth for complex applications;*
- *need for instructor acceptance of e-learning;*
- *getting employees to make time for e-learning;*
- *too much time spent on developing the technology and not enough on the instruction;*
- *lack of consistent direction, support, or involvement from management or senior management.*

On the other hand, Saccol et al. (2009) examined the technological and economic challenges, social and contextual challenges, challenges regarding the deployment of new technologies and new learning practices and pedagogical challenges. Ting (2005) studied on future challenges of m-learning and specified three challenges: the concept of adaptive learning, where the instructional strategies and learning content should be designed to adapt to learner's profile and personal needs, the limited text display and the location and response time. James (2008) handled challenges for mobile-learning in Thailand. He studied on managerial, behavioral and technical (technological) challenges. Grohmann, Hofer & Gunnar (2005) indicated some restrictions concerning the use of mobile terminal devices for the deployment of (technology-enhanced) learning, these are system performance of mobile terminal devices, display / monitor features of mobile terminal devices,

battery power of mobile terminal devices, network connection, input devices / operating devices and programming languages.

Changes and risks

There are some challenges and limitation for mobile learning, and they will also be in future so sustainable m-learning should adapt to possible changes. Grohmann and his colleagues (2005) studied on changes and risks of mobile learning and specified as follow: independence from location and time; personalized adaptive learning; changes in the culture of learning; integration into the course of work; mobile learning in context of integrated, blended learning; cost reduction; lack of autodidactic competence; lack of social contact; loss of privacy; lack of profitability; lack of acceptance; lack of standards.

In GSMA Connected Living Programmed: m-Education (2012), potential risks were handled the title safeguarding, security and privacy. Accessing inappropriate content and communication, mobile bullying, distraction, financial difficulty and illegal file sharing/downloading were given under safeguarding. On the other hand, some healthy and safety risks were listed as being targeted by thieves, eye strain and RSI, sleep disruption and obsessive use. In addition, according to them, learner privacy and autonomy, and data and system privacy and security are other risks of mobile education.

Ally and Tsinakos (2014) stated that it is required to guard against possible risks. They studied on increasing access through mobile learning and specified 5 top risks of mobile learning as entrenched digital divides: digital inequality, digital literacy and digital citizenship; digital distractions and threats such as theft of

devices, cyber-bullying and information overloading; the opposite of a green manifesto: short lifespan, high power consumption and recycling; uncontrolled, misleading effects on outcomes: teaching and learning benefits that may not really be present; and poor return on investment.

As a result of this part of literature review, the following critical sustainability issues were identified and the sustainability factors will be discussed under these titles: technological, developmental, pedagogical, assessment, psychological, social, legal & ethical, organizational & institutional and financial issues.

Technological Aspects

Many researchers handled the sustainability issues from technological perspective. According to Stansfield and et al. (2009), appropriate infrastructure & standards (cost effectiveness, systems security, adoption of open-source technologies), support for staff & users / students (adoption of open-source technologies, effective training, maintenance agreements in place), embracing innovation (identifying new trends, integration with mainstream programs, pro-active management) and testing and evaluation (rapid application development, clear technology requirements) are key issues of sustainable e-learning.

Ktoridou and Eteokleous (2005) address the technological aspects on their study. According to them, when mobile devices are compared with PC or desktops, mobile devices have advantages in terms of portability, transfer, usability, battery life, time, familiarity and youth lifestyle but have disadvantages in terms of functionality, expansion and upgrade, connectivity and interoperability, connectivity costs and security. Pea and Maldonado (2006) handled seven device features

contributing to the rise in handheld use within schools and beyond: (1) size and portability; (2) small screen size; (3) computing power and modular platform; (4) communication ability through wireless and infrared beaming networks; (5) wide range of available multipurpose applications; (6) ready ability to synchronize and back-up with other computers; and (7) stylus driven interface.

Standards and architecture, tools and technologies, and functionality and uses are important factors from the technological view of e-learning (Conole, 2004).

Kukulska-Hulme (2007) pointed out that “m-learning activity continues to take place on devices which are not designed for educational use, and that therefore usability issues are frequently reported”. He gave some usability issues related to physical attributes as small screen size, heavy weight, inadequate memory and short battery life, network speed and reliability, and physical environment.

Five broad categories of technology must be considered from technological viewpoint of m-learning; these are transport, platform, delivery, media technologies, and development languages (Attewell, 2005). Cobcroft (2006) handled mobile devices, wireless infrastructure, learning management systems (LMS) in his literature review into mobile learning in the university context. Sánchez and his colleagues (2013) investigated the factors that determine the acceptance of the WebCT learning system among students. The factors they investigated are technical support; computer self-efficacy; perceived ease of use; perceived usefulness; attitude; and system usage. The study revealed the importance of the technical support variable. Oinas-Kukkonen and Kurkela, V. (2003), stated that network accessibility is a main advantage of m-learning. So, it can be taken for inspection of its effect on sustainability.

From a technology viewpoint, restrictions that may impede m-learning sustainability as discussed by Maniar and Bennett (2007), include following eight aspects: small screen size and poor screen resolution, lack of data input capability, low storage, low bandwidth; limited processor speed, short battery life, software issues and interoperability, and lack of standardization. There are some technological challenges and limitation for mobile learning, lack of standards is one of them (Grohmann et al., 2005). Georgiev and his colleagues (2006), also examine the technological challenges of transition from e-learning to m-learning in their study in terms of student, educators and developers. According to them, challenges are for developers:

- *less memory, less computing power, smaller screen size, absence (in most cases) of keyboard, etc.*
- *need to know very well all the abilities and downfalls of the particular mobile devices and communication technologies to successfully design and develop a mobile learning system.*

for educators:

- *need to know very well how to operate mobile devices,*
- *need to know what to require from the developers,*
- *need to know what the limits and abilities of such systems are*
- *need to be also fluent with the modern communications devices used by their students.*

for students:

the different features of mobile devices compared to the personal computers

Mekuria (2009), studied on sustainability factors in mobile broadband technology and services. Some following questions are handled with the study: (1)

Which technology is suitable for designing, activating and affordable delivery of relevant mobile broadband services? (2) Which technology provides easy to tools and protocols to create local mobile content and integrate it to the global web knowledge through mobile IP technologies? (3) Which technology has support to alternative energy usage and provides low power network topologies? (4) What is the contribution of such a technology deployment for the long term mobile-ICT development initiative and digital inclusion? (5) Which technology can give the needed spinoff and employment creation through mobile local content and service provision for social and economic development? (6) Which technology and/or combination of technologies, has the inherent capacity for long term industry support and sustainable service provision. (7) Which technology can provide the maximum spectral efficiency for a given licensed frequency area, by a network operator.

Developmental Aspects

M-learning developmental aspects were also identified from literature. For example, Zurita and Nussbaum (2004) emphasized some developmental factors that essential for the adoption of the project such as interactivity, coordination, negotiation and communication, organization of material, mobility, and motivation and collaboration. Papanikolaou and Mavromoustakos (2006) handled the issues as critical success factors for the development of mobile learning applications such as learners' needs and requirements and examination of the quality components which are usability, functionality, reliability, efficiency, maintainability and portability. According to Bates and Poole (2003), the appropriateness of the technology for students, ease of use and reliability, costs, teaching and learning approaches, interactivity and novelty

are important success factors. According to Intratat, it is essential for developers and designers to find not only interesting content but also techniques to create attractive, stimulating, and encouraging materials.

Berge and Kearsley (2003) studied about the sustainability of distance training and received design and developmental responses: time and costs associated with the development of e-learning; keeping up with rapid changes in technology; identifying what training needs can best be met by e-learning; creating and maintaining interest in e-learning; too much time spent on developing the technology and not enough on the instruction. Ktoridou and Eteokleous (2005) studied about the role of the educators and the students in the design, development and implementation of the innovation and collaboration among various stakeholders: educators, students / learners, engineers, computer scientists.

Igwe (2002) identified some challenges which are using e-learning as an addition to traditional forms of teaching and learning in tertiary education and unsatisfactory knowledge on the real costs and benefits of e-learning investments. In this study, partnerships and networks are seen as possible solutions for these challenges. Georgiev et al. (2006) also examined the developmental challenges of transition from e-learning to m-learning in their study in terms of student, educators and developers. According to them, while mobile device properties, the information transfer speeds, connection technologies, memory, development platform choice and test ability are challenges, educators challenge with requirement of fluency in the authoring tools for mobile learning systems and the system restrictions. Casany et al. (2012) underlined the some developmental changes in the traditional practices of educational institutions, materials and content, and devices or platforms.

Bhalalusesa and Arshad (2013) stated that “Since m-learning is a part of e-learning, most of the learning materials created in e-learning environment can be used in m-learning”. According to them, learning materials that can be used in m-learning environment may not be effective because of the nature and constraints of mobile devices. Small screen size and poor screen resolution, lack of data input capability, low storage, low bandwidth; limited processor speed, short battery life, software issues and interoperability, and lack of standardization are some aspects related to mobile devices (Maniar & Bennett, 2007). On the other hand, there are some multimedia-based systems have insufficient learner-content interactivity and flexibility (Zhang et al., 2004).

Pedagogical Aspects

Many researchers handled mobile learning in terms of pedagogic aspects. One definition for sustainability of m-learning was ability to address current educational needs and intent of m-learning. According to some researchers, instructional activity is one of the most important pedagogical aspect instructional activities mobile learning. Naismith and his colleagues (2004), studied on mobile technologies and learning, structured the classification of activities around the main theories which are behaviorist, constructivist, situated, collaborative, informal and lifelong, and learning and teaching support theories and areas of learning relevant to learning with mobile technologies. On the other hand, Kailasrao (2012) handled first activities provided by mobile learning, then the most common mobile communication devices (iPod, MP3 Player, PDA, USB Drive, E-Book Reader, Smart Phone, Ultra-Mobile PC (UMPC)) and their functions with their potential instructional uses and then significance of

behaviorist, constructivist, situated, collaborative and informal theories in mobile learning.

Stansfield and his colleagues (2009) specified some important pedagogical sustainability issues which are appropriate pedagogical models and approaches, appropriate and stimulating content, embracing innovation, quality evaluation and support for staff & users/students. Granića and Ćukušić (2011) studied on educational evaluation of an e-learning platform and they conclude that accurate quality assessment is provided by end-user testing.

Ktoridou and Eteokleous (2005) studied on pedagogical aspects to be considered in Cyprus tertiary education and suggested that the following pedagogical questions of m-learning are critically important: “How mobile devices can be used in higher education classrooms?”, “Curriculum and learning materials development”, “In what contents mobile technology could be used?”, and “What pedagogical methods and instructional approaches could be applied?”. According to James (2008), “M-learning pedagogy should accommodate different learner perspectives in developing learning strategies, models and applications; support virtual networked and collaborative learning practices; help develop university staff – tutorial and support; and create a focal point of operation that helps create communication patterns and activities that bridge students/stakeholders and the university towards common pedagogic goals”. Identifying what training needs can be met best by e-learning is one of the most important pedagogical challenges of e-learning initiatives (Berge and Kearsley, 2003).

There are some pedagogical challenges and limitation for mobile learning and personalized adaptive learning and lack of standards are some of them (Grohmann et al., 2005). Attewell and Savill-Smith (2004) handled changes in teaching and

learning in their study under such titles: Individualization, collaborative and active learning, informal learning with multiple media and, cognitive and behavioral change. Georgiev and his colleagues (2006) handled current challenges in the transition from e- to m-learning in terms of student, educators and developers. According to them some pedagogical challenges are little knowledge about different pedagogical approaches and technological limitations of the mobile devices, the focus of m-learning and requirement for being self-organized.

Mostakhdemin-Hosseini (2009) studied on analysis of pedagogical considerations of m-learning in smart devices. He implicated that the main focuses of the mobile learning pedagogical consideration must be directed to content of the learning materials and the context where the learning occurs. Conole (2004) collected the research themes and questions under the hood of pedagogical aspects; these are understanding the learning process, design and development issues, delivery and integration, support and evaluation, and quality assurance.

There are other studies about pedagogical aspects of m-learning. Kearney et al. (2012) inspected the mobile learning from a pedagogical viewpoint. The paper based on three central features of mobile learning: authenticity, collaboration and personalization, embedded in the unique time-space contexts of mobile learning. Park (2001) categorized educational applications of mobile technologies into four types as high transactional distance socialized m-learning, high transactional distance individualized m-learning, low transactional distance socialized m-learning and low transactional distance individualized m-learning.

Villaverde et al. (2006) studied on learning styles' recognition in e-learning environments. They state that there are some e-learning systems determine a student learning style; and then adapting their behavior according to the students' styles and

it is required for effectiveness. Laurillard (2007) studied on pedagogical forms for mobile learning. The study handled “whether the m-learning design motivate students for some issues or not”.

Assessment Aspects

“Assessment is probably the most important thing we can do to help our students learn” (Brown, 2004). So the assessment issues of m-learning system were also inspected by many researchers.

According to Gaytan and McEwen (2007), students enroll in online courses because of such reasons: distance from campus, works full time, irregular work schedule/convenient, prefers online learning and only way it was offered. As assessment strategies for online courses, they lay emphasis on a wide variety of clearly explained assignments, continual, immediate, and detailed feedback, understanding of assignments, the quality of interaction and a variety of assessment techniques (e.g., projects, rubrics, portfolios, self-assessment peer evaluation, threaded discussions, online chats, timed quizzes.)

Robles and Braathen (2002) studied on online assessment techniques and handled such issues: understanding the assignments, understanding the content material, different learning styles, comparability of the rigor of the online course, student opinions about the course, being sure students participate, group cohesiveness and meeting the learning outcomes.

Buchanan (2002) listed some potential difficulties with measurement of some constructs as: breakdowns in connectivity, validity, secure server and encrypted communications, the use of norms or cutting scores, different populations,

and practical and ethical reasons (e.g., data security). On the other hand, Graff (2003) claimed that possessing poor IT skills is drawback of online assessment.

Iahad (2004) et al. evaluated the online assessment as usability and functionality evaluation. Three evaluation criteria of usability evaluation are loading and response time, ease-of-use and whether the online test is informative. The evaluation criteria specified for the functionality evaluation are delivery, assessment and feedback. Sun et al. (2008) proved that “if an e-Learning system provides more or diversified assessment tools and methods, users’ satisfaction will increase because of feedback from the assessment”.

Psychological Aspects

M-learning process is a different learning system with respect to traditional learning. The context-dependent nature of memory, human cognitive resources are finite, distributed cognition and situated learning, metacognition and individual differences matter are essential for mobile learning (Terras & Ramsay, 2012). Because of such changes, some problems should be solved, such as matching teaching contents with the student's learning style (Franzoni & Assar, 2009). According to Ting, staff members are studying how learning materials and teaching strategies should be designed and delivered and MacCallum and Jeffrey stated that academics also studied for more interactivity and more dynamic teaching (as cited in Handal et al., 2013).

Learners possess the psychological infrastructure in an effective mobile learning initiative (Terras & Ramsay, 2012). Learning should engage learners in the learning process in addition to good learning outcomes (Shen et al., 2009).

Successful implementation of m-learning in higher education will be based on m-learning acceptance of users (Abu-Al-Aish & Love, 2013). Jan et al. (2012) studied on the adoption of e-learning from institutional perspective. As a result, they suggest that “training managers may need to build an e-learning community to create normative expectations and provide success stories of high profiles employee’s e-learning experience to promote the adoption of their e-learning”. Chokri (2012) thinks that adoption of the e-learning technology in teaching and learning is important and believes that sustainability of technology in education is impossible without answering the question why aren't students interested in e-learning?

On the other hand, Sørebo et al. (2009) studied on the title the role of self-determination theory in explaining teachers’ motivation to continue to use e-learning technology. The results show that “extension of IS-continuance theory with constructs that represent users’ basic psychological needs and intrinsic motivation can be useful for predicting their e-learning continuance intentions”. Wagner et al. (2008) also think that the success of e-learning is dependent on the extent to which is satisfies the needs and addresses the concerns of its key stakeholders such as students, instructors, employees and institution. Sfenrianto and Suhartanto (2011) stated that, that adopting learning styles and motivation improve learning performance and for developing an e-learning system, the importance of this psychological issue should be understood.

Social Aspects

Many studies discuss the importance of the social environment of learning system. Preece (2000) identified some key components contribute to good sociability which

are: people who interact socially to satisfy needs, perform roles, etc.; a shared purpose that provides a reason for community; policies that guide people interaction, virtual environments to support and mediate social interaction.

Lowenthal (2009) stated that “Theories of social presence help explain how students and teachers interact and learn online”. Aragon (2003) specified some important strategies used to establish and maintain social presence by e-learning initiatives. He recommends developing welcome messages, including student profiles, incorporating audio, limiting class size and structuring collaborative learning activities to developers. On the other hand contributing to discussion boards, promptly answering e-mail, providing frequent feedback, striking up a conversation, sharing personal stories and experiences, using humor, using emotions, addressing students by name and allowing students options for addressing the instructor are strategies for e-learning instructors according to him.

Essam and Al-Ammary (2013) studied about the impact social interaction on the e-learning at Arab Open University. Results show that student-student interaction is more important impact on using e-learning at Arab Open University than student-instructor interaction. On the other hand, it is essential that how students and teachers socially interact in online courses is related to discourse (Lowenthal, 2010). Discourse was defined as “purposeful conversation or dialogue” in E-Perimer Series (Nichols, 2009). Nichols inspected the design elements (setting expectations and preparing opportunities for discourse), facilitation elements (initial messages and ongoing engagement), developing a written style and managing the facilitation workload under the title teaching presence.

Legal and Ethical Aspects

Some legal and ethical issues were handled in literature as follow:

Mason (1986) introduced four ethical concerns specific to the Information

Age:

privacy: which information can be withheld and which cannot, under what conditions and with what safeguards;

accuracy: the authenticity, and fidelity of stored information;

ownership: both of the information and the channels through which it is transmitted

accessibility: what information does a person or an organization have a right or a privilege to obtain, under what conditions and with what safeguards?

Wright (2011) studied on ethical and safe *ICT* practices and listed the following legal, ethical and safety factors:

Legal: Copyright infringement/appropriate attribution; discrimination: disability, racial, religious; hacking, breach of terms and conditions; theft: piracy of software and digital audio/video files; defamation: libellous content; and sedition.

Ethical: Plagiarism/fraud; “netiquette”; cultural sensitivity, blasphemy, obscenity; intimidation, harassment, stalking, blackmail; image manipulation; and respect

Safe: Privacy issues, especially children’s personal information online; security of information: passwords; financial details; stranger danger – online predators; cyber-bullying; exposure to inappropriate content; and health and safety due to overuse: ergonomics, visual strain, etc.

Lally et al. (2012) examined the ethical dimensions of researching the mobile, ubiquitous and immersive technology enhanced learning (MUITEL), with a

particular focus on learning in informal settings and following factors are revealed: informed consent, access to technology: potential for discrimination and abuse, user generated content, attachment, introducing unsuitable materials, intrusion of privacy and unmonitored spaces.

Social and political influence, cultural diversity, bias, geographical diversity, learner diversity, information accessibility, etiquette, and the legal issues are related with ethical issues of e-learning (Khan, B. H. (Ed.), 2001). He found answers to such questions:

- *Are teaching strategies adjusted for varying learning preferences?*
- *Do courses accommodate students with disabilities? Are views of controversial issues presented via resources, course content and teaching strategies?*
- *Do courses demonstrate sensitivity to student's location, internet accessibility, and holidays?*
- *Is content designed for those with little computer experience?*
- *Are copyright, plagiarism, and privacy policies clearly defined?*

Wishart (2011) studied on ethical considerations in implementing mobile learning in the workplace. She stated that commonly accepted four primary ethical principles “do good, avoid harm, autonomy and justice-equal access to resource” can be used to frame the six key areas of concern in mobile learning. These are personal information, images, informed consent, ownership, data storage and protection, user generated content.

Traxler and Bridges (2005) inspected the ethical and legal challenges of mobile learning. In the study, such concepts are handled: informed consent, participant risk, participant withdrawal, payment or compensation, confidentiality

and anonymity, private and public distinctions, roles, status and power, cultural differences, developing effective debriefing and netiquette.

Organizational and Institutional Aspects

Wang et al. (2007) inspected the m-learning in an organizational context with such issues: system quality, information quality, service quality, system use, user satisfaction and net benefits: individual impact and organizational impact.

According to Berge and Kearsley (2003), finding and retaining e-learning staff is one of the most important organizational challenges for e-learning initiatives.

Stansfield et al. (2009) specified some organizational key issues in the development of sustainable e-learning and virtual campus initiatives: teamwork, roles & responsibilities (peer review ,bottom-up approach, regular evaluation), bureaucracy & administration (senior level project champion, managing diversity), language, culture, gender: multi-lingual solutions, intercultural dialogue, managing diversity, project management (clear vision & strong leadership, pro-active management approach, effective partnerships with all stakeholders). On the other hand, Conole (2004) handled such issues in his study: users' role and responsibilities, structures and processes, and context and culture. On the other hand they specified also some important consolidation aspects which are involving stakeholders (accreditation, involving key external decision makers, embracing e-learning environment), continued evaluation (identifying new trends, meeting real needs), marketing (embedded strategies, effective market research), dissemination (identifying best practices, embedded strategies), develop center of excellence (accreditation ,identifying best practices), and planning for sustainability (effective &

realistic business model ,meeting real needs).

Financial Aspects

From financial viewpoint, there are some studies examine the factors which can affect the sustainability of mobile learning. Stansfield et al. (2009) specified some financial key issues in the development of sustainable e-learning and virtual campus initiatives: appropriate costing methods (direct costs, indirect costs, effective & transparent business model), cost benefit analysis (financing future developments, effective & transparent business model, tangible benefits, intangible benefits) and wider institutional context (risk analysis, senior level project champion).

To increase the quality of education of students, financial funding consideration is important (Nenadic et al., 2012). Successfully orchestrating a multi-campus faculty development program required a good deal of resources, both monetary and human (Reilly et al., 2012). According to them, primary precondition is to make a good and well worked-out financial plan at the institution level.

According to Traxler (2004), content development costs, teaching costs, software development costs, hardware costs and usage costs and phone charges should be considered separately in mobile learning projects. On the other hand, Timpone (2008) indicated such costs: instructional and administrative applications, software, maintenance, support, professional development, and connectivity and infrastructure costs.

One of the most common barriers or issues to e-learning implementation is lack of financial resource (Clarke et al., 2005). On the other hand, demonstrating return on investment for e-learning is one of the most important financial challenges

of e-learning initiatives (Berge and Kearsley, 2003). Upper management wants demonstration return on investment (ROI) and reduce training cost, and that it is cost-effective and cost-efficient (Raths, 2001).

Literature Summary

The literature was reviewed about current sustainability factors, educational needs, adoption, success factors, limitations and challenges, and changes and risk of mobile learning projects. The critical sustainability factors were identified and discussed under those titles: pedagogical, technological, financial, organizational & institutional, developmental, psychological, social, legal & ethical and assessment aspects. The sustainability factors based on literature are combined with the other factors which are obtained from interviews (Table 1).

Table 1 Literature-based and Interview-based Sustainability Factors

ASPECTS	FACTORS
Technological Aspects	system security
	connectivity
	accessibility
	interoperability
	modularity
	memory adequacy*
	quality standards
	requirement specification
	expansion and upgrade
	maintenance
	testing
	availability of support for system use*
	availability of support for connection problems*
	accessibility of support
	effectiveness of support
Developmental Aspects	attractiveness
	interactivity
	usability
	social presence*
	flexibility and maintainability
	effectiveness of materials
	efficiency of content
	validity of content*
	clarity of content*
	extent of content
	renewal of materials and content*
	size of the materials*
	data usage of materials*
	screen resolution
	processor speed
	connection technologies
	mobile Internet quota*
	following quality standards
	testing
	user test and feedback*
	requirement specification
	maintenance
	cooperation among staff, instructors & users
	identification of new trends
	implementation of new ideas
Pedagogical Aspects	appropriateness of instructional approaches
	appropriateness of pedagogical methods and instructional activities
	appropriateness of content
	appropriateness of learning environment
	appropriateness of materials and applications

	consideration of different learning styles
	essentiality of metacognition
	consideration of readiness level*
	quality standards*
	identification of real needs
	user feedback
	understanding the learning process/complexity
	accessibility of support
	effectiveness of support
Assessment Aspects	usability of assessment media
	functionality of assessment media
	connectivity of assessment media
	security of assessment media
	appropriateness of feedback
	appropriateness of response time
	validity of instruments
	reliability of instruments
	clarity of instruments
	variety of instruments
	grade proportion of exams*
	use of norms or cutting scores
	cheating*
	ambiguity about respondent
	IT skills of users
Psychological Aspects	motivation
	satisfaction
	confidence*
	availability of support for adoption of process
	availability of support for adaptation to process
	accessibility of support
	effectiveness of support
Social Aspects	social interactivity of learning environments*
	integration with social networks*
	collaborative learning activities
	feedback and support
	personal stories and experiences share
	humor use
	emotions use
	discourse
Legal & Ethical Aspects	accessibility of information
	discrimination in content
	informed consent
	privacy and security of personal information
	accuracy of stored information
	netiquette
	intellectual property and copyright sensitivity*

Organizational & Institutional Aspects	leadership strength
	clarity role and responsibilities
	communication between staffs*
	teamwork and coordination
	innovative approach*
	partnership strategy
	system, product and information quality policies
	finding and retaining of staff
	need for instructor acceptance
	cooperation with peer initiatives
	interdisciplinary dialog*
	project-based studies and workshops*
	publicity*
	misconceptions
	popular departments*
Financial Aspects	sufficiency of financial source
	cost effectiveness
	tangible and intangible benefits
	return on investment
	effective risk management
	transparency and efficiency of business model
	financial expert level

*Interview-based sustainability factors

CHAPTER 3

THE THEORATICAL FRAMEWORK OF THE STUDY AND HYPOTHESES

Theoretical Framework of the Study

The theoretical framework was developed to guide the study after the factor analyses were applied to the sustainability items which were obtained from literature and interviews for grouping the items under some factors which are the independent variables.

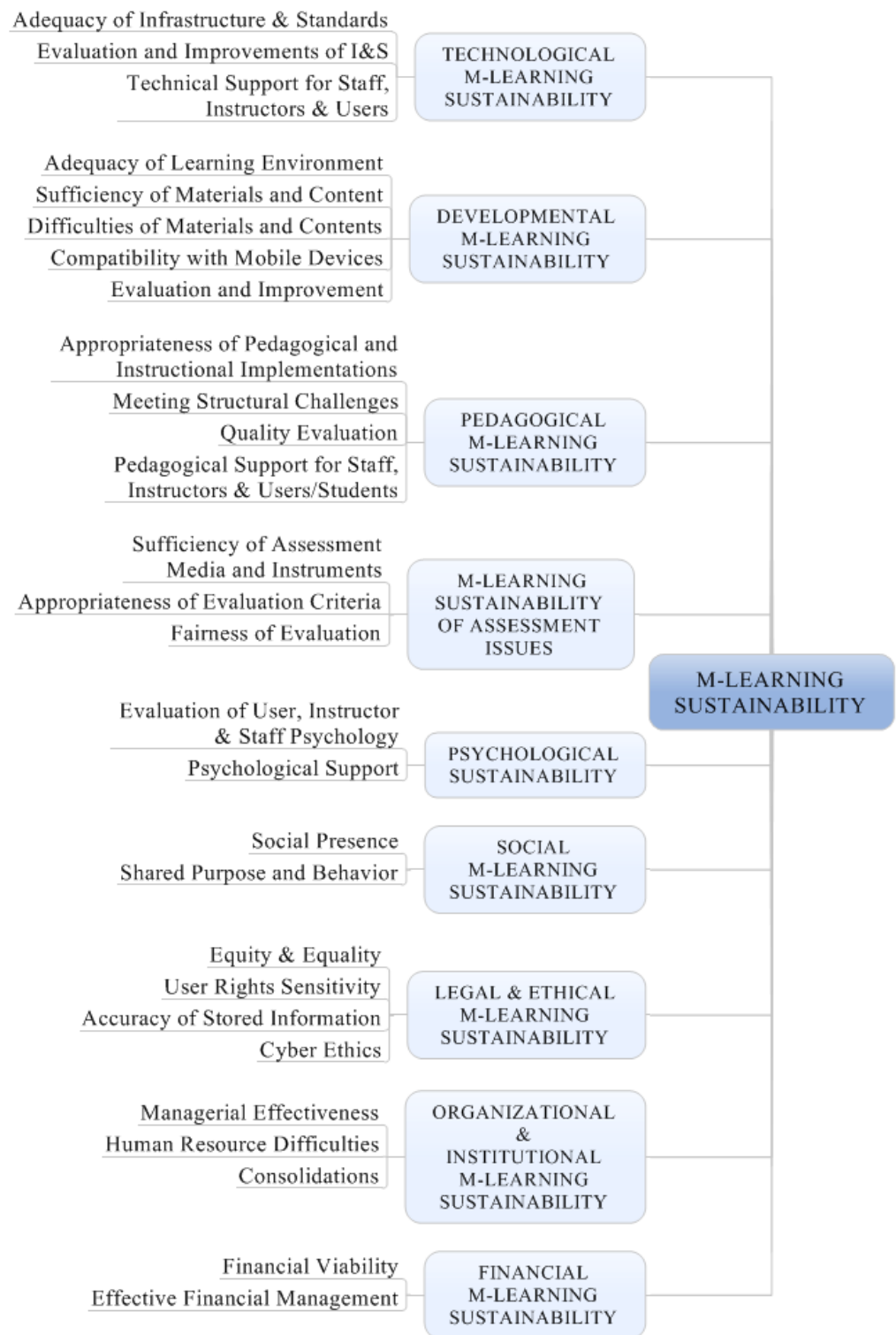


Figure 1 The Theoretical Framework

Hypotheses

Our hypotheses depend on the variables which are obtained from factor analyses and literature.

H₁: Adequacy of infrastructure and standards will be associated with perceived general technological m-learning sustainability.

H₂: Evaluation and improvements of infrastructure and standards will be associated with perceived general technological m-learning sustainability.

H₃: Technical support for staff, instructors and users will be associated with perceived general technological m-learning sustainability.

H₄: Perceived general technological m-learning sustainability will be associated with perceived general m-learning sustainability.

H₅: Adequacy of learning environment will be associated with perceived general developmental m-learning sustainability.

H₆: Sufficiency of materials and content will be associated with perceived general developmental m-learning sustainability.

H₇: Difficulties of materials and contents will be associated with perceived general developmental m-learning sustainability.

H₈: Compatibility with mobile devices will be associated with perceived general developmental m-learning sustainability.

H₉: Evaluation and improvement will be associated with perceived general developmental m-learning sustainability.

H₁₀: Perceived general developmental m-learning sustainability will be associated with perceived general m-learning sustainability.

H₁₁: Appropriateness of pedagogical and instructional implementations will be associated with perceived general pedagogical m-learning sustainability.

H₁₂: Meeting structural challenges will be associated with perceived general pedagogical m-learning sustainability.

H₁₃: Quality evaluation will be associated with perceived general pedagogical m-learning sustainability.

H₁₄: Pedagogical support for staff, instructors and users will be associated with perceived general pedagogical m-learning sustainability.

H₁₅: Perceived general pedagogical m-learning sustainability will be associated with perceived general m-learning sustainability.

H₁₆: Sufficiency of assessment media and instruments will be associated with perceived general assessment m-learning sustainability.

H₁₇: Appropriateness of evaluation criteria will be associated with perceived general assessment m-learning sustainability.

H₁₈: Fairness of evaluation will be associated with perceived general assessment m-learning sustainability.

H₁₉: Perceived general m-learning sustainability in assessment issues will be associated with perceived general m-learning sustainability.

H₂₀: Evaluation of user, instructor and staff psychology will be associated with perceived general Psychological m-learning sustainability.

H₂₁: Psychological support will be associated with perceived general Psychological m-learning sustainability.

H₂₂: Perceived general psychological m-learning sustainability will be associated with perceived general m-learning sustainability.

H₂₃: Social presence and will be associated with perceived general Social m-learning sustainability.

H₂₄: Shared purpose and behavior will be associated with perceived general Social m-learning sustainability.

H₂₅: Perceived general social m-learning sustainability will be associated with perceived general m-learning sustainability.

H₂₆: Equity & equality will be associated with perceived general legal and ethical m-learning sustainability.

H₂₇: User rights sensitivity will be associated with perceived general legal and ethical m-learning sustainability.

H₂₈: Accuracy of stored information with perceived general legal and ethical m-learning sustainability.

H₂₉: Cyber ethics will be associated with perceived general legal and ethical m-learning sustainability.

H₃₀: Perceived general legal and ethical m-learning sustainability will be associated with perceived general m-learning sustainability.

H₃₁: Organizational effectiveness will be associated with perceived general organizational and institutional m-learning sustainability.

H₃₂: Human resource difficulties will be associated with perceived general organizational and institutional m-learning sustainability.

H₃₃: Consolidations will be associated with perceived general organizational and institutional m-learning sustainability.

H₃₄: Perceived general organizational and institutional m-learning sustainability will be associated with perceived general m-learning sustainability.

H₃₅: Financial viability will be associated with perceived general financial m-learning sustainability.

H₃₆: Effectiveness of financial management will be associated with perceived general financial m-learning sustainability.

H₃₇: Perceived general financial m-learning sustainability will be associated with perceived general m-learning sustainability.

CHAPTER 4

METHODOLOGY

Research Design

The research design of this study includes mixed (both quantitative and qualitative) research methods. With qualitative research, it is aimed to benefit from experiences, perspectives and ideas of experts, reducing restrictions. On the other hand, the quantitative research provided opportunity to reach more person concerned and to increase the generalizability and the objectivity of the study. The research design of this study consists of 5 phases.

In *Phase I*, the literature was reviewed about current sustainability factors, educational needs, adoption, success factors, limitations and challenges, and changes and risk of mobile learning projects. The following critical sustainability aspects were identified and discussed: pedagogical, technological, economical, organizational & institutional, developmental, psychological, social, legal & ethical and assessment aspects. The sustainability factors depends on literature are specified.

In *Phase II*, in addition to literature, an investigation was made in order to obtain additional sustainability factors from experts. The investigation was based on formal interviews conducted with heads of distance education centers and university lecturers who give distance courses at universities which has m-learning facilities. These additional sustainability factors are combined with the factors depend on literature, then these factors are evaluated, and collected under the subtitles for each sustainability aspect which were discussed in literature.

In *Phase III*, another investigation was made for obtaining data to understand the effects of these factors on perceived m-learning sustainability. This investigation was based on a survey research conducted with lecturers who give distance courses at universities which have m-learning facilities; staffs from management, system and support, development and design, and assessment units at distance education centers of universities; and distance education students who can reach the learning system by using mobile devices.

In *Phase IV*, after the data collection, factor analyses were applied to the sustainability factors which were obtained from literature and interviews and these factors were grouped under some titles which are the independent variables. The theoretical framework for m-learning sustainability was developed to guide the study and hypotheses which depend on these variables.

Lastly, in *Phase V*, answers were given to the research questions, with the hypothesis testing.

Data Collection and Instrumentation

After handling the sustainability factors based on literature, with structured interview, the ideas and thoughts of 11 experts were obtained for additional sustainability factors. “Structured interviews are based on predetermined and standardized identical set of questions” (Saunders *et al.*, 2009). This interview consists of six predetermined and standardized questions, and comment area (as seen Appendix A). The interview is conducted via e-mail. Obtained data was used for preparing survey questionnaires.

On the other hand, survey questionnaire was formed from the obtained sustainability factors based on literature and interviews. These questions collected under 9 titles which are technological, developmental, pedagogical, assessment, psychological, social, legal & ethical and organizational & institutional parts. 5 survey forms were formed from these parts and conducted with concerned population which are with instructors who give distance courses at universities which has m-learning facilities; staffs from management, system and support, development and design, and assessment units at distance education centers of universities; and distance education students who can reach the learning system from mobile devices. The five population types and concerned survey parts were given in Figure 2. First survey form consists of the technological and psychological parts and it is conducted on system staffs. The second one includes the developmental, pedagogical and psychological parts for design and development staffs. Third survey form is for instructors and consist of the psychological, pedagogical and assessment parts. The fourth survey form includes the developmental, social and psychological parts and it is conducted on students. The last survey form is for administrator and the concerned parts are legal and ethical, organizational and institutional, and financial parts.

Each survey form includes descriptive items like name, institution (these are not required), age, position and working or learning year in m-learning environment. Another item is about accessibility to learning system from mobile devices. It is critical item since if there is not accessibility from mobile devices, no need to answers of other items. Each survey form includes also one item for each m-learning sustainability parts and 5 general m-learning sustainability items based on the definition of m-learning sustainability. Totally 134 items which are 6 descriptive nominal and ratio scale items, 113 Likert scale items consist of five intervals about 9

m-learning sustainability aspects, 10 Likert scale items consist of five intervals for general perceived sustainability of 9 m-learning sustainability aspects and 5 general perceived m-learning sustainability Likert scale items consist of five intervals were prepared for data collection (as seen in Appendix B).

First the administrators of university distance education centers are contacted via telephone or e-mail in order to reach the contact of students, staffs and instructors. Some administrator personally communicated with them.

Totally 894 completed survey parts has been collected from 5 survey forms for 9 parts. There is not precise sample size since some respondent are either administrator or instructor and some of them are both administrator and development staff or both administrator and system staff. They could respond to more than one survey form if they are concerned that forms.

System Staffs	• Technological Issues • Psychological Issues
Design and Development Staffs	• Developmental Issues • Pedagogical Issues • Psychological Issues
Instructors	• Psychological Issues • Pedagogical Issues • Assessment Issues
Students	• Developmental Issues • Social Issues • Psychological Issues
Administrators	• Legal & Ethical Issues • Organizational & Institutional Issues • Financial Issues

Figure 2 Respondent and Concerned Survey Parts

Population and Sample

The population of this study consists of lecturers who give distance courses at universities which have m-learning facilities; staffs from management, system and support, development and design, and assessment units at distance education centers of universities; and distance education students who can reach the learning system from mobile devices.

For this study, snowball sampling is used for survey research. According to Baltar & Brunet (2012) “Snowball sampling is a useful methodology in studies that respondents are few in number and hard to reach”. It is attempted to send mail to all managers of university distance education centers which have m-learning facilities and ask them to reach other samples. The sample sizes for all part of the survey research were given in Table 2.

Table 2 Information about Survey and Responses

	System Staff	Design & Development Staff	Instructor	Student	Management Staff	Sample Size	# of Independent Variables	Ratio of subjects to variables
Technological	X					75	3	25:1
Developmental		X		X		152	5	22:1
Pedagogical		X	X			80	4	27:1
Assessment			X	X		119	3	30:1
Psychological	X	X	X	X		142	2	71:1
Social				X		105	2	52:1
Legal & Ethical					X	73	4	19:1
Organizational & Institutional					X	74	3	25:1
Financial					X	74	2	15:1

According to Hair et al. (1995), the minimum ratio of subjects to independent variables is 5:1 for multiple regression analysis and Miller and Kuncz (1973) and Halinski and Feldt (1970) reported 10:1 as a more conservative ratio (as cited in Kotrlik & Higgins, 2001). Our ratio of subjects to independent variable is acceptable as given in Table 2.

Variables Used in the Study

Table 3 Independent Variables

TECHNOLOGICAL ASPECTS	Adequacy of Infrastructure & Standards Evaluation and Improvements of I&S Technical Support for Staff, Instructors & Users
DEVELOPMENTAL ASPECTS	Adequacy of Learning Environment Sufficiency of Materials and Content Difficulties of Materials and Contents Compatibility with Mobile Devices Evaluation and Improvement
PEDAGOGICAL ASPECTS	Appropriateness of Pedagogical and Instructional Implementations Meeting Structural Challenges Quality Evaluation Pedagogical Support for Staff, Instructors & Users/Students
ASSESSMENT ASPECTS	Sufficiency of Assessment Media and Instruments Appropriateness of Evaluation Criteria Fairness of Evaluation
PSYCHOLOGICAL ASPECTS	Evaluation of User, Instructor & Staff Psychology Psychological Support
SOCIAL ASPECTS	Social Presence Shared Purpose and Behavior
LEGAL & ETHICAL ASPECTS	Equity & Equality User Rights Sensitivity Accuracy of Stored Information Cyber Ethics
ORGANIZATIONAL & INSTITUTIONAL ASPECTS	Managerial Effectiveness Human Resource Difficulties Consolidations
FINANCIAL ASPECTS	Financial Viability Effective Financial Management

After the data collection, factor analyses were applied to the sustainability factors which were obtained from literature and interviews and these factors were grouped under some titles which are the independent variables (shown in Table 3). The theoretical framework for m-learning sustainability was developed to guide the study and hypotheses which depend on these variables.

Validity of the Study

The main types of validity are content, construct, and criterion validity. This study established content and construct validity. Content validity is “the degree to which the content of the items adequately represent the universe of all relevant items under study” (Cooper & Schindler, 2003). First we established face validity (content validity) by examining the topic carefully and developing the questionnaire in respect of literature. Then we established panel of judges validity (content validity) by consulting with experts in questionnaire development and sampling design.

On the other hand, factorial validity is a form of construct validity (Lu, 2006) and it is established for this study. The items were grouped before hypothesis testing by Factor Analyses with appropriate values (as presented in Chapter 5).

Reliability of the Instrument

Cronbach’s reliability test was computed to determine the internal consistency for the survey items. It is most commonly used (Tavakol & Dennick, 2011). The results revealed high levels of reliability with Cronbach's Alpha > .9 for all scales according

to Kline (2013). The results of Cronbach's reliability tests were presented in Chapter 5.

Data Analysis Tools

First, the data obtained from the survey questionnaires were transferred into Excel 2010 and then transferred into the Statistical Package for Social Sciences (SPSS) Version 21.

CHAPTER 5

ANALYSES AND RESULTS

The reporting of analysis, results and discussion were handled under six sections for each aspect of study. Hypotheses are given in the first section. The second section is discussing the demographic profile of respondents and reports the results for the third research question “How do staffs, students and instructors of m-learning initiatives perceive the m-learning sustainability of their initiatives in terms of concerned aspect and general issues?” The third section is for discussing the reliability of the survey instrument. While factor analyses are presented in fourth section, the items and variables belong to that part are given in fifth section. The sixth section includes the regression analyses for the hypotheses and results for first and second research questions which are “What are the significant and relevant factors that can affect the sustainability of mobile learning?” and “What does the statistical evidence suggest about how the significant and relevant factors affect the sustainability of mobile learning?”.

Technological Issues

Hypotheses

H₁: Adequacy of infrastructure and standards will be associated with perceived general technological m-learning sustainability.

H₂: Evaluation and improvements of infrastructure and standards will be associated with perceived general technological m-learning sustainability.

H₃: Technical support for staff, instructors and users will be associated with perceived general technological m-learning sustainability.

H₄: Perceived general technological m-learning sustainability will be associated with perceived general m-learning sustainability.

Descriptive Analysis

As a result of data collection process for technological sustainability issues, 75 valid responses have been collected. As shown in Table 4, 52% of the respondents of the survey part about technological issues are 20-30 years old and %44 of the respondents' experience year is more than 3.

Table 4 Demographic Profile of Respondents

Age		<20	20-30	30-40	40-50	50>	Total
	Frequency	2	39	19	9	6	75
	Percent	2.7	52	25.3	12	8	100
Experience		<1	1-3 year(s)	3-5 years	5>		Total
	Frequency	15	27	18	15		75
	Percent	20.0	36.0	24.0	20.0		100.0

The Table 5 includes the mean values belongs to technological sustainability factors which are reached from literature review and interview. According to descriptive analysis, each factor has value more than 3.5 except the quality standards issue which is also more than average of the item values (3) with 3.41 mean values. The mean value of accessibility issue is 4.19 and it has highest mean value.

On the other hand, the value of perceived general technological m-learning sustainability is 3.69 and the value of perceived general m-learning sustainability is 3.44. They are also not in critical level since the values are more than 3.

Table 5 Descriptive Statistics of Variables

Technological Issues	N	Mean
system security	75	3.68
connectivity	75	3.84
accessibility	75	4.19
interoperability	75	3.89
modularity	75	3.63
memory adequacy	75	3.80
quality standards	75	3.41
requirement specification	75	3.53
expansion and upgrade	75	3.55
maintenance	75	3.57
testing	75	3.64
availability of system use support	75	3.88
availability of support for connection problems	75	3.60
accessibility of supports	75	3.68
effectiveness of support	75	3.80
Perceived General Technological M-learning Sustainability	75	3.69
Perceived General M-learning Sustainability	75	3.44

Reliability Analysis

Table 6 Reliability Statistics

Cronbach's Alpha	N of Items
.925	21

Cronbach's Alpha analysis was used for finding the reliability values of each variable. According to Cronbach's Alpha analysis, as shown by Table 6, the overall value of Cronbach's Alpha was found as .925. According to Kline (2013), the reliability of the scale is quite high since it is more than .9. There is no item to increase the overall alpha value, if it is deleted (as seen in Table 7).

Table 7 Item-Total Statistics

Technological Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
system security	.607	.921
connectivity	.628	.921
accessibility	.572	.922
interoperability	.591	.921
modularity	.432	.925
memory adequacy	.542	.923
quality standards	.567	.922
requirement specification	.560	.922
expansion and upgrade	.599	.921
maintenance	.645	.920
testing	.566	.922
availability of system use support	.589	.921
availability of support for connection problems	.656	.920
accessibility of supports	.483	.924
effectiveness of support	.556	.922
Perceived General Technological M-learning Sustainability	.789	.918
Perceived General M-learning Sustainability[ability to address current educational needs]	.645	.920
Perceived General M-learning Sustainability [ability to address the intent of m-learning]	.691	.919
Perceived General M-learning Sustainability[having potential to be adopted by users]	.487	.923
Perceived General M-learning Sustainability [maintaining a certain condition indefinitely or making progress]	.485	.924
Perceived General M-learning Sustainability [adaptation to possible changes]	.669	.920

Factor Analysis

In this section, Exploratory Factor Analysis is used to classify the 15 sustainability aspects into certain groups. The reliability of the scale is high with the .925 Cronbach's alpha value. On the other hand, the subjects-to-variables ratio should be at least 5 and preferably 10 (Everitt, 1975). Corresponding ratio for this study is 6 and sample size is adequate for the analysis. When we took a rule of thumb into consideration, sample is found to be highly adequate for factor analysis with the .818 Kaiser-Meyer-Olkin Measure value (Table 8) because it is greater than .50 (a rule of

thumb). In addition, the significance level of Barlett's Test (.000 as seen in Table 8) is below .001 therefore it is indicating sufficiently large correlations for principal component extraction and this test showed that the data is suitable for analysis.

Table 8 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.818
Bartlett's Test of Sphericity	Approx. Chi-Square	558.546
	df	105
	Sig.	.000

The Total Variance Explained table (Table 9) shows that 62.157% of the total variance is explained by classifying these 15 aspects into 3 components. Below 50% is interpreted as unsatisfactory by many researchers and 60% or more is preferred as a rule of thumb.

Table 9 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.306	42.041	42.041	6.306	42.041	42.041	3.473	23.153	23.153
2	1.633	10.884	52.924	1.633	10.884	52.924	2.995	19.966	43.119
3	1.385	9.233	62.157	1.385	9.233	62.157	2.856	19.039	62.157
4	1.072	7.144	69.302						
5	.837	5.578	74.880						
6	.677	4.512	79.392						
7	.582	3.882	83.274						
8	.526	3.505	86.778						
9	.384	2.559	89.338						
10	.358	2.384	91.721						
11	.350	2.334	94.055						
12	.289	1.925	95.980						
13	.262	1.748	97.728						
14	.189	1.260	98.989						
15	.152	1.011	100.000						

Table 10 Rotated Component Matrix

Technological Items	Component		
	1	2	3
system security	.401	.447	.285
connectivity	.429	.578	.206
accessibility	.397	.602	.180
interoperability	.331	.620	.219
modularity	.061	.827	.016
memory adequacy	.025	.817	.214
quality standards	.673	.398	.000
requirement specification	.770	.068	.230
expansion and upgrade	.732	.107	.268
maintenance	.796	.196	.164
testing	.631	.207	.265
availability of system use support	.291	.087	.771
availability of support for connection problems	.341	.142	.781
accessibility of supports	.037	.203	.800
effectiveness of support	.199	.193	.735

With the Rotated Component Matrix, it can be determined which variables load together under which factor. According to the Rotated Component Matrix (Table 10), 15 aspects were classified into 3 components as specified in theoretical framework of the study. The first group under component 2 was named as “Adequacy of Infrastructure & Standards”. The second group under first component was named as “Evaluation and Improvements of I & S”. The last group under component 3 was named as “Technical Support for Staff, Instructors & Users”.

Items and Variables

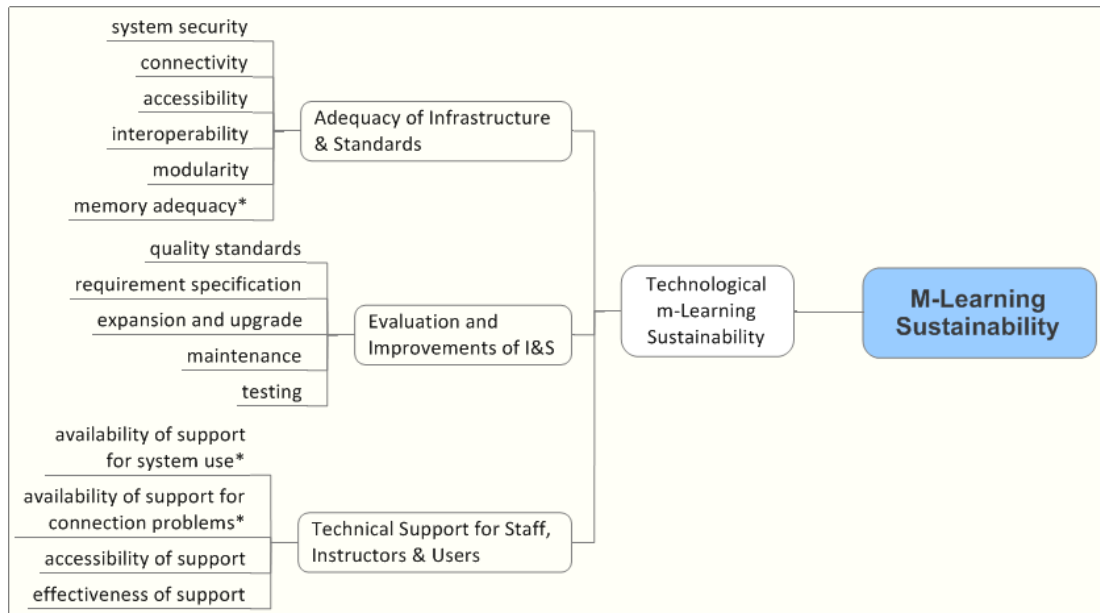


Figure 3 Technological Aspects

Regression Analyses

For testing hypotheses 1, 2 and 3, a multiple regression analysis was constructed.

The three influential variables “adequacy of infrastructure & standards”, “evaluation and improvements of infrastructure and standards”, and “technical support for staff, instructors and users” were used as independent variables, while perceived general technological m-learning sustainability was used as a dependent variable. The ANOVA table (Table 11) shows that F value of 30.116 having a significance level of 0.000 and the significance value is less than .05.

Table 11 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.368	3	7.456	30.116	.000 ^a
	Residual	17.578	71	.248		
	Total	39.947	74			

As seen in Table 12, the adjusted R^2 is .541 and .541 of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 2.001 auto-correlation between the independent variables and it is between desired range of 1.5-2.5. So we can examine the hypotheses and coefficients.

Table 12 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.748 ^a	.560	.541	.498	2.011

a. Predictors: (Constant), adequacy of infrastructure & standards, evaluation and improvements of infrastructure and standards, and technical support for staff, instructors and users

b. Dependent Variable: perceived general technological m-learning sustainability

The results of regression analysis are presented in Coefficient table (Table 13). It shows that P-values of three independent variables are less than .05 and they are considered to have meaningful relationships with perceived general technological m-learning sustainability. Those factors are memory adequacy, investment, expansion and upgrade, and cost effectiveness.

Therefore, all variables contribute significantly to the regression equation and hypotheses 1, 2 and 3 are supported by this test. The regression equation is specified as follows: $PGTS = .651 + .364 X_1 + .256 X_2 + .272 X_3$

Table 13 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.651	.326		1.998	.050
	adequacy of infrastructure & standards (X_1)	.364	.090	.367	4.064	.000
	evaluation and improvements of I & S (X_2)	.256	.088	.271	2.907	.005
	technical support for staff, instructors and users (X_3)	.272	.083	.305	3.261	.002

a. Dependent Variable: Perceived General Technological M-learning Sustainability (PGTS)

In the formula, PGTS is perceived general technological m-learning sustainability.

X_1 is adequacy of infrastructure & standards, X_2 is evaluation and improvements of infrastructure and standards, and X_3 is technical support for staff, instructors and users.

For testing hypotheses 4, a linear regression analysis was used. The perceived general technological m-learning sustainability was used as independent variables, while perceived general m-learning sustainability was used as a dependent variable. As shown in ANOVA table (Table 14), F value of 76.475 having a significance level of 0.000 which is less than .05.

Table 14 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.827	1	25.827	76.475	.000 ^a
	Residual	24.653	73	.338		
	Total	50.480	74			

a. Predictors: (Constant), Perceived General Technological M-learning Sustainability

b. Dependent Variable: Perceived General M-learning Sustainability

As seen in Table 15, the adjusted R^2 is .505 and independent variable explains .505 of the variance in the dependent variable. Durbin-Watson value shows that there is 1.769 auto-correlation between the independent variable and it is between desired range of 1.5-2.5. Thus we can examine the hypotheses and coefficients.

Table 15 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.715 ^a	.512	.505	.5811326	1.769

a. Predictors: (Constant), Perceived General Technological M-learning Sustainability

b. Dependent Variable: Perceived General M-learning Sustainability

Coefficient table (Table 16) presents the results of regression analysis of the Hypothesis 4. It shows that the P-value is less than .05 and there is a meaningful

relationship between perceived general technological m-learning sustainability
perceived general technological m-learning sustainability. Therefore hypothesis 4
was also supported by the linear regression test.

Table 16 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.470	.346		1.359	.178
	Perceived General Technological M-learning Sustainability	.804	.092	.715	8.745	.000

a. Dependent Variable: Perceived General M-learning Sustainability

Developmental Issues

Hypotheses

H₅: Adequacy of learning environment will be associated with perceived general developmental m-learning sustainability.

H₆: Sufficiency of materials and content will be associated with perceived general developmental m-learning sustainability.

H₇: Difficulties of materials and contents will be associated with perceived general developmental m-learning sustainability.

H₈: Compatibility with mobile devices will be associated with perceived general developmental m-learning sustainability.

H₉: Evaluation and improvement will be associated with perceived general developmental m-learning sustainability.

H₁₀: Perceived general developmental m-learning sustainability will be associated with perceived general m-learning sustainability.

Descriptive Analysis

152 valid responses have been collected as a result of data collection process for developmental sustainability issues. As shown in Table 17, 55.3% of the respondents of the survey part about developmental issues are 20-30 years old and %43.4 of the respondents' experience year is more than 3.

The Table 18 includes the mean values belongs to developmental sustainability factors which are reached from literature review and interview. According to descriptive analysis, each factor has value more than 3.0 except the

extent of content issue which has 2.99 mean values. We can say that extent of the content issue is critical developmental issue for m-learning initiatives. The maximum mean value belongs to usability of learning environment issue with 3.76 mean values.

Table 17 Demographic Profile of Respondents

Age		<20	20-30	30-40	40-50	50>	Total
	Frequency	9	84	39	10	10	152
	Percent	5.9	55.3	25.7	6.6	6.6	100.0
Experience		0-1	1-3 year(s)	3-5 year(s)	5++		Total
	Frequency	35	51	29	37		152
	Percent	23.0	33.6	19.1	24.3		100.0

Table 18 Descriptive Statistics of Variables

Developmental Issues	N	Mean
attractiveness of learning environment	152	3.53
interactivity of learning environment	152	3.57
usability of learning environment	152	3.76
social presence of learning environment	152	3.57
flexibility and maintainability of learning environment	152	3.55
extent of content	152	2.99
renewal of materials and content	152	3.12
size of the materials	152	3.31
data usage of materials	152	3.13
effectiveness of materials	152	3.61
efficiency of content	152	3.52
validity of content	152	3.57
clarity of content	152	3.52
screen resolution	152	3.51
processor speed	152	3.51
connection technologies	152	3.49
mobile Internet quota	152	3.11
following quality standards	152	3.16
testing	152	3.46
user test and feedback	152	3.30
requirement specification	152	3.39
maintenance	152	3.50
identification of new trends	152	3.27
implementation of new ideas	152	3.22
cooperation among staff, instructors & users	152	3.49
Perceived General Developmental M-learning Sustainability	152	3.45
Perceived General M-learning Sustainability	152	3.19

On the other hand, the value of perceived general developmental m-learning sustainability is 3.45 and the value of perceived general m-learning sustainability is 3.19. They are also not in critical level since the values are more than 3.

Reliability Analysis

Cronbach's Alpha analysis was used for finding the reliability values of each variable. According to Cronbach's Alpha analysis, as can be observed from the Table 19, the overall value of Cronbach's Alpha was found as .964 and it is quite high since it is more than .9 (Kline, 2013).

Table 19 Reliability Statistics

Cronbach's Alpha	N of Items
.964	31

If we delete the extent of content issue, it would increase the alpha from .964 to .966 as seen in Table 20. Nevertheless this increase is not dramatic and both values reflect a reasonable degree of reliability.

Table 20 Item-Total Statistics

Developmental Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
attractiveness of learning environment	.712	.963
interactivity of learning environment	.716	.963
usability of learning environment	.747	.963
social presence of learning environment	.547	.964
flexibility and maintainability of learning env.	.736	.963
extent of content	.319	.966
renewal of materials and content	.442	.965
size of the materials	.374	.965
data usage of materials	.325	.965
effectiveness of materials	.678	.963
efficiency of content	.711	.963
validity of content	.674	.963
clarity of content	.674	.963
screen resolution	.687	.963
processor speed	.732	.963
connection technologies	.731	.963

mobile Internet quota	.590	.964
following quality standards	.740	.963
testing	.696	.963
user test and feedback	.732	.963
requirement specification	.792	.963
maintenance	.771	.963
identification of new trends	.719	.963
implementation of new ideas	.698	.963
cooperation among staff, instructors & users	.726	.963
Perceived General Developmental M-learning Sustainability	.887	.962
Perceived General M-learning Sustainability [ability to address current educational needs]	.803	.963
Perceived General M-learning Sustainability [ability to address the intent of m-learning]	.836	.962
Perceived General M-learning Sustainability [having potential to be adopted by users]	.767	.963
Perceived General M-learning Sustainability [maintaining a certain condition indefinitely or making progress]	.606	.964
Perceived General M-learning Sustainability [adaptation to possible changes]	.776	.963

Factor Analysis

In this section, 25 sustainability aspects were classified into certain groups with factor analysis. The reliability of the scale was found high with the .964 Cronbach's alpha value. On the other hand, the subjects-to-variables ratio of this study is more than 5 and sample size is adequate for the analysis. Sample is found to be highly adequate for factor analysis with the .818 Kaiser-Meyer-Olkin Measure value (Table 21) because it is greater than .50 (a rule of thumb). In addition, the significance level of Barlett's Test (.000 as seen in Table 21) is below .05 therefore this test showed that the data is suitable for analysis.

The Total Variance Explained table (Table 22) shows that 71.786% of the total variance is explained by classifying these 25 aspects into 5 components. 60% or more is preferred and below 50% is unsatisfactory. Thus, our value is satisfactory.

Table 21 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.916
Bartlett's Test of Sphericity	Approx. Chi-Square	2939.009
	df	300
	Sig.	.000

Table 22 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.070	48.279	48.279	12.070	48.279	48.279	5.420	21.679	21.679
2	2.186	8.745	57.024	2.186	8.745	57.024	3.453	13.812	35.491
3	1.318	5.274	62.298	1.318	5.274	62.298	3.224	12.897	48.388
4	1.298	5.194	67.491	1.298	5.194	67.491	3.189	12.757	61.145
5	1.074	4.294	71.786	1.074	4.294	71.786	2.660	10.641	71.786
6	.876	3.504	75.290						
7	.727	2.906	78.196						
8	.645	2.581	80.777						
9	.539	2.158	82.935						
10	.524	2.097	85.032						
11	.468	1.870	86.903						
12	.407	1.629	88.532						
13	.373	1.494	90.026						
14	.320	1.280	91.306						
15	.308	1.230	92.536						
16	.295	1.182	93.718						
17	.258	1.033	94.751						
18	.247	.989	95.740						
19	.222	.886	96.626						
20	.205	.820	97.446						
21	.161	.646	98.092						
22	.154	.616	98.707						
23	.123	.492	99.199						
24	.118	.472	99.671						
25	.082	.329	100.000						

Extraction Method: Principal Component Analysis.

According to the Rotated Component Matrix (Table 23), 25 aspects were classified into 5 components. The first group under component 2 was named as “Adequacy of Learning Environment”. The second group under fifth component was named as “Difficulties of Materials and Contents”. The third group aspects under component 4 were named as “Sufficiency of Materials and Content”. The fourth group under component 3 was named as “Compatibility with Mobile Devices”. As title, “Evaluation and Improvement” was given to the last group in first component.

Table 23 Rotated Component Matrix

Developmental Items	Component				
	1	2	3	4	5
attractiveness of learning environment	.398	.602	.220	.292	.081
interactivity of learning environment	.293	.731	.271	.243	.085
usability of learning environment	.284	.724	.240	.334	.107
social presence of learning environment	.241	.736	.172	.034	.085
flexibility and maintainability of learning environment	.390	.576	.237	.259	.203
extent of content	.219	.002	.151	-.021	.587
renewal of materials and content	.162	-.019	.256	.135	.743
size of the materials	-.026	.202	.068	.134	.841
data usage of materials	.008	.125	.007	.090	.834
effectiveness of materials	.327	.361	.227	.561	.041
efficiency of content	.266	.460	.180	.646	.088
validity of content	.319	.124	.150	.844	.113
clarity of content	.263	.186	.171	.790	.192
screen resolution	.280	.275	.767	.151	.134
processor speed	.324	.172	.781	.283	.158
connection technologies	.299	.281	.761	.258	.107
mobile Internet quota	.188	.235	.698	.071	.269
following quality standards	.656	.242	.269	.289	.119
testing	.798	.189	.097	.186	.154
user test and feedback	.770	.304	.119	.231	.059
requirement specification	.713	.290	.220	.289	.152
maintenance	.793	.166	.231	.258	.172
identification of new trends	.733	.278	.308	.133	.022
implementation of new ideas	.719	.267	.266	.148	.035
cooperation among staff, instructors & users	.549	.157	.318	.466	.063

Items and Variables

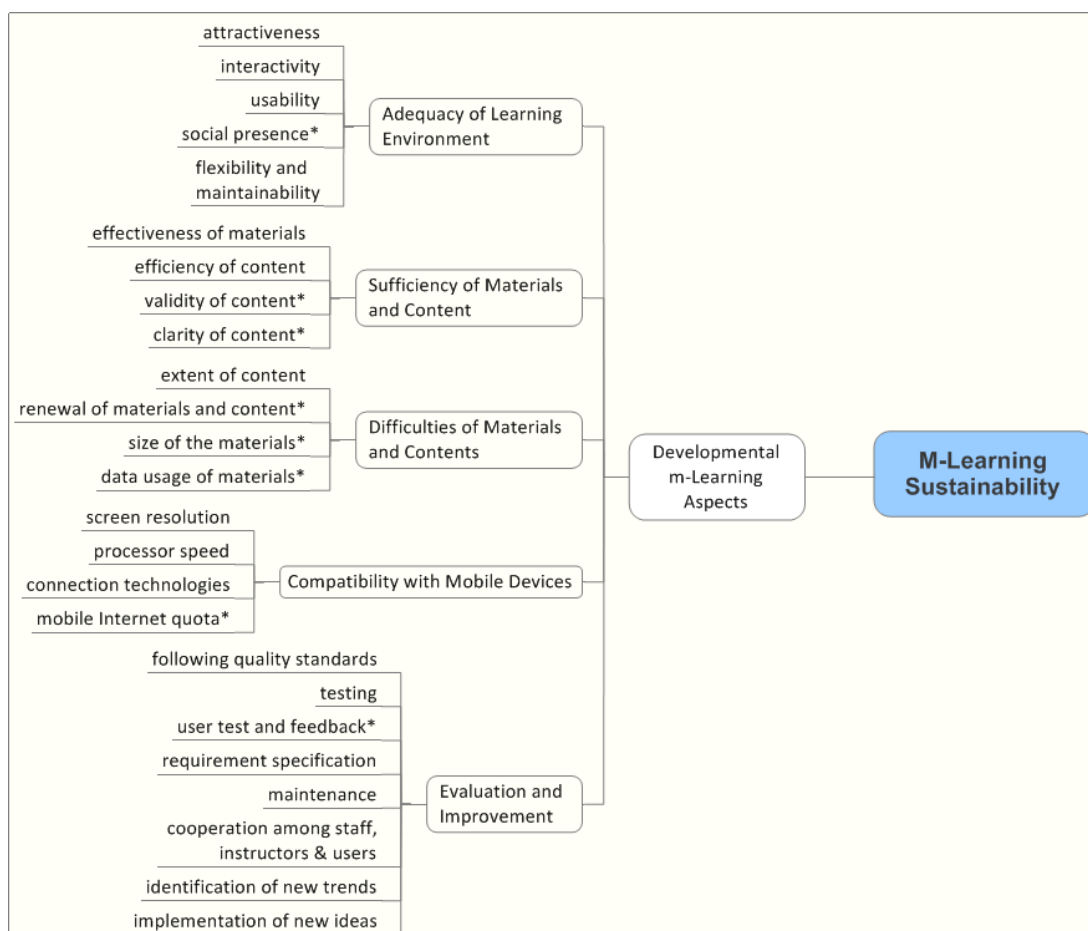


Figure 4 Developmental Variables

Regression Analyses

Multiple regression analysis was used for testing hypotheses 5, 6, 7, 8 and 9.

“Adequacy of Learning Environment”, “Difficulties of Materials and Contents”, “Sufficiency of Materials and Content”, “Compatibility with Mobile Devices” and “Evaluation and Improvement” were used as independent variables, while perceived general developmental m-learning sustainability was used as a dependent variable.

The ANOVA table (Table 24) shows that the significance value is .000 and less than .05.

According to Table 25, .712 (the adjusted R^2 value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 1.975 auto-correlation between the independent variables and it is between desired range of 1.5-2.5. Therefore, we can examine the hypotheses and coefficients.

Table 24 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	93.528	5	18.706	75.548	.000 ^a
	Residual	36.149	146	.248		
	Total	129.678	151			

According to Table 25, .712 (the adjusted R^2 value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 1.975 auto-correlation between the independent variables and it is between desired range of 1.5-2.5. Therefore, we can examine the hypotheses and coefficients.

Table 25 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.849 ^a	.721	.712	.498	1.975

The results of regression analysis are presented in Coefficient table (Table 26). It shows that P-values of four independent variables are less than .05 and they are considered to have meaningful relationships with perceived general developmental m-learning sustainability. Those factors are adequacy of learning environment, difficulties of materials and contents, sufficiency of materials and content, and evaluation and improvement. “Compatibility with Mobile Devices” is significant at the .1 level. Therefore, all variables contribute significantly to the regression equation and hypotheses 5, 6, 7, 8 and 9 are substantiated by this test. The regression equation is specified as follows:

$$PGDS = .298 + .228X_5 + .118 X_6 + .258 X_7 + .095 X_8 + .316 X_9$$

In the formula, PGDS is perceived general developmental m-learning sustainability. X_5 is adequacy of learning environment, X_6 is difficulties of materials and contents, X_7 is sufficiency of materials and content, X_8 is compatibility with mobile devices and X_9 is evaluation and improvement.

Table 26 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.298	.176		1.687	.094
	Adequacy of Learning Environment (X_5)	.228	.060	.243	3.779	.000
	Sufficiency of Materials and Content (X_6)	.118	.047	.120	2.503	.013
	Difficulties of Materials and Contents (X_7)	.258	.056	.279	4.622	.000
	Compatibility with Mobile Devices (X_8)	.095	.054	.105	1.776	.078
	Evaluation and Improvement(X_9)	.316	.061	.325	5.165	.000

a. Dependent Variable: Perceived General Developmental M-learning Sustainability (PGDS)

On the other hand, linear regression analysis was used for testing hypotheses 10. The perceived general developmental m-learning sustainability was used as independent variables, while perceived general m-learning sustainability was used as a dependent variable. As shown in ANOVA table (Table 27), F value of 76.475 having a significance level of 0.000 which is less than .05.

Table 27 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	86.377	1	86.377	315.320	.000 ^a
	Residual	41.090	150	.274		
	Total	127.467	151			

a. Predictors: (Constant), Perceived General Developmental M-learning Sustainability

b. Dependent Variable: Perceived General M-learning Sustainability

According to Table 28, the independent variable explains .675 (the adjusted R²) of the variance in the dependent variable. Durbin-Watson value shows that there is 1.800 auto-correlation between the independent variable and it is between desired range of 1.5-2.5. The hypotheses and coefficients can be examined.

Table 28 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.823 ^a	.678	.675	.5233874	1.800

a. Predictors: (Constant), Perceived General Developmental M-learning Sustainability

b. Dependent Variable: Perceived General M-learning Sustainability

Table 29 (the coefficient table) presents the results of regression analysis of the Hypothesis 10. It shows that the P-value is less than .05 and there is a meaningful relationship between perceived general developmental m-learning sustainability and perceived general m-learning sustainability. Therefore hypothesis 10 was also supported by the linear regression test.

Table 29 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.470	.346		1.359	.178
	Perceived General Developmental M-learning Sustainability	.804	.092	.715	8.745	.000

a. Dependent Variable: Perceived General M-learning Sustainability

Pedagogical Issues

Hypotheses

H₁₁: Appropriateness of pedagogical and instructional implementations will be associated with perceived general pedagogical m-learning sustainability.

H₁₂: Meeting structural challenges will be associated with perceived general pedagogical m-learning sustainability.

H₁₃: Quality evaluation will be associated with perceived general pedagogical m-learning sustainability.

H₁₄: Pedagogical support for staff, instructors and users will be associated with perceived general pedagogical m-learning sustainability.

H₁₅: Perceived general pedagogical m-learning sustainability will be associated with perceived general m-learning sustainability.

Descriptive Analysis

80 valid responses have been collected as a result of data collection process for pedagogical sustainability issues. As shown in Table 30, the majority of respondents (43.8%) of the survey part about pedagogical issues are 20-30 years old and %42.6 of the respondents' experience year is more than 3.

Table 30 Demographic Profile of Respondents

Age		<20	20-30	30-40	40-50	50>	Total
	Frequency	2	35	22	10	11	80
	Percent	2.5	43.8	27.5	12.5	13.8	100.0
Experience		0-1	1-3 year(s)	3-5 year(s)	5++		Total
	Frequency	15	31	17	17		80
	Percent	18.8	38.8	21.3	21.3		100.0

The mean values of pedagogical sustainability factors which were reached from literature review and interview were given in Table 31. According to descriptive analysis, there is not any critical issue; each factor has value more than 3.0. The maximum mean value belongs to appropriateness of learning environment with 3.61 and the minimum mean value belongs to accessibility of pedagogical support with 3.08.

Table 31 Descriptive Statistics of Variables

Pedagogical Issues	N	Mean
appropriateness of instructional approaches	80	3.55
appropriateness of pedagogical methods and instructional activities	80	3.49
appropriateness of content	80	3.49
appropriateness of learning environment	80	3.61
appropriateness of materials and applications	80	3.49
consideration of different learning styles	80	3.30
essentiality of metacognition	80	3.48
consideration of readiness level	80	3.16
quality standards	80	3.24
identification of real needs	80	3.40
user feedback	80	3.49
understanding the learning process/complexity	80	3.40
accessibility of support	80	3.08
effectiveness of support	80	3.19
Perceived General Pedagogical M-learning Sustainability	80	3.46
Perceived General M-learning Sustainability	80	3.28

On the other hand, the value of perceived general pedagogical m-learning sustainability is 3.46 and the value of perceived general m-learning sustainability is 3.28. The mean of general pedagogical m-learning sustainability values is greater than the mean of general m-learning sustainability values. They are also not in critical level since the values are more than 3.

Reliability Analysis

According to Cronbach's Alpha analysis, the overall value of Cronbach's Alpha was found as .952, as can be observed from the Table 32. It is quite high since it is more than .9 (Kline, 2013). There is no item to increase the overall alpha value, when it was deleted (as seen in Table 33).

Table 32 Reliability Statistics

Cronbach's Alpha	N of Items
.952	20

Table 33 Item-Total Statistics

Developmental Issues	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
appropriateness of instructional approaches	.690	.949
appropriateness of pedagogical methods and instructional activities	.777	.948
appropriateness of content	.788	.948
appropriateness of learning environment	.766	.948
appropriateness of materials and applications	.689	.949
consideration of different learning styles	.611	.951
essentiality of metacognition	.756	.948
consideration of readiness level	.653	.950
quality standards	.696	.949
identification of real needs	.724	.949
user feedback	.615	.951
understanding the learning process/complexity	.658	.950
accessibility of support	.724	.949
effectiveness of support	.620	.951
Perceived General Pedagogical M-learning Sustainability	.817	.948
Perceived General M-learning Sustainability [ability to address current educational needs]	.686	.949
Perceived General M-learning Sustainability [ability to address the intent of m-learning]	.777	.948
Perceived General M-learning Sustainability [having potential to be adopted by users]	.612	.950

Perceived General M-learning Sustainability [maintaining a certain condition indefinitely or making progress]	.490	.952
Perceived General M-learning Sustainability [adaptation to possible changes]	.700	.949

Factor Analysis

In this section, 14 sustainability aspects were classified into certain groups with factor analysis. The reliability of the scale was found high with the .952 Cronbach's alpha value. On the other hand, the subjects-to-variables ratio of this study is which more than 5 (80:14). Sample is found to be highly adequate for factor analysis with the .881 Kaiser-Meyer-Olkin Measure value (Table 34) because it is greater than .50. In addition, the significance level of Barlett's Test (.000 as seen in Table 34) is below .05 therefore this test showed that the data is suitable for analysis.

Table 34 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.881
Bartlett's Test of Sphericity	Approx. Chi-Square	880.085
	df	91
	Sig.	.000

The Total Variance Explained table (Table 35) shows that 78.553% of the total variance is explained by classifying these 14 aspects into 4 components. 60% or more is preferred as a rule of thumb and below 50% is unsatisfactory. Thus, our value is satisfactory.

Table 35 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.057	57.548	57.548	8.057	57.548	57.548	3.399	24.278	24.278
2	1.144	8.170	65.718	1.144	8.170	65.718	2.711	19.362	43.640
3	1.010	7.217	72.935	1.010	7.217	72.935	2.498	17.843	61.483
4	.786	5.617	78.553	.786	5.617	78.553	2.390	17.069	78.553
5	.740	5.283	83.836						
6	.469	3.353	87.188						
7	.409	2.922	90.110						
8	.326	2.330	92.440						
9	.276	1.971	94.411						
10	.240	1.712	96.123						
11	.180	1.286	97.409						
12	.161	1.147	98.556						
13	.123	.881	99.437						
14	.079	.563	100.000						

Table 36 Rotated Component Matrix

Pedagogical Items	Component			
	1	2	3	4
appropriateness of instructional approaches	.790	.206	.256	.269
appropriateness of pedagogical methods and instructional activities	.779	.286	.310	.275
appropriateness of content	.775	.261	.314	.319
appropriateness of learning environment	.766	.444	.192	.220
appropriateness of materials and applications	.517	.658	.215	.054
consideration of different learning styles	.248	.750	.032	.324
essentiality of metacognition	.339	.712	.338	.212
consideration of readiness level	.162	.631	.435	.241
quality standards	.434	.339	.114	.618
identification of real needs	.289	.212	.201	.812
user feedback	.163	.155	.207	.865
understanding the learning process/complexity	.304	.416	.543	.123
accessibility of support	.232	.230	.841	.222
effectiveness of support	.257	.106	.867	.163

According to the Rotated Component Matrix (Table 36), 14 aspects were classified into 4 components. The first group under component 1 was named as “Appropriateness of Pedagogical and Instructional Implementations”. The second group under component 2 was named as “Meeting Structural Challenges”. The third group aspects under component 4 were named as “Quality Evaluation”. As title, “Pedagogical Support for Staff, Instructors & Users/Students” is given to the last group in component 3.

Items and Variables

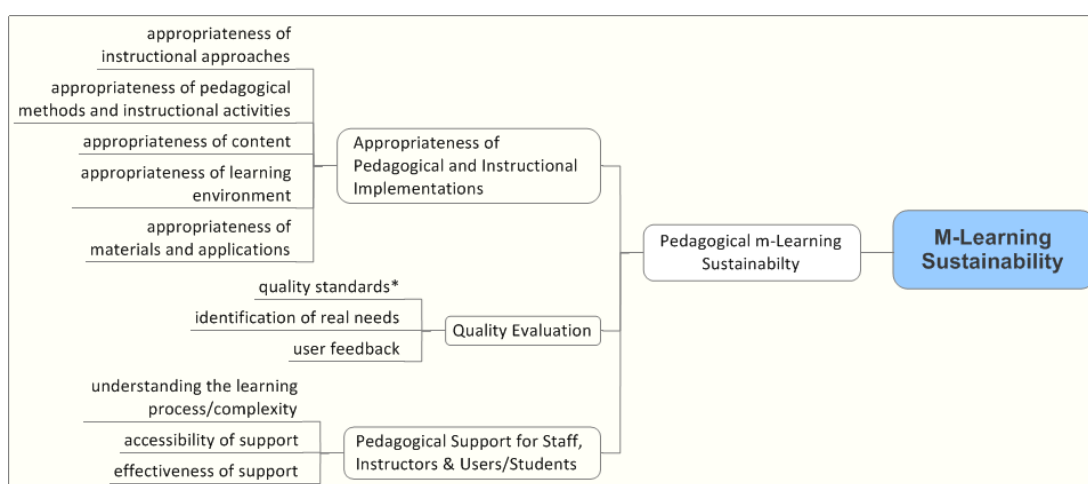


Figure 5 Pedagogical Variables

Regression Analyses

Multiple regression analysis was used for testing hypotheses 11, 12, 13 and 14.

Table 37 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	40.928	4	10.232	36.613	.000 ^a
	Residual	20.960	75	.279		
	Total	61.887	79			

As independent variables “Appropriateness of Pedagogical and Instructional Implementations”, “Meeting Structural Challenges”, “Quality Evaluation” and “Pedagogical Support for Staff, Instructors & Users” were used, while perceived general pedagogical m-learning sustainability was used as a dependent variable. The ANOVA table (Table 37) shows that the significance value is .000 and less than .05.

According to Table 38, .643 (the adjusted R^2 value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 2.141 auto-correlation between the independent variables. In order to be able examine the hypotheses and coefficients; it should be between desired range of 1.5-2.5.

Table 38 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.813 ^a	.661	.643	.529	2.141

The results of regression analysis are presented in Coefficient table (Table 39). It shows that the significance value of the independent variable “Meeting Structural Challenges” is more than .1 and it is considered to have not meaningful relationships with perceived general pedagogical m-learning sustainability. Therefore, hypothesis 12 is not substantiated by this test. P-values of the two independent variables which are “Quality Evaluation” and “Pedagogical Support for Staff, Instructors & Users/Students” are less than .05 and they are considered to have meaningful relationships with perceived general pedagogic m-learning sustainability.

“Appropriateness of Pedagogical and Instructional Implementations” is significant at the .1 level. Therefore, these three variables contribute significantly to the regression equation and hypotheses 11, 13 and 14 are substantiated by this test.

Table 39 Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.744	.240		3.103	.003
Appropriateness of pedagogical and instructional implementations (X ₁₁)	.178	.103	.181	1.726	.088
Meeting structural challenges (X ₁₂)	.141	.100	.145	1.405	.164
Quality evaluation (X ₁₃)	.164	.078	.188	2.089	.040
Pedagogical support for staff, instructors & users/students (X ₁₄)	.404	.082	.445	4.945	.000

a. Dependent Variable: Perceived General Pedagogical M-learning Sustainability (PGPS)

It shows that the significance value of the three independent variable are less than .05 and it is considered to have meaningful relationships with perceived general pedagogical m-learning sustainability. Therefore, all variables contribute significantly to the regression equation and hypothesis 11, 13 and 14 are substantiated by this test. The regression equation is specified as follows:

$$PGPS = .744 + .178X_{11} + .164X_{13} + .404 X_{14}$$

In the formula, PGPS is perceived general pedagogical m-learning sustainability. X₁₁ is appropriateness of pedagogical and instructional implementations, X₁₃ is quality evaluation and X₁₄ pedagogical support for staff, instructors & users/students.

On the other hand, linear regression analysis was used for testing hypotheses 15. The perceived general pedagogical m-learning sustainability was used as independent variables, while perceived general m-learning sustainability was used as a dependent variable. As shown in ANOVA table (Table 40), F value of 89.009 having a significance level of 0.000 which is less than .05.

Table 40 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	33.250	1	33.250	89.009	.000 ^a
	Residual	29.138	78	.374		
	Total	62.387	79			

According to Table 41, .527 (the adjusted R^2 value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 1.638 auto-correlation between the independent variable and it is between desired range of 1.5-2.5. The hypothesis and coefficient can be examined.

Table 41 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.730 ^a	.533	.527	.6111942	1.638

Table 42 (the coefficient table) presents the results of regression analysis of the Hypothesis 15. It shows that the P-value is less than .05 and there is a meaningful relationship between perceived general pedagogical m-learning sustainability and perceived general m-learning sustainability. Therefore hypothesis 15 was supported by the linear regression test.

Table 42 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.750	.278		2.701	.008
	Perceived General Pedagogical M-learning Sustainability	.733	.078	.730	9.434	.000

a. Dependent Variable: Perceived General M-learning Sustainability

Assessment Issues

Hypotheses

H₁₆: Sufficiency of assessment media and instruments will be associated with perceived general assessment m-learning sustainability.

H₁₇: Appropriateness of evaluation criteria will be associated with perceived general assessment m-learning sustainability.

H₁₈: Fairness of evaluation will be associated with perceived general assessment m-learning sustainability.

H₁₉: Perceived general m-learning sustainability in assessment issues will be associated with perceived general m-learning sustainability.

Descriptive Analysis

As a result of data collection process, 119 valid responses have been collected about m-learning sustainability in assessment issues. As seen in Table 43, 65.6 % of the respondents of the survey part about assessment issues are younger than 30 and 63% of the respondents' experience year is less than 3 since there is also student group as respondent in this part.

Table 43 Demographic Profile of Respondents

Age		<20	20-30	30-40	40-50	50>	Total
	Frequency	9	69	20	10	11	119
	Percent	7.6	58.0	16.8	8.4	9.2	100.0
Experience		0-1	1-3 year(s)	3-5 year(s)	5++		Total
	Frequency	32	43	21	23		119
	Percent	26.9	36.1	17.6	19.3		100.0

The Table 44 includes the mean values belongs to sustainability factors of m-learning assessment which are reached from literature review and interview.

According to descriptive analysis, cheating, ambiguity about respondent and IT skills of user issues are critical issues in assessment with 2.85, 2.93 and 2.80 mean values since their mean values less than 3.0.

The maximum mean value belongs to clarity of instrument issue with 3.63 mean values.

Table 44 Descriptive Statistics of Variables

Assessment Items	N	Mean
usability of assessment media	119	3.50
functionality of assessment media	119	3.48
connectivity of assessment media	119	3.48
security of assessment media	119	3.50
appropriateness of feedback	119	3.41
appropriateness of response time	119	3.54
validity of instruments	119	3.39
reliability of instruments	119	3.51
clarity of instruments	119	3.63
variety of instruments	119	3.44
grade proportion of exams	119	3.42
use of norms or cutting scores	119	3.53
cheating	119	2.85
ambiguity about respondent	119	2.93
IT skills of users	119	2.80
Perceived General Sustainability of M-learning Assessment	119	3.43
Perceived General Sustainability of M-learning	119	3.17

On the other hand, the mean value of perceived general sustainability of m-learning assessment (3.43) is higher than the mean value of perceived general sustainability of m-learning assessment (3.17). They are not in critical level since the values are more than 3.

Reliability Analysis

The overall value of Cronbach's Alpha was found as .965 with the Cronbach's Alpha analysis as can be seen in the Table 45. It is quite high since it is more than .9.

Table 45 Reliability Statistics

Cronbach's Alpha	N of Items
.965	21

If we delete the cheating issue, it would increase the alpha from .965 to .968 as seen in Table 46. Nevertheless this increase is not dramatic and both values reflect a reasonable degree of reliability.

Table 46 Item-Total Statistics

Developmental Issues	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
usability of assessment media	.853	.962
functionality of assessment media	.826	.963
connectivity of assessment media	.791	.963
security of assessment media	.766	.963
appropriateness of feedback	.826	.963
appropriateness of response time	.740	.963
validity of instruments	.847	.962
reliability of instruments	.882	.962
clarity of instruments	.857	.962
variety of instruments	.797	.963
grade proportion of exams	.707	.964
use of norms or cutting scores	.709	.964
cheating	.334	.968
ambiguity about respondent	.415	.967
IT skills of users	.358	.967
Perceived General Sustainability of M-learning Assessment	.832	.963
Perceived General M-learning Sustainability [ability to address current educational needs]	.845	.962
Perceived General M-learning Sustainability [ability to address the intent of m-learning]	.868	.962

Perceived General M-learning Sustainability [having potential to be adopted by users]	.817	.963
Perceived General M-learning Sustainability [maintaining a certain condition indefinitely or making progress]	.756	.963
Perceived General M-learning Sustainability [adaptation to possible changes]	.789	.963

Factor Analysis

In this section, 15 sustainability aspects were classified into certain groups with factor analysis. The reliability of the scale was found high with the .965 Cronbach's alpha value. On the other hand, the subjects-to-variables ratio of this study is more than 5 (119:15), so sample sizes is adequate for the analysis. Sample is found to be highly adequate for factor analysis with the .912 Kaiser-Meyer-Olkin Measure value (Table 47) because it is greater than .50 (a rule of thumb). In addition, the significance level of Barlett's Test (.000 as seen in Table 47) is below .05 therefore this test showed that the data is suitable for analysis.

Table 47 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.912
Bartlett's Test of Sphericity	Approx. Chi-Square	1722.602
	df	105
	Sig.	.000

The Total Variance Explained table (Table 48) shows that 78.038% of the total variance is explained by classifying these 15 aspects into 3 components. Since 60% or more is preferred as a rule of thumb and below 50% is unsatisfactory, our value is satisfactory.

Table 48 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.920	59.466	59.466	8.920	59.466	59.466	7.295	48.633	48.633
2	1.893	12.618	72.084	1.893	12.618	72.084	2.358	15.718	64.351
3	.893	5.954	78.038	.893	5.954	78.038	2.053	13.687	78.038
4	.643	4.286	82.324						
5	.516	3.443	85.767						
6	.453	3.019	88.785						
7	.345	2.301	91.086						
8	.330	2.200	93.287						
9	.246	1.639	94.926						
10	.188	1.252	96.178						
11	.148	.989	97.167						
12	.129	.859	98.027						
13	.115	.766	98.793						
14	.096	.643	99.435						
15	.085	.565	100.000						

Table 49 Rotated Component Matrix

	Component		
	1	2	3
usability of assessment media	.825	.176	.294
functionality of assessment media	.791	.152	.320
connectivity of assessment media	.782	.225	.253
security of assessment media	.785	.237	.124
appropriateness of feedback	.819	.117	.271
appropriateness of response time	.777	.082	.222
validity of instruments	.868	.096	.227
reliability of instruments	.892	.133	.211
clarity of instruments	.893	.054	.238
variety of instruments	.836	.125	.195
grade proportion of exams	.458	.106	.835
use of norms or cutting scores	.423	.142	.851
cheating	.138	.813	.017
ambiguity about respondent	.119	.840	.220
IT skills of users	.148	.856	.016

According to the Rotated Component Matrix (Table 49), 15 aspects were classified into 3 components. The first group under component 1 was named as “Sufficiency of Assessment Media and Instruments”. The second group under third component was named as “Appropriateness of Evaluation Criteria”. As title, “Fairness of Evaluation” was given to the last group in second component

Item and Variables

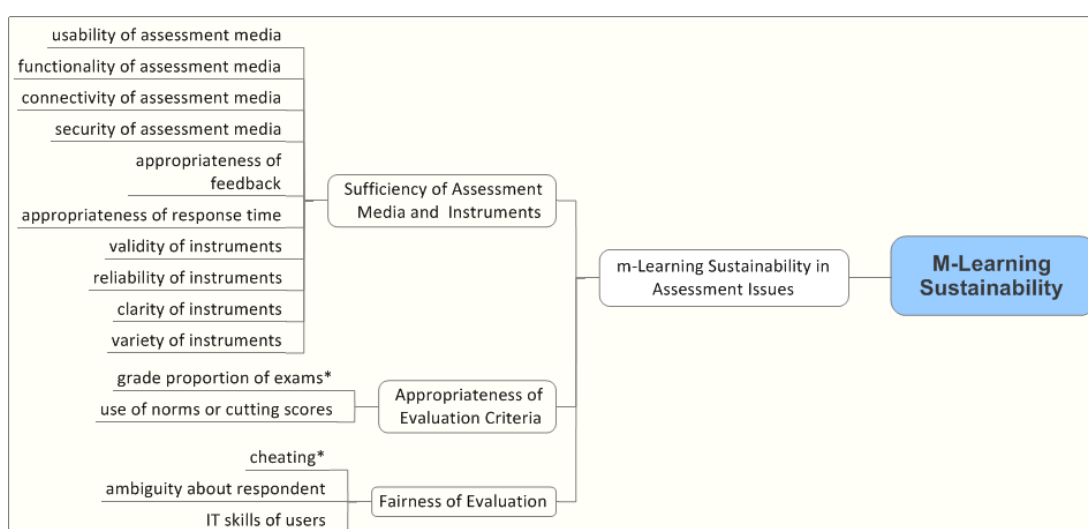


Figure 6 Assessment Variables

Regression Analyses

Multiple regression analysis was used for testing hypotheses 16, 17 and 18.

Table 50 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	90.940	3	30.313	72.319	.000 ^a
	Residual	48.203	115	.419		
	Total	139.143	118			

“Sufficiency of Assessment Media and Instruments”, “Appropriateness of Evaluation Criteria” and “Fairness of Evaluation” were used as independent variables, while

perceived general sustainability of m-learning assessment was used as a dependent variable. The Table 50 shows that the significance value is .000 and less than .05.

According to Table 51, .645 (the adjusted R² value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 1.530 auto-correlation between the independent variables and it is between desired range of 1.5-2.5. Therefore, we can examine the hypotheses and coefficients.

Table 51 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.808 ^a	.654	.645	.647	1.530

The results of regression analysis are presented in Coefficient table (Table 52). It shows that P-values of all independent variables are less than .05 and they are considered to have meaningful relationships with perceived general sustainability of m-learning assessment. Those factors are sufficiency of assessment media and instruments, appropriateness of evaluation criteria and fairness of evaluation. Therefore, all variables contribute significantly to the regression equation and hypotheses 16, 17, and 18 are supported by this test. The regression equation is specified as follows:

$$PGSA = .472 + .573X_{16} + .248X_{17} + .124 X_{18}$$

Table 52 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.472	.219		2.160	.033
	Sufficiency of Assessment Media and Instruments X ₁₆	.573	.075	.553	7.680	.000
	Appropriateness of Evaluation Criteria X ₁₇	.248	.063	.279	3.936	.000
	Fairness of Evaluation X ₁₈	.124	.060	.121	2.086	.039

a. Dependent Variable: Perceived General Sustainability of M-learning Assessment (PGSA)

In the formula, PGSA is perceived general sustainability of m-learning assessment. X_{16} is sufficiency of assessment media and instruments, X_{17} is appropriateness of evaluation criteria and X_{18} fairness of evaluation.

Table 53 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	87.640	1	87.640	157.755	.000 ^a
	Residual	64.999	117	.556		
	Total	152.639	118			

a. Predictors: (Constant), Perceived General Sustainability of M-learning Assessment

b. Dependent Variable: Perceived General M-learning Sustainability

According to Table 54, the independent variable explains .571 (the adjusted R^2) of the variance in the dependent variable. Durbin-Watson value shows that there is 1.746 auto-correlation between the independent variable and it is between desired range of 1.5-2.5. The hypotheses and coefficients can be examined.

Table 54 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.758 ^a	.574	.571	.745	1.746

a. Predictors: (Constant), Perceived General Sustainability of m-Learning Assessment

b. Dependent Variable: Perceived General m-Learning Sustainability

Table 55 Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.447	.227		1.968	.051
Perceived General Sustainability of M-learning Assessment	.794	.063	.758	12.560	.000

a. Dependent Variable: Perceived General m-Learning Sustainability

Table 55 (the coefficient table) presents the results of regression analysis of the Hypothesis 19. It shows that the P-value is less than .05 and there is a meaningful relationship between perceived general sustainability of m-learning assessment and

perceived general sustainability of m-learning. Therefore hypothesis 19 was also supported by the linear regression test.

Psychological Issues

Hypotheses

H₂₀: Evaluation of user, instructor and staff psychology will be associated with perceived general Psychological m-learning sustainability.

H₂₁: Psychological support will be associated with perceived general Psychological m-learning sustainability.

H₂₂: Perceived general psychological m-learning sustainability will be associated with perceived general m-learning sustainability.

Descriptive Analysis

142 valid responses have been collected as a result of data collection process for psychological sustainability issues. As shown in Table 56, 65.5% of the respondents of the survey part about psychological issues are younger than 30 and %63.3 of the respondents' experience year is less than 3.

Table 56 Demographic Profile of Respondents

Age		<20	20-30	30-40	40-50	50>	Total
	Frequency	9	84	24	13	12	142
	Percent	6.3	59.2	16.9	9.2	8.5	100.0
Experience		0-1	1-3 year(s)	3-5 year(s)	5++		Total
	Frequency	35	55	29	23		142
	Percent	24.6	38.7	20.4	16.2		100.0

The Table 57 includes the mean values belongs to psychological sustainability factors which are reached from literature review and interview. According to descriptive analysis, there is not any critical issue; each factor has value more than

3.0. The minimum mean value belongs to effectiveness of psychological support with 3.01.

Table 57 Descriptive Statistics of Variables

Psychological Issues	N	Mean
motivation	142	3.25
satisfaction	142	3.36
confidence	142	3.31
availability of support for adoption of process	142	3.35
availability of support for adaptation to process	142	3.37
accessibility of support	142	3.08
effectiveness of support	142	3.01
Perceived General Psychological M-learning Sustainability	142	3.31
Perceived General M-learning Sustainability	142	3.25

On the other hand, the value of perceived general psychological m-learning sustainability is 3.31 and the value of perceived general m-learning sustainability is 3.25. There is not dramatic difference between them and they are not in critical level since the values are more than 3.

Reliability Analysis

Cronbach's Alpha analysis was used for finding the reliability values of each variable. According to Cronbach's Alpha analysis, as can be observed from the Table 58, the overall value of Cronbach's Alpha was found as .972 and it is quite high since it is more than .9 (Kline, 2013).

Table 58 Reliability Statistics

Cronbach's Alpha	N of Items
.972	13

There is no item to increase the overall alpha value, if it is deleted (as seen in Table 59). All of them have high value.

Table 59 Item-Total Statistics

Psychological Issues	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
motivation	.800	.971
satisfaction	.851	.970
confidence	.872	.969
availability of support for adoption of process	.900	.969
availability of support for adaptation to process	.896	.969
accessibility of support	.839	.970
effectiveness of support	.825	.970
Perceived General Psychological M-learning Sustainability	.848	.970
Perceived General M-learning Sustainability [ability to address current educational needs]	.820	.970
Perceived General M-learning Sustainability [ability to address the intent of m-learning]	.859	.969
Perceived General M-learning Sustainability [having potential to be adopted by users]	.824	.970
Perceived General M-learning Sustainability [maintaining a certain condition indefinitely or making progress]	.756	.972
Perceived General M-learning Sustainability [adaptation to possible changes]	.853	.970

Factor Analysis

In this section, 7 sustainability aspects were classified into certain groups with factor analysis. The reliability of the scale was found high with the .972 Cronbach's alpha value. On the other hand, the subjects-to-variables ratio of this study is more than 5 (142:7) and sample size is adequate for the analysis. Sample is found to be highly adequate for factor analysis with the .906 Kaiser-Meyer-Olkin Measure value (Table 60) because it is greater than .50 (a rule of thumb). In addition, the significance level

of Barlett's Test (.000 as seen in Table 60) is below .05 therefore this test showed that the data is suitable for analysis.

The Total Variance Explained table (Table 61) shows that 88.228% of the total variance is explained by classifying these 7 aspects into 2 components. 60% or more is preferred as a rule of thumb and below 50% is unsatisfactory. Thus, our value is satisfactory.

Table 60 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.906
Bartlett's Test of Sphericity	Approx. Chi-Square	1156.191
	df	21
	Sig.	.000

Table 61 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.679	81.122	81.122	5.679	81.122	81.122	3.570	51.003	51.003
2	.497	7.106	88.228	.497	7.106	88.228	2.606	37.225	88.228
3	.283	4.049	92.277						
4	.184	2.623	94.900						
5	.154	2.203	97.104						
6	.117	1.670	98.774						
7	.086	1.226	100.000						

Extraction Method: Principal Component Analysis.

According to the Rotated Component Matrix (Table 62), 7 aspects were classified into 2 components. The first group under component 1 was named as "Evaluation of User, Instructor & Staff Psychology". The second group under second component was named as "Psychological Support". Since the item 4 and 5 is related to

psychological support and has value more than .500 we group them under second title.

Table 62 Rotated Component Matrix

Psychological Items	Component	
	1	2
motivation	.828	.378
satisfaction	.863	.383
confidence	.840	.415
availability of support for adoption of process	.708	.571
availability of support for adaptation to process	.756	.536
accessibility of support	.436	.871
effectiveness of support	.413	.878

Items and Variables

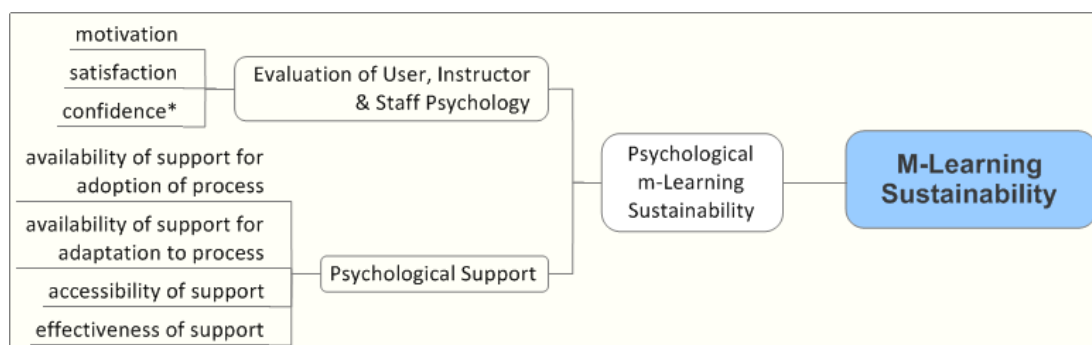


Figure 7 Psychological Variables

Regression Analyses

Multiple regression analysis was used for testing hypotheses 20 and 21. “Evaluation of User, Instructor & Staff Psychology” and “Psychological Support” were used as independent variables, while perceived general psychological m-learning sustainability was used as a dependent variable. The ANOVA table (Table 63) shows that the significance value is .000 and less than .05 with 154.296 P-value.

Table 63 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	107.807	2	53.903	154.296	.000 ^a
	Residual	48.560	139	.349		
	Total	156.366	141			

The Table 64 show that .685 (the adjusted R^2 value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 1.728 auto-correlation between the independent variables and it is between desired range of 1.5-2.5. Therefore, we can examine the hypotheses and coefficients.

Table 64 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.830 ^a	.689	.685	.591	1.728

The results of regression analysis are presented in Coefficient table (Table 65). It shows that P-values of two independent variables are less than .05 and they are considered to have meaningful relationships with perceived general psychological m-learning sustainability. Those factors are evaluation of user, instructor & staff psychology and psychological support.

Table 65 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.865	.149		5.814	.000
	Evaluation of User, Instructor & Staff Psychology X_{20}	.249	.080	.273	3.119	.002
	Psychological Support X_{21}	.562	.084	.588	6.724	.000

a. Dependent Variable: Perceived General Psychological M-learning Sustainability (PGPMS)

Therefore, all variables contribute significantly to the regression equation and hypotheses 20 and 21 are substantiated by this test. The regression equation is specified as follows:

$$\text{PGPMS} = .865 + .249X_{20} + .562 X_{21}$$

In the formula, PGDS is perceived general Psychological m-learning sustainability. X_{20} is evaluation of user, instructor & staff psychology and X_{21} is psychological support

On the other hand, linear regression analysis was used for testing hypotheses 22. The perceived general psychological m-learning sustainability was used as independent variables, while perceived general m-learning sustainability was used as a dependent variable. As shown in ANOVA table (Table 66), F value of 188.316 having a significance level of 0.000 which is less than .05.

Table 66 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	95.429	1	95.429	188.316	.000 ^a
	Residual	70.945	140	.507		
	Total	166.373	141			

According to Table 67, the independent variable explains .571 (the adjusted R^2) of the variance in the dependent variable. Durbin-Watson value shows that there is 1.570 auto-correlation between the independent variable and it is between desired range of 1.5-2.5. The hypotheses and coefficients can be examined.

Table 67 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.757 ^a	.574	.571	.7118613	1.570

Table 68 (the coefficient table) presents the results of regression analysis of the Hypothesis 22. It shows that the P-value is less than .05 and there is a meaningful

relationship between perceived general psychological m-learning sustainability and perceived general m-learning sustainability. Therefore hypothesis 22 was also supported by the linear regression test.

Table 68 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.661	.198		3.343	.001
	Perceived General Psychological M-learning Sustainability	.781	.057	.757	13.723	.000

a. Dependent Variable: Perceived General M-learning Sustainability

Social Issues

Hypotheses

H₂₃: Social presence and will be associated with perceived general Social m-learning sustainability.

H₂₄: Shared purpose and behavior will be associated with perceived general Social m-learning sustainability.

H₂₅: Perceived general social m-learning sustainability will be associated with perceived general m-learning sustainability.

Descriptive Analysis

105 valid responses have been collected as a result of data collection process for social sustainability issues. As shown in Table 69, 71.5% of the respondents of the survey part about social issues were younger than 30 since the respondents are students and %60.9 of the respondents' m-learning experience year is less than 3.

Table 69 Demographic Profile of Respondents

Age		<20	20-30	30-40	40-50	50>	Total
	Frequency	12	88	5	0	0	105
	Percent	11.4	83.8	4.7	0	0	100.0
Experience		0-1	1-3 year(s)	3-5 year(s)	5++		Total
	Frequency	10	61	32	2		105
	Percent	9.5	33.3	19.0	20.0		100.0

The Table 70 includes the mean values belongs to social sustainability factors which are reached from literature review and interview. Personal stories and experiences share, humor use and emotions use are critical issue for m-learning initiative. Their

mean values are respectively 2.97, 2.99 and 2.88. On the other hand, the maximum mean value belongs to social interactivity of learning environment with 3.40 mean values.

Table 70 Descriptive Statistics of Variables

Social Issues	N	Mean
social interactivity of learning environments	105	3.40
integration with social networks	105	3.28
collaborative learning activities	105	3.09
feedback and support	105	3.29
personal stories and experiences share	105	2.97
humor use	105	2.99
emotions use	105	2.88
discourse	105	3.38
Perceived General Social M-learning Sustainability	105	3.49
Perceived General M-learning Sustainability	105	3.15

The value of perceived general social m-learning sustainability (3.49) is greater than the value of perceived general m-learning sustainability (3.15). They are not in critical level since the values are more than 3.

Reliability Analysis

Cronbach's Alpha analysis was used for finding the reliability values of each variable. According to Cronbach's Alpha analysis, as can be observed from the Table 71, the overall value of Cronbach's Alpha was found as .957 and it is quite high since it is more than .9 (Kline, 2013).

There is no item to increase the overall alpha value, when it is deleted (as seen in Table 72).

Table 71 Reliability Statistics

Cronbach's Alpha	N of Items
.957	14

Table 72 Item-Total Statistics

Social Issues	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
social interactivity of learning environments	.757	.954
integration with social networks	.685	.955
collaborative learning activities	.810	.953
feedback and support	.808	.952
personal stories and experiences share	.703	.955
humor use	.730	.954
emotions use	.726	.954
discourse	.650	.956
Perceived General Social M-learning Sustainability	.817	.952
Perceived General M-learning Sustainability [ability to address current educational needs]	.819	.952
Perceived General M-learning Sustainability [ability to address the intent of m-learning]	.851	.952
Perceived General M-learning Sustainability [having potential to be adopted by users]	.807	.952
Perceived General M-learning Sustainability [maintaining a certain condition indefinitely or making progress]	.738	.954
Perceived General M-learning Sustainability [adaptation to possible changes]	.826	.952

Factor Analysis

In this section, 8 sustainability aspects were classified into certain groups with factor analysis. The reliability of the scale was found high with the .957 Cronbach's alpha value. On the other hand, the subjects-to-variables ratio of this study is more than 5 (105:8) and sample size is adequate for the analysis. Sample is found to be highly

adequate for factor analysis with the .844 Kaiser-Meyer-Olkin Measure value (Table 73) because it is greater than .50 (a rule of thumb). In addition, the significance level of Barlett's Test (.000 as seen in Table 73) is below .05 therefore this test showed that the data is suitable for analysis.

Table 73 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.844
Bartlett's Test of Sphericity	Approx. Chi-Square	684.572
	df	28
	Sig.	.000

The Total Variance Explained table (Table 74) shows that 78.492% of the total variance is explained by classifying these 8 aspects into 2 components. 60% or more is preferred as a rule of thumb and below 50% is unsatisfactory. Thus, our value is satisfactory.

Table 74 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.148	64.347	64.347	5.148	64.347	64.347	3.335	41.684	41.684
2	1.132	14.145	78.492	1.132	14.145	78.492	2.945	36.809	78.492
3	.543	6.788	85.280						
4	.441	5.513	90.794						
5	.296	3.698	94.492						
6	.207	2.589	97.081						
7	.144	1.803	98.884						
8	.089	1.116	100.000						

Extraction Method: Principal Component Analysis.

According to the Rotated Component Matrix (Table 75), 8 aspects were classified into 2 components. The first group under component 2 was named as "Social

Presence”. The second group under first component was named as “Shared Purpose and Behavior”. Since the item 4 is more related to the “shared purpose and behavior” issue according to two experts and it has value more than .500 we group them under second title.

Table 75 Rotated Component Matrix

Social Items	Component	
	1	2
social interactivity of learning environments	.234	.930
integration with social networks	.189	.905
collaborative learning activities	.506	.696
feedback and support	.534	.673
personal stories and experiences share	.772	.333
humor use	.805	.354
emotions use	.902	.208
discourse	.803	.210

Items and Variables

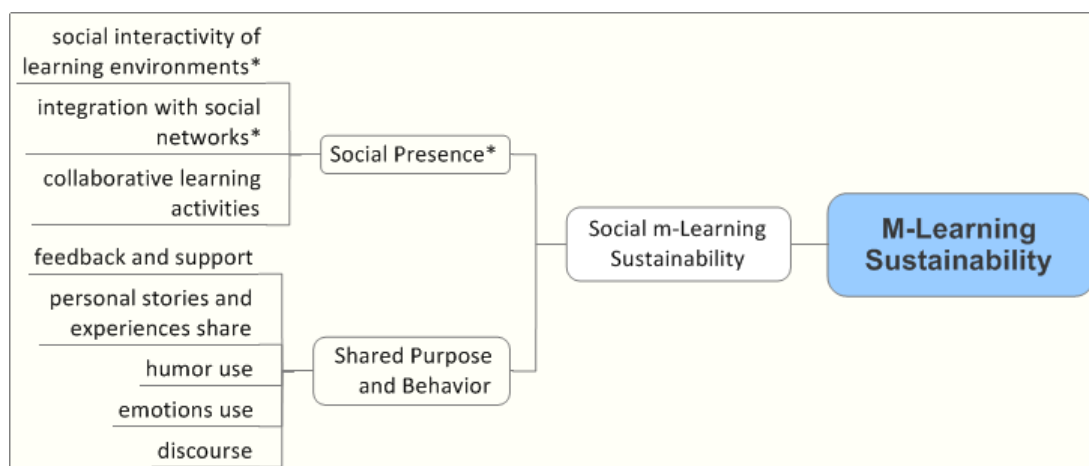


Figure 8 Social Variables

Regression Analyses

Multiple regression analysis was used for testing hypotheses 23 and 24. “Social Presence” and “Shared Purpose and Behavior” are used as independent variables, while perceived general social m-learning sustainability was used as a dependent variable. The ANOVA table (Table 76) shows that the significance value is .000 and less than .05.

Table 76 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	83.191	2	41.596	83.130	.000 ^a
	Residual	51.038	102	.500		
	Total	134.229	104			

The Table 77 show that .612 (the adjusted R² value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 1.805 auto-correlation between the independent variables and it is between desired range of 1.5-2.5. Therefore, we can examine the hypotheses and coefficients.

Table 77 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.787 ^a	.620	.612	.707	1.805

The results of regression analysis are presented in Coefficient table (Table 78). It shows that P-values of two independent variables are less than .05 and they are considered to have meaningful relationships with perceived general social m-learning sustainability. Those factors are social presence and shared purpose and behavior. Therefore, all variables contribute significantly to the regression equation and hypotheses 23 and 24 are substantiated by this test. The regression equation is specified as follows:

$$PGSS = .831 + .571X_{23} + .339 X_{24}$$

Table 78 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.831	.218		3.814	.000
	Social Presence	.571	.084	.544	6.761	.000
	Shared Purpose and Behavior	.339	.087	.315	3.916	.000

a. Dependent Variable: Perceived General Social M-learning Sustainability (PGSS)

In the formula, PGSS is perceived general social m-learning sustainability. X_{23} is social presence and X_{24} is shared purpose and behavior

On the other hand, linear regression analysis was used for testing hypotheses 25. The perceived general social m-learning sustainability was used as independent variables, while perceived general m-learning sustainability was used as a dependent variable. As shown in ANOVA table (Table 79), F value of 132.275 having a significance level of 0.000 which is less than .05.

Table 79 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	74.841	1	74.841	131.275	.000 ^a
	Residual	58.721	103	.570		
	Total	133.562	104			

According to Table 80, the independent variable explains .556 (the adjusted R^2) of the variance in the dependent variable. Durbin-Watson value shows that there is 1.666 auto-correlation between the independent variable and it is between desired range of 1.5-2.5. The hypotheses and coefficients can be examined.

Table 81 (the coefficient table) presents the results of regression analysis of the Hypothesis 25. It shows that the P-value is less than .05 and there is a meaningful relationship between perceived general social m-learning sustainability and

perceived general m-learning sustainability. Therefore hypothesis 25 was also supported by the linear regression test.

Table 80 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.749 ^a	.560	.556	.755	1.666

a. Predictors: (Constant), Perceived General Social M-learning Sustainability.

b. Dependent Variable: Perceived General M-learning Sustainability.

Table 81 Coefficients

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	.550	.239		2.301	.023
	Perceived General Social M-learning Sustainability.	.747	.065	.749	11.458	.000

a. Dependent Variable: Perceived General M-learning Sustainability.

Legal and Ethical Issues

Hypotheses

H₂₆: Equity & equality will be associated with perceived general legal and ethical m-learning sustainability.

H₂₇: User rights sensitivity will be associated with perceived general legal and ethical m-learning sustainability.

H₂₈: Accuracy of stored information will be associated with perceived general legal and ethical m-learning sustainability.

H₂₉: Cyber ethics will be associated with perceived general legal and ethical m-learning sustainability.

H₃₀: Perceived general legal and ethical m-learning sustainability will be associated with perceived general m-learning sustainability.

Descriptive Analysis

73 valid responses have been collected as a result of data collection process for legal and ethical sustainability issues. As shown in Table 82, the majority of respondents (54.8%) of the survey part about legal and ethical issues are older than 30 years since the respondents are administrators. However, only %49.3 of the respondents' experience year is more than 3.

The mean values of legal and ethical sustainability factors which were reached from literature review and interview were given in Table 83. According to descriptive analysis, there is not any critical issue; each factor has value more than

3.5. The maximum mean values belong to privacy and security of personal information and accuracy of stored information with the value 3.99.

Table 82 Demographic Profile of Respondents

Age		<20	20-30	30-40	40-50	50>	Total
	Frequency	2	31	23	9	8	73
	Percent	2.7	42.5	31.5	12.3	11.0	100.0
Experience		0-1	1-3 year(s)	3-5 year(s)	5++		Total
	Frequency	12	25	19	17		73
	Percent	16.4	34.2	26.0	23.3		100.0

Table 83 Descriptive Statistics of Variables

Legal & Ethical Issues	N	Mean
accessibility of information	73	3.70
discrimination in content	73	3.71
informed consent	73	3.55
privacy and security of personal information	73	3.99
accuracy of stored information	73	3.99
netiquette	73	3.86
intellectual property and copyright sensitivity	73	3.84
Perceived General Legal & Ethical M-learning Sustainability	73	3.78
Perceived General M-learning Sustainability	73	3.59

On the other hand, the mean value of perceived general legal and ethical m-learning sustainability (3.78) is higher than the mean value of perceived general m-learning sustainability (3.59). They are not in critical level since the values are more than 3.

Reliability Analysis

According to Cronbach's Alpha analysis, the overall value of Cronbach's Alpha was found as .948, as can be observed from the Table 84. It is quite high since it is more than .9 (Kline, 2013).

Table 84 Reliability Statistics

Cronbach's Alpha	N of Items
.948	12

There is no item to increase the overall alpha value dramatically, when it was deleted (as seen in Table 85).

Table 85 Item-Total Statistics

Legal and Ethical Issues	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
accessibility of information	.558	.950
discrimination in content	.764	.943
informed consent	.803	.942
privacy and security of personal information	.777	.943
accuracy of stored information	.749	.944
netiquette	.760	.944
intellectual property and copyright sensitivity	.849	.942
Perceived General Legal and Ethical M-learning Sustainability	.744	.944
Perceived General M-learning Sustainability [ability to address current educational needs]	.813	.942
Perceived General M-learning Sustainability [ability to address the intent of m-learning]	.761	.944
Perceived General M-learning Sustainability [having potential to be adopted by users]	.694	.946
PGMLS[maintaining a certain condition indefinitely or making progress]	.828	.941
PGMLS[adaptation to possible changes]	.826	.945

Factor Analysis

The reliability of the scale was found high with the .948 Cronbach's alpha value. On the other hand, the subjects-to-variables ratio of this study is which more than 5 (73:7) and sample size is adequate for the analysis. Sample is found to be highly adequate for factor analysis with the .896 Kaiser-Meyer-Olkin Measure value (Table

86) because it is greater than .50 (a rule of thumb). In addition, the significance level of Barlett's Test (.000 as seen in Table 86) is below .05 therefore this test showed that the data is suitable for analysis.

Table 86 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.896
Bartlett's Test of Sphericity	Approx. Chi-Square	316.964
	df	21
	Sig.	.000

The Total Variance Explained table (Table 87) shows that 65.325% of the total variance is explained by classifying these 7 aspects into 1 component. 60% or more is preferred as a rule of thumb and below 50% is unsatisfactory.

Table 87 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.573	65.325	65.325	4.573	65.325	65.325
2	.782	11.173	76.498			
3	.506	7.224	83.722			
4	.398	5.684	89.406			
5	.324	4.624	94.030			
6	.236	3.365	97.395			
7	.182	2.605	100.000			

Extraction Method: Principal Component Analysis.

Since only one component was extracted, the rotation cannot be rotated. We have been classified the 14 aspects into 4 components. "Equity & Equality was given to "accessibility of information" and "discrimination in content" as title. The "informed consent and privacy" and "security of personal information" were classified under the title "User Rights Sensitivity". Accuracy of stored information issue was not classified under any title. Lastly, "Cyber Ethics" is given to the issues "netiquette" and "intellectual property and copyright sensitivity" as name.

Items and Variables

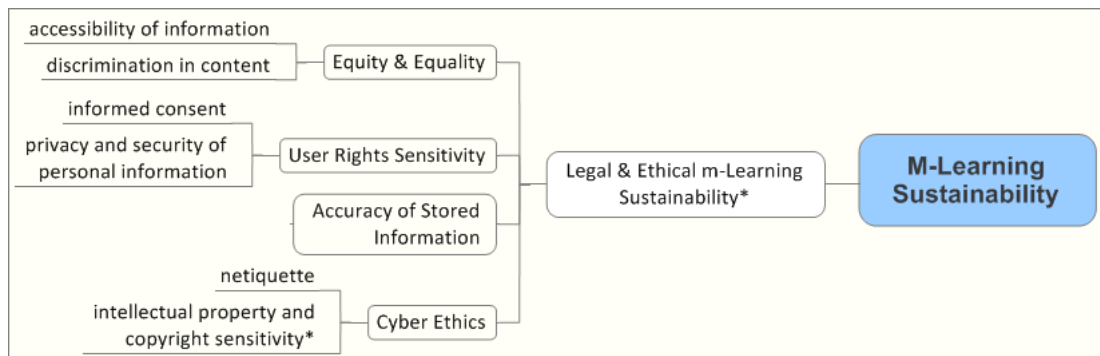


Figure 9 Legal and Ethical Items & Variables

Regression Analyses

Multiple regression analysis was used for testing hypotheses 26, 27, 28 and 29.

Table 88 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.259	4	9.315	56.384	.000 ^a
	Residual	11.234	68	.165		
	Total	48.493	72			

As independent variables “equity & equality”, “user rights sensitivity”, “accuracy of stored information” and “cyber ethics” are used, while perceived general legal and ethical m-learning sustainability was used as a dependent variable. The ANOVA table (Table 88) shows that the significance value is .000 and less than .05.

According to Table 89, .755 (the adjusted R^2 value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 1.830 auto-correlation between the independent variables. In order to be able examine the hypotheses and coefficients; it should be between desired range of 1.5-2.5.

Table 89 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.877 ^a	.768	.755	.406	1.830

The results of regression analysis are presented in Coefficient table (Table 90). It shows that the significance value of the four independent variable are less than .05 and it is considered to have meaningful relationships with perceived general legal and ethical m-learning sustainability. Therefore, all variables contribute significantly to the regression equation and hypothesis 26, 27, 28 and 29 are substantiated by this test.

Table 90 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.690	.220		3.145	.002
	Equity & Equality (X ₂₆)	.176	.077	.196	2.294	.025
	User Rights Sensitivity (X ₂₇)	.274	.095	.329	2.867	.006
	Accuracy of Stored Information (X ₂₈)	.214	.069	.266	3.107	.003
	Cyber Ethics (X ₂₉)	.178	.086	.209	2.081	.041

a. Dependent Variable: Perceived General Legal and Ethical M-learning Sustainability (PGLES)

The regression equation is specified as follows:

$$\text{PGLES} = .690 + .176X_{26} + .274X_{27} + .214 X_{28} + .178 X_{29}$$

In the formula, PGLES is perceived general legal and ethical m-learning sustainability. X₂₆ is equity & equality, X₂₇ is user rights sensitivity, X₂₈ is accuracy of stored information and X₂₉ is cyber ethics.

On the other hand, linear regression analysis was used for testing the hypothesis 30. The perceived general legal and ethical m-learning sustainability was used as independent variables, while perceived general m-learning sustainability was

used as a dependent variable. As shown in ANOVA table (Table 91), F value of 75.147 having a significance level of 0.000 which is less than .05.

Table 91 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29.499	1	29.499	75.147	.000 ^a
	Residual	27.871	71	.393		
	Total	57.370	72			

a. Predictors: (Constant), Perceived General Legal and Ethical M-learning Sustainability

b. Dependent Variable: Perceived General M-learning Sustainability

According to Table 92, .507 (the adjusted R² value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 1.675 auto-correlation between the independent variable and it is between desired range of 1.5-2.5. The hypothesis and coefficient can be examined.

Table 92 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.717 ^a	.514	.507	.627	1.675

a. Predictors: (Constant), Perceived General Legal and Ethical m-Learning Sustainability

b. Dependent Variable: Perceived General m-Learning Sustainability

Table 93 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.353	.348		1.013	.314
	Perceived General Legal and Ethical M-learning Sustainability	.780	.090	.717	8.669	.000

a. Dependent Variable: Perceived General m-Learning Sustainability

Table 93 (the coefficient table) presents the results of regression analysis of the Hypothesis 30. It shows that the P-value is less than .05 and there is a meaningful relationship between perceived general legal and ethical m-learning sustainability and perceived general m-learning sustainability. Therefore hypothesis 30 is supported by the linear regression test.

Organizational and Institutional Issues

Hypotheses

H₃₁: Organizational effectiveness will be associated with perceived general organizational and institutional m-learning sustainability.

H₃₂: Human resource difficulties will be associated with perceived general organizational and institutional m-learning sustainability.

H₃₃: Consolidations will be associated with perceived general organizational and institutional m-learning sustainability.

H₃₄: Perceived general organizational and institutional m-learning sustainability will be associated with perceived general m-learning sustainability.

Descriptive Analysis

74 valid responses have been collected as a result of data collection process for organizational and institutional sustainability issues. As shown in Table 94, the majority of respondents (55.8%) of the survey part about organizational and institutional issues are older than 30 years since the respondents are administrators. However, only %48.7 of the respondents' experience year is more than 3.

Table 94 Demographic Profile of Respondents

Age		<20	20-30	30-40	40-50	50>	Total
	Frequency	2	31	23	10	8	74
	Percent	2.7	41.9	31.1	13.5	10.8	100.0
Experience		0-1	1-3 year(s)	3-5 year(s)	5++		Total
	Frequency	12	26	19	17		74
	Percent	16.2	35.1	25.7	23.0		100.0

The mean values of organizational and institutional sustainability factors which were reached from literature review and interview were given in Table 95. According to descriptive analysis, all factors have mean values more than 3.0 except finding and retaining of staff with 2.85. So it can be seen as critical issue. On the other hand, the maximum mean values belong to communication between staffs and innovative approach with the value 3.87.

Table 95 Descriptive Statistics of Variables

Organizational and Institutional Issues	N	Mean
leadership strength	74	3.78
clarity role and responsibilities	74	3.62
communication between staffs	74	3.87
teamwork and coordination	74	3.81
innovative approach	74	3.87
partnership strategy	74	3.62
system, product and information quality policies	74	3.74
finding and retaining of staff	74	2.85
need for instructor acceptance	74	3.00
cooperation with peer initiatives	74	3.24
interdisciplinary dialog	74	3.32
project-based studies and workshops	74	3.37
publicity	74	3.28
misconceptions	74	3.34
popular departments	74	3.46
Perceived General Organizational and institutional M-learning Sustainability	74	3,47
Perceived General M-learning Sustainability	74	3,61

On the other hand, the mean value of perceived general organizational and institutional m-learning sustainability (3.47) is lower than the mean value of perceived general m-learning sustainability (3.61). They are both not in critical level since the values are more than 3.

Reliability Analysis

According to Cronbach's Alpha analysis, the overall value of Cronbach's Alpha was found as .963, as can be observed from the Table 96. It is quite high since it is more than .9 (Kline, 2013).

Table 96 Reliability Statistics

Cronbach's Alpha	N of Items
.963	22

Table 97 Item-Total Statistics

Organizational and Institutional Issues	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
leadership strength	.724	.961
clarity role and responsibilities	.735	.961
communication between staffs	.660	.962
teamwork and coordination	.764	.961
innovative approach	.797	.960
partnership strategy	.771	.961
system, product and information quality policies	.836	.960
finding and retaining of staff	.376	.964
need for instructor acceptance	.544	.963
cooperation with peer initiatives	.730	.961
interdisciplinary dialog	.744	.961
project-based studies and workshops	.713	.961
publicity	.760	.961
misconceptions	.720	.961
popular departments	.690	.962
Perceived General Organizational and Institutional M-learning Sustainability1	.804	.961
Perceived General Organizational and Institutional M-learning Sustainability2	.872	.960
Perceived General M-learning Sustainability [ability to address current educational needs]	.789	.961
Perceived General M-learning Sustainability [ability to address the intent of m-learning]	.827	.960
Perceived General M-learning Sustainability [having potential to be adopted by users]	.682	.962
Perceived General M-learning Sustainability [maintaining a certain condition indefinitely or making progress]	.598	.963
Perceived General M-learning Sustainability [adaptation to possible changes]	.826	.952

There is no item to increase the overall alpha value dramatically, when it was deleted (as seen in Table 97).

Factor Analysis

In this section, 15 sustainability aspects were classified into certain groups with factor analysis. The reliability of the scale was found high with the .963 Cronbach's alpha value. the subjects-to-variables ratio of this study is almost 5 (74:15). On the other hand, sample is found to be highly adequate for factor analysis with the .910 Kaiser-Meyer-Olkin Measure value (Table 98) because it is greater than .50 (a rule of thumb). In addition, the significance level of Barlett's Test (.000 as seen in Table 98) is below .05 therefore this test showed that the data is suitable for analysis.

Table 98 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.910
Approx. Chi-Square		841.303
Bartlett's Test of Sphericity	df	105
	Sig.	.000

The Total Variance Explained table (Table 99) shows that 73.463% of the total variance is explained by classifying these 15 aspects into 3 components. 60% or more is preferred as a rule of thumb and below 50% is unsatisfactory.

According to the Rotated Component Matrix (Table 100), 15 aspects were classified into 3 components. The first group under component 1 was named as "Managerial Effectiveness". The second group under third component was named as "Human Resources Difficulties". "Consolidations" was given as title to the last group under component 2.

Table 99 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.418	56.119	56.119	8.418	56.119	56.119	4.727	31.516	31.516
2	1.592	10.614	66.733	1.592	10.614	66.733	4.589	30.592	62.108
3	1.009	6.729	73.463	1.009	6.729	73.463	1.703	11.354	73.463
4	.627	4.183	77.646						
5	.574	3.827	81.472						
6	.528	3.518	84.990						
7	.482	3.214	88.204						
8	.396	2.639	90.843						
9	.307	2.046	92.889						
10	.240	1.600	94.490						
11	.234	1.560	96.049						
12	.194	1.292	97.341						
13	.170	1.130	98.471						
14	.123	.820	99.291						
15	.106	.709	100.000						

Extraction Method: Principal Component Analysis.

Table 100 Rotated Component Matrix

Organizational Items	Component		
	1	2	3
leadership strength	.799	.243	.193
clarity role and responsibilities	.731	.368	.133
communication between staffs	.848	.140	.175
teamwork and coordination	.855	.245	.216
innovative approach	.734	.415	.239
partnership strategy	.676	.485	.066
system, product and information quality policies	.723	.432	.275
finding and retaining of staff	.173	.084	.841
need for instructor acceptance	.292	.222	.708
cooperation with peer initiatives	.341	.783	.018
interdisciplinary dialog	.288	.801	.138
project-based studies and workshops	.307	.764	.093
publicity	.258	.813	.224
misconceptions	.205	.854	.092
popular departments	.264	.658	.371

Item and Variables

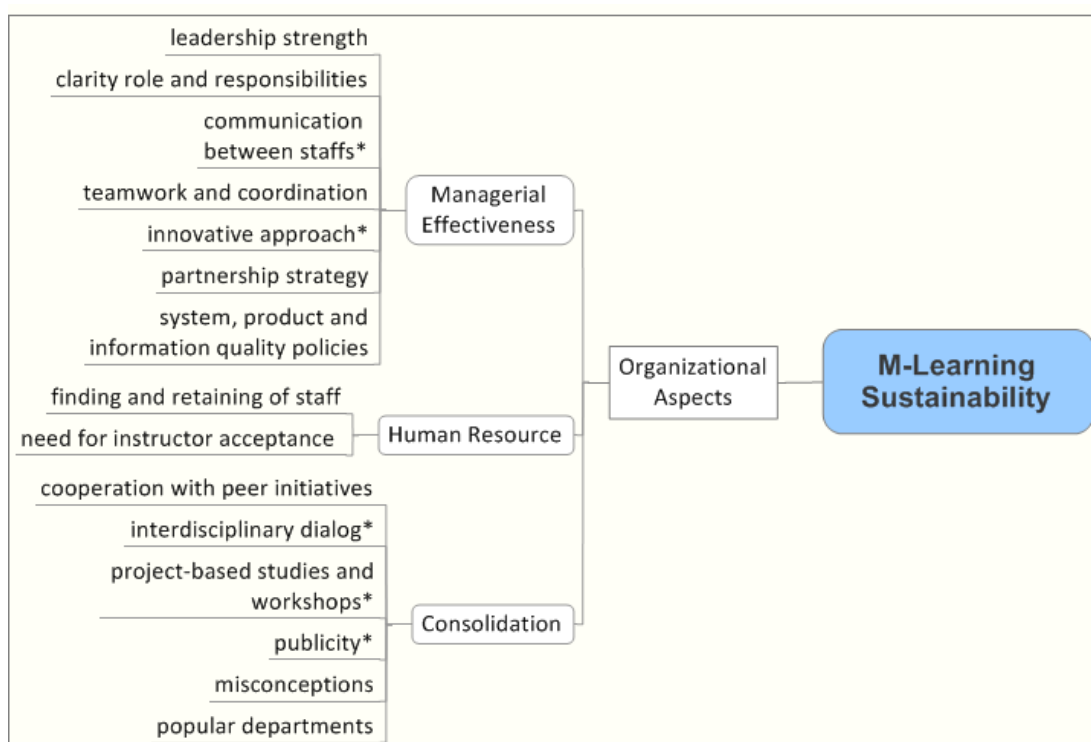


Figure 10 Organizational & Institutional Items and Variables

Regression Analyses

Multiple regression analysis was used for testing hypotheses 31, 32 and 33. As independent variables “Managerial Effectiveness”, “Human Resource Difficulties” and “Consolidations” were used, while perceived general organizational and institutional m-learning sustainability was used as a dependent variable. The ANOVA table (Table 101) shows that the significance value is .000 and less than .05.

According to Table 102, .846 (the adjusted R^2 value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 1.680 auto-correlation between the independent variables. In

order to be able examine the hypotheses and coefficients; it should be between desired range of 1.5-2.5.

Table 101 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34.340	3	11.447	134.813	.000 ^b
	Residual	5.944	70	.085		
	Total	40.284	73			

a. Dependent Variable: General Organizational and Institutional M-learning Sustainability

b. Predictors: (Constant), managerial effectiveness, human resource difficulties and consolidations

The results of regression analysis are presented in Coefficient table (Table 103). It shows that the significance value of the independent variable are less than .05 and it is considered to have meaningful relationships with perceived general organizational and institutional m-learning sustainability.

Table 102 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.923 ^a	.852	.846	.2914	1.680

a. Dependent Variable: General Organizational and Institutional M-learning Sustainability

b. Predictors: (Constant), managerial effectiveness, human resource difficulties and consolidations

Table 103 Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.301	.173		1.740	.086
Managerial Effectiveness (X ₃₁)	.324	.058	.374	5.633	.000
Human Resource Difficulties (X ₃₁)	.124	.057	.118	2.175	.033
Consolidations (X ₃₃)	.466	.053	.559	8.853	.000

a. Dependent Variable: Perceived General Organizational and Institutional M-learning Sustainability (PGOIS)

Therefore, all variables contribute significantly to the regression equation and hypothesis 31, 32 and 33 are substantiated by this test. The regression equation is specified as follows:

$$PGOIS = .301 + .324X_{31} + .124X_{32} + .466 X_{33}$$

In the formula, PGLES is perceived general organizational and institutional m-learning sustainability. X_{31} is managerial effectiveness, X_{32} is human resource difficulties and X_{33} is consolidations.

On the other hand, linear regression analysis was used for testing the hypothesis 34. The perceived general organizational and institutional m-learning sustainability was used as independent variables, while perceived general m-learning sustainability was used as a dependent variable. As shown in ANOVA table (Table 104), F value of 127.121 having a significance level of 0.000 which is less than .05.

Table 104 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30.796	1	30.796	127.121	.000 ^b
	Residual	17.442	72	.242		
	Total	48.238	73			

a. Dependent Variable: Perceived General M-learning Sustainability

b. Dependent Variable: Perceived General Organizational and Institutional M-learning Sustainability

According to Table 105, .633 (the adjusted R^2 value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 1.825 auto-correlation between the independent variable and it is between desired range of 1.5-2.5. The hypothesis and coefficient can be examined.

Table 105 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.799 ^a	.638	.633	.4922	1.823

a. Dependent Variable: Perceived General M-learning Sustainability

b. Dependent Variable: Perceived General Organizational and Institutional M-learning Sustainability

Table 106 (the coefficient table) presents the results of regression analysis of the Hypothesis 34. It shows that the P-value is less than .05 and there is a meaningful relationship between perceived general organizational and institutional m-learning

sustainability and perceived general m-learning sustainability. Therefore hypothesis 34 is supported by the linear regression test.

Table 106 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.592	.273		2.168	.033
	Perceived General Organizational and Institutional M-learning	.874	.078	.799	11.275	.000

a. Dependent Variable: Perceived General M-learning Sustainability

Financial Issues

Hypotheses

H₃₅: Financial viability will be associated with perceived general financial m-learning sustainability.

H₃₆: Effectiveness of financial management will be associated with perceived general financial m-learning sustainability.

H₃₇: Perceived general financial m-learning sustainability will be associated with perceived general m-learning sustainability.

Descriptive Analysis

74 valid responses have been collected as a result of data collection process for financial sustainability issues. As shown in Table 107, the majority of respondents (55.8%) of the survey part about financial issues are older than 30 years since the respondents are administrators. %48.7 of the respondents' experience year is more than 3.

Table 107 Demographic Profile of Respondents

Age		<20	20-30	30-40	40-50	50>	Total
	Frequency	2	31	23	10	8	74
	Percent	2.7	41.9	31.1	13.5	10.8	100.0
Experience		0-1	1-3 year(s)	3-5 year(s)	5++		Total
	Frequency	12	26	19	17		74
	Percent	16.2	35.1	25.7	23.0		100.0

The mean values of financial sustainability factors which were reached from literature review and interview were given in Table 108. According to descriptive

analysis, all factors have mean values more than 3.0. The maximum mean values belong to the issue “tangible and intangible benefits” with the value 3.39.

Table 108 Descriptive Statistics of Variables

Financial Issues	N	Mean
sufficiency of financial source	74	3.24
cost effectiveness	74	3.27
tangible and intangible benefits	74	3.39
return on investment	74	3.24
effective risk management	74	3.01
transparency and efficiency of business model	74	3.28
financial expert level	74	3.11
Perceived General Financial M-learning Sustainability	74	3.19
Perceived General M-learning Sustainability	74	3.61

On the other hand, the mean value of perceived general financial m-learning sustainability (3.19) is lower than the mean value of perceived general m-learning sustainability (3.61). They are both not in critical level since the values are more than average value.

Reliability Analysis

According to Cronbach’s Alpha analysis, the overall value of Cronbach's Alpha was found as .956, as can be observed from the Table 109. It is quite high since it is more than .9 (Kline, 2013).

Table 109 Reliability Statistics

Cronbach's Alpha	N of Items
.956	13

There is no item to increase the overall alpha value dramatically, when it was deleted (as seen in Table 110).

Table 110 Item-Total Statistics

Financial Issues	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
sufficiency of financial source	.742	.954
cost effectiveness	.781	.953
tangible and intangible benefits	.824	.952
return on investment	.758	.953
effective risk management	.814	.952
transparency and efficiency of business model	.813	.952
financial expert level	.795	.952
Perceived General Financial M-learning Sustainability	.859	.951
Perceived General m-Learning Sustainability [ability to address current educational needs]	.722	.954
Perceived General M-learning Sustainability [ability to address the intent of m-learning]	.761	.953
Perceived General M-learning Sustainability [having potential to be adopted by users]	.716	.954
PGMLS [maintaining a certain condition indefinitely or making progress]	.676	.956
PGMLS [adaptation to possible changes]	.824	.952

Factor Analysis

In this section, 7 sustainability aspects were classified into certain groups with factor analysis. The reliability of the scale was found high with the .956 Cronbach's alpha value. the subjects-to-variables ratio of this study is almost 5 (74:7). On the other hand, sample is found to be highly adequate for factor analysis with the .893 Kaiser-Meyer-Olkin Measure value (Table 111) because it is greater than .50 (a rule of thumb). In addition, the significance level of Barlett's Test (.000 as seen in Table 111) is below .05 therefore this test showed that the data is suitable for analysis.

Table 111 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.893
Approx. Chi-Square		416.187
Bartlett's Test of Sphericity	df	21
Sig.		.000

The Total Variance Explained table (Table 112) shows that 82.156% of the total variance is explained by classifying these 7 aspects into 2 components. 60% or more is preferred as a rule of thumb and below 50% is unsatisfactory.

Table 112 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.072	72.451	72.451	5.072	72.451	72.451	2.978	42.545	42.545
2	.679	9.706	82.156	.679	9.706	82.156	2.773	39.612	82.156
3	.361	5.151	87.308						
4	.323	4.614	91.922						
5	.231	3.302	95.224						
6	.178	2.547	97.770						
7	.156	2.230	100.000						

Extraction Method: Principal Component Analysis.

Table 113 Rotated Component Matrix

Financial Issues	Component	
	1	2
sufficiency of financial source	.269	.900
cost effectiveness	.370	.837
tangible and intangible benefits	.549	.702
return on investment	.599	.607
effective risk management	.869	.334
transparency and efficiency of business model	.886	.299
financial expert level	.753	.449

According to the Rotated Component Matrix (Table 113), 7 aspects were classified into 2 components. The first group under component 2 was named as “Financial

Viability”. The second group under the second component was named as “Effectiveness of Financial Management”.

Items and Variables

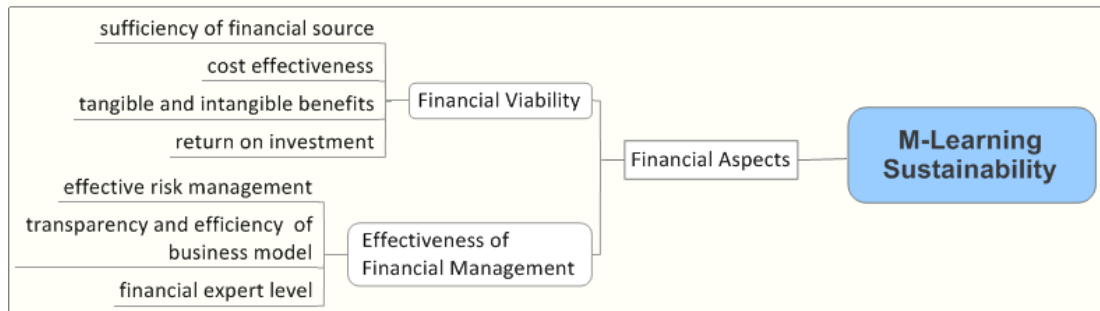


Figure 11 Financial Items and Variables

Regression Analyses

Multiple regression analysis was used for testing hypotheses 35 and 37. As independent variables “Financial Viability” and “Effectiveness of Financial Management” were used, while perceived general financial m-learning sustainability was used as a dependent variable. The ANOVA table (Table 114) shows that the significance value is .000 and less than .05.

Table 114 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	52.898	2	26.449	129.926	.000 ^b
	Residual	14.453	71	.204		
	Total	67.351	73			

a. Dependent Variable: perceived general financial m-learning sustainability

b. Predictors: (Constant), financial viability, effectiveness of financial management

According to Table 115, .779 (the adjusted R^2 value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that

there is 2.281 auto-correlation between the independent variables and it is between desired range of 1.5-2.5.

Table 115 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.886 ^a	.785	.779	.4512	2.281

a. Dependent Variable: perceived general financial m-learning sustainability

b. Predictors: (Constant), financial viability, effectiveness of financial management

The results of regression analysis are presented in Coefficient table (Table 116). It shows that the significance value of the two independent variable are less than .05 and it is considered to have meaningful relationships with perceived general financial m-learning sustainability.

Table 116 Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.327	.186		1.753	.084
financial viability (X ₃₅)	.445	.085	.460	5.203	.000
effectiveness of financial management (X ₃₆)	.447	.083	.478	5.403	.000

a. Dependent Variable: Perceived General Financial M-Learning Sustainability (PGFS)

Therefore, all variables contribute significantly to the regression equation and hypothesis 35 and 36 are substantiated by this test. The regression equation is specified as follows:

$$PGFS = .327 + .445X_{35} + .447X_{36}$$

In the formula, PGLES is perceived general financial m-learning sustainability. X₃₅ is financial viability and X₃₆ is effectiveness of financial management.

On the other hand, linear regression analysis was used for testing the hypothesis 37. The perceived general financial m-learning sustainability was used as

independent variables, while perceived general m-learning sustainability was used as a dependent variable. As shown in ANOVA table (Table 117), F value of 73.305 having a significance level of 0.000 which is less than .05.

Table 117 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29.929	1	29.929	73.305	.000 ^b
	Residual	29.396	72	.408		
	Total	59.325	73			

According to Table 118, .498 (the adjusted R² value) of the variance in the dependent variable is explained by the independent variables. Durbin-Watson value shows that there is 1.750 auto-correlation between the independent variable and it is between desired range of 1.5-2.5. The hypothesis and coefficient can be examined.

Table 118 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.710 ^a	.504	.498	.6390	1.750

a. Dependent Variable: Perceived General M-learning Sustainability

b. Predictors: (Constant), Perceived General Financial M-learning Sustainability

Table 119 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.496	.259		5.771	.000
	Perceived General Financial M-Learning Sustainability	.667	.078	.710	8.562	.000

a. Dependent Variable: Perceived General M-learning Sustainability

Table 119 (the coefficient table) presents the results of regression analysis of the Hypothesis 37. It shows that the P-value is less than .05 and there is a meaningful relationship between perceived general financial m-learning sustainability and

perceived general m-learning sustainability. Therefore hypothesis 37 is supported by the linear regression test.

Results and Discussion

For the analyses of the data, descriptive analyses, reliability analyses, factor analyses, multiple regression analyses and linear regression analysis techniques were respectively used.

Demographic analyses inform us about how much the respondents have knowledge about survey questions. As a result of demographic analyses, percentages of respondents whose m-learning experience more than 3 years of each sustainability aspects: technological, developmental, pedagogical assessment, psychological, social, legal and ethical, organizational and institutional and financial aspects are respectively 44, 43.4, 42.6, 36.9, 36.6, 39, 49.3, 48.7 and 48.7 (presented in Table 120). The average percentage of experience more than 3 years is 43 and it can be interpreted as not a low value but it can be more.

Table 120 M-learning Experience of the Respondents

Issues	Percentage of respondents whose m-learning experience more than 3 years
Technological	44
Developmental	43.4
Pedagogical	42.6
Assessment	36.9
Psychological	36.6
Social	39
Legal & Ethical	49.3
Organizational	48.7
Financial	48.7

When we examine the descriptive statistics of sustainability factors with respect to 9 sustainability aspects, it can be seen that some issues are at critical level and some of them are minimum level.

Table 121 The Issues at Critical, Minimum and Maximum Level

Issues	Critical Factors	Mean Value	Minimum Mean Value	Mean Value	Maximum Mean Value	Mean Value
Technological			quality standards	3.41	accessibility	4.19
Developmental	extent of the content	2.99	extent of the content	2.99	usability of learning environment	3.76
Pedagogical			accessibility of pedagogical support	3.08	appropriateness of learning environment	3.61
Assessment	cheating	2.85	IT skills of user	2.8	clarity of instrument	3.63
	ambiguity about respondent	2.93				
	IT skills of user	2.8				
Psychological			psychological support	3.01	availability of support for adaptation to process	3.37
Social	personal stories and experiences share	2.97	emotions use	2.88	social interactivity of learning environment	3.4
	humor use	2.99				
	emotions use	2.88				
Legal & Ethical			informed consent	3.55	privacy and security of personal information	3.99
					accuracy of stored information	3.99
Organizational and Institutional	finding and retaining of staff	2.85	finding and retaining of staff	2.85	innovative approach	3.87
Financial			effective risk management	3.01	tangible and intangible benefits	3.39

Extent of the content as developmental issue (with 2.99 mean value); cheating, ambiguity about respondent and IT skills of user as assessment issues (with 2.85-

2.93-2.80 mean values); personal stories and experiences share, humor use and emotions use as social issues (with 2.97-2.99-2.88 mean values); and finding and retaining of staff as organizational and institutional issue (with 2.99 mean value); are the issues at critical level.

From technological, developmental, pedagogical, assessment, psychological, social, legal and ethical, organizational and institutional, and financial aspects, respectively quality standards, extent of the content, accessibility of pedagogical support, IT skills of user, psychological support, emotions use, informed consent, finding and retaining of staff and effective risk management issues have minimum mean value so these issues should be solved to increase the general sustainability of that aspect. The maximum mean value belongs to accessibility, usability of learning environment, appropriateness of learning environment, clarity of instrument, availability of support for adaptation to process, social interactivity of learning environment, privacy and security of personal information, accuracy of stored information, innovative approach, and tangible and intangible benefits issues (The mean values were given in Table 121).

Table 122 Descriptive Statistics of General Sustainability Responses

Issues	Perceived Sustainability for issues	General M-learning Sustainability	Difference
Technological	3.69	3.44	0.25
Developmental	3.45	3.19	0.26
Pedagogical	3.46	3.28	0.18
Assessment	3.43	3.17	0.26
Psychological	3.31	3.25	0.06
Social	3.49	3.15	0.34
Legal & Ethical	3.78	3.59	0.19
Organizational	3.47	3.61	-0.14
Financial	3.19	3.61	-0.42

When the dimensional sustainability mean values are examined, we can see that all of them higher than the average value 3 (shown in Table 122). The maximum mean

values belong to Technological and Legal & Ethical Issues with the values 3.69 and 3.78. The minimum mean values belong to Financial and Psychological Issues with the values 3.19 and 3.31. On the other hand, when we examine the general m-learning sustainability mean values and difference values, the general m-learning sustainability was perceived higher by administrator with the values 3.59 and 3.61 and only organizational and institutional and financial status were perceived lower than general m-learning sustainability mean values. As a result, organizational and institutional, and financial issues can be perceived as critical issues since their mean values are lower than the perceived general m-learning sustainability mean value.

The Table 123 shows the result of reliability analyses for all survey parts. As a result of reliability analyses, Cronbach's Alpha values were found more than .9 for each survey part: Technological part = 0.925; developmental part = 0.964; pedagogical part = 0.952; assessment part = 0.965; psychological part = 0.972; social part = 0.957; legal and ethical part = 0.948; organizational and institutional part = 0.963; and financial part = 0.956. There is no item to increase the overall alpha value dramatically, when it is deleted as stated in analyses.

Table 123 Reliability Analyses

Issues	Cronbach's Alpha	N of Items
Technological	0.925	21
Developmental	0.964	31
Pedagogical	0.952	20
Assessment	0.965	21
Psychological	0.972	13
Social	0.957	14
Legal & Ethical	0.948	12
Organizational	0.963	22
Financial	0.956	13

Thanks to the Factor analyses, all items were grouped under the titles which are given as independent variables except “Legal and Ethical Aspects”. Since only one

component was extracted in factor analysis of “Legal and Ethical Aspects”, the items are grouped together with an expert who studies about this issue.

Table 124 shows that sample was found to be adequate for factor analyses of all parts with the Kaiser-Meyer-Olkin Measure value more than .800. In addition, the significance levels of Barlett’s Tests are .000 for all of them; therefore this test showed that the data is suitable for the analyses. On the other hand, each value of The Total Variance Explained is more than .6 and this value is seen as satisfactory. The number of items and components were also given in Table 124.

Table 124 Results of Factor Analyses

Issues	KMO Measure	Bartlett's Test	The Total Variance Explained	# of Items	# of Components
Technological	.818	.000	62.157	15	3
Developmental	.916	.000	71.786	25	5
Pedagogical	.881	.000	78.553	14	4
Assessment	.912	.000	78.038	15	3
Psychological	.906	.000	88.228	7	2
Social	.844	.000	78.492	8	2
Legal & Ethical	.896	.000	65.325	7	1
Organizational and Institutional	.910	.000	73.463	15	3
Financial	.893	.000	82.156	7	2

The result of regression analyses were given in Table 125. As a result of regression analyses, the significance value of the independent variable “Meeting Structural Challenges” is more than .1 and it is considered to have not meaningful relationships with the dependent variable “Perceived General Pedagogic M-learning Sustainability”. Therefore the hypothesis 12 was rejected.

On the other hand, the developmental independent variable “Compatibility with Mobile Devices” and the pedagogical independent variable “Appropriateness of Pedagogical and Instructional Implementations” were found significance at .1 level.

All other variables are considered to have meaningful relationships with the m-learning sustainability.

Table 125 Result of Regression Analyses

Hypothesis	Factors	Coefficients	t	Sig.	Significant
		Beta			
	TECHNOLOGICAL M-LEARNING SUSTAINABILITY				
1	Adequacy of Infrastructure & Standards	.367	4.064	.000	Yes
2	Evaluation and Improvements of I&S	.271	2.907	.005	Yes
3	Technical Support for Staff, Instructors & Users	.305	3.261	.002	Yes
4	Perceived General Technological M-learning Sustainability	.715	8.745	.000	Yes
	DEVELOPMENTAL M-LEARNING SUSTAINABILITY				
5	Adequacy of Learning Environment	.243	3.779	.000	Yes
6	Sufficiency of Materials and Content	.120	2.503	.013	Yes
7	Difficulties of Materials and Contents	.279	4.622	.000	Yes
8	Compatibility with Mobile Devices	.105	1.776	.078	Yes*
9	Evaluation and Improvement	.325	5.165	.000	Yes
10	Perceived General Developmental M-learning Sustainability	.715	8.745	.000	Yes
	PEDAGOGICAL M-LEARNING SUSTAINABILITY				
11	Appropriateness of Pedagogical and Instructional Implementations	.181	1.726	.088	Yes*
12	Meeting Structural Challenges	.145	1.405	.164	No
13	Quality Evaluation	.188	2.089	.040	Yes
14	Pedagogical Support for Staff, Instructors & Users/Students	.445	4.945	.000	Yes
15	Perceived General Pedagogical M-learning Sustainability	.730	9.434	.000	Yes
	ASSESSMENT M-LEARNING SUSTAINABILITY				
16	Sufficiency of Assessment Media and Instruments	.553	7.680	.000	Yes
17	Appropriateness of Evaluation Criteria	.279	3.936	.000	Yes
18	Fairness of Evaluation	.121	2.086	.039	Yes

19	General Sustainability of M-learning Assessment	.758	12.560	.000	Yes
PSYCHOLOGICAL M-LEARNING SUSTAINABILITY					
20	Evaluation of User, Instructor & Staff Psychology	.273	3.119	.002	Yes
21	Psychological Support	.588	6.724	.000	Yes
22	Perceived General Psychological M-learning Sustainability	.757	13.723	.000	Yes
SOCIAL M-LEARNING SUSTAINABILITY					
23	Social Presence	.544	6.761	.000	Yes
24	Shared Purpose and Behavior	.315	3.916	.000	Yes
25	Perceived General Social M-learning Sustainability	.749	11.458	.000	Yes
LEGAL AND ETHICAL M-LEARNING SUSTAINABILITY					
26	Equity & Equality	.196	2.294	.025	Yes
27	User Rights Sensitivity	.329	2.867	.006	Yes
28	Accuracy of Stored Information	.266	3.107	.003	Yes
29	Cyber Ethics	.209	2.081	.041	Yes
30	Perceived General Legal and Ethical M-learning Sustainability	.717	8.669	.000	Yes
ORGANIZATIONAL AND INSTITUTIONAL M-LEARNING SUSTAINABILITY					
31	Managerial Effectiveness	.374	5.633	.000	Yes
32	Human Resource Difficulties	.118	2.175	.033	Yes
33	Consolidations	.559	8.853	.000	Yes
34	Perceived General Organizational and Institutional M-learning	.799	11.275	.000	Yes
FINANCIAL M-LEARNING SUSTAINABILITY					
35	Financial Viability	.460	5.203	.000	Yes
36	Effective Financial Management	.478	5.403	.000	Yes
37	Perceived General Financial M-learning Sustainability	.710	8.562	.000	Yes

*Significance at .1 levels.

The model consisting of 27 factors in 9 dimensions was developed after the analyses (as presented in Figure 12).

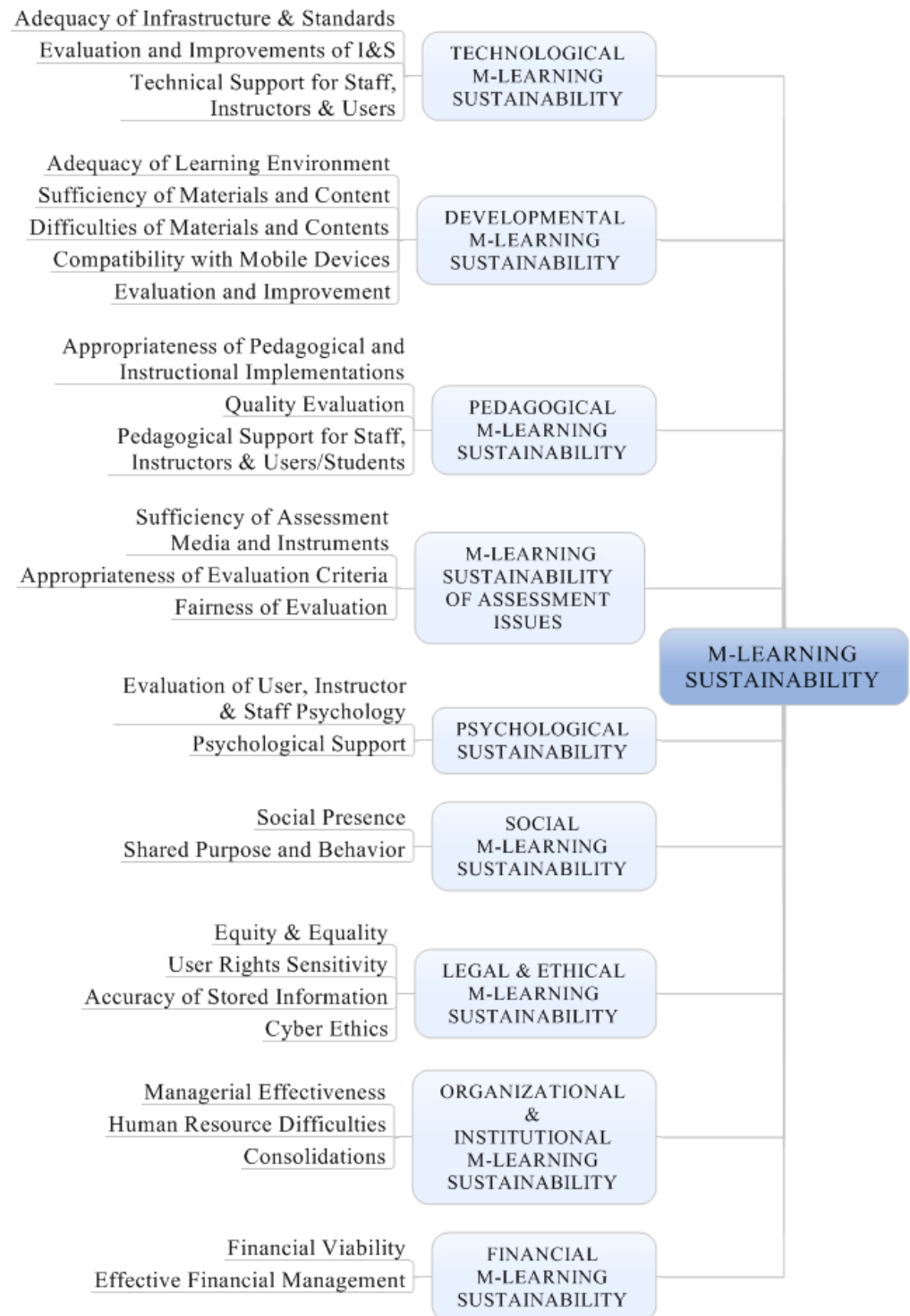


Figure 12 The Final Model for M-learning Sustainability

CHAPTER 6

CONCLUSION, LIMITATION AND RECOMMENDATIONS

Chapter one is about the introduction of the study, the literature review is given in chapter two, in chapter three the theoretical framework and hypotheses are presented, chapter four is about the methodology of the study and data analyses and results are given in chapter five. This chapter provides the conclusion and presents the limitations and recommendations.

Conclusion

In this study, the aims are specifying the current situation of m-learning and identifying factors affect m-learning sustainability.

Research questions of this study are: What are the significant and relevant factors that can affect the sustainability of mobile learning? What does the statistical evidence suggest about how the significant and relevant factors affect the sustainability of mobile learning? What is the current situation of the sustainability of m-learning at universities in Turkey?

The research design of this study includes mixed (both quantitative and qualitative) research methods.

The literature was reviewed about current sustainability factors, educational needs, adoption, success factors, limitations and challenges, and changes and risk of mobile learning projects. The following critical sustainability aspects were identified and discussed: pedagogical, technological, financial, organizational & institutional,

developmental, psychological, social, legal & ethical and assessment aspects. The sustainability factors depends on literature are specified (shown in Table 1).

In addition to literature, an investigation was made in order to obtain additional sustainability factors from 11 experts in order to benefit from experiences, perspectives and ideas of experts. The investigation was based on structural interviews conducted with heads of distance education centers and university lecturers who use m-learning strategies. These additional sustainability factors combined with the factors based on literature, evaluated, and collected under the subtitles for each sustainability aspect which were discussed in literature (shown in Table 1).

Another investigation was made for understanding the effects of these factors on perceived m-learning sustainability. This investigation was based on a survey research which consists of 5 survey forms which includes concerned survey parts and conducted with lecturers who give distance courses at universities which has m-learning facilities; staffs from management, system and support, development and design, and assessment units at distance education centers of universities; and distance education students who can reach the learning system from mobile devices. The five population types and concerned survey parts were given in Figure 2. We contact with the administrator of university distance education centers via telephone or e-mail in order to demand contact of students, staffs and instructors. Some administrator personally communicated with them. The sample sizes for all part of the survey research were given in Table 2. Totally 894 completed survey parts have been collected from 5 survey forms for 9 parts.

After the data collection, answers were given to the research questions, with the data analyses. For the analyses of the data, descriptive analyses, reliability

analyses, factor analyses, multiple regression analyses and linear regression analyses techniques were respectively used.

Demographic analyses inform about how much the respondents have information about survey questions. It is observed that the average percentage of m-learning experience more than 3 years is 43 and so we can say that it is not low but it can be more.

When the descriptive statistics of sustainability factors are examined with respect to 9 sustainability aspects, it can be seen that some issues are at critical level and some of them are minimum level.

As a result of descriptive analyses, extent of the content as developmental issue (with 2.99 mean value); cheating, ambiguity about respondent and IT skills of user as assessment issues (with 2.85-2.93-2.80 mean values); personal stories and experiences share, humor use and emotions use as social issues (with 2.97-2.99-2.88 mean values); and finding and retaining of staff as organizational and institutional issue (with 2.99 mean value); are the issues at critical level.

From technological, developmental, pedagogical assessment, psychological, social, legal and ethical, organizational and institutional, and financial aspects, respectively quality standards, extent of the content, accessibility of pedagogical support, IT skills of user, psychological support, emotions use, informed consent, finding and retaining of staff and effective risk management issues have minimum mean value so these issues should improve to increase the general sustainability of that aspect. The maximum mean value belongs to accessibility, usability of learning environment, appropriateness of learning environment, clarity of instrument, availability of support for adaptation to process, social interactivity of learning environment, privacy and security of personal information, accuracy of stored

information, innovative approach, and tangible and intangible benefits issues (The mean values were given in Table 121).

The descriptive statistics inform also about the dimensional sustainability mean values. All of them higher than the average value 3 (shown in Table122). The maximum mean values belong to Technological and Legal& Ethical Issues with the values 3.69 and 3.78. The minimum mean values belong to Financial and Psychological Issues with the values 3.19 and 3.31. On the other hand, when the general m-learning sustainability mean values and difference values are examined, the general m-learning sustainability was perceived higher by administrator with the values 3.59 and 3.61 and only organizational and financial status perceived lower than general m-learning sustainability mean values. As a result, financial issues can be perceived as critical issues since its mean value is low and lower than general m-learning sustainability mean value.

As a result of reliability analyses, Cronbach's Alpha values were found more than .9 for each survey part. As stated in analyses, here is no item to increase the overall alpha value dramatically, when it was deleted.

Factor analyses were applied to the sustainability factors which were obtained from literature and interviews and these factors were grouped under some titles which are the independent variables were presented in Figure 1. Thanks to the Factor analyses, all items were grouped under the titles which are given as independent variables except “Legal and Ethical Aspects”. Since only one component was extracted in factor analysis of “Legal and Ethical Aspects”, we grouped the items together with an expert who was studied about this issue. The theoretical framework and hypotheses which depend on these variables were developed for m-learning sustainability to guide the study (presented in Chapter 4).

As a result of regression analyses, the significance value of the independent variable “Meeting Structural Challenges” is more than .1 and it is considered to have not meaningful relationships with the dependent variable “Perceived General Pedagogic m-Learning Sustainability”. Therefore the hypothesis 12 is rejected. On the other hand, the developmental independent variable “Compatibility with Mobile Devices” and the pedagogical independent variable “Appropriateness of Pedagogical and Instructional Implementations” were found significance at .1 levels. All other variables are considered to have meaningful relationships with the m-learning sustainability.

The model consisting of 27 factors in 9 dimensions was developed after the analyses (as presented in Figure 12).

Limitations

Firstly, in this research, three limitations were identified that could limit the generalizability of the results:

- 1) The investigation is geographically limited to Turkey.
- 2) A nonprobability sampling technique was used for sampling.
- 3) Time and resources are limited.

Secondly, the existence of response bias may also be a limitation for two reasons:

- 1) The participants were asked to complete a web-based survey with no incentives provided

2) Some statistical methods used in this study are based on traditional assumptions.

Recommendations for Additional Research

As a recommendation for future research, there is a need for more focused studies on expert perceptions. In this study, experts were not previously exposed to the literature-based sustainability factors. Just main sustainability aspects and some examples about the answers were given them. A summative overview of the literature can be presented to them and interviews can be occurred face to face.

In addition, it is struggled to reach the universities in other countries and also other institutions in Turkey such as government and business institutions but one or two response were obtained. Future studies could investigate m-learning sustainability factors for the universities in other countries and for government and business institutions.

APPENDIX A
INTERVIEW QUESTIONS

Institution:

Name-Surname:

Official Title:

E-mail:

Please answer the question about the factors that can affect the sustainability of mobile learning initiatives in terms of pedagogical, technological, financial, organizational, developmental, psychological, consolidation, assessment and other aspects.

Interview questions about m-learning initiatives

1-What are the success factors of m-learning in order to maintain a certain condition indefinitely or make progress? (such as collaborative working, provide awareness)

2-Can you describe any major barriers or challenge you faced or may face during m-learning process? (such as connection, material quality control, finance)

3-What may be possible changes during m-learning process? (such as new mobile technology, infrastructure etc.)

4-How can your department and the institution adapt to possible changes and risks? (such as R&D, precaution etc.)

5-What may be main attributes m-learning initiatives need to be adopted by users? (efficient learning environment, pedagogical support etc.)

6-What are the current needs for ideal m-learning initiative? (such as motivation, content novelty etc.)

Please state here if there is any other comment.

APPENDIX B

SURVEY QUESTIONNAIRE

SUSTAINABILITY OF MOBILE LEARNING

This survey was prepared as part of a master thesis at the MIS Department of Bogazici University. In this study, the factors that can affect the sustainability of mobile learning are handled. If you want to be informed about the results of the study, you can contact me with the mail address at the end of the survey.

*Please answer the questions if only you can access to your learning system from mobile devices like PDA, tablet, smart phone etc.

PERSONAL INFORMATION

Acrology of Your Name and Surname: (ex: AC, It is not required.)

Your Institution: (It is not required.)

Your Position:

Your Age:

- ☐ less than 20 years
- ☐ between 20-30 years
- ☐ between 30-40 years
- ☐ between 40-50 years
- ☐ more than 50 years

Is there access from mobile devices (PDA, smart phone, tablet etc.) to your learning system? (Please continue if only you can access to your learning system from mobile devices.)

- ☐ Yes
- ☐ No

The year in m-Learning environment

- ☐ less than 1 year
- ☐ between 1-3 year/s
- ☐ between 3-5 years
- ☐ more than 5

TECHNOLOGY

1) Functions of Infrastructure & Standards

Please rate the capability of your system infrastructure and standards on a rating scale of 1-5. (1: Poor, 5: Excellent)

	1	2	3	4	5
system security	☐	☐	☐	☐	☐
connectivity	☐	☐	☐	☐	☐
accessibility	☐	☐	☐	☐	☐
interoperability	☐	☐	☐	☐	☐
modularity	☐	☐	☐	☐	☐
memory adequacy	☐	☐	☐	☐	☐

2) Testing and Evaluation of Infrastructure & Standards

Please evaluate your technological infrastructure and standards by frequency of testing.

	never	seldom	sometimes	mostly	always
Testing and evaluating is made with quality standards.	☐	☐	☐	☐	☐
Requirement specification is made.	☐	☐	☐	☐	☐
Expansion and upgrade is made.	☐	☐	☐	☐	☐
Maintenance is made.	☐	☐	☐	☐	☐
Pilot test is made.	☐	☐	☐	☐	☐

3) Technical Support for Staff, Instructors & Users

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
System use support is available.	☐	☐	☐	☐	☐
Support for connection problems is available.	☐	☐	☐	☐	☐
Technical support is easily accessible at all times.	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neither NorDisagree	Agree	Strongly Agree
Given technical supports are effective.	☐	☐	☐	☐	☐

4) General Technological Status

Please rate the technological sustainability of your m-learning initiative on a rating scale of 1-5

	1	2	3	4	5	
insufficient	☐	☐	☐	☐	☐	sufficient

DESIGN AND DEVELOPMENT

5) Learning Environment

Please rate the learning environment of your system in the context of following factors on a rating scale of 1-5. (1: Poor, 5: Excellent)

	1	2	3	4	5
attractiveness	☐	☐	☐	☐	☐
interactivity	☐	☐	☐	☐	☐
usability	☐	☐	☐	☐	☐
social presence	☐	☐	☐	☐	☐
flexibility and maintainability	☐	☐	☐	☐	☐

6) Material and Application

	Strongly Disagree	Disagree	Neither NorDisagree	Agree	Strongly Agree
The instructional materials and applications are effective.	☐	☐	☐	☐	☐
Instructional materials are reviewed and renewed periodically	☐	☐	☐	☐	☐
Size of the instructional materials and applications is high.	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
Data usage of the instructional materials and applications is high.	☐	☐	☐	☐	☐

7) Content

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
The course contents are efficient.	☐	☐	☐	☐	☐
The extent of the course contents is immense.	☐	☐	☐	☐	☐
The course contents are related to the subject.	☐	☐	☐	☐	☐
The course contents are clear enough.	☐	☐	☐	☐	☐

8) Compatibility with Mobile Devices

Please rate the compatibility of the instructional environments, materials and applications with following properties of mobile devices on a rating scale of 1-5. (1: Poor, 5: Excellent)

	1	2	3	4	5
screen resolution	☐	☐	☐	☐	☐
processor speed	☐	☐	☐	☐	☐
connection technologies	☐	☐	☐	☐	☐
internet quota	☐	☐	☐	☐	☐

9) Innovation and Improvement

Please rate the innovation and improvements in developments on a rating scale of 1-5. (1: Poor, 5: Excellent)

	1	2	3	4	5
identification of new trends	☐	☐	☐	☐	☐
implementation of new idea	☐	☐	☐	☐	☐

10) Testing and Evaluation

Please evaluate the following factors by frequency of testing.

	Never	Seldom	Sometimes	Mostly	Always
Testing and evaluating is made with quality standards.	☐	☐	☐	☐	☐
Requirement specification is made.	☐	☐	☐	☐	☐
User evaluation is taken	☐	☐	☐	☐	☐
Maintenance is made.	☐	☐	☐	☐	☐
Pilot test is made.	☐	☐	☐	☐	☐

11) Cooperation among Staff, Instructors & Users

Please rate the cooperation among staff, instructors and users.

	1	2	3	4	5	
Not Adequate	☐	☐	☐	☐	☐	Adequate

12) General Developmental Status

Please rate the sustainability of your m-learning initiative in the context of design and developments.

	1	2	3	4	5	
Poor	☐	☐	☐	☐	☐	Excellent

PEDAGOGY

13) Appropriateness of Pedagogical and Instructional Implementations

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
During course development appropriate instructional approaches are considered.	☐	☐	☐	☐	☐
During course development appropriate pedagogical methods and instructional activities are considered.	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neither Nor Disagree	Agree	Strongly Agree
Courses include pedagogically appropriate content.	☐	☐	☐	☐	☐
Courses include pedagogically appropriate learning materials and applications.	☐	☐	☐	☐	☐
Courses have pedagogically appropriate learning environments.	☐	☐	☐	☐	☐
During course development the readiness level of students are considered.	☐	☐	☐	☐	☐
During course development the various learning styles of students are considered.	☐	☐	☐	☐	☐
Courses are pedagogically appropriate for students to able to follow their learning process	☐	☐	☐	☐	☐

14) Pedagogical Evaluation

Please evaluate the following factors by frequency of testing.

	Never	Seldom	Sometimes	Mostly	Always
Testing and evaluating is made with quality standards.	☐	☐	☐	☐	☐
An evaluation process is used to identify real educational needs.	☐	☐	☐	☐	☐
User feedback is taken.	☐	☐	☐	☐	☐

15) Pedagogical Support for Staff, Instructors & Users/Students

	Strongly Disagree	Disagree	Neither NorDisagree	Agree	Strongly Agree
Support for understanding the learning process is available at all times.	☐	☐	☐	☐	☐
Pedagogical support is easily accessible at all times.	☐	☐	☐	☐	☐
Pedagogical supports are effective.	☐	☐	☐	☐	☐

16) General Pedagogical Status

Please evaluate the sustainability of your m-learning initiative in the context of pedagogy.

	1	2	3	4	5	
Poor	☐	☐	☐	☐	☐	Excellent

ASSESSMENT AND EVALUATION

17) Assessment Media and Delivery Techniques

Please rate the following assessment media capabilities and delivery techniques on a rating scale of 1-5. (1: Poor, 5: Excellent)

	1	2	3	4	5
usability	☐	☐	☐	☐	☐
functionality	☐	☐	☐	☐	☐
connectivity	☐	☐	☐	☐	☐
security	☐	☐	☐	☐	☐
feedback convenience	☐	☐	☐	☐	☐
response time convenience	☐	☐	☐	☐	☐

18) Assessment Tools

Please rate the following concepts in the context of assessment tools. (1: Poor, 5: Excellent)

	1	2	3	4	5
validity	☐	☐	☐	☐	☐

	1	2	3	4	5
reliability	☐	☐	☐	☐	☐
clarity	☐	☐	☐	☐	☐
variety	☐	☐	☐	☐	☐

19) Evaluation

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
The grade proportion of mid-term activities and exams is appropriate.	☐	☐	☐	☐	☐
The use of norms or cutting scores is appropriate.	☐	☐	☐	☐	☐
During assessment, cheating is problem.	☐	☐	☐	☐	☐
There is ambiguity about respondent during assessment.	☐	☐	☐	☐	☐
IT readiness level of the user may affect the evaluation.	☐	☐	☐	☐	☐

20) General Assessment and Evaluation Status

Please evaluate the sustainability of your m-learning initiative in the context of assessment and evaluation.

	1	2	3	4	5	
Poor	☐	☐	☐	☐	☐	Excellent

PSYCHOLOGY

21) Staff, Instructor and Learner/User Psychology

Please rate the psychological evaluations and supports of your m-learning initiative.
(1: Poor, 5: Excellent)

	1	2	3	4	5
consideration of motivation	☐	☐	☐	☐	☐
consideration of satisfaction.	☐	☐	☐	☐	☐

	1	2	3	4	5
consideration of confidence	☐	☐	☐	☐	☐
Adoption support is available for staffs, instructors and learners	☐	☐	☐	☐	☐
Adaptation support is available for staffs, instructors and	☐	☐	☐	☐	☐
Pedagogical support is easily accessible at all times.	☐	☐	☐	☐	☐
Pedagogical supports are effective.	☐	☐	☐	☐	☐

22) General Psychological Status

Please evaluate the sustainability of your m-learning initiative in terms of psychological issues.

	1	2	3	4	5	
Poor	☐	☐	☐	☐	☐	Excellent

SOCIAL INTERACTION

23) Social Presence of Learning Environments

Please rate the social presence of your m-learning system. (1: Poor, 5: Excellent)

	1	2	3	4	5
social interactivity	☐	☐	☐	☐	☐
integration with social networks	☐	☐	☐	☐	☐

24) Manner and Behaviors

Please rate the usage level and sufficiency of the following factors in your initiative. (1: Poor, 5: Excellent)

	1	2	3	4	5
collaborative learning activities	☐	☐	☐	☐	☐
feedback and support	☐	☐	☐	☐	☐
personal stories and experiences share	☐	☐	☐	☐	☐
humor use	☐	☐	☐	☐	☐

	1	2	3	4	5
emotions use	☐	☐	☐	☐	☐
discourse	☐	☐	☐	☐	☐

25) General Social Interactivity Status

Please evaluate the sustainability of your m-learning initiative in terms of social interactivity.

	1	2	3	4	5	
Poor	☐	☐	☐	☐	☐	Excellent

LEGAL & ETHICAL ISSUES

26) Legal & Ethical Issues

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
Intellectual property and copyright sensitivity is considered.	☐	☐	☐	☐	☐
All users including who have a disability can access the system easily.	☐	☐	☐	☐	☐
Discrimination issue like gender, religion, race discrimination is considered.	☐	☐	☐	☐	☐
Users, staffs and instructors have informed about the consents which they give to system.	☐	☐	☐	☐	☐
Privacy and security of personal information is ensured.	☐	☐	☐	☐	☐
Accuracy of stored information and accounts is guaranteed.	☐	☐	☐	☐	☐
There are sensitivity and studies	☐	☐	☐	☐	☐

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
--	----------------------	----------	-------------------------------	-------	-------------------

concerning
netiquette.

27) General Legal & Ethical Status

Please evaluate the sustainability of your m-learning initiative in terms of legal and ethical issues.

	1	2	3	4	5	
Poor	☐	☐	☐	☐	☐	Excellent

ORGANIZATIONAL & INSTITUTIONAL ASPECTS

28) Organization, Structure and Design

Please rate the following factors in your initiative on the rating scale of 1-5. (1: Poor, 5: Excellent)

	1	2	3	4	5
leadership strength	☐	☐	☐	☐	☐
clarity of role and responsibilities	☐	☐	☐	☐	☐
communication among staffs	☐	☐	☐	☐	☐
teamwork	☐	☐	☐	☐	☐

29) Institutional Approaches

Please rate the following factors in your initiative on the rating scale of 1-5. (1: Poor, 5: Excellent)

	1	2	3	4	5
innovative approach	☐	☐	☐	☐	☐
partnership strategies	☐	☐	☐	☐	☐
system, product and information quality policies	☐	☐	☐	☐	☐

30) Consolidations

Please rate the following consolidation issues in your initiative on the rating scale of 1-5. (1: Poor, 5: Excellent)

	1	2	3	4	5
cooperation with peer initiatives	☐	☐	☐	☐	☐

	1	2	3	4	5
interdisciplinary dialog	☐	☐	☐	☐	☐
project-based studies and workshops	☐	☐	☐	☐	☐
publicity	☐	☐	☐	☐	☐
misconceptions	☐	☐	☐	☐	☐
popular departments	☐	☐	☐	☐	☐

31) Human Resource

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
There are finding and retaining staff problems.	☐	☐	☐	☐	☐
The initiative has a problem about instructor acceptance for teaching.	☐	☐	☐	☐	☐

32) General Organizational Status

Please rate the sustainability of your m-learning initiative in terms of organizational and institutional issues.

	1	2	3	4	5	
Poor	☐	☐	☐	☐	☐	Excellent

33) General Consolidation Status

Please rate the sustainability of your m-learning initiative in terms of consolidation issues.

	1	2	3	4	5	
Poor	☐	☐	☐	☐	☐	Excellent

ECONOMY & FINANCE

34) Financial Issues

Please rate the following factors in your initiative on the rating scale of 1-5. (1: Poor, 5: Excellent)

	1	2	3	4	5
sufficiency of financial resource	☐	☐	☐	☐	☐

	1	2	3	4	5
cost effectiveness	☐	☐	☐	☐	☐
tangible and intangible benefits	☐	☐	☐	☐	☐
return on investment	☐	☐	☐	☐	☐
effective risk management	☐	☐	☐	☐	☐
transparency and efficiency of business model	☐	☐	☐	☐	☐
financial expert level	☐	☐	☐	☐	☐

35) General Financial Status

Please rate the financial sustainability of your m-learning initiative.

	1	2	3	4	5	
Poor	☐	☐	☐	☐	☐	Excellent

GENERAL MOBIL LEARNING SUSTAINABILITY

36) General Sustainability of Mobil Learning Initiative

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
Our m-learning initiative can address current educational needs	☐	☐	☐	☐	☐
Our m-learning initiative can address the intent of m-learning	☐	☐	☐	☐	☐
Our m-learning initiative has potential to be adopted by users	☐	☐	☐	☐	☐
Our m-learning initiative can maintain a certain condition indefinitely or make progress	☐	☐	☐	☐	☐
Our m-learning initiative can adapt to possible changes	☐	☐	☐	☐	☐

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