Developing Employability and Job-Related Skills at Mobile Learning Environments: a case study at an industrial training centre

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PhD e-Research and Technology Enhanced Learning

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Declaration

This thesis results entirely from my own work and has not been offered previously for any other degree or diploma. The word-length of this thesis conforms to the permitted maximum.

Signature: *Ahmed Mokhtar Abdelaziz*

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Abstract

This study investigates how mobile technologies play a role in the development of employability and job-related skills for trainees at Saudi Aramco's Industrial Training Centres (SAITCs) in Saudi Arabia. Adopting a case study approach, qualitative and quantitative data was collected from 133 trainees and 29 instructors participating in an iPad training programme at SAITCs. The data was collected through semi-structured online questionnaires, interviews, onsite observations, and program documents.

Findings of this study were linked to existing literature on mobile learning (M-Learning); especially in Vocational and Technical Education and Training (VTET) contexts. It is anticipated that the findings of this study will contribute to the community of researchers and educators in the field of educational research generally, the field of M-Learning, and VTET in particular, in a number of ways. Firstly, this study provides new insights on how mobile devices play a role in the development of employability and job-related skills in industrial training workplaces. Secondly, it offers a better understanding of the key aspects, dynamics, and features of M-Learning environments in the field of VTET. Third, it presents new insights on how mobile devices are linked with specific learning and teaching approaches and practices that have the potential to impact the learning and teaching experience.

It is suggested that the findings of this study will have some impact on the perceptions and practices of curriculum developers and the pedagogical considerations of trainees and instructors in terms of learning and teaching with mobile devices. Finally, this research will offer some insights to Saudi Aramco policy makers and administrators that will enable them to improve the full implementation of the iPad program across the training centres.

Contents

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I dedicate this thesis to the soul of my father.

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Publications derived from work on the Doctoral Programme

No sections of the thesis have been published or submitted for a higher degree elsewhere. The thesis is not a result of joint research; it was entirely completed by the researcher.

List of abbreviations

App	Application
ATP	Apprenticeship Training Programme
BOTU	Basic Operations Training Unit
ETU	Electrical Training Unit
ITC	Industrial Training Centre
ITD	Industrial Training Department
MTU	Mechanical Training Unit
M-Learning	Mobile learning
PCSTU	Process Control and System Technician Unit
SAITC	Saudi Aramco Industrial Training Centre
VTET	Vocational and Technical Education and Training

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1. Chapter 1: Introduction and Background

In this chapter, I will give a detailed account of the research context (where this study fits in broader research) and the research setting (where the study was conducted) of this thesis. After that, I will introduce the research questions of this study. Following, I will elaborate on my motivation to this research, explaining how my interest in exploring mobile learning was developed. Finally, I will give an overview on the structure of the whole thesis.

1.1. Research Context

1.1.1. Vocational and Technical Education and Training (VTET)

Vocational and Technical Education and Training (VTET) has been conceptualised in the literature and introduced under different themes by different researchers. The major concepts that have been recognized in the literature about VTET include:

- **Vocational Education** (Lucas, 2014; Zeman, Hrad & Podhradský, 2013)
- **Vocational Training** (Zeman et al., 2013; Sampson, 2006)
- **Vocational Education and Training (VET)** (Wilke & Magenheim, 2017; Bacca, Baldiris, Fabregat & Sabine Graf, 2015; Ricky & Rechell, 2015; Akshay, Sreeram, Anand, Venkataraman & Bhavani, 2012; Skills Australia, 2011; Finnish National Board of Education, 2010; Martin et al., 2009; Lin, Chen & Chen, 2008)
- **Vocational and Professional Education and Training (VPET)** (Ng, R., Lam, Ng, K., & Lai, 2016)
- **Technical and Vocational Education** (Rus, Yasin, Yunus, Rahim, Ismail, 2015; King & Palmer, 2010)
- **Technical and Vocational Education and Training (TVET)** (Hartl, 2009; Nyerere, 2009)

Evidence-based research indicated that although the terms *'vocational'* and *'technical'* are used interchangeably in literature, vocational education is broader and contains all types of technical and non-technical occupations (Lucas, 2014). In this respect, Lucas (2014) introduced three categories of vocational education, emphasising the medium through which the work is expressed:

"1. *physical materials* – for example, bricklaying, plumbing, hairdressing, professional make-up.
1. *people* – for example, financial advice, nursing, hospitality, retail, and care industries.
2. *symbols (words, numbers and images)* – for example, accountancy, journalism, software development, graphic design". (P. 3)

For the sake of this study, I used *'Vocational and Technical Education and Training'* (VTET) to serve three purposes: First, it is in line with existing research in this area

(Rus et al., 2015; King & Palmer, 2010; Hartl, 2009; Nyerere, 2009). Second, the findings of this study have the potential to impact a wide range of educational and training institutes which offer various types of training on different occupations; specially those contexts adopting M-Learning. Third, although the context of this study is mainly technical, where trainees study specialisations related to operational and maintenance jobs in the field of the oil industry, other administrative and clerical jobs are also provided.

In this respect, VTET is defined as "education programmes that are designed for learners to acquire the knowledge, skills and competencies specific to a particular occupation, trade or class of occupations or trades" and this is the key difference between this type of education and the other forms of education (Bacca et al., 2015, p. 49). Arguably, VTET plays a significant role in the development of human resources by providing a means for creating and developing skilled manpower (Akshay, Sreeram, Anand, Venkataraman, & Bhavani, 2012; King & Palmer, 2010; David, Yin, & Chalon, 2009). According to the European Centre for the Development of Vocational Training (2011), VTET benefits can be clustered using a classical typology based on the nature of results as in the figure below (Figure 1.1). "Two main categories can be identified: economic benefits and social benefits. Both can be analysed on three different levels: the micro level (the benefits for individuals); the meso level (benefits for enterprises/groups); and the macro level (benefits for society as a whole)" (European Centre for the Development of Vocational Training, 2011, p. 4).

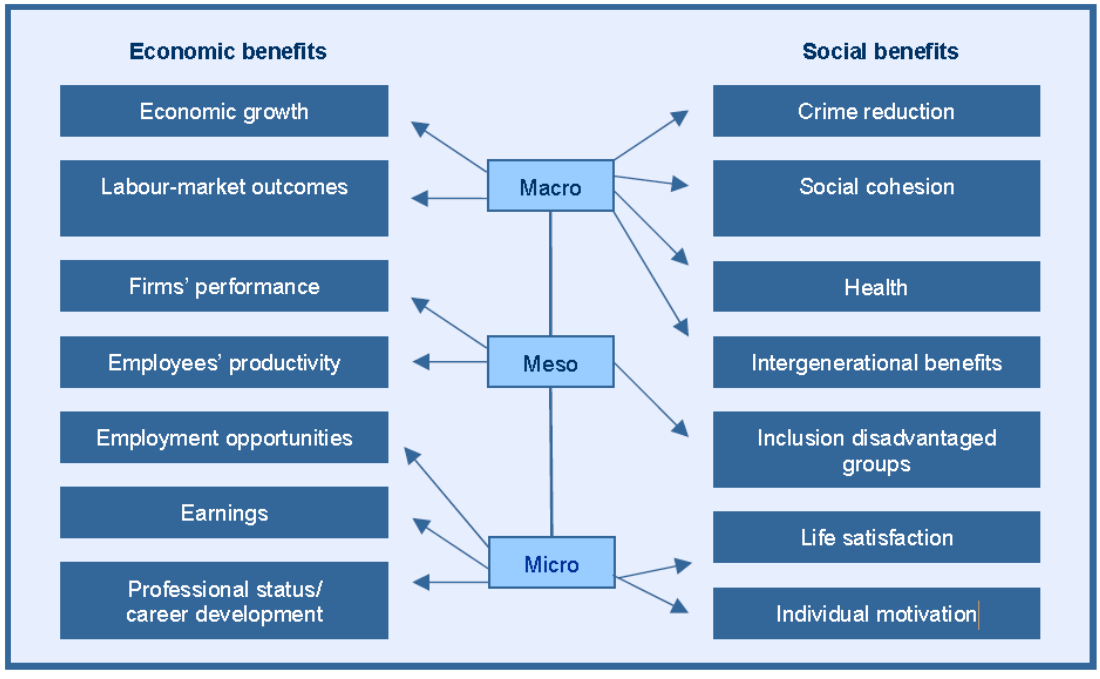

Figure 1.1: VTET Benefits, (European Centre for the Development of Vocational Training, 2011).

Similarly, Hoeckel (2008, p. 4) summarized the short-term and long-term benefits of VTET for the trainees, employers, and the society in the following table (Table 1.1):

	Individual	Employer	Society
Short-term benefits	• Employment chances • Earning levels • Work satisfaction • Drop out less likely from vocational than general courses (US data)	• Higher productivity from well trained workforce • Saved costs from recruiting external skilled workers (incl. time for integration and risk of hiring a person not known to the company)	• Saved expenses for social benefits (unemployment as consequence of failed transition from education to work)
Long-term benefits	• Flexibility and mobility • Lifelong learning (more likely to receive training and upgrade skills later in life)	• Supply benefits (e.g. image improvement) • Less turnover (no need for retraining of new workers)	• Externalities from productivity gain due to better education • Increase in tax income from higher earnings

Table 1.1: Short-Term and Long-Term Benefits of VTET, (Hoeckel, 2008).

More specifically, Masadeh (2012) argued that there are several and widely-documented benefits of VTET training programs in terms of "improved employee skills, knowledge, attitudes, and behaviours and results like enhanced staff performance, job satisfaction, productivity, and profitability" (p. 63). Hence, as a prerequisite to developing a well-rounded employee, a set of employability and job-related skills have to be developed. However, evidence suggests that an identification of a list of the skill-sets needed to perform a specific job is a complex task because there appears to be a limited agreement amongst researchers on what this list should include (Rodzalan & Saat, 2012; Dacre Pool & Sewell, 2007; Kelly, 2001). Arguably though, researchers often used to base their evaluation of the required skill-sets by distinguishing between *technical* and *generic* skills as follows.

Technical skills are defined as discipline- or role-specific skills while *generic skills* are overarching, meta skills which are common to a range of occupations (Bryson, 2017; Lucas, 2014; Rodzalan & Saat, 2012; Cheetham & Chivers, 1998 and1996). Generic skills may enable introspection or self-examination, and they include creativity, analysis, problem solving, self-development, information literacy, working with technology, written and verbal communication, working in teams, critical thinking, and collaboration (Garwood, 2013; Bridgstock, 2009; Cheetham & Chivers,

1998). These skills are also referred to as soft skills which "are generally understood as socio-emotional, intra-personal and inter-personal skills" (Vaughan, 2017, p. 2).

Soft skills are skills, abilities, and traits that pertain to personality, attitude, and behaviour while hard skills refer to formal or technical skills (Rao, 2014; Snell, Snell-Siddle, & Whitehouse, 2002; Moss & Tilly, 1996). It is argued that developing soft skills provides better chances of employability and job stability. Rao (2014) clarified that

> Although a few successful students from educational institutions demonstrate adequate skills and get into corporate, they are fired subsequently due to lack of soft skills as they find it tough to get along within the corporate ambience... It is rightly said that people rise in organizations because of hard skills and fall due to dearth of soft skills. The hard skills are nothing but the core skills, domain skills, and technical skills. The soft skills complement the hard skills in evolving students as successful professionals. (p. 43)

Arguably therefore, whilst many studies confirmed the need for effective training programs for the development of both discipline-specific and generic skills, there is limited in-depth research on VTET learners' and instructors' learning and teaching needs to review, develop, and share innovative pedagogical practices, and trade-specific examples of VTET across institutions and industries (Ng et al., 2016; Ricky & Rechell, 2015; Avis, 2014; Lee, Lam, Liu, & Pang, 2014).

In this respect, perhaps the question that might arise is:
In the age of highly advanced and digital technology, what may be the most optimal approach to deliver effective VTET training programs?

Perhaps it is possible to argue that mobile learning (M-Learning) can provide an ideal approach for effective VTET training programs.

There is evidence to suggest that there is a suitability for technology-enabled and M-Learning in VTET contexts. Noe, Clarke, and Klein (2014) reported that "in 2012, technology-based learning, which includes e-learning, online learning, and mobile learning, was used on average in 39% of organizations' formal learning hours" (247). They argued that providing formal training and development programs using advanced technology is one way that organizations are attempting to overcome the difficulties of learning in today's workplace. Other researchers highlighted the pedagogical value and effectiveness of M-learning in learning and training. For example, it was argued that mobile technologies have the potential to promote active learning (Dyson, Litchfield, Lawrence, Raban, & Leijdekkers, 2009), enable trainees to apply academic theories into practices (Ricky & Rechell, 2015), move learning outside classrooms and into students' real and virtual environments, (Mango, 2015;

Sung, Chang, & Yang, 2015; Ozdamli & Cavus, 2011), and support authentic learning activities (Dyson et al., 2009).

Nonetheless, there remains limited sufficient research in the field of VTET (Wilke & Magenheim, 2017; Ng et al., 2016; Mingyong, 2015; Lin et al., 2008). Interestingly, the effectiveness and the role of mobile and flexible technologies to develop employability and job-related skills, enhance learning and teaching, and facilitate the specific needs in VTET programs remains uncertain despite the evidence-based research that indicates promising results using M-Learning to enhance learning and teaching in higher educational institutions. For example, Ng et al. (2016) advocated M-Learning as an innovative pedagogical practice for VTET which has the potential to benefit both instructors and students. More specifically, Pimmer and Pachler (2013) argued that "the particular value of work-based M-Learning lies in connecting learning across different contexts, thereby bridging typical dichotomies of educational science" (p. 195). They claimed mobile devices have the potential to enable bridging creation and sharing of content, bridging learning at work, bridging individual and social learning, bridging informal and formal learning contexts, and bridging (socio-) cognitive, cultural and constructivist perspectives.

In light of this, the aim of this study is to investigate the role of M-Learning in the field of VTET with special attention to its role in developing the required employability job-related skills for trainees. Moreover, this study will show the unique aspects, dynamics, and features of M-Learning environments within VTET contexts.

1.1.2. M-Learning

M-Learning became a recognized term in 2005 although it was introduced in early 1990s (Wong, 2015; Crompton, 2013). Since then, research and speculation on M-Learning have been growing at a rapid rate; especially with the introduction of smart handheld devices such as smart phones and tablets (Crompton, Burke, Gregory, & Gräbe, 2016). Hence, there has been much interest in the concept of M-Learning and its relevance to well-established learning constructs, theories, and approaches, as well as its practical implications.

M-Learning has been given numerous definitions. For example, Ozdamli and Cavus (2011), Stevens and Kitchenham (2011), and Quinn (2000) characterized M-learning as a learning model that allows learners to obtain learning materials anywhere and anytime using mobile technologies and the Internet. Clarke and Svanaes (2014) defined M-learning as "learning using mobile technologies such as mobile phones, smartphones, e-readers and Tablets" (p. 1). Despite the variety in definitions, scholars focused only on the ubiquity of M-Learning and its technological aspects mostly as will be presented in the following chapter (Pimmer, Pachler, & Attwell, 2010).

Furthermore, several studies confirmed that M-Learning has various affordances as well as limitations and challenges. For example, Dyson et al. (2009) confirmed the particular suitability of mobile technologies for active learning. They explained that mobile applications can support "authentic learning activities, including student use of the multimedia capabilities of mobile devices for developing digital narratives, the gathering and analysis of field data, concept mapping, and student production of podcasts" (p. 253). Moreover, it is argued that adopting M-Learning at VTET workplaces has the potential to enable trainees to apply academic theories into practices. Ricky and Rechell (2015) clarified that

> …everyday practice and engagement with authentic activities were consistently viewed as more effective than print-based instructional materials. For that to be possible, effective means of pedagogies that take advantage of the mobile and flexible technologies need to be introduced to facilitate better quality learning and teaching in VET to engage students in their situated workplaces. (p. 97)

Moreover, several other studies claimed that M-Learning has the potential to move learning outside classrooms and into students' real and virtual environments, thus re-conceptualizing learning as personal, situational, creative, collaborative, and lifelong (Mango, 2015; Sung et al., 2015; Liaw, Marek, & Hsiu-Mei, 2010). These features have been argued to augment the learning experience, which is the situation, activity, or process in which new knowledge, concepts, ideas, or skills are acquired (Passey, 2010), and where the learner can reflectively "draw upon previous experience to understand and evaluate the present, so as to shape future action and formulate new knowledge" (Abbott, 1994).

To achieve this purpose, specifically-tailored VTET training programs are required. Arguably, well-designed VTET training programs facilitate the acquisition and development of a range of skills. Hillage and Pollard (1998) argued that the main objective of VTET programs is to equip apprentices with the required skills, knowledge, and attitudes to perform a specific job. Unlike traditional education which focuses on contemplation of academic concepts, a VTET program focuses on and values mastery of hands-on skills (Ricky & Rechell, 2015). Arguably, it is claimed that M-Learning may provide an appropriate environment within which VTET programs can achieve their intended objectives (Ricky & Rechell, 2015).

Conversely, M-Learning has been criticized for various technical and pedagogical concerns. Challenges pertaining to connectivity, screen size, compatibility between devices, distractions, lack of properly-developed learning content have been documented by many researchers (Clarke & Svanaes, 2014; Kaalberg, 2014; Kucirkova, Messer, Sheehy, & Panadero, 2014; Vu, 2013; Tamim, Bernard, Borokhovski, Abrami, and Schmid, 2011; Nordin, Embi, & Yunus, 2010). It has been argued that multitasking on mobile technologies may impair learning by the

distractions caused by phone ringing, texting, and constant visits to social medial platforms (Serah, 2014; Zhao, Reimer, Mehler, D'Ambrosio, & Coughlin, 2013; Junco, 2012; Harman & Sato, 2011). Moreover, despite the benefits of mobility, Gikas and Grant (2013), Traxler (2010), and Tella (2003) warned against the pitfalls that learning across different contexts and at different times may produce fragmented knowledge and incomplete schemata. Finally, Shuib, Shamshirband, and Ismail (2015) argued that addiction to technology can lead to problems "such as emotional stress, damaged relationships and attention deficit disorder" (p. 240).

In this respect, both theoretical and practical publications on M-Learning emphasize that M-learning has been investigated through small, narrow, and highly context-bound studies where the technical side of M-learning dominates attempts of investigating or exploring it thoroughly (Ahmed & Ghareb, 2017; Kucirkova et al., 2014; Clark & Luckin, 2013; Vu, 2013). Peng, Su, Chou, and Tsai (2009) argued that "when reviewing current M-Learning studies, researchers have noted that a number of studies treat the issues of the technical design and the development of mobile technologies. Seldom do any of these studies elaborate on learning theories to support M-Learning" (p. 175). MacCallum and Parsons (2016) confirmed that "an appropriate and considered pedagogical approach will help ensure that learning is the primary and main concern and that the technology is not used for technology's sake" (p. 175). Questions related to whether mobile technologies can really have an impact on learning or can lead to developing specific skills, what aspects, dynamics, and features of M-Learning environments may underlie the appropriation of portable, wireless technologies for impactful and effective training opportunities, and what factors can improve, enhance, impinge, or hinder engagement and performance still need more attention from researchers of M-Learning. This is, of course, accompanied with –as mentioned earlier– the claim that researchers have given little attention to M-Learning at VTET more generally and the area of the development of employability skills in particular. These form some of the main drives behind this research.

Hence, it is possible to suggest that investigating the topic of this study should be through the lens of a sophisticated theoretical framework or model for framing M-Learning which has the potential to guide effective instructional design and evaluate the quality of M-Learning programs (Park, 2011). However, existing literature indicated that attempts to introduce a comprehensive or sophisticated theoretical framework or model for M-Learning are still modest (Crompton, 2013; Sha, Looi, Chen, Zhang, 2012; Park, 2011; Koole, 2006).

> Hence numerous frameworks have been proposed in the literature, ranging from complex multi-level models (e.g. Parsons, Ryu, and Cranshaw 2007) to smaller frameworks that often omit important socio-cultural characteristics of learning or of pedagogy. Common themes include portability of M-Learning devices and mobility of learners; interactivity; control and communication. These

> descriptions acknowledge the prime importance of context, including spatial and temporal considerations, for analysing m-learning experiences. However, they typically attempt to merge affordances of mobile devices or characteristics of applications with features of the learners' experience. (Kearney, Schuck, Burden & Aubusson, 2012, p. 3)

Significantly, the literature on M-Learning is evolving. Therefore, building on an existing model and adapting it in a way that adds to research on M-Learning can contribute to the evolving literature. Hence, I argue that Koole's (2006) Framework for the Rationale Analysis of Mobile Education (FRAME) is a useful model for framing M-Learning. It has a socio-cultural background that aims "to establish a description of the mobile learning process which, in turn, will allow the development of an operational definition of mobile learning" (Koole, 2006, p. 32). It is a heuristic model which is "a tool like a lens, that allows someone to critically examine a given phenomenon" (Koole, 2011, para. 3). Arguably therefore, adopting and adapting a specific and sophisticated model for framing M-Learning will help to identify the different aspects of M-Learning. More elaboration and insights on VTET and M-Learning - with its aspects and potential role in developing employability and job-related skills, adapted framework - will be introduced in chapter two, Literature Review, of this study.

1.2. Research Setting

The research context of this study; namely, Saudi Aramco Industrial Training centres (SAITCs), best fits with the purpose of this study for various reasons, which mainly include:

- SAITCs offer vocational training programs which aim at developing various discipline-specific and generic skills for its trainees.
- M-Learning is a newly-adopted initiative at SAITCs. Trainees, instructors, curriculum developers, and administrators are aspiring to make the best use of its potentials.
- A new digital content has been developed specifically for the training program.
- SAITCs endeavor to create effective training environments through adopting effective pedagogical training and learning approaches whilst providing all necessary support.
- There is an integration of theoretical learning with practical work at SAITCs. Trainees learn the theoretical part inside their classrooms, then join the workshops for hands-on practice.

In light of the above, the context of this study is outlined below.

1.2.1. Background on SAITCs

This study was conducted at one of Saudi Aramco's Industrial Training Centres (SAITCs), in the Kingdom of Saudi Arabia. SAITCs are part of the company's Industrial Training Department (ITD) which is a department in the company's Training and Development (T&D) organization.

Originally, Saudi Aramco is one of the leading oil producers worldwide, and according to Saudi Aramco's Official Website (2017), a significant prerequisite to maintain its ranking as one of the top oil companies is its inclination to invest in designing, creating and developing training and professional development programmes that can provide its employees with the most up-to-date and essential knowledge and skills. The company's T&D organization exerts considerable efforts to create an atmosphere that ensures professional development, learning, and teaching are continuously supported in its different training programs. One way of achieving this objective is through SAITCs which offer training programs to high school and vocational college graduates through the Apprenticeship Training Programme (ATP).

The ATP was designed to prepare trainees for entry-level jobs with Saudi Aramco. It helps them to obtain the required knowledge and skills to fulfill operational, maintenance, administrative, clerical as well as other jobs. The program provides participants with academic (English, math, clerical, and science) and vocational (craft specialization) training to ensure that they have the knowledge and skills essential to be successful in their future jobs. In general, trainees start their training by attending academic courses in which various generic skills such as English language, communication, ICT, critical thinking, collaboration, presentation, study, safety, typing, as well as other skills are focused on. Upon completing the academic section, successful trainees move on to the job skills section where they study various disciplines such as welding, electrical, mechanical, and other specializations.

This program, which is a condition for craftsmen to join the company as regular employees, does not offer formal graduation certificates to the attendees, and it is not part of the Saudi government educational system. However, for the past twenty years, the ATP has been accredited by the Accrediting Council for Continuing Education & Training (ACCET), which is recognized by the United States Department of Education. All academic and job skills courses of the ATP are taught in English only because it is the medium of communication in the company. The curriculum development and the test and assessment administration are the responsibility of a separate division under T&D organization; namely Program Development and Evaluation Division (PD&ED). After graduating from SAITCs, these trainees may join the company as regular employees.

1.2.2. Technological Enhancements to the ATP

During the last ten years, SAITCs training programmes have witnessed numerous enhancements to maintain delivering to the highest standards. These enhancements include, but are not limited to, the use of the latest training equipment and educational technologies and tools such as Moodle, the Promethean Interactive Whiteboards, fully integrated commercial textbooks with online copies which have talking books and built-in video and audio files, and oil production and refining mock-ups, equipment, and simulators. Finally, the most recent addition to the academic and job skills training operations at SAITCs is the use of the iPad which was adopted in October 2015.

The adoption of cutting-edge technologies at the SAITCs originates from the vision statement of the company's Industrial Training Department (ITD) which confirms that "we are value driven, customer focused, and technology oriented". The use of technologies has always been envisioned to enhance the training experience at SAITCs and to ensure the graduates meet the requirements of the job standards.

However, from the internal reviews conducted by the Program Development and Evaluation Division and the Quality Assurance and Training Performance Measurement Unit of the company as well as the external reviews conducted by ACCET (for example), more focus was requested to be directed on supporting a more learner-centered learning environment, fostering a personalized learning experience, and providing more opportunities for improving trainees' engagement, motivation, and achievement of the learning aims.

It is arguable that the above-mentioned technologies, such as the computer laboratories, interactive whiteboards, and job skills equipment and simulators may have a positive impact on the trainees' performance, involvement in the learning process, motivation, and achievement. However, unlike the iPads, they are all left inside the SAITCs when trainees go home, and their role is not extended beyond the working hours or outside the training centers. In addition, none of these technologies and equipment provides an easily accessible tool for trainees to stay connected with the training content, with the teachers, with each other, or with the bigger learning communities. They do not provide a customizable medium or platforms for each trainee's needs and preferences. In addition, the extra resources and supplementary materials that they can afford are limited and, if available, they are accessible only at the training centers, not from outside. A suggestion to adopt M-Learning using the iPads was made to help maximize the potential of educational technologies at SAITCs, and to ameliorate the above-mentioned shortcomings in place.

1.2.3. Adoption of the iPad

The iPad was adopted at SAITCs as an emerging technology that has the potential to enhance training delivery and improve the training environment. The initiative came

top-down and was sponsored by the T&D management. It was deemed that the iPad could be adopted as a learning medium that may maximize flexibility to meet the needs of trainees, instructors, and line organizations and may facilitate the acquisition of the required knowledge and skills. Hence, all trainees and instructors were granted brand new iPads at the beginning of the training programme and were allowed to take them home and forever. Moreover, instructors had received on-the-job training on using the iPad for teaching and learning purposes, and the trainees were given adequate orientation on using the devices for learning. It is worth mentioning that there is a separate department – also under T&D organization of the company – which is in charge of supplying the learning materials, devices, equipment, and machines; namely, Learning Solution and Services Department (LSSD).

In 2016, a completely new curriculum, with function-based interactive content, was designed for the iPad program. The new syllabi, all digital, were designed by the Academic Curriculum and Testing Unit (AC&TU) in the form of iBooks and were installed on the trainees' and instructors' devices. The new curriculum had been reported formally, through reports from the implementation group leaders, and informally, through informal meetings and discussions, to be more engaging, motivating, interactive, and objective-oriented, yet a more in-depth evaluation of some content features and components was required.

Arguably therefore, unlike previous technologies used at the SAITCs, the iPad's extra features that allow anytime and anywhere learning, access to a remarkable number of applications and learning resources, high level of security and control of content, allowance for different forms of social interaction and collaboration to happen, ability to facilitate creating and sharing, presentations, submissions, and e-portfolios, and availability of user-friendly applications that can help instructors to create quizzes and provide grades immediately offer a potentially transformative technology inside and outside the workplace (Chen & Yan, 2016; Hillier & Beauchamp, 2014; Noor-Ul-Amin, 2013).

Interested in learning more about the impact of the iPad in the workplace, I conducted two small-scale studies on the iPad for two PhD program module assignments. The first one was a qualitative study on "Conceptions of the iPad among Teachers at Saudi Aramco Industrial Training Centres", while the second one was a quantitative study on the "The Impact of Using the iPad on Saudi Aramco Trainees' Achievement and General Behaviours". Conducting these two studies helped me to gain more knowledge about mobile learning and helped me to obtain a better understanding of the phenomenon. However, a need for conducting a more comprehensive study to explore the potential role of M-learning in developing employability and job-related skills at the SAITCs and to investigate the key dynamics and features of M-Learning environments together with the absence of relevant research aroused my interest to conduct this study.

1.3. Research Questions

This study set out to answer the following main and sub research questions:

Main Research Question

- To what extent and how can mobile devices play a role in developing employability and job-related skills for trainees at an industrial training workplace?

Sub-Research Question

- What are the key aspects, dynamics, and features of M-Learning environments at VTET contexts?
- What are the potential enhancements of M-Learning environments at VTET contexts?

1.4. Research Motivation

1.4.1. Researcher's Experience and Perspective on Teaching and Learning with M-Learning

My interest in studying and learning about English language methodology and curriculum development has been continuous ever since I joined Faculty of Education, English Department, at Ain Shams University in 1996. However, after joining Saudi Aramco in 2006 as an advanced ITC teacher of English and finding myself immersed in a context which was highly-rich in the most up-to-date educational technologies, my interest was focused more on educational technology. This drove me to take various courses, online and face-to-face, specializing in learning and teaching using specific technologies such as the Interactive Whiteboards, which I hold a certificate from Promethean as a curriculum developer and a certified trainer, and Moodle, which I received my first online course for in 2007 from the University of Wisconsin-Madison, USA in Online Tools and Techniques. My experience with educational technology has been enriched by the master's degree which I obtained from the University of Manchester, UK in TESOL and Educational Technology in 2012. Finally, my PhD program at Lancaster University has significantly helped me to develop a robust philosophical background on the use of educational technology and e-research.

Having this interest in studying and learning about educational technologies, intertwined with my work context that is rich with various technologies, has energized me to investigate the use of these technologies in the workplace. This has been done in the form of some projects I initiated and completed such as converting hard copies of textbooks into flipcharts on ActivStudio program with rich resources and supplementary materials, developing lessons and communities of practice platforms on Moodle, and finally, supervising the implementation of the iPad program at Ras Tanura SAITC. This is in addition to writing research papers for my taught courses for the masters and the PhD degrees on available technologies at my workplace.

I have not taught classes for the past nine years, and thus, I do not have experience teaching using mobile technologies specifically. However, I have been coordinating and supervising the implementation of English programs since 2009 and have observed many classes formally and informally. This position helped in this study as, ostensibly, all insights and findings of this study were based on the practices and comments that participants shared with me and those which I observed in the context of study.

1.4.2. Interest in the Topic

The topic I have chosen for this thesis is important for me for a number of reasons. On a personal level, I am very much intrigued by educational technologies in general, and by M-Learning and mobile technologies in particular. I have a strong belief that mobile technologies have the potential to achieve transformation in learning and teaching processes.

On the academic level, I am very interested in developing and introducing something new in the field of educational research in general, and M-Learning, in particular. I hope that this study will provide some insights to the discussion on using M-Learning in the field of VTET with a special attention to their role in developing the employability and job-related skills. It is also hoped this study will provide an analysis to the key features and dynamics of M-Learning environments at VTET. Introducing the key features and dynamics of M-Learning environments and reflecting on them will add to the academic debate on M-Learning, guide the design and implementation of such training programs at similar contexts, and provide practical guidelines which can lead to informed decisions about creating impactful M-Learning environments. Furthermore, this study contributes to the academic debates on M-learning through a different lens, which is the use of mobile devices at vocational and industrial training contexts. This highlights the importance of this study in terms of its purpose and context.

Finally, another significant reason that has driven me to adopt this topic is professional experience. The training centre where I work has been piloting the iPad for two years and conducting a study on M-learning may provide some insights to the policymakers, curriculum developers, administrators, practitioners, and trainees that may guide them towards better implementation for the program. Insights from this study may assist them to augment the learning/teaching experience using the available mobile devices. Furthermore, Saudi Aramco has been a pioneer and, as often, plays a leading role in developing the community and the other Saudi educational institutes. Evaluating new initiatives and programs in an academic style through such a study can provide insights to the other educational institutes in Saudi Arabia. These reasons formed the main drives to decide on this topic.

1.5. Outline of Thesis

In this chapter, I have done the following:

- introduced the theoretical framework on which the study is based within broader research work.
- outlined the development of my interest in this research, and how it has practical and theoretical background.
- provided background information about the setting of this study, and how the iPad is implemented at the Saudi Aramco Industrial Training centers.
- indicated what I set out to achieve in this study, and how.

The remaining chapters are organised as follows:

- Chapter 2, "Literature Review", contextualizes this study in the relevant literature.
- Chapter 3, "Research Design" is an account of the research methodology and methods of data collection and data analysis.
- Chapter 4, "Findings and Results", provides a detailed discussion of the study findings and results.
- Finally, Chapter 5, Implications and Conclusion" outlines the implications and conclusion for this study.

2. Chapter 2: Literature Review

This chapter is a literature review on VTET, with emphasis on the requirements for developing employability and job-related skills and the role that M-Leaning may play in this area. It is argued that the development of thes skills needs an effective training environment where its aspects and dynamics add to the effectiveness of the training experience. Since M-Learning has been argued to be potentially effective in the training and delivery of VTET, a discussion of M-Learning focusing on M-Learning definition, an adapted model for framing M-Learning and its key aspects and features, and the affordances as well as challenges of M-Learning formed the main domains of this chapter.

2.1. Search Strategy

Searching for relevant literature was based on three factors; firstly, the key concepts of this study which included VTET with focus on the learning outcomes of VTET programs, effective VTET training programs, and vocational, industrial, and employability skills; secondly the concept of M-Learning with focus on its role in VTET, hence covering M-Learning definition, framing, and affordances and challenges; and, finally, the role of M-Learning in developing trainees' key employability and job-related skills and the aspects and dynamics of M-Learning environments. Each factor formed the main boundaries for my literature review.

Searches for relevant literature were conducted on Google Scholar, Education Index, Lancaster University OneSearch, and ERIC databases combining Boolean Logic the following terms:

1. Variations of VTET such as Vocational Education (VE), Vocational Training (VT), Vocational Education and Training (VET), Vocational and Professional Education and Training (VPET), Technical and Vocational Education (TVE), Technical and Vocational Education and Training (TVET)
2. Employability and industrial skills
3. M-Learning, mobile technologies, Tablets, iPads, digital technology, M-Learning frames

Although there were no results that matched the specific scope and focus of this study, more than 3 thousand of results appeared relevant to the above-mentioned main concepts and themes. The abstracts and conclusions for these results were used for selection purposes in order to remove sources that were unrelated to the purpose and findings of this study. 312 published and peer-reviewed articles, opinion papers, and theoretical texts appeared relevant to frame my literature review and included at least one of the following criteria: (1) research conducted in a VTET context; especially adopting M-Learning, (2) on the iPad or other smart mobile devices; preferably in or after 2010 (the introduction of the iPads), (3) focusing on developing employability and job-related skills, and (4) providing an insightful theoretical model or frame applicable to this research.

2.2. Vocational and Technical Education and Training (VTET)

The link between VTET and economic productivity and social well-being has been evidenced by many studies (Akshay, et al., 2012; Allais, 2012; Clarke, & Winch, 2012; Winch, 2000). Arguably, VTET plays a significant role in the development of human resource by creating skilled workforce, increasing industrial productivity, and improving the quality of life (Akshay et al., 2012), and, arguably therefore, constitutes a strategic component of any educational policy (King & Palmer, 2010). Lin et al. (2008) confirmed that the primary goal of VTET is "to provide technical human resource required in economic development of the nation and to solve unemployment" (p. 1). It endeavours to "impart knowledge, skills and attitudes necessary to perform job-related tasks. It aims to improve job performance in a direct way" (Truelove, 1992, p. 273). In this regard, it would appear that practical, precise behaviours, operations, and gestures are easier to acquire through industrial training and appropriate conditions for continual learning (David et al., 2009).

Unlike traditional education which focuses on contemplation of academic concepts, VTET programs focus on and value the mastery of hands-on skills and pursue the idea that "learners acquire more generic and higher-level knowledge together with work professionalism" (Ricky & Rechell, 2015, p. 96). Often this mastery of *'hands-on skills'* requires specifically-tailored training programs, which is a feature that characterizes training at SAITCs.

In this respect, training has been defined as "A planned process to modify attitude, knowledge or skill behaviour through a learning experience to achieve effective performance in any activity or range of activities. Its purpose, in the work situation, is to develop the abilities of the individual and to satisfy current and future manpower needs of the organisation" (Manpower Services Commission (MSC), U.K., 1981, p. 62). Reflective of this perspective, I suggest that it would be valuable to identify the learning outcomes of VTET programs.

2.2.1. Learning Outcomes of VTET Programs

The objective of VTET programs is to equip trainees with the required skills, knowledge, and attitudes to perform a specific job (Baartman & De Bruijn, 2011; Stasz, 2001; Hillage & Pollard, 1998). More specifically, Lucas (2014) clarified that "traditionally vocational education outcomes are framed in terms of skills or competencies relating to particular vocational domains with, recently, a greater interest in what are increasingly referred to as twenty-first century or wider skills" (p. 4). Hence, Bryson (2017) argued that skill is simple and complex at the same time, which he clarified by claiming that "commonly we assume skill refers to one's ability to do things, but when we approach skill from different perspectives it shows us that skill is also located in the job or activity, and that skill is socially constructed" (p. 17). Likewise, King and Palmer (2010) defined skill as the "capability of accomplishing something with precision and certainty and the ability to perform a function acquired

or learned with practice" (p. 32). In light of this, it is argued that to be employed learners, trainees, or apprentices should develop a set of both technical and generic skills.

Whilst, there is no specific list of skill-sets for VTET programs to adopt and deliver to trainees or apprentices, various researchers have introduced different sets of skills that form the learning outcomes of most VTET programs such as Rao (2014), Rodzalan and Saat (2012), Dacre Pool and Sewell (2007), Snell et al. (2002), Kelly (2001), Cheetham and Chivers (1998 & 1996), Hillage and Pollard (1998), Merriënboer, (1997), and Moss and Tilly (1996). Interestingly, the skill-sets that these researchers introduced below form basic requirements at the context of this study and are part of the training program objectives.

Hillage and Pollard (1998) referred to them as 'employability assets', and introduced them in three categories:

> **'baseline assets'** such as basic skills and essential personal attributes (such as reliability and integrity)
> **'intermediate assets'** such as occupational specific skills (at all levels), generic or key skills (such as communication and problem solving) and key personal attributes (such as motivation and initiative), and
> **'high level assets'** involving skills which help contribute to organisational performance (such as team working, self-management, and commercial awareness). (p. 2)

Other researchers continued to distinguish between various skills at two levels: *technical skills* and *generic skills*. Cheetham and Chivers (1996 and 1998) argued that there is a number of generic, high-level, overarching, meta skills which are common to all occupations, and which are defined as skills in acquiring other skills (Hall, 1986), in contrary to those which are more prosaic and more role-specific skills. Cheetham and Chivers (1998) argued that high-level, overarching skills may enable introspection or self-examination. They may either "enhance other (more prosaic) competencies or may be important to their acquisition. They include such things as creativity, analysis, problem solving and self-development (and related learning skills)" (p. 268).

Adopting a different categorization style, Rao (2014), Snell et al. (2002), and Moss and Tilly (1996) distinguished between soft and hard skills. They clarified that soft skills are skills, abilities, and traits that pertain to personality, attitude, and behaviour rather than to formal or technical knowledge. Vaughan (2017) explained that soft skills are generally understood as "socio-emotional, intra-personal and inter-personal skills (for example, communication skills, critical thinking)" (p. 2). Rao (2014) further clarified that the hard skills are "nothing but the core skills, domain skills, and

technical skills. The soft skills complement the hard skills in evolving students as successful professionals" (p. 43).

In a similar way, Merriënboer (1997) distinguished between complex cognitive or technical skills and simple skills. He argued that skills such as doing arithmetic addition, classifying objects, typing, and social and interpersonal skills are examples of simple single skills. Conversely, he argued that skills such as fault diagnosis in electronic system, designing engineered system, language skills, controlling dynamic production processes, developing logistic system, as well as many others are examples of complex skills. Likewise, Lucas (2014) proposed the following six capabilities that go to make up the working competence of a vocational worker:

> 1. Routine expertise (being skilful) 2. Resourcefulness (stopping to think to deal with the non-routine) 3. Functional literacies (communication, and the functional skills of literacy, numeracy, and ICT) 4. Craftsmanship (vocational sensibility; aspiration to do a good job; pride in a job well done) 5. Business-like attitudes (commercial or entrepreneurial – financial or social - sense, 6. Wider skills (for employability and lifelong learning). (p. 4)

Also, Bridgstock (2009) introduced four main types of skills required for maximum employability. These include:

1- **Discipline-specific skills:** These are the skills included in training program curricula to address specific occupational requirements. "These skills originate in specific domains, disciplines or subject matter areas" (p. 37).
2- **Generic skills**. These include such skills as information literacy, working with technology, written and verbal communication, working in teams and numeracy.
3- **Self-management skills.** "These skills relate to the individual's perception and appraisal of themselves in terms of values, abilities, interests and goals" (p. 37).
4- **Career building skills.** These are the skills relating to "finding and using information about careers, labor markets and the world of work and then locating, securing and maintaining work, as well as exploiting career opportunities to gain" (p. 37).

These skill-sets are not far from what has been argued to be *'21st century skills'*, which include mainly some version of the "4 C's (critical thinking, communication, collaboration, and creativity) skills that students need to succeed in higher education and the workplace of the future" (Garwood, 2013, p. 28). Nevertheless, it has to be highlighted that the focus on these skills does not mean that they are just emerging now, or that they are unique to the 21st century. Actually, some researchers and philosophers had these skills in their discussions for at the least 2000 years (Garwood, 2013).

Finally, I argue that generic skills are basic, teachable, transferable skills required to obtain, keep, and do well on a job (Rodzalan & Saat, 2012; Dacre Pool & Sewell, 2007; Kelly, 2001). Arguably, skills such as safety, communication, teamwork, critical thinking and problem solving, Information and Communication Technologies (ICT), leadership, entrepreneurship, typing, searching, lifelong learning and ethics are dominant examples of generic skills (Rodzalan & Saat, 2012). These skills have been imbedded in the SAITCs academic and job skills training programs.

As I draw together the evidence presented above, there may appear to be a lack of a specific list of VTET or employability skills. Moreover, quite a lot of the existing literature focusses on skills in isolation, and usually focusses more on hard skills than soft skills. The present research, conversely, focusses on both kinds of skills - technical and generic skills, and attempts to provide a more holistic overview. Hence, I argue that the following skills form the most commonly cited employability skills that VTET training programs focus on:

- Safety Skills
- Teamworking, Cooperation, and Collaboration Skills
- Craftsmanship Skills (Technical Skills)
- Creativity, Problem Solving, and Critical Thinking Skills
- Presentation Skills
- Communication Skills (Verbal and Written Communication)
- Independent, Self-Development, and Lifelong Learning Skills
- Searching Skills
- ICT Skills
- Typing Skills

Hence, it has to be reiterated that there is potential for a common agreement claiming that the acquisition and development of the above-mentioned skills require effective training programs and strategies (Johnson & Proctor, 2017; Harrison, 2015; Merriënboer, 1997).

2.2.2. Effective VTET Training Programs

Numerous researchers argued that the acquisition and development of VTET or employability skills require effective training programs that cover both discipline-specific skills and generic skills. However, although there appears to be a lack of in-depth research on VTET learners' and instructors' learning and teaching needs that review, develop, and share innovative pedagogical practices, and trade-specific examples of VTET across institutions and industries (Ng et al., 2016; Ricky & Rechell, 2015; Avis, 2014; Lee et al., 2014; Tsang et al., 2014), some existing studies introduced some helpful insights.

For example, Merriënboer (1997) confirmed that "human cognitive processing capacity constrains the acquisition of complex cognitive skills. As effective training strategy should lower cognitive load by not training all constituent skills at once and by decreasing extraneous cognitive load" (p. 29). Rodzalan and Saat (2012) argued that "there is an issue in generic skills deficiency among engineering students" (p. 358). Hence, it is suggested that to overcome this issue, industrial training should serve as the best medium to develop generic skills for students in the academic program where trainees may have the opportunity to integrate the theoretical learning with the practical work (Rodzalan & Saat, 2012). In order to achieve this and to ensure effective delivery of VTET, the vocational pedagogy should go beyond the use of lectures, literature review, and tutorials which are heavily emphasized in traditional schooling (Ng et al., 2016; Ricky & Rechell, 2015). Hashim (2008) argued that the focus on effective training programs has to be shifted more to self-directed learning and self-development methods.

> Work-related training and formal instructor-led courses only contribute to a part of the individual's learning, with the increase now to more self-directed learning and self-development methods. Self-directed learning has most often been used to describe a form of study in which individuals using their own initiative and taking responsibility for their own learning, with and without help of others, for planning, conducting and evaluating their own learning activities, instead of waiting for their organisation to tell them what to learn and how to learn it. (p. 262)

Finally, amongst the pedagogical approaches that have been argued to be effective in facilitating better quality in training and delivery of VTET and employability skills and to engage students in their situated workplaces is M-Learning (Ricky & Rechell, 2015; Pimmer, et al., 2010). Hence, it is argued that although M-Learning has both clearly-identified pros and cons, it has been estimated that its advantages far outweigh the disadvantages (Mingyong, 2015). Arguably therefore, the effectiveness of mobile and flexible technologies to enhance learning and teaching and to facilitate the specific needs in VTET is still uncertain despite the fact that research has showed promising results using M-Learning to enhance learning and teaching in higher educational institutions (Ng et al., 2016). The aim of this study is to twofold: 1) to provide insights into the use of M-Learning in the field of VTET with focus on its role in developing the employability and job-related skills; and, 2) to analyse the key features and dynamics of M-Learning environments at VTET.

2.3. Learning Environment:

In a general sense, a learning environment is the medium where learning and teaching take place. It is the sum of the internal and external circumstances and influences

surrounding and affecting a person's learning (Jawaid & Aly, 2014), and it is "dependent upon each and everything in an educational organization like curriculum design, teaching methods, teachers' behaviour with students, the atmosphere during teaching sessions, the social and academic environment and support system during stress" (Jawaid & Aly, 2014. P. 319). Similarly, the Glossary of Education Reform, referred to 'learning environment' as "the diverse physical locations, contexts, and cultures in which students learn" (para. 1). Finally, according to Bates (2015), a learning environment includes:

- the characteristics of the learners
- the goals for teaching and learning
- the activities that will best support learning
- the assessment strategies that will best measure and drive learning
- the culture that infuses the learning environment.

Recognizing how mobile devices may play a role in maintaining, altering, adding, and/or augmenting the relations between these components of M-Learning environments, and also exploring the emergent dynamics, aspects, and features of M-Learning environments is one of the key purposes of this study. More specifically, this study will focus on the emerging behaviours and roles of instructors and learners, the forms of interaction, the role of the digital learning materials and content, and the types of learning, engagement, and performance; all of which form key aspects of M-Learning environments.

2.4. M-Learning

The role of Information and Communication Technologies (ICTs) more generally and mobile technologies in particular in improving learning has been explored by many researchers. It has been argued that ICTs have the potential to innovate, accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, and to strengthen teaching and help schools change (Matthew, Joro, & Manasseh, 2015; Nwokeafor, 2015; Serah, 2014; Adu, 2013). The use of ICTs such as simulations, videos, and multimedia computer software that combine text, sound, and colourful moving images avail opportunities that can make learners more immersed in the learning process. Arguably, ICTs have the potential to make complex processes easier to understand, foster co-operative learning and reflection on the content, provide opportunities for adapting the learning content and tasks to the needs and capabilities of each individual learner, support the development of complex thinking skills, and engage learners in constructing their own knowledge (Bai, Mo, Zhang, Boswell, & Rozelle, 2016; Anderson & Rainie, 2012; Livingstone, 2012). Mobile devices are the latest forms of ICTs used in education, and they are the most distinguishing aspect of M-Learning.

2.4.1. Defining M-Learning

Currently, there is no agreement upon a definition for M-Learning (Crompton, 2013; Keskin & Metcalf, 2011; Nordin, et al., 2010). Kukulska-Hulme (2009) attributed this lack of agreement partly to the rapid evolution that this field is experiencing, and to the lack of a definition of mobility and whether it is related to learner mobility, device mobility, or content mobility.

As a result, researchers have given M-Learning numerous and different definitions. However, literature review indicates that these definitions proposed by different researchers fall under six main categories; specifically, (1) Technological Aspect/Device, (2) Functional Components and Communication Style, (3) Mobility, (4) Ubiquity, (5) Convenience, Expediency, and Immediacy, and (6) Tool-mediated and Socio-cultural Activity. The table below (Table 2.1) summarizes some of the definitions, their classifications, and the researchers who introduced them.

Classifications	Authors (Year)	Definition of M-Learning
Technological Aspect/Device	Clarke & Svanaes (2014)	Learning using mobile technologies such as mobile phones, smartphones, e-readers and Tablets.
	Sarrab & Elgamel (2012)	The use of mobile and handheld IT devices, such as mobile telephones, laptops, PDAs and tablet PC technologies, in training, learning and teaching.
	Stevens & Kitchenham (2011)	Meaningful learning that occurs through the use of wireless handheld devices such as cell phone, personal digital assistant, mini-computer, or iPod.
	Quinn (2000)	Learning through mobile computational devices.
Functional Components and Communication Style	Chang, Sheu, & Chan (2003)	Mobile learning has three essential elements: the mobile learning device, the communication infrastructure and a learning activity model.
	Hoppe, Joiner, Milrad & Sharples (2003)	It is e-learning using mobile devices and wireless transmission.
Mobility	Wassa, Hotte, Diop & Niang (2015).	The act of learning using mobile devices and wireless technologies in order to promote learner mobility.

Ubiquity	Hummel & Hlavacs (2003)	A situation in which a multitude of connected and embedded systems and devices work together to build an ambient computing environment … allows [people] both to access learning content from anywhere at anytime, and to communicate with colleagues or lecturers synchronously and asynchronously much more frequently.
	Ozdamli & Cavus (2011), Stevens & Kitchenham (2011), Quinn (2000)	A learning model that allows learners to obtain learning materials anywhere and anytime using mobile technologies and the internet.
	Kesk & Metcalf (2011)	The exploitation of ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning.
	MoLoNET (2007)	The exploitation of ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning.
Convenience, expediency, and immediacy	Peng, Su, Chou, & Tsai (2009)	Mobile learners use ubiquitous computing technologies to learn the right thing at the right time at the right place.
Tool-mediated and socio-cultural activity	Sharples, Taylor & Vavula (2007)	The process to know through connections across multiple contexts among people and personal interactive technologies.

Table 2.1: Classifications of M-Learning definitions, 2018.

Arguably, these definitions do not provide a comprehensive definition for M-Learning as they focus only on individual aspects or features of M-Learning as indicated in the six categories above (Pimmer, et al., 2010). Moreover, there appears to be a lack of discussion of the learning objective and learning materials or contents in these definitions. To this end, I suggest that providing a comprehensive definition for M-Learning can start from providing a general definition of learning and casing it with the distinguishing aspects of the M-Learning.

Primarily, learning itself has been defined from different perspectives. Passey (2014) explained that learning is made up of many constituent parts and that different theories and constructs of learning (such as behaviourism or behaviourist approaches,

social constructivist approaches, social constructionist approaches, computer-assisted learning or e-learning, computer-supported collaborative learning, and networked learning) have been adopted and given more attention by different researchers. Passey (2014, p. 9) argued that "different researchers have taken different perspectives, and that different constructs are viewed from different positions", and proposed that learning, in a general sense, can be defined as "a gaining of knowledge, ideas or concepts not already known or recognised" (p. 8).

If we add the well-grounded, distinguishing aspects of M-Learning to this general definition of learning, I, thus, define M-Learning as 'a type of learning that allows learners, as individuals or groups, to gain knowledge, ideas, skills, or concepts not already known or recognised from formal or informal contents using mobile technologies at anytime and anywhere'.

This definition provides a more comprehensive and clearer explanation of M-Learning and its distinguishing aspects and features. Arguably, it has a socio-cultural background; it sets the objective of learning as the gaining of new knowledge, ideas, and skills; it identifies the scope of learning from various types of learning materials and contents whether formal and informal; it identifies the technological medium of learning, specifically, mobile technologies; and it incorporates ubiquity; thus, highlighting learning through different contexts.

Adopting such a holistic and socioculturally-oriented definition has the potential to act as a guiding tool to the process of identifying the key dynamics, aspects, and features of M-Learning Environments. It can also provide a useful lens to practitioners and other researchers to understand the key elements of M-Learning. However, in order to validate this definition, an identification of the distinguishing aspects and features of M-Learning has to be evaluated. Hence, this discussion should start with a representation of a model for framing M-Learning, or rather more accurately, an adapted model for framing M-Learning.

2.4.2. A Model for Framing M-learning

Why Framing?

Framing in social sciences is given due attention as it facilitates the process of representing a set of theoretical perspectives on how reality is perceived, organized, and communicated by individuals and groups. Framing is given several definitions. Entman (2007) defined framing as "the process of culling a few elements of perceived reality and assembling a narrative that highlights connections among them to promote a particular interpretation" (p. 164). Gamson and Modigliani (1987) defined a frame as "a central organizing idea or story line that provides meaning to an unfolding strip of events, weaving a connection among them" (p. 376). Frames are argued to put issues into meaningful contexts by using and drawing on culturally available ideas and symbols (Schön, 2001). The concept of *context* is crucial to framing because

providing a context within which information is presented and processed "allows framing to be applied across a broad spectrum of communication situations" (Hallahan, 1999, p. 209).

Framing fundamentally involves selection and salience. To frame is "to select some aspects of perceived reality and make them more salient in the communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation and/or treatment recommendation for the item described" (Entman, 1993, p. 55). Hence, well-established frames may perform four functions; specifically, *problem definition*, *causal analysis*, *moral judgment*, and *remedy promotion* (Entman, 2007). In the context of this study, endeavours have been made to explore and provide an adapted and well-established frame for M-Learning. This will primarily help to provide a definition for the topic under study, M-Learning, and make moral judgements by evaluating the causal agents and aspects of M-Learning as well as their effects. Suggesting remedies to current learning processes may also result from framing M-Learning in this research.

2.4.3. Framing M-learning

Although M-Learning has been intensively researched since its term became recognized in 2005, attempts to introduce a comprehensive or sophisticated model for framing it are still modest (Crompton, 2013). Arguably, there have been some attempts to produce a framework for M-Learning which ranged from complex multi-level models to small ones which omit or ignore important features and aspects of learning or pedagogy (Rikala, 2015; Kearney, et al., 2012; Ozdamli, & Cavus, 2011; Park, 2011; Wingkvist & Ericsson, 2010; Laurillard & Pachler, 2007).

Hence, in his review of the models and frameworks for designing M-Learning experiences and environments, Hsu and Ching (2015) categorized and synthesized a total of 17 suggested models and frameworks (Table 2.2). They were divided into five categories: 1) pedagogies and learning environment design; 2) platform/system design; 3) technology acceptance; 4) evaluation; and 5) psychological construct.

Category (number of articles)	Author (Year)	Proposed Framework/Model
Pedagogies and Learning Environment Design (6)	Koole (2009)	The Framework for the Rational Analysis of Mobile Education (FRAME)
	Peng, Su, Chou, & Tsai (2009)	The Conceptual Framework of Ubiquitous Knowledge Construction
	Park (2011)	A Pedagogical Framework for Mobile Learning in Distance Education

	Schmitz, Klemke, & Specht (2012)	A Framework of Analysis of Design Patterns for Mobile Learning Games
	Abdullah, Hussin, Asra, & Zakaria (2013)	Mlearning Scaffolding Five stage Model
	Ng & Nicholas (2013)	A Person-centered Sustainable Model for Mobile Learning Platform/System Design (5)
Platform/ System Design (5)	Taylor, Sharples, O'Malley, Vavoula, & Waycott (2006)	Task Model for Mobile Learning
	Motiwalla (2007)	An M-Learning Framework (for designing applications for collaborative learning)
	Parsons, Ryu, & Cranshaw (2007)	A Framework for M-Learning Design Requirements
	Uden (2007)	Using Activity Theory as a Framework for Designing Mobile Learning
	Zurita & Nussbaum (2007)	The MCSCL Framework (based on Engestrom's Expanded Activity Theory Model) Technology Acceptance (4)
Technology Acceptance (4)	Huang, Lin, & Chuang (2007)	An Extended Technology Acceptance Model (in the context of mobile learning; adding perceived enjoyment and perceived mobility value)
	Yau & Joy (2010)	A Mobile Learning Preferences Model
	Chang, Yan, & Tseng (2012)	An Extended Technology Acceptance Model (in the context of mobile learning; adding perceived convenience)
	Park, Nam, & Cha (2012)	A General Structural Model of Students' Acceptance of Mobile Learning
Evaluation (1)	Vavoula & Sharples (2009)	A 3-Level Evaluation Framework of Mobile Learning Psychological
Construct (1)	Sha, Looi, Chen, & Zhang (2012)	An Analytic Self-Regulated Learning (SRL) Model of Mobile Learning

Table 2.2: Models and Frameworks for Designing M-Learning Experiences and Environments, (Hsu and Ching, 2015).

Arguably, these frameworks represented fragmented endeavours in the process of framing M-Learning. Rather than researchers develop a comprehensive model or framework based on findings of previous research, they continued to develop new

models separately. Besides, researchers' findings were generally based on small-scaled, narrow, and context-based studies. In this respect, and attempting to avoid some of these drawbacks, I tried to adapt and introduce a model for framing M-Learning which is based on a well-recognized model, Koole's (2006) Framework for the Rationale Analysis of Mobile Education (FRAME) (Figure 2.1), and which has a social-cultural background.

Arguably, Koole's FRAME best fits with the purpose of this study which is to explore the role of mobile devices in developing employability and job-related skills and to identify the key dynamics, features, aspects as well as the potential enhancements of M-Learning environment. For example, Hsu and Ching (2015) argued that there are four models and frameworks categorized under pedagogies and learning environment design, and on top of them is Koole's FRAME, The Framework for the Rational Analysis of Mobile Education. Also, Asiimwe, Grönlund, and Hatakka (2017) argued that researchers and practitioners used the FRAME model to explain the dynamics of a mobile learning environments. Furthermore, Laohajaratsang (2013) argued that the FRAME model can be used as a reference model for evaluation in a pilot studies to design M-Learning activities. It provides a simple, intuitive, and concise way for considering and designing mobile learning activities (Hsu & Ching, 2015). Likewise, Porumb et al. (2013) argued that the FRAME model can be used as a conceptual model to design and develop a learning management systems and application. They proposed that using the FRAME model in design and development "can bring together the technical perspective and the didactical perspective" (p. 96). Finally, Hsu and Ching (2015) argued that Koole's framework has the potential to provide "a practical checklist to assist educators when considering the foundational components and intersections of components of mobile learning when designing M-Learning curricula" (p. 7).

Further to that, Koole (2006) explained that this model is intended "to establish a description of the mobile learning process which, in turn, will allow the development of an operational definition of mobile learning" (p. 32). According to Hosler (2016), Koole's FRAME is "a model for guiding the development of learning materials, mobile pedagogy, and learning strategies, and is readily applied to inquiry-based, authentic learning experiences" (p. 384). It is a heuristic model which is, according to Koole (2011) "a tool like a lens, that allows someone to critically examine a given phenomenon" (para. 3). These advantages support my decisions to adopt and adapt Koole's FRAME for this research.

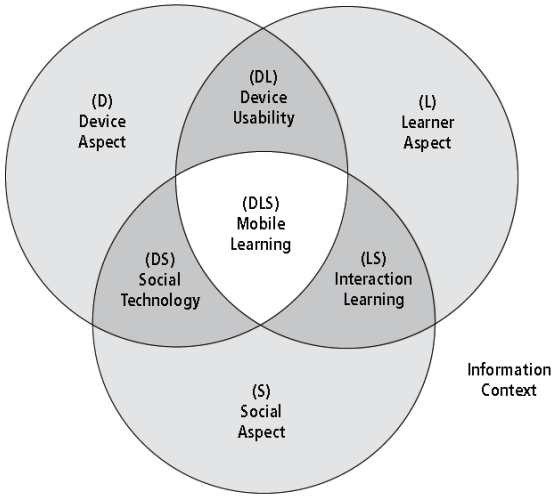

Figure 2.1: The FRAME Model, (Koole, 2006).

The FRAME model consists of a three-circle Venn diagram representing the learner aspect (L), the social aspect (S) and the device aspect (D). The circles overlap in the Venn diagram representing the attributes of the relationships between the three aspects. Koole (2009a) concluded that M-Learning is a combination of the interactions between learners, their devices, and other people:

> The intersections where two circles overlap contain attributes that belong to both aspects. The attributes of the device usability (DL) and social technology (DS) intersections describe the affordances of mobile technology (Norman 1999). The intersection labelled interaction learning (LS) contains instructional and learning theories with an emphasis on social constructivism. All three aspects overlap at the primary intersection (DLS) in the centre of the Venn diagram. Hypothetically, the primary intersection, a convergence of all three aspects, defines an ideal mobile learning situation. By assessing the degree to which all the areas of the FRAME model are utilized within a mobile learning situation, practitioners may use the model to design more effective mobile learning experiences. (p. 27)

Although this FRAME model structures some key aspects of M-Learning, it ignores another key aspect which is *content*. It is true that Koole highlighted that "effective mobile learning can empower learners by enabling them to better assess and select relevant information"; however, *information* is apparently different from *learning content*. While information is general, content is a course- and objective-based, trustworthy, focused, digestible, and end-user directed forms of carefully-selected information. Leibtag (2010) explained that information informs us how to make our content better.

> Content answers the question, “So what?” Content explains how a topic or solution or idea relates to you. Information does not. Content advises you on what to do next. Information does not. Content is like a trustworthy consultant. Information is like an encyclopedic professor. Content does the heavy lifting of interpreting information so you can make a decision or take action. (Jones, 2012, para.2)

In this sense, I further enhanced Koole’s FRAME to include content as a fourth key aspect for M-Learning; the thing which will result in new features, attributes, and dimensions of M-Learning and a better description of its processes and effective learning experiences (Figure 2.2). The adapted model - LDSC Frame Model For M-Learning - consists of four layers of basic and complicated intersections.

The first layer consists of the basic aspects that form the foundations of M-Learning which are the learner (L), the device (D), the social (S), and the content (C) aspects. The second is the basic bipolar intersections between the basic aspects, and they are the learner/device intersection (LD), the device/social intersection (DS), the social/content intersection (SC), and the learner/content intersection (LC). Although the Venn diagram shows only four types of intersections at this level, there are two other intersections that are not clearly outlined here; namely, the learner/social intersection (LS) and the device/content intersection (DC). These two intersections will be represented and elaborated on at higher layers of this diagram.

The third layer of intersections is tripolar and is a higher level of combinations between the basic aspects and bipolar intersections. Finally, the fourth layer and the highest level of intersection is the proposed representation of M-Learning which, hypothetically, defines an ideal M-Learning situation and experience. These aspects will be more elaborated on below.

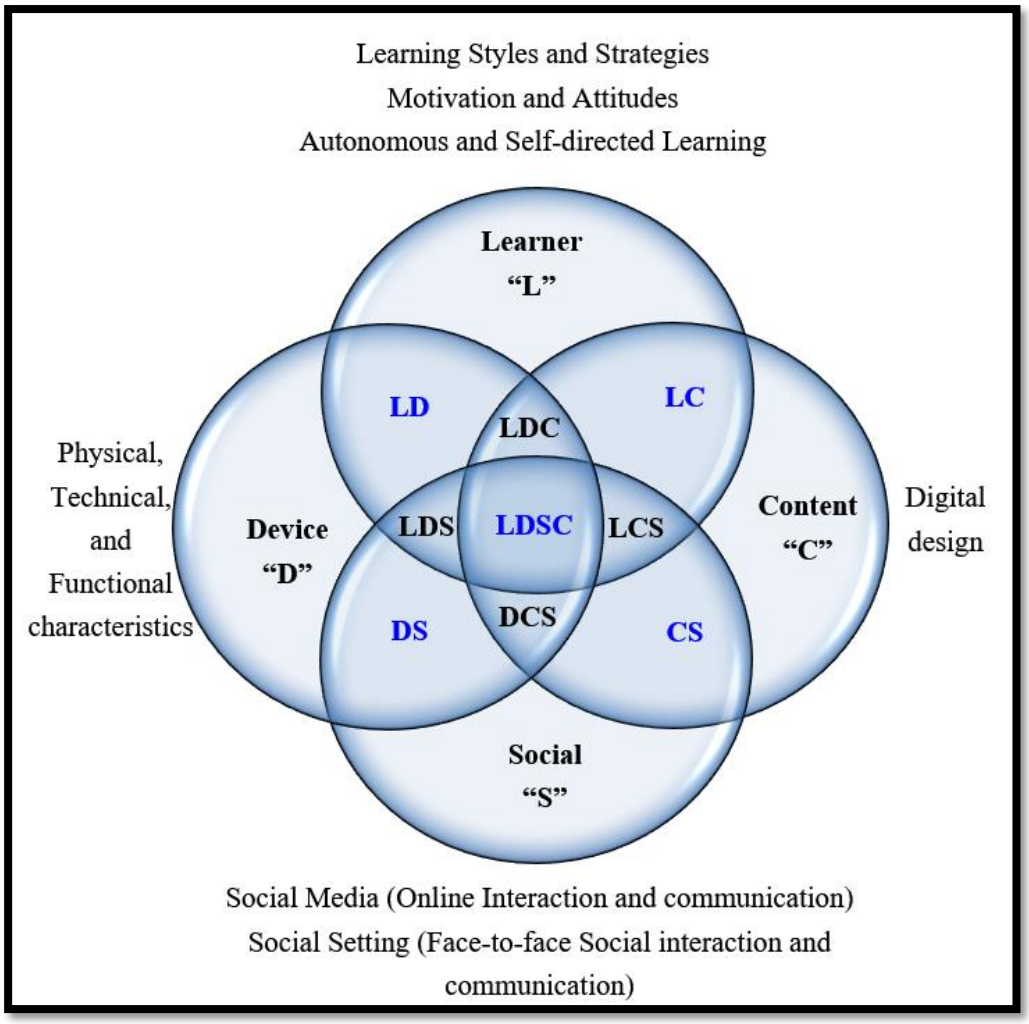

Figure 2.2: Adapted Frame Model For M-Learning, 2018.

The first layer consists of the basic aspects that form the foundation of an ideal M-Learning situation and experiences. These include: the learner (L), the device (D), the social (S), and the content (C) aspects.

2.4.3.1. Learner Aspect (L)

The learner aspect (L) (Figure 2.3) considers the learner's characteristics that have been argued to impact the learning process and its outcomes. These are predominantly:

- Learning Styles and Learning Strategies
- Motivation and Attitudes
- Autonomous and Self-Directed Learning

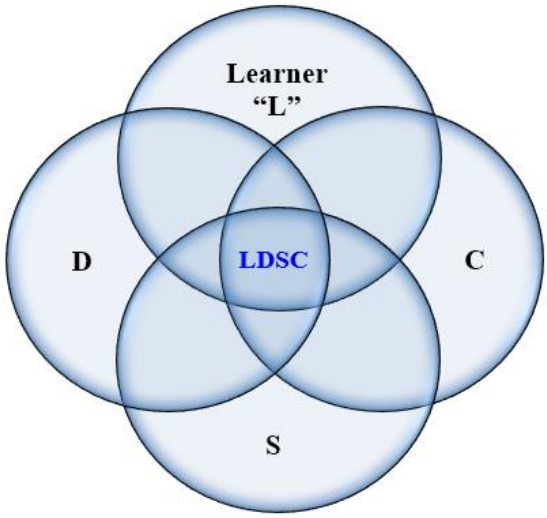

Figure 2.3: The Learner Aspect (L), (Koole, 2006).

- **Learning Styles and Learning Strategies**

Learning styles are simply preferred and habitual cognitive styles or approaches which are applied when individuals respond to learning tasks and when organizing and representing information. They are most probably inborn or fixed early in life (Riding & Rayner, 2012; Das, 1988).

In this regard, several theories exploring learning styles have been introduced and applied in educational practices. Eminent examples are 'Felder-Silverman Learning Style Theory' (Felder, 1993; Felder & Silverman, 1988), 'Gardner's Multiple Intelligences Theory' (Gardner, 1993), and 'Kolb's learning style theory' (Kolb, 1984; Kolb & Fry, 1975). Arguably, Felder's Model is the most appropriate for the overall focus of this study, which is M-Learning. Felder and Silverman described learning styles, distinguishing between preferences on four dimensions: active/reflective, sensing/intuitive, visual/verbal, and sequential/global. Lin (2004) elaborated on Felder and Silverman's learning style theory, providing classification of student learning styles and their implementation rules which help both theoretical and practical applications. Table 2.1 below combines and summarizes Felder's Leaning dimensions and Lin's classifications and their implementation rules. Carver et al., (1999) argued that "while these preferences are dynamic on a daily basis, in general an individual can be categorized with a preferred learning style in each dimension" (p. 34).

Implementation Rules	Definition	Dimension Or Learning Style		Definition	Implementation Rules
• Providing discussion area • Reminding student to guess several possible questions	**(Do it)** Study in groups to discuss, guess possible question and answer them, find ways to do something with learning concepts.	**Active**	**Reflective**	**(Think about it)** Think about quietly before going ahead; stop periodically to review what have been learned, write summaries.	• Think before going ahead • Stop periodically to review what have been learning • Writing summaries
• Example first and following is the exposition • Hand-on work, such as practicing in the applying environment	**(Facts)** Learn facts, example followed by the exposition, hand-on work, practical material.	**Sensing**	**Intuitive**	**(Concepts)** Abstract, concept, theory, exposition before example.	• Exposition first and following is the example • More concept and abstract
• More pictures, graphs, diagrams • Animation and demonstration • Colour important concepts	**(Pictures)** Graphs, diagrams, flow charts, schematics, demonstrations, concept maps, colour notes, slides with multimedia.	**Visual**	**Verbal**	**(Audio and text)** Require reading or lecture	• Text • Audio
• Step by step to present material • Constrict links	**(Step by step)** Logically present or outline the material in order.	**Sequential**	**Global**	**(Big picture)** Large picture precede detail, context of the subject.	• Give big picture of the course • Provide all the links

Table 2.3: Felder's Leaning Dimensions and their Implementation Rules (Lin, 2004; Carver, Howard, & Lane, 1999).

Conversely, learning strategies are explained as a sequence of operations and procedures that a learner may use to achieve learning or to acquire, retain, and retrieve different kinds of knowledge and performance (Zafar & Meenakshi, 2012; Das, 1988; Schmeck, 1988). Ehrman, Leaver, and Oxford (2003) reported six main groups of learning strategies:

1. Cognitive strategies enable the learner to manipulate the language material in direct ways, e.g., through reasoning, analysis, note-taking, and synthesizing.

2. Metacognitive strategies (e.g., identifying one's own preferences and needs, planning, monitoring mistakes, and evaluating task success) are used to manage the learning process overall.

3. Memory-related strategies (e.g., acronyms, sound similarities, images, key words) help learners link one L2 item or concept with another but do not necessarily involve deep understanding.

4. Compensatory strategies (e.g., guessing from the context; circumlocution; and gestures and pause words) help make up for missing knowledge.

> **5. Affective strategies**, such as identifying one's mood and anxiety level, talking about feelings, rewarding oneself, and using deep breathing or positive self-talk, help learners manage their emotions and motivation level.
> **6. Social strategies** (e.g., asking questions, asking for clarification, asking for help, talking with a native-speaking conversation partner, and exploring cultural and social norms) enable the learner to learn via interaction with others and understand the target culture. (p. 316)

The importance of identifying, understanding, and considering learning styles and strategies is that they significantly impact the learning process and its outcomes (Lin, 2004). Arguably, the popularity and prevalence of the learning-styles approach is attributed to its success in fostering learning and instruction (Pashler, McDaniel, Rohrer & Bjork, 2008). For example, understanding learners' individual differences may lead to an appropriate inclusion of learning materials that match or serve various cognitive and learning styles and strategies in course design and pedagogical practices (Riding & Rayner, 2012). Furthermore, Li, Medwell, Wray, Wang and Xiaojing (2016) argued that the usefulness of learning styles could also be shown to impact instructors' understanding of the learners' individual differences. Learning might be better facilitated if instructors were cognizant of both their teaching styles and the learning styles of their students (Romanelli, Bird, & Ryan, 2009).

> When teachers are critically aware of learning styles, they are likely to be very careful when designing a lesson plan, during their teaching, and when assessing individual students. Similarly, when parents are critically aware of learning styles, they may be more understanding of their children's differences from others and be more supportive of their children. Supportive parents are important in influencing pupils learning (Desforges & Abouchaar, 2003). Furthermore, in Othman and Amiruddin's studies, learning style approaches are found to some extent to improve students' motivation (2010). (Li et al., 2016**, p. 92)**

Moreover, Wetzig (2004) argued that "evidence suggests that through improving students' awareness of their own learning style, they are better able to take responsibility for their own learning, which leads to improved learning outcomes" (p. 3). Another benefit of understanding and recognizing the learning styles and learning strategies is that it helps educators and practitioners to treat learners as unique individuals (Pashler et al., 2008). As a result, many researchers recommend that instructors provide a diverse range of learning activities and strategies for learners in an effort to accommodate differences in learning styles and learning strategies (Wetzig, 2004; Harris et al 1995; Brown 1998: Felder & Silverman 1998).

Henceforth, it can be argued that the incorporation of the discussion about learning styles and learning styles is grounded in the belief that they may impact the aspects of 'Learner (L)'and 'Content (C)' of the adapted LDSC model.

However, learning styles and learning strategies have been critiqued for almost as much as they have been suggested. For example, there appears to be no empirical evidence to suggest that instruction should be tailored to individual learning styles (Sutherland, 2014; Rohrer & Pashler, 2012; Paterson & Pratt, 2007). Li et al. (2016**)** argued that there is a lack of research evidence supporting the validity of relying on learning styles in a pedagogical context. Moreover, it is a complicated process for instructors to understand and identify the learners' various learning styles and learning strategies and not all learning contexts enable course designers, instructors, and learners to design learning materials, courses, and strategies (Hall & Moseley, 2005).

Finally, Sutherland (2014) critiqued the process of labelling learners as having a particular style of learning.

> When pedagogy is adapted to the learning style of the group being educated, the educator does not challenge the creative thinking of the student. The dichotomous nature of learning styles infers that students are ultimately one type of learner or another (Coffield et al., 2004). For example, a learner may be considered a converger versus a diverger, a pragmatist versus a theorist or a concrete versus abstract learner. Furthermore, when students in a group are from varied cultures, the proposed style of teaching may not have the same impact on international students (Scott, 2010). (Sutherland, 2014, p. 25)

Hence, and from a different lens, the impact of ICT on learning styles and learning strategies has been highlighted by many studies (Attwell, 2007; Pachler, 2005; Shaw & Marlow, 1999). It is argued that learners of this generation, 'digital natives', (Prensky, 2001, p.1) who grow up with new technology, and who are "the 'native speakers' of the digital language of computers, video games and the Internet" have been greatly influenced by their competency in using various ICTs (Bull, Thompson, Searson, Garofalo, Park, Young, & Lee, 2008, p. 6). For example, their usage of different technologies at formal and informal settings has continued to impact their learning styles, strengths, and preferences (Centeno & Sompong, 2012). Furthermore, Whittenberger (2013) listed four ways in which technology impacts and improves learning:

- Students can interact with the technology at their own pace and review material when necessary to aid understanding or memory.

- Computer-based tools help students develop their visual, kinesthetic, aural, and oral skills.
- Students with physical disabilities can use computers with adaptive devices so that they can participate fully with their classmates.
- Computers help students transform data from numbers to graphs or translate words from one language to another. (para. 14)

Specific to M-Learning, existing research confirmed that M-Learning has the potential to support diverse learning styles and provide a mechanism where learners will have their own individualised learning processes (Kukulska-Hulme, Sharples, Milrad, Arnedillo-S´anchez, & Vavoula, 2009; Yau & Joy, 2006). Mobile technologies share all features of 'traditional' technologies in addition to their specific features which include portability, all in one (no attachments or peripherals are required), constant connectivity, and easier access to a lot of resources. Therefore, program designers and developers as well as teachers and practitioners have to pay attention to employing the specific features of mobile technologies to augment the learning process and maximise the benefit resulting from meeting different learning styles and strategies.

- **Motivation and Attitudes**

Motivation and attitudes determine the level of effort that students exert for learning and for the success of the learning process (Eddy, 2012; Zafar & Meenakshi, 2012; Ellis, 1985). According to Ehrman et al. (2003), psychological research indicated that successful learners usually have positive attitudes toward learning, a need for achievement, and a high degree of intrinsic motivation. Researchers have introduced various classifications for motivation, and mainly identified three types:

- **Global Motivation**, which consists of a general motivational orientation to the goal of learning at the personality level.
- **Situational Motivation**, which refers to the motivation experienced by a learner toward a given situation or activity at a specific point in time.
- **Task Motivation**, which is defined as the motivation for performing particular learning tasks and is a combination of generalized and situation-specific motives (Dornyei & Tseng, 2009; Guay & Mageau, 2003; Ellis, 1985).

Existing literature indicated that motivation is afforded by the aspects of M-Learning, which include '*control over goals'*, '*ownership'*, '*fun'*, '*communication'*, and *'learning-in-context'*. Shannon (2016), Yang (2012), and Laurillard and Pachler (2007) argued that in M-Learning environments, motivation is increased by an association with the social and entertainment features of the device, when learners are engaged in authentic learning tasks, and when task-based assignments are availed to learners. However, I argue that measures to enhance learners' intrinsic motivation

when implementing M-Learning programs need to be identified and embedded in the training programs based on many factors and variables such as learners' age, learners' knowledge of using the device and content, program objectives and resources, and teaching models.

- **Autonomous and Self-Directed Learning**

Holec (1981) defined learner autonomy as learner self-direction and control of the learning process. Zhang (2016) elucidated that it is also "a capacity for detachment, critical reflection, decision-making and independent action" (p. 7). Autonomous learning makes learners more accountable for and independent in their own learning, and it is, thus, based on the principle of choice of learning objectives and strategies for achieving those objectives (Cotterall, 2000). It involves "finding problems, setting a goal, making up plans, selecting contents, self-evaluation" (Qing, 2016, p. 115).

Lyddon (2016) argued that autonimous learners should possess these five characterstics: compliance, competence, cognizance, introspection, and diplomacy. They can be represented on a horizontal cline, with increasingly autonomous learners displaying more of them from left to right.

> The least autonomous students are non-compliant, that is, they chose not to participate in the assigned learning activities. Those who are compliant but incompetent participate but may not follow the prescribed requirements out of lack of understanding and failure to seek clarification. Those who are only additionally competent follow the assignment directions to the letter while sometimes awkwardly violating the intended pedagogical purpose. Those who are traditionally cognizant also understand the teacher's rationale, those who are introspective can see the personal value of the assignment, and those who are diplomatic can negotiate task completion accordingly. (Lyddon, 2016, p. 305)

In this regard, M-Learning is argued to have availed new potentials for increased learner autonomy by providing a means of ubiquitous learning as well as access to a limitless variety of rich and multimodal content. Even greater levels of learner autonomy can be achieved by including training on how to take advantage of mobile technologies in learner training programs. Lyddon (2016) elaborated that "as technological artifacts can be considered extensions of our physical and mental faculties, mobile technologies open up promising new possibilities in terms of the exercise of learner autonomy" (p. 306).

Hence, I argue that the impact of the learner aspect (L) on the effectiveness of M-Learning is determined by the level learners are trained to use the mobile devices and their readiness to shift from paper-based environment to blended learning

environment or fully digital curriculum. Conversely, M-Learning may help to enhance the learning process through the opportunities it provides for diversified learning styles and learning strategies, access to a limitless variety of rich and multimodal content, and opportunities for enhancing the motivation level of learners by the aspects of ownership, fun, communication, and learning in context. This is reflective of the perspective of Koole (2009a) who suggested that M-Learning may help to "enhance encoding, recall, and transfer of information by allowing learners to access content in multiple formats and highlighting the contexts and uses of the information" (p. 3).

So far, the discussion of the learner aspect (L) has focused on learning styles and learning strategies, motivation and attitudes, and autonomous and self-directed learning. The evidence supporting this discussion is grounded in the principle that these factors have a significant impact on the learning process, and, thus, M-Learning programs have to be designed in a way that takes these factors into consideration.

2.4.3.2. Device Aspect (D)

The device aspect (D) (Figure 2.4) refers to the medium where M-Learning occurs, for example, mobile devices such as tablets, iPads, and mobile phones. Such devices are versatile technologies that enable browsing the internet, taking high-definition pictures, reading online journals and books, making high quality video and audio recordings and conversations as well as many other learning-oriented functions (Hillier & Beauchamp, 2014; Kucirkova et al., 2014; Mullen, 2014; Vu, 2013).

Mobile devices are the distinguishing element of M-Learning, and it is argued that their impact on M-Learning is determined by the physical, technical, and functional characteristics of the device. These characteristics result from the hardware and software design of the devices. What distinguishes mobile devices over the other technologies with the same features is that they do not require wiring to other peripheral devices. Mobile devices, with their portability and multi-functionalities, have been argued to make learning "expedient, immediate, authentic, accessible, efficient and convenient" (Lai, Yang, Chen, Ho, & Chan, 2007, p. 328).

The portability and multi-functionalities, together with the simple interface and the high resolution multi-touch displays, of the mobile devices have made them popular with a broad range of users of all ages (Kucirkova et al., 2014). In this respect, it is argued that the most effective use of the mobile devices varies depending on learners' age, subject area, preparedness of teachers, available technical support, learning content and materials, and learning goals and outcomes (Henderson & Yeow, 2012). Some schools, adopting the concept of Bring Your Own Device (BYOD), make use of the learners' mobile phones for specific reasons such as popularity, convenience, and availability. Others may adopt specific types of mobile devices as convenient (Moreira, Ferreira, Santos, & Durão, 2016; Thornton & Houser, 2005).

Considering this, the device design and capabilities have a significant impact on the physical and psychological comfort levels of the users (Koole, 2009a; Koole, 2006). The device physical characteristics include device size, weight, physical comfort, input and output capabilities, and processes internal to the machine such as storage capabilities, power, processor speed, compatibility, and expandability (Koole, 2009a; Koole, 2006). A well-designed device should facilitate the learning tasks and activities and enable the learner to focus on them rather than on the tools for accomplishing them. Hence, I argue that the faster, more comfortable, user-friendly, reliable, and compatible with other technologies the device is, the higher the physical and psychological levels of the users are, and the more effective the device.

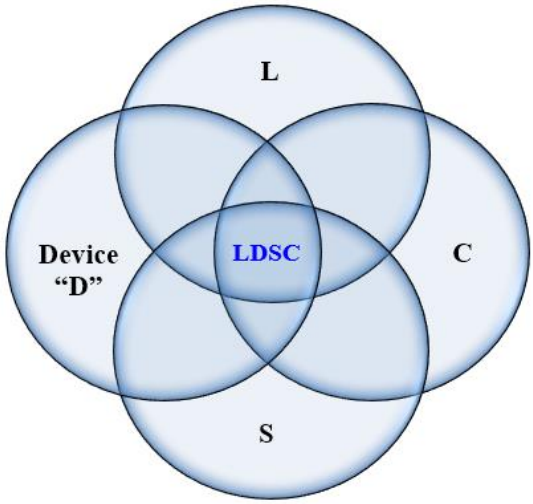

Figure 2.4: The device aspect (D), (Koole, 2006).

2.4.3.3. Social Aspect (S)

The social aspect (S) (Figure 2.5) takes into account the processes of social interaction, cooperation, networking, and communication in the learning process. I argue that there are two versions of this aspect: the social media and the social setting. The social media refers to Web 2.0 technologies and social media applications such as YouTube, Blogs, Skype, Facebook, Linkedln, Wikis, Twitter, and Flickr (Pimmer & Tulenko, 2016). But the social setting refers to the learning environment with its face-to-face interaction and communication which includes the classroom, the institute, and the larger communities.

The social aspect in the learning process is well-grounded in the educational and socio-cultural research. Some of the learning theories and constructs that argued for the importance of the social aspect in learning include situated learning (Lave & Wenger, 1991), Socio-cultural theory (Vygotsky, 1978), Connectivism (Siemens, 2004), and Navigationism (Brown, 2006). The key features that characterise the social aspect are communication, interaction, and collaboration amongst all the participants in the learning process.

Social media applications (Apps) are argued to introduce new channels of communication, facilitate social interactions through various user-friendly platforms, allow users to take more active roles, and provide tools for collaborative work (Hsu & Lin, 2017; Kim, Jeong, Dwivedi, & Zhang, 2016; Pimmer & Tulenko, 2016). Social media create collaborative teams and learning communities that advance students' participations and engagements and play a significant role in constructive learning (AlHajri, Al-Sharhan, & Al-Hunaiyyan, 2017; Ng, R., Lam, Ng, K., & Lai, 2016). Ada, Stansfield, and Baxter (2015) confirmed that "social media plays an important role in helping facilitate and promote participatory information sharing, interoperability, user-centred design and collaboration using social software, sharing content, tagging, social networking, blogs, wikis and RSS" (p. 71). Likewise, Sharples and Pea (2014) confirmed that the sociocultural perspective is particularly supported by M-Learning "because with these wireless handheld devices, learning can occur anywhere, in or out of class and with or without a teacher" (p. 512).

Hence, I argue that the role of the social aspect (S) on the effectiveness of M-Learning is determined by the ubiquitous nature of mobile devices and their various technical capabilities that facilitate continuous communication, interaction, and collaboration, both on the face-to-face social setting and the social media. As such, the social aspect (S) of this LDSC model that ensures the existence of several types of social activities as well as the transmission of cultural information supports the underlying thread of social constructivist philosophy in M-Learning environments (Martiniello & Paparella, 2016; Koole, 2009a). Arguably therefore, program designers and developers are likely to be required to consider carefully the social aspect when developing M-Learning programs to provide room for utilizing this aspect of mobile technologies.

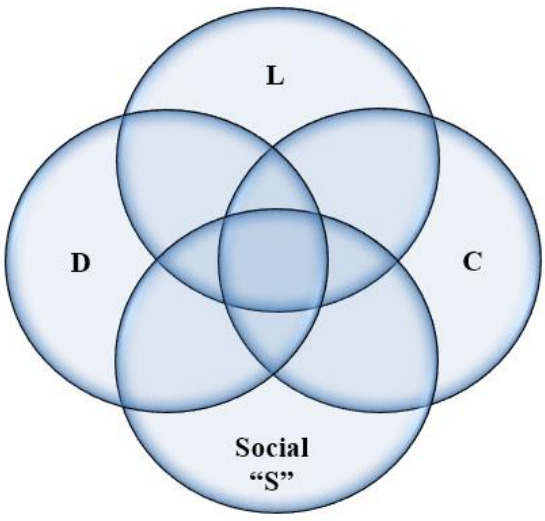

Figure 2.5: The social aspect (S), (Koole, 2006).

2.4.3.4. Content Aspect (C)

The content aspect (C) (Figure 2.6) forms the key addition to Koole's (2006) seminal work on M-Learning FRAME. I argue that it significantly enhances the frame model as it sets new relationships and outlines new dimensions of M-Learning. Content refers to the materials or subject matter that is required to be learned (Mishra & Koehler, 2006). The design of content in M-Learning significantly impacts the learning process and its outcomes since the level of content flexibility, adaptability, interactivity, and compatibility with the various mobile devices is argued to determine the effectiveness of learning (John, Thavavel, Jayaraj, Muthukumar, & Jeevanandam, 2016; Yousafzai, Chang, Gani, & Noor, 2016; Wyroll, 2014).

Content in M-Learning can be considered in the context of formal and informal learning, and arguably, this is a distinguishing feature of the nature of content in M-Learning environments. Schools and organizations design their mandated learning content with specific knowledge and/or skills based on specific objectives for specific learning outcomes. Learners are required to learn and demonstrate competency of this mandated content in order to pass the tests. However, in addition to the possibility of accessing the formal learning content at anytime and at anywhere, access to unlimited resources and supplementary materials in different modalities (the informal content) has been made easier with mobile devices. Hence, there is a powerful representation to valued formal content outside schools in these informal resources (Bull et al., 2008). Thus, content enhancement, clarification, adaptability, and comprehension is made more accessible through the easy access to various types of online informal content (Malcolm, Hodkinson & Colley, 2003).

Arguably, creating a digital content with multimedia is critical to the success of M-Learning programs. Pimmer and Pachler (2013) clarified that "from a pedagogical perspective, the learner-centred creation and sharing of content such as multimedia materials in the form of text, audio, images and video is much more promising" (p. 195). Pimmer and Pachler (2013) and Woodill (2012) argued that creating a proper and novel content, specifically designed for learning and based on mobile technologies, rather than producing applications or websites that simply repackage classroom materials to be read or played with on mobile devices. Also, Dubey (2015) highlighted the importance of providing handy information and knowledge to improve on-the-job performance. Likewise, Zhao, Anma, Ninomiya, and Okamoto (2008) recommended that contents should be adapted to learners' experience and preferences; thus, providing personalized contents "by exploiting other contextual data during learning, such as learning location, time, learners' learning activity, educational strategy etc" (p. 154). Moreover, Motiwalla (2007) argued that the content is more useful "when it is personalized (i.e., when students can control or filter the content) and collaborative (i.e., when students can reflect and react to the information that they receive), as suggested by the constructive and conversational learning models." (p. 586). Therefore, Ozdamli and Cavus (2011) recommended that "content should be decided in consultation with all stakeholders such as learners,

teachers, parents etc. Otherwise teachers cannot get the desired results" (p. 940). Interestingly, content at the context of this study was created based on a needs analysis study in which stakeholders including line organization supervisors, instructors, and trainees participated at various levels, and there is an ongoing evaluation to the content to optimize it.

Besides, Chen et al. (2008) confirmed that **"**providing multi-sensory learning content by combining written and pictorial annotation will have a differential effect on the learning performance of students with different verbal and visual abilities" (p. 95). Likewise, Zeman, Hrad, and Podhradský (2013) recommended the "development of the courses in off-line version that would be suitable for e-book readers; development of printer-friendly version; and development of supplementary materials (worksheets for teachers and students, tests, on-line version for Moodle LMS)" (p. 149). It could be argued therefore that the role of the content aspect (C) on the effectiveness of M-Learning is determined by the degree of how well-designed the content is; especially in terms of flexibility, adaptability, interactivity, and compatibility with various mobile devices. This should safeguard a potential bridge between social media and academic content; the thing which ensures an effective M-Learning environment.

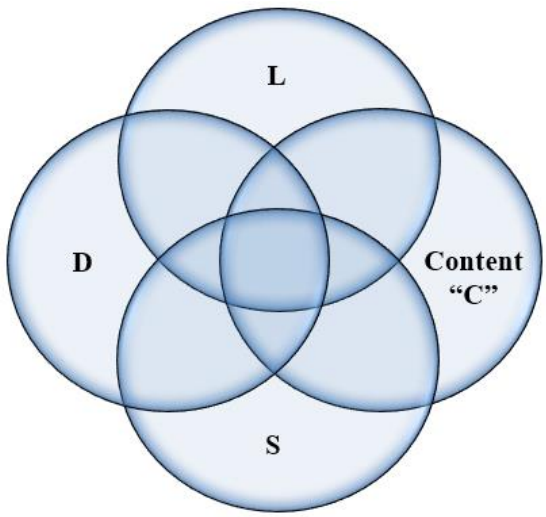

Figure 2.6: The content aspect (C), 2018.

The second layer of the proposed LDSC model is the basic bipolar intersections between the basic aspects, and they are the learner/device intersection (LD), the device/social intersection (DS), the social/content intersection (SC), and the learner/content intersection (LC). Although the Venn diagram shows only four types of intersections at this level, there are two other intersections that are not clearly outlined here; namely, the learner/social intersection (LS) and the device/content intersection (DC). These two intersections will be represented and elaborated on at higher layers of this diagram.

2.4.3.5. Learner/Device (Learner Orientation/ Device Usability) Intersection (LD)

The learner/device (learner orientation/device usability) intersection (Figure 2.7) contains elements that belong to both the learner (L) and device (D) aspects, and how they impact the learning process. It outlines how mobile devices can avail learning conditions and resources that may suit different learners' characteristics, needs, styles, strategies, and objectives. Furthermore, it illustrates how the physical, technical, and functional characteristics and capabilities of mobile devices, which result from the hardware and software design, can impact the physical and psychological comfort levels of the learners as well as their cognitive engagement with the learning tasks. Issues related to screen size and resolution, interface, processor speed, battery life, weight of the device, storage space, and compatibility with other devices are to be quoted here. These characteristics and capabilities may impact learners' mobility with the device, within devices, and amongst content and resources. They may also impact the learner's concentration on accomplishing the cognitive and learning tasks, as well as the learner's level of motivation, satisfaction, and psychological comfort. Evidence from the literature suggests that these are all interconnected factors that impact the learning process and its outcomes (Clarke & Svanaes, 2014; Kaalberg, 2014; Kucirkova et al., 2014; Mullen, 2014; Clark & Luckin, 2013; Vu, 2013; Tamim et al., 2011; Nordin et al.,2010). For example, the level of psychological comfort affects the cognitive load and the speed with which users can perform tasks (Koole, 2009).

Conversely, this intersection (LD) displays how the learner's orientation towards the mobile device can impact his/her learning with those mobile devices in formal and informal contexts. Hence, I argue that the following questions can provide a guide to understanding how the learner may approach the device.

- Does the learner use the device to the highest capacity for learning purposes; especially in the classroom?
- Does the learner distract his/her learning process with the various applications and games on the devices?
- Does the learner access valid and proved supplementary learning materials? Is he/she trained on good searching skills?
- Does the learner take recommended precautions on using mobile devices (screen savers, seating positions, device protective cases)?
- Can the learner manipulate different mobile devices?

Thus, this intersection highlights some other critical issues that educational institutes and organizations developing M-Learning environments need to consider. They have to ensure that they are using convenient mobile devices. More importantly, they need to ensure that learners receive enough training, guidance, and follow-up with their use of the mobile devices.

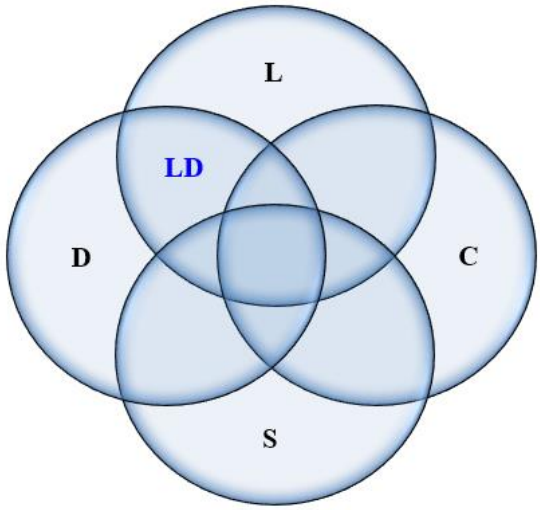

Figure 2.7: The learner/device Aspect (LD), (Koole, 2006).

2.4.3.6. Device/Social (Social Technology) Intersection (DS)

The device/social (social technology) intersection (Figure 2.8) contains elements that belong to both the device (D) and the social (S) aspects of the proposed LDSC model. According to Koole (2009a), social technology describes "how mobile devices enable communication and collaboration amongst *multiple* individuals and systems" (p. 34). This becomes of paramount importance; especially at giant corporations which comprise numerous departments and specializations such as the context of this study.

In the previous discussion of the social (S) aspect of the LDSC model, it was argued that there are two versions for this aspect: the social setting and the social media where the former refers to face-to-face communication, collaboration, and interaction, and the latter refers to social media interaction. The role that mobile devices can play in both may be revolutionary; especially with the features of portability and mobility. Various studies confirmed that coordinating, facilitating, and documenting face-to-face communication, interaction, and collaboration is made easier with mobile devices through various applications and tools (AlHajri et al., 2017; Kim, et al., 2016; Martiniello & Paparella, 2016). Tools such as the cameras, voice recorders, and note-taking Apps. can document, sustain, and recycle face-to-face communication and interaction. Moreover, mobile devices introduce myriads of social media applications and user-friendly platforms that provide new channels for online communication, interaction, and collaboration. Arguably therefore, mobile devices allow for creating and facilitating collaborative teams and learning communities, thus, advancing the potential for students' constructive learning through active participation and engagement (AlHajri et al., 2017; Kim, et al., 2016; Martiniello & Paparella, 2016; Ng et al., 2016).

Hence, it is the responsibility of educational institutes and learning organizations developing M-Learning environments to ensure using mobile devices and applications

that can facilitate and promote participatory information sharing within and across systems, collaboration, content and documents sharing, and social networking (Ada et al., 2015; Koole, 2009a).

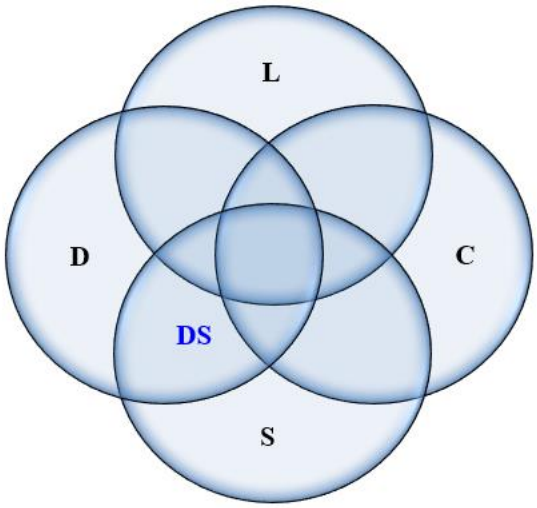

Figure 2.8: The device/social Aspect (DS), (Koole, 2006).

2.4.3.7. Social /Content Intersection (SC)

The social content intersection (Figure 2.9) contains elements that belong to both the content (C) and the social (S) aspects of the proposed M-Learning LDSC model.

According to Gartner IT Glossary (2017), social content is "unstructured data created, vetted, marked-up or delivered through a social process or channel and destined for human consumption. Social content scenarios range from the use of enterprise-managed blogs and wikis, to externally hosted environments (Twitter, Facebook, YouTube, and others) for document sharing and collaboration, to tools for supporting project teams" (para. 1). Amer-Yahia, Huang, and Yu (2009) argued that users on social content sites create, develop, and share content in various communities based on "explicit friendship, shared interest and common user properties" (p. 947). Interestingly, there appears to be a lack of research on how this aspect may change our understanding of the types of social interaction at M-Learning environments.

In discussing social content, *Information Discovery*, *Content Management*, and *Information Presentation* have to be considered. This is imperative particularly to amend the challenges of storing and managing social content. Amer-Yahia et al. (2009) clarified that *Information discovery* refers to the process of discovering content items that are relevant to a user query session. *Content Management* refers to the process of managing social information from remote sites as well as the maintenance and retrieval of the social content. *Information Presentation* refers to the process of producing different presentation alternatives and facets which can give the users a richer information exploration experience.

Clerck (2016) conceptualized *social content optimization* where sharing content via different social channels and even across devices is seen as the creation of content within a broader context and that it should require a little effort while resulting in a high impact at the same time. “A tweet, for instance, can - and should - be approached as a contextual piece of content and social object as such” (Clerck, 2016, para. 7). Clerck (2016) argued that a typical *social content strategy* should consider the needs and behaviours of target audiences and their audiences, facilitate the integration of user-generated content and social content, surpass the simple sharing of content to production and reproduction of content based on emergent needs, and connect social collaboration and business principles with the content strategy. Hence, I argue that although Clerck was targeting marketing social content, these concepts can be compared with educational social content. Online platforms and applications that can support the creation of online and virtual communities and provide opportunities for the production of educational social content are apparently abundant and user-friendly (Osakwe, Dlodlo, & Jere, 2017).

In this sense, I argue that (CS) intersection of the LDSC model highlights the importance for educational institutes and organizations adopting M-Learning environments to ensure that mobile devices promote the process of social content; especially with focus on how content can be socially created, not only shared or distributed.

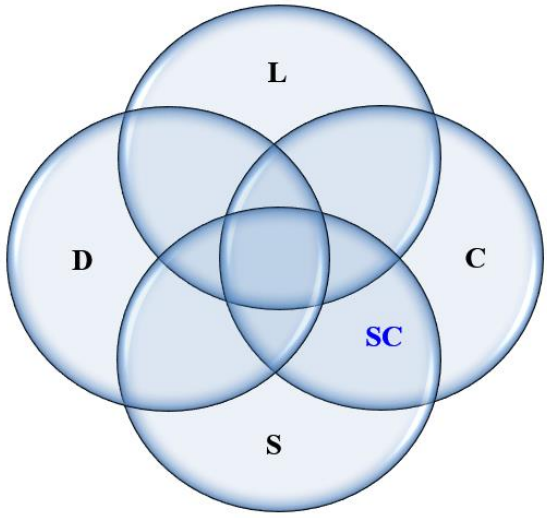

Figure 2.9: The Social/Content Aspect (SC), 2018.

2.4.3.8. Learner/Content (Content Engagement) Intersection (LC)

The learner/content (content engagement) intersection (Figure 2.10) contains elements that belong to both the learner (L) and content (C) aspects of the proposed LDSC model.

Learners' engagement with the materials or subject matter lies in the core of the learning process. It is referred to as "cognitive engagement", and it can occur in many forms (Rittle-Johnson, Siegler, & Alibali, 2001; Bloom & Krathwohl, 1956). Gresalfi and Barab (2011) introduced four different forms of engagement: procedural, conceptual, consequential, and critical. They elucidated that procedural and conceptual engagement "describe the ways students think about content" and consequential and critical engagement "concern the coordination of content, contexts, and learner decision-making" (p. 302).

Content engagement involves *content contextualization*, *content understanding* and *content growth*. Content contextualization is "a local phenomenon that arises as a result of a number of factors, including students' needs, students' goals, teachers' goals, local constraints, and the teacher's pedagogical values" (Squire, MaKinster, Barnett, Luehmann, & Barab, 2003, p. 483). In M-learning, content can be contextualized even though learning happens across different settings. This can be achieved by setting learning objectives and communicating them with the learners (Sotsenko, Jansen, & Milrad, 2013).

Content understanding can be viewed as "a matter of degree in which an individual understands concepts, principles, structures, or processes at a relatively deep level and is able to demonstrate certain behaviours" (Hoffman, Wu, Krajcik, & Soloway, 2003, p. 325). Achieving content understanding, therefore, requires a degree of relevance in what is being learned, which, in turn, enhances learners' engagement. It is argued that that academic content becomes more relevant when it is firmly integrated with the development of social and personal skills for learners. Schussler (2009) clarified that "as adults, we do not choose to engage in tasks in which we see no relevance. We should not expect students to be any different" (p. 119). The significance of content understanding and methods of facilitating it at the context of this study form a prerequisite for preparing trainees for job skills.

Finally, content growth refers to the continuous process of developing the learning materials or subject matter (Hoffman et al., 2003, p. 325). A well-designed learning model should ensure that the academic content has a high level of flexibility, adaptability, and interactivity (John et al., 2016; Yousafzai et al., 2016; Wyroll, 2014; Chen et al., 2008). Learners' interaction with the content - with opportunities to develop it - enhances their engagement. Furthermore, designing content tasks that create a context for teachers' orchestration of students' learning, not simply content coverage or acquisition, further enhances learners' reasoning and engagement with the learning content (Gresalfi & Barab, 2011, p. 301).

Arguably, the introduction of mobile devices in education has created a shift in the learner/content relationship (Wong & Looi, 2010). Mobile devices are argued to increase learners' engagement with content and empower them to create and contribute content in authentic environments using Web 2.0 tools with the assistance

of constant connectivity (Gikas & Grant, 2013; Wong & Looi, 2010). According to Gikas and Grant (2013), M-Learning provides opportunities for learners "to collaborate, discuss content with classmates and instructors, and create new meaning and understanding". Therefore, program designer and developers are required to consider methods and strategies that have the potential to maximize learners' engagement with the learning materials and content.

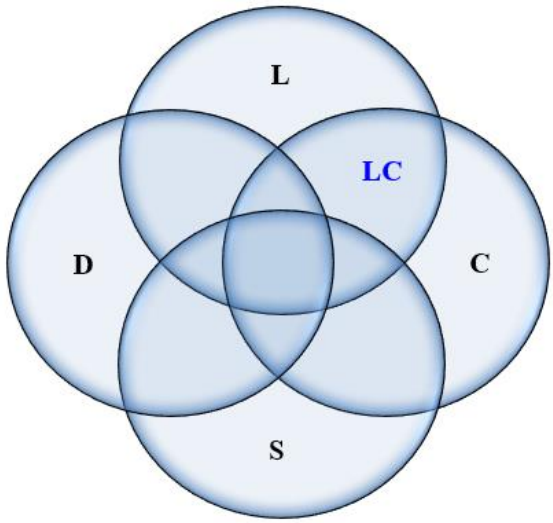

Figure 2.10: The learner/content Aspect (LC), 2018.

2.4.3.9. Tripolar Intersections:

The third layer of the LDSC model is the tripolar intersections. It includes 'learner/device/content (LDC) intersection', 'learner/device/social (LDS) intersection', 'device/content/social (DCS) intersection', and 'learner/content/social (LCS) intersection' (Figure 2.11).

Each of these intersections contains elements that belong to both the basic and bipolar aspects of the proposed LDSC model for M-Learning introduced in the above discussion. It is at this level of the model that Koole's seminal work on defining and framing M-learning appears as a partial description of M-Learning. She introduced the integration of the LDS aspects as the "effective mobile learning" (Koole & Ally, 2006), which it could be claimed as an incomplete description of M-Learning. Hence, I suggest that the adapted model, LDSC, introduces a more comprehensive and a better understanding of effective M-Learning by integrating the four aspects: the leaner, device, social, and content (LDSC).

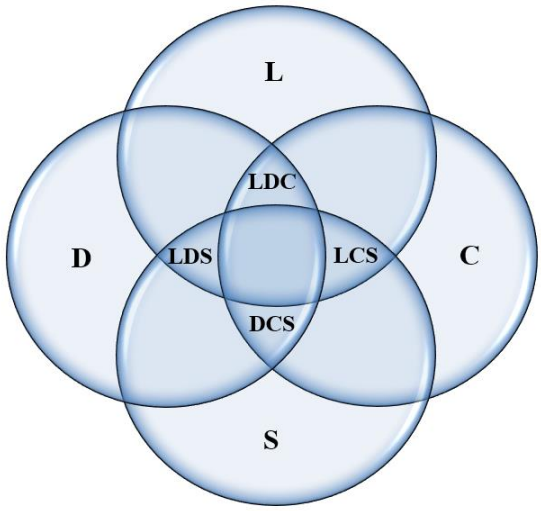

Figure 2.11: The tripolar intersections, 2018.

Finally, the fourth layer and the highest level of intersection is the proposed representation M-Learning.

2.4.3.10. Learner/Device/Social/Content Intersection (LDSC)

The learner, device, social, and content (LDSC) intersection (Figure 2.12) theoretically represents a more comprehensive and effective model for framing M-Learning. It defines an ideal M-Learning situation and illustrates the integration of the individual aspects as well as the interactions and intersections beyond their specific boundaries. Hence, I argue that the stronger the recognition of the qualities, specifications, and needs of each individual aspect, the more effective the M-Learning environment is. Finally, it can be argued that this adapted model for framing M-Learning can validate the proposed definition of M-Learning as 'a type of learning that allows learners, as individuals or groups, to gain knowledge, ideas, or concepts not already known or recognised from formal or informal contents using mobile technologies at anytime and anywhere'.

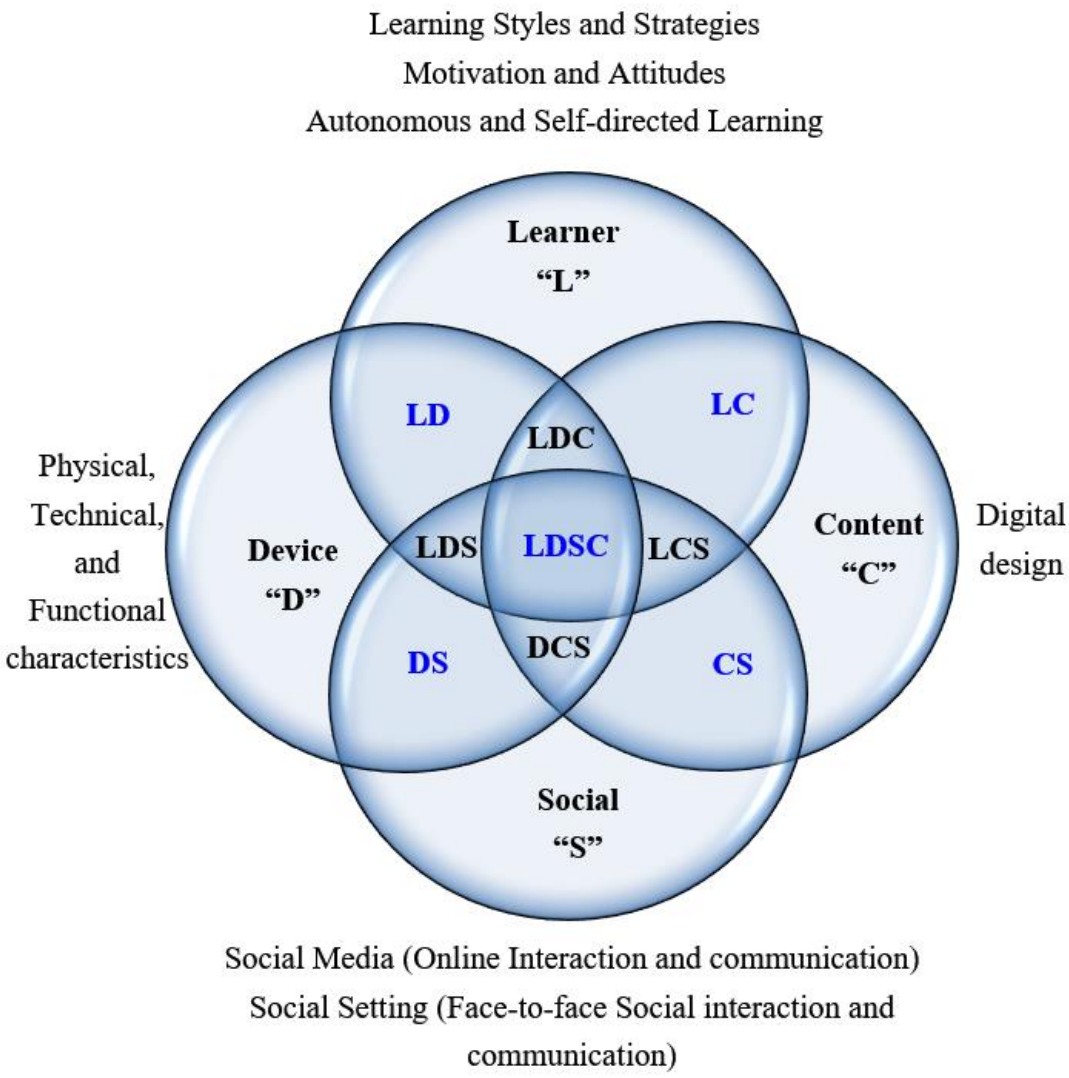

Figure 2.12: The learner (L), Device (D), Social (S), and Content (C) intersection (the LDSC Model, Adapted FRAME Model), 2018.

2.4.4. The Role of M-Learning in VTET

Researchers advocated the suitability and impact of M-Learning in VTET from different perspectives. For example, Martin, et al. (2009) argued that mobility is impactful on learning and training. Learners, trainees, and trainers are all becoming more mobile, and they spend up to half of their time in mobility (Martin, et al., 2009). Hence, mobile technologies facilitate ubiquitous access to rich and diversified types of information and resources as well as support just-in-time and in context, which arguably have a positive impact on the learning and development of job-related skills (Martin, et al., 2009). Likewise, Chen, Kao, and Sheu (2003) argued that "the wireless learning environment integrates many information resources, and supports learners to do non-linear, multidimensional, and flexible learning and thinking. It especially facilitates complex and ill-structured learning content, such as the cross-subject, theme-based learning activities" (p. 348). Also, uploading videos of different courses delivered by expert specialists and instructors increases the potential of exposure to

different types of supplementary materials. Arguably, trainees can access these resources at their convenience on their devices; thus, enriching the training experience (Mingyong, 2015).

Furthermore, Nie (2015) highlighted the learner's aspect as a key factor in effective mobile education and training. She confirmed that digital space has been fully integrated in the lives of the current learners who grew up in an era of networked, digital information and social interaction. Nie (2015) argued that network creation and social activities are gradually incorporated into the training activities. She also highlighted that utilizing the learners' interest in the network and digital media will reinforce learning outside the classroom and emphasize learning anytime and anywhere. Interestingly, trainees at the context of this study usually have the latest technologies integrated in their daily lives, including smart phones, watches, and even cars. Employing their interest in these technologies for training purposes inside and outside the classroom is argued to impact their learning and mastery of the target skills.

Likewise, Ng et al. (2016) argued that studies have found M-Learning best connects theories and practices to enrich VTET learning experiences. Wilke and Magenheim (2017) clarified that components of media-support of action-oriented tasks or work orders embedded in the technical workflows, videos in which technical and work processes are explained, easy access to technical vocabulary for the description of processes and structures, interactive learning contents provided in different modalities are all components that have the potential to offer an effective training opportunity. Research indicated the importance of utilizing new technologies to blend face-to-face teaching with e-learning or M-Learning to enhance students' motivation, interaction and learning effectiveness in VTET (Ng et al., 2016). Also, utilizing various kinds of media and multiple representations have the potential to enhance learning and teaching in VTET" (Ng et al., 2016). At the context of this study, a digital content (iBooks) was developed with rich multimodal aspects that are claimed to help trainees retain the processes, equipment information, task requirements, and new knowledge more than the previous text-based curriculum. However, this discussion opens the door for an in-depth overview on M-Learning pros and cons.

2.4.5. Affordances of M-Learning

A plethora of literature found that M-Learning has numerous affordances. Arguably, what distinguishes M-Learning over conventional learning is its ability to function in formal (e.g., workshops and classrooms) and informal (e.g., museums, zoos) environments (Sung et al., 2015), meeting the urgency of learning need and knowledge acquisition (Lin et al., 2008), offering exciting opportunities to place learners in challenging active learning environments (Laurillard & Pachler, 2007), enabling learning independent of time and location constraints (Abfalter, et al., 2004),

and providing learners with immediate feedback and supporting learners with different learning needs (Ouyang and Stanley, 2014).

Furthermore, M-Learning is generally reported to increase learners' engagement, performance, and motivation, provide access to diversified learning resources, facilitate the use of multimedia, awaken creativity by trying different applications and programs, and provide countless opportunities to support learning and performance. Moreover, M-Learning has the potential to move learning outside classrooms and into students' real and virtual environments, thus re-conceptualizing learning as personal, situational, creative, collaborative, and lifelong (Sung et al., 2015; Ozdamli & Cavus, 2011; Liaw et al., 2010; Passey, 2010). Dyson et al. (2009) confirmed the particular suitability of mobile technologies for active learning. They explained that mobile applications can support "authentic learning activities, including student use of the multimedia capabilities of mobile devices for developing digital narratives, the gathering and analysis of field data, concept mapping, and student production of podcasts" (p. 253).

Moreover, M-learning has been argued to support and increase collaboration between learners and to empower them by enabling them "to select and assess relevant information, redefine their goals, and reconsider their understanding of concepts within a shifting and growing frame of reference" (Koole & Ally, 2006, p. 4). Traditionally, collaboration and participative authenticity required learners to be physically present in the learning context. This is not a requirement anymore with Mobile technologies and simulated authenticity as they blur or fracture the boundaries and allow learners to be "located in their normal spaces and contexts where the conditions of the real-world contexts are replicated" (Burden & Kearney, 2016, p. 31).

Additionally, MoLeNet (2007) listed the following as major affordances for M-Learning. M-Learning has the potential to:

- help bridge the gap between mobile phone literacy and ICT literacy
- help to raise the self-confidence and self-esteem of non-traditional learners
- take place outside, whilst travelling, in the workplace or in the classroom
- be used to capture evidence and for assessment (para. 6)

Finally, M-Learning - through appropriate design and implementation - has the potential to revolutionize learning by students' use of mobile devices as personal learning tools to synergize formal and informal learning (Wong & Looi, 2010). The formal content can be learned in informal surroundings as informal learning experiences outside school offer a potential bridge between social media and academic content (Nordin et al., 2010).

Arguably, these affordances of M-Learning can augment trainees' learning experience, and they far outweigh the cons, or rather challenges, that will be evaluated below (Mingyong, 2015).

2.4.6. Challenges of M-Learning

Using mobile technologies in education is a mixed blessing as they may also have some negative learning effects (Sung et al., 2015; Gaudreau, Miranda, & Gareau, 2014; Handal, MacNish, & Petocz, 2013). First, Sung et al. (2015) highlighted the limitedness of experimental studies investigating the role of mobile devices on the learning process and pedagogical requirements. They confirmed that "more proven effective teaching methods need to be elaborated and then integrated into learning scenarios" (p. 82). Other research findings confirmed the more importance, active, and real role of instructional design and pedagogy over the presentence of technology in determining the value of educational experiences (Tamim et al., 2011).

Bidin and Abu Ziden (2012) highlighted '*obsolescence'* as a negative aspect of mobile devices. New technologies evolve so quickly and "the lessons that the teachers come up today on digital literacy for instance, might wrap up futile as new options might just pop-up weeks after they master a particular device" (p. 726). Moreover, most of the learning contents cannot be utilized due to incompatibility between the devices and the content utilization requirements (Yousafzai et al., 2016, p. 788). Alrasheedi and Capretz (2014) argued that it is a challenge to design a common user interface for mobile devices as they are too varied. Furthermore, Rodríguez, Riaza, and Gomez (2017) concluded that as new technologies, mobile devices represent a challenge for teachers to better adapt to different capacities, possibilities, and needs of learners, and for students to learn how to use these devices in an "appropriate, thoughtful, critical and healthy way" (p. 3). Thus, adopting and implementing M-Learning calls for a change in academic programs; the thing which mandates conducting countless M-Learning presentations, seminars, workshops, and conferences (Mohammad, Mamat & Isa, 2016).

Furthermore, mobile technologies multitasking impairs learning by the distraction caused by phone ringing, texting, and constant visits to social medial platforms (Serah, 2014; Junco, 2012; Harman & Sato, 2011; Kirschner & Karpinski, 2010; Pasek, More, & Hargittai, 2009). Gikas and Grant (2013), Traxler (2010), and Tella (2003) warned that learning across different contexts and at different times may produce "fragmented knowledge and incomplete schemata". Shuib et al. (2015) explained that addiction to technology can lead to problems "such as emotional stress, damaged relationships and attention deficit disorder" (p. 240).

Further to that, effective use of mobile technologies for learning purposes is still questionable. Ricky and Rechell (2015) argued that "students prefer using mobile devices and flexible technologies for entertainment, to acquiring information and

communicating with others but they seldom use them for educational purposes" (p. 98). Thus, in order to make the best use of mobile technologies for pedagogical purposes, learners have to develop a mindset that maintains a high degree of self-directness, self-management, persistence and independency (Ricky & Rechell, 2015).

In addition, there is a concern about the negative impact mobile devices may have on health. Shuib et al. (2015) argued that the excess use of mobile devices may lead to the propensity of brain tumours in users. They confirmed that

> Six studies explored the relationship between the utilization of mobile phones and acoustic neuroma, with conflicting results (Chesher, 2007; Dani & Vanishree, 2013; Harrison et al., 2013; Pascu et al., 2013; Varshney & Vetter, 2002; Walsh, 2009). The number of accessible studies is constrained by the lack of research and short time since the introduction of mobile phones. (Shuib et al., 2015, p. 240)

Likewise, Clarke and Svanaes (2014), Kaalberg (2014), Kucirkova et al. (2014), Mullen (2014), Clark and Luckin (2013), Vu (2013), Tamim et al., (2011), and Nordin et al. (2010) reported numerous challenges for mobile technologies and M-Learning which include:

- Mobile technologies should not be overrated now. Countless technologies starting from programmed learning, the internet, computers, the interactive whiteboards, and others were claimed to transform education, but they have not.
- Technical problems associated with the internet connectivity, speed and coverage result in frustration and classroom disruption.
- There is no evidence that pedagogical practices have been changed with the introduction of mobile technologies in education.
- Some studies found no relationship between using mobile technologies and learners' academic performance and achievement.
- It has been reported that mobile technologies form a source of distraction for learners as they keep moving between various applications; the thing which negatively impacts their academic performance.
- It is time consuming and causing a lot of uncertainty to design mobile technology-infused activities and lessons.
- Mobile technologies were designed as media-consumption devices intended for individual use and to deliver content. This raises a red flag on mobile technologies' capability of affording the creation or collaboration of content. Thus, using it for pedagogical purposes needs changing teaching methods significantly.

- It has been evidenced that negative teachers' and learners' perceptions of technology impact the infusion of mobile technologies in education negatively.
- Network coverage and content download and use may form a real problem; especially in remote areas and contexts with poor infrastructure and technical problems.

2.5. Summary

In this chapter, a literature review on vocational and technical education and training with emphasis on the development of employability and job-related skills as well as the potential role of M-Learning at VTET contexts and the key aspects and features of M-Learning environments was introduced. An adapted model for framing M-Learning was presented. Koole's (2006) seminal work on M-Learning FRAME was used and adapted to include the aspect of content; which resulted in new attributes and dimensions for M-Learning and a better description of its processes and aspects. A new definition of M-Learning as *a type of learning that allows learners, as individuals or groups, to gain knowledge, ideas, or concepts not already known or recognised from formal or informal contents using mobile technologies at anytime and anywhere* has been proposed. Finally, the advantages and disadvantages of M-Learning were evaluated and synthesized.

3. Chapter 3: Research Design

This chapter explains the research design and research methodology used in this study; namely case study approach. Initially, an overview on the theoretical and philosophical underpinnings of case study methodology is presented. Next, a discussion of the methodology implementation follows. The complexity of the mixed methods used are evaluated and presented, with details on the different data collection methods, data analysis, and reporting process. Finally, strategies employed for confirming the case study findings and achieving trustworthiness are synthesised.

3.1. A Theoretical Overview on Case Study Methodology

Case study is a research methodology that focuses on a single unit, instance, or complex phenomena in action and within their contexts. The goal is to arrive at a detailed description and in-depth understanding of the entity, the "case", which could be a person, a class, an organization, or a community (Ary, Jacobs, & Razavieh, 2010; Woodside, 2010; Cohen, Manion, & Morrison, 2007). Eisenhardt (1989) clarified that case studies focus on "understanding the dynamics present within single settings" (p. 534). Hancock and Algozzine (2016) and Merriam (2001) argued that insights collected from case studies can directly impact policies, procedures, as well as future research.

Case studies have a number of strengths that make them attractive to educational researchers. Their major strengths lie in their "attention to the subtlety and complexity of the case in its own right" (Cohen et al., 2007, p. 253). Case study data are 'strong in reality' and they have the potential to enable researchers to capture unique features to understanding the situation which may otherwise be lost in larger scale data such as questionnaires (Mok, 2011; Baxter & Jack 2008). Case studies are 'a step to action' as they result in insights for individuals, policy makers, and organization evaluators. Furthermore, case studies tend to blend a description of events with the analysis of them in a context where the researcher is integrally involved in the case (Cohen et al., 2007).

Case study research may require the researcher to spend more time in the environment of study than is the case with other types of research due to the need for collecting and analysing information from multiple sources (Hancock & Algozzine, 2016). By employing several data collection methods, case studies ensure that the issue is not explored through one lens, but "rather a variety of lenses which allows for multiple facets of the phenomenon to be revealed and understood" (Baxter & Jack, 2008, p. 544). However, it is argued that case studies – also like other research methods – have some inherit weaknesses. For example, the results of case studies may not be generalizable if scientific rigour and reliability have not been ensured (Noor, 2008). Moreover, they may not be easily open to cross-checking if they become overtly too selective, biased, personal and subjective (Cohen et al., 2007).

As for this study, I adopted a 'case study' approach because this research is concerned with understanding the role of mobile devices in developing employability and job-related skills in a specific context of vocational education as well as the key dynamics, aspects, features and areas of improvement at this context. The case is one of the SAITCs which provide vocational training programs of various discipline-specific and generic skills using M-Learning. These SAITCs integrate the theoretical learning with practical, hands-on training within the same context. Moreover, the company provides the trainees and the instructors with iPads which have a digital learning content that was especially designed and developed to suit and serve the company purposes. Therefore, SAITCs form a unique context, and a case study approach would be elected as a convenient research method for this research.

In this respect, all the decisions about designing and implementing the case study such as binding the case, sampling, and employing the research instruments were mainly influenced by pragmatic considerations relating to the research site. As an insider at the context of this study, I had sufficient knowledge about the trainees' and instructors' backgrounds, how they may respond to the data collection methods, how much time they would take to respond to the questionnaires, their favourite ways of sharing their insights, and how much data they would share in writing versus orally. These considerations helped me to make decisions about the questions to include in the questionnaires and the interviews, whether they should be translated or not, which specific instruments would collect sufficient data that would help in answering specific research questions and areas of focus, and the order in which the data collection methods would be employed. Further details about these decisions and considerations are in section 3.5 below, Research Data (Sources, Collection, and Analysis).

3.2. Philosophical Stance and the Researcher's Role in This Study

All research is guided by a paradigm of inquiry, which is a set of assumptions and beliefs that represent the researcher's worldview (Guba & Lincoln, 1994). In this respect, researchers should "make explicit the larger philosophical ideas they espouse" (Creswell, 2003, p. 6) because they inform the design and conduct as well as the choices of methodology and methods of the study. Furthermore, they help readers to understand and evaluate why specific elements of research have been adopted. Therefore, researchers have to clearly explain their worldviews or ontological and epistemological stances (Christie, 2016).

3.2.1. Ontology

According to Guba and Lincoln (1994), ontological positions are concerned with the question "What is the nature of reality?". Ary et al. (2010), Yin (2003), and Stake (1995) clarified that case studies are based on a constructivist paradigm where truth is relative and dependent on one's perspective. This paradigm is based on the notion of

the social construction of reality which is constructed through human relationships and is situated within a historical moment and social context (Creswell, 2003). Social reality is created subjectively; however, the notion of objectivity is not declined (Miller & Crabtree, 1999). According to Baxter and Jack (2008), one of the advantages of case studies is the close collaboration between the researcher and the participants (Miller & Crabtree, 1999). Through stories, the participants are able to describe their "views of reality and this enables the researcher to better understand the participants' actions" (Baxter and Jack, 2008, p. 545).

My ontological position for this study is mainly informed by the constructivist paradigm since I take the position that truth and reality are socially constructed through human interactions and relationships. I believe that multiple constructed realities do exist, rather than a single objective reality. Through the discussions and chosen data collection methods, participants in this study have interpreted and constructed their understanding of the role of mobile devices in developing employability and job-related skills and the key dynamics and aspects of M-Learning environments. Their interpretations and understanding have been influenced by the interactions and relationships between the participants and the researcher.

3.2.2. Epistemology

Epistemological positions are concerned with how knowledge can be acquired and how it can be communicated to the others. It examines the relationship between knowledge and the researcher during discovery (Cohen et al., 2007). Epistemology is also concerned with the question of "What is the nature of the relationship between the research participants and the researcher?" (Guba & Lincoln, 1994). Epistemology is concerned with the nature and forms of knowledge as either objective, hard, tangible, known or subjective, soft, intangible, and experienced (Thody, 2006).

In this study, findings and knowledge are constructed through interactions between the researcher and the study participants by reflecting on and interpreting data collected through various qualitative and quantitative methods of data collection. This mixed methods approach has a pragmatic epistemological underpinning to conduct confirmatory and exploratory research and provide a more complete understanding of the student/instructor experience (Onwuegbuzie & Leech, 2005). I am an insider in this study due to being a staff member in the training centre where this study was conducted; therefore, it is important to declare my philosophical positions as explained above. A detailed account of actions taken and positions adopted during this study has been introduced throughout to serve two purposes: first, since this is a case study, a detailed and descriptive account of the decisions, actions, and positions taken by me has to be made clear so that other researchers or practitioners find out how similar this case is to their contexts, and, thus, decide on how much they can benefit from the study findings in their contexts. Second, it helps in limiting the

negative impact of the researcher's bias as an insider by showing measures taken to ensure rigour of the research.

3.3. Designing and Implementing the Case Study

In order to design and implement a rigorous case study, I have taken the following considerations and procedures.

3.3.1. Determining the Case/Unit of Analysis

Miles and Huberman (1994) defined the case as "a phenomenon of some sort occurring in a bounded context" (p. 25). The phenomenon here is using mobile technologies for vocational training at SAITCs.

3.3.2. Binding the Case

This is the stage when the researcher considers what the case will *not* be in order to ensure that the study remains reasonable in scope. Yin (2003) and Stake (1995) suggested placing boundaries to prevent the topic from becoming too broad or with too many objectives. Suggestions on how to bind a case include adding: (a) time and place; (b) time and activity; and (c) definition and context (Baxter & Jack, 2008). For this study, place, activity, and definition and context boundaries were placed as follows:

I explored whether and how mobile devices could develop employability and job-related skills as well as the key dynamics and aspects of M-Learning environments (*activity*) at SAITCs (*place*). A convenient description of the *context, activities,* and the definition of the major themes of this study, such as M-Learning, VTET, vocational and job-related skills was introduced earlier in chapters one and two.

3.3.3. Determining the Type of Case Study

Hancock and Algozzine (2016), Yin (2003), and Stake (1995) used different terms to describe a variety of case study types such as explanatory, exploratory, or descriptive; single, holistic case studies or multiple-case studies; as well as intrinsic, instrumental, or collective case studies. For the sake of this study, I adopted a holistic single, instrumental, exploratory case study type. A *holistic single case study* is considered when looking at participants in an environment as a unique situation (such as SAITCs) (Yin, 2003). *Instrumental case studies* provide insight, detail, and understanding of a particular situation or phenomenon to refine a theory (which is using mobile technologies for learning at SAITCs) (Baxter & Jack, 2008). *Exploratory case studies* are used to explore those situations in which the intervention being evaluated has no clear, single set of outcomes (Yin, 2003). Exploratory case studies seek to "discover relevant features, factors, or issues that might apply in similar situations" (Henderson & Yeow, 2012, p. 81). Therefore, rather than testing or comparing a phenomenon as in explanatory case studies, this research explored

whether and how mobile technologies can play a role in developing the required employability and job-related skills and the key dynamics and features M-Learning environments have at VTET contexts.

3.4. Sampling

I used the entire population attending/teaching the iPad pilot program at SAITCs (133 trainees and 29 instructors) for the questionnaires. All invitees voluntarily participated in the questionnaires. The number of instructors and trainees attending the iPad program was not too large and inviting them all to participate in the questionnaire provided a potential for a whole scope of ideas and insights from participants with various interests and capabilities. Furthermore, this adequate number of participants helped with the data analysis of the quantitative part of the questionnaire (Cohen et al., 2007).

Conversely, I adopted non-probability purposive sampling for the interviews to deliberately and purposely recruit knowledgeable, interested, uninterested, and unbiased participants (Ary et al., 2010; Cohen et al., 2007). Non-probability sampling is grounded in the principle that researchers can target a specific group that is actually representing itself, rather than the wider population (Cohen et al., 2007).

In this respect, and in order to ensure that this sampling is done properly, I have done the following:

Firstly, all trainees and instructors were asked to answer two questionnaires, one developed for instructors and the other for trainees for the purpose stated in the data collection section below. Recruitment took place by an email message with a link to the online questionnaires.

Secondly, knowledgeable, interested, uninterested, and unbiased participants were recruited for the interviews. These were the trainees and instructors who were judged based on some desired characteristics which included trainees who achieved the highest and the lowest in their academic and job skills courses, trainees with a high and low degree of motivation to participate in the iPad program based on instructors' observations, instructors who had been involved in the iPad program since the beginning of the initiative, instructors who gave presentations and workshops for in-house training programs, and senior instructors who coordinated the implementation of the iPad program. I assumed that participants of these characteristics could give a full image of the role of M-learning at the context of this study.

Ethical considerations were completed before the start of this study. The research was approved by the Department of Educational Research at Lancaster University, where I am a PhD student. Consent forms were signed by participants, and precautions, such as making the questionnaire anonymous, were considered to eliminate potential bias

that might result from the researcher's supervisory role in the context of study. It was also ensured that the research conforms to research and publishing ethical guidelines of the training department of Saudi Aramco.

3.5. Research Data (Sources, Collection, and Analysis)

I collected both quantitative and qualitative data using different methods for this study. Several of the literature reviews related to educational research (Meyer, 2013; Wilson, 2012; Weimer & Lenze, 1991; Eisenhardt, 1989) recommended an increase in mixed method studies in order to generate more synergetic data and develop a richer picture of the field. As explained earlier, I used online questionnaires of Likert scales and open-ended questions, semi-structured interviews, field observations as well as program documents and reports to collect data for this study. These data collection methods were employed as follows:

The questionnaires, interviews, and program documents were employed in the same order. Hence, employing the questionnaires first helped me in two ways:
The answers to the open ended-questions enabled me to identify some emerging and premature themes that needed further exploration and validation. Moreover, the statistical analysis of the quantitative part of the questionnaires helped me to capture some trainees' and teachers' tendencies and areas of focus. As a result, the data that was received from the questionnaires guided my thinking during the process of preparing the questions of the semi-structured interviews.

Besides, the unstructured observations were collected simultaneously along with the questionnaires and interviews as they were not bound by a specific period of time. I continued to note down all relevant observations, whether new or repeated, while conducting the other methods of data collection. Upon developing the research themes, supportive documents such as screenshots from evaluation videos and learning content as well as relevant email messages were used to validate the data obtained from the other methods.

This approach enabled me to collect systematic data and to develop my findings in a coherent and robust way. It also helped me to some extent to discuss which elements of the LDSC model were investigated by particular instruments as follows:

The learner Aspect

The learner aspect was discussed through the questionnaires, interviews, and observations with focus of the following topics:

- Previous experience learning/teaching with the iPad
- Participants' attitudes towards using the iPad for learning/teaching purposes
- How the iPad helps trainees to develop their skills
- Applications and websites which learners are often engaged with

- Experiences and stories about the use of the iPad for learning/teaching purposes

The Device Aspect

The device aspect was discussed through the observations and documents with focus of the following topics:

- How studying with the iPad is different from studying with textbooks
- Information about the hardware provided and the control applications
- Forms of engagement with the device and its applications
- Advantages and disadvantages of learning/teaching with the iPad

The Social Aspect

The social aspect was discussed through the questionnaires, interviews, and observations with focus of the following topics:

- How the iPads impacts trainees' interaction as well as communication and teamworking skills
- Learning inside and outside the classroom
- Forms of online as well as face-to-face interactions at M-Learning environments

The Content Aspect

The content aspect was discussed through the questionnaires, interviews, observations, and documents with focus of the following topics:

- Supplementary materials and online resources used to enhance the prescribed content
- Features of the digital content and its role at M-Learning environments
- The role of the device in deepening the content knowledge

The table below (Table 3.1) summarises which data collection methods were used to investigate in-depth specific aspects of the LDSC.

Method / Aspect	Questionnaires	Interviews	Observations	Documents
Learner	Yes	Yes	Yes	
Device			Yes	Yes
Social	Yes	Yes	Yes	
Content	Yes	Yes	Yes	Yes

Table 3.1: Data Collection Methods & Specific Aspects of the LDSC, 2018.

In this respect, below is a detailed discussion of each of these data collection methods.

3.5.1. Questionnaires

Two questionnaires, one for trainees and the other for instructors, were created and shared with the study participants (Appendices one and two). The trainees' questionnaire included questions that may reflect effective learning practices using the iPad while the instructors' questionnaire included questions that may reflect best teaching methods and practices using the iPad. I decided to introduce the trainees' questionnaires in English and in Arabic and gave the trainees the liberty to choose answering in their native language or in English to ensure that they would understand the questions accurately and articulate their ideas precisely.

The questionnaires had closed questions with multiple choice ratings and open-ended questions. The closed questions were intended to generate frequencies of responses and comparisons that could be statistically analysed (Cohen et al., 2007). For example, they provided quantitative data measuring participants' attitudes towards the iPad and quantifying factors that may have had an impact on the program progress such as the percentages of trainees and instructors who worked with iPads before joining Saudi Aramco and how satisfied they were with using the iPads in learning and teaching, as well as the frequencies and patterns of attitudes, concepts, and themes. Moreover, the open-ended items of the questionnaire could give participants a chance to write their experiences and stories about the topic under investigation at their convenience and to be more reflective in their answers; thus, generating more accurate data (Reja, et al., 2003).

Building and Piloting the Questionnaires:

I chose to conduct the questionnaire online, not paper-based, for several reasons. Online questionnaires have the potential to generate a greater number of responses which could be collected and analysed efficiently and quickly, and with minimized cost in comparison with paper-based surveys (Wright, 2005; Sheehan & Hoy, 1999). In addition, "web page-based surveys allow for anonymity in responses, since the respondent can choose whether to provide his or her name or not" Sheehan & Hoy, 1999, para. 9), and they can eliminate any potential for bias that the interviewer may bring to the questionnaire as there is no direct contact with the respondents. Finally, I ensured that the questionnaires were less than 4 pages long, and each item or questions did not exceed 20 words (Oppenheim, 1992). Moreover, I ensured that completing the questionnaires required less than half an hour in order to ensure that they were not too long, and to avoid making them counterproductive (Dornyei, 2003).

Questions within the questionnaires (Appendices one and two) were based on literature about M-learning, the target skills needed for Saudi Aramco employees, propositions of this study, and the research questions. I developed the questionnaires with four study and work colleagues: an ESL/EFL expert holding an MA in TESOL and educational technology from the University of Manchester working at Qatar University, a coordinator of the iPad English program at Ras Tanura SAITC, a senior trainer from the job skills section at Ras Tanura SAITC, and a PhD program

colleague. This preceded the feedback received from the PhD supervisor on the questionnaires. The comments on the questionnaire items, the accuracy of the translation of the trainee questionnaires, the design, and the layout enabled me to ensure that questions acted like "measures; each question has a job to do, and that job is the measurement of a particular variable" (Oppenheim, 1992, p. 144).

Finally, I piloted the questionnaire on a group of four trainees and three instructors to evaluate its content and check clarity of items. It was shared with them that their feedback on the questionnaire should be focused on content and layout; specifically, with regards to ambiguities or difficulties in wording, readability levels, redundant and irrelevant items, attractiveness and appearance of the questionnaire, time taken to complete the questionnaire, and items that were too easy, too difficult, too complex or too remote from the respondents' experience (Cohen et al., 2007). No changes were needed based on their feedback; therefore, I continued with the plan of sharing the questionnaires with the rest of study participants. However, in order to avoid any potential impact of my supervisory role at the SAITC, I asked a colleague to administer the questionnaires.

3.5.2. Interviews

Conducting interviews to collect data for this study was inevitable. Data from the questionnaires and the other sources mentioned above would not provide comprehensive and sufficient data for this research. Interviews "allow for greater depth than the case with other methods of data collection" (Cohen et al., 2007, p. 352). During the interviews, I not only recorded or considered the 'conscious' spoken output of the interviewees, I was also able to collect some important information from their 'unconscious' pauses, gestures, facial expressions, body language and self-confidence.

To avoid bias during conducting the interviews as much as possible, I did the following (Cohen et al., 2007). I obtained a written consent from each interviewee to proceed with the interview, clarified issues of anonymity and confidentiality, and reviewed with them the purpose of the interview, and whether, how, and when the interviewee may receive results of the research. I confirmed to each interviewee that insights, best practices, and concerns on using the iPad may be shared with the company management in the form of a final study report; however, single participant responses would not be shared with anyone. I was keen to ask open-ended questions and to avoid leading and multiple-part questions. I ensured that spending time listening to each interviewee and providing him with a complete chance to offer his perspectives was more important than providing my own perspectives (Hancock & Algozzine, 2016).

Building and Piloting the Interview Questions:

I created 10 predetermined questions for instructors (Appendix three) and another 10 for trainees (Appendix four). They were also based on literature about M-learning, the target skills needed for Saudi Aramco employees, propositions of this study, and the research questions. The predetermined interview questions were also reviewed by the four colleagues mentioned above and as well as study supervisor. I asked follow-up questions designed to probe more deeply issues of interest to the interviewees. In this manner, semi-structured interviews "invite interviewees to express themselves openly and freely and to define the world from their own perspectives, not solely from the perspective of the researcher" (Hancock & Algozzine, 2016, p. 39).

Operationalizing the Interviews:

I conducted the interviews from May 5 to May 20, 2017 with 14 trainees and 20 instructors in order to listen to their unique points of view and to examine how mobile devices impacted their learning from their unique perspective. Each participant was interviewed once for approximately 35 minutes. Data saturation, that is no new themes, perspectives, or perceptions were evident in the data, was achieved at script 29. I realized that saturation was achieved at this stage because participants in the sample were similar in their experiences with respect to the research domain (Guest, Bunce, & Johnson, 2006).

Interviews were cell phone-recorded, file-named in a folder, backed up on a private online platform, and protected with a password to secure an accurate account of the conversations and to avoid losing data. Later, all recordings were transcribed to categorize information into a coding scheme as will be explained below. The transcript lengths ranged between 9 to 17 pages resulting in the analysis of a comprehensive set of interview information.

3.5.3. Observations

I employed *'unstructured observation'* for the phenomenon under study to collect data which was not obtainable by the other methods (Appendix five Sample Observation Log). Unstructured observations provide "a rich description of a situation which, in turn, can lead to the subsequent generation of hypotheses" (Cohen et al., 2007, p. 398). The data that this method could provide included information related to the physical setting and environment within which the training activities took place as well as the behaviour of trainees and instructors involved in the training program with the iPad (Cohen et al., 2007). Observations generated complementary data which led to further insights and a better understanding of the phenomenon under study.

Unlike the questionnaires and interviews which may "rely on people's sometimes biased perceptions and recollections of events, observations of the setting by a case study researcher may provide more objective information related to the research topic" (Hancock & Algozzine, 2016, p. 46). However, researchers have to identify and rectify the impact of their own biases and to ensure the impartiality of their

observations. Thus, to conduct effective, meaningful and impartial observations, I identified what had to be observed by creating an observation guide, which is a list that included "the time/date/location of the observation, names/positions of persons being observed, specific activities and events related to the research questions, and initial impressions and interpretations of the activities and events under observation" (Hancock & Algozzine, 2016, p. 47).

Operationalizing the Observations:
259 unstructured observations over a period of more than 15 months, from November 2016 to February 2018 were collected. Similar observations were gathered and tabulated with the number of repetitions. A summary of the predominant ideas collected during these observations has been introduced together with a classification for the locations (inside or outside the classroom) and the observed people (trainees, instructors, and/or administrators). While doing so, I ensured the following:

- Observations were done and documented on spot and right away.
- Commenting on the observations was recorded after the observation, not before.
- Events were captured in the same order in which they occurred.
- My notes reflected what I was thinking and wrote my thoughts down on soft notes using Evernote application (Hancock & Algozzine, 2016; Cohen et al., 2007).

3.5.4. Documents

Gathering data from relevant documents to supplement and compensate for the limitations of other methods is an important data collection method. Documentary evidence such as email messages and reports on the implementation and evaluation of the iPad program as well as videos were employed as a method to cross-validate information gathered from the questionnaires, interviews, and unstructured observations. Screenshots of some content pages were used as a source of data to validate the themes and discussion about content. Similarly, screenshots of some videos that were developed by the company instructors and program designers as a means of program evaluation were also employed to validate some concepts related to M-Learning environment. Hancock and Algozzine (2016) argued that "when combined with information from interviews and observations, information gleaned from documents provides the case study researcher with important information from multiple data sources" (p. 52).

Operationalizing the Documents:
I used all accessible documents that would not cause any ethical issues with the company such as the email messages, program evaluation reports, company content, and program evaluation videos. The data collected from these documents were

represented in a descriptive form, and in a way that supported the data collected from the other sources of information. I ensured anonymity of data selected and avoided using any documents that were deemed with confidential information.

3.6. Data Synthesis and Analysis

Synthesizing data which means combining, integrating, and summarizing findings was carried out on an inductive basis. Broad generalizations, conclusions, and themes were generated from the transcripts, participants' discussions, observations, and the quantitative data (Gale, Heath, Cameron, Rashid, & Redwood, 2013; Fereday & Muir-Cochrane, 2006). In this sense, Thomas (2006) Argued that the "primary purpose of the inductive approach is to allow research findings to emerge from the frequent, dominant, or significant themes inherent in raw data, without the restraints imposed by structured methodologies" (p. 238). In a more specific sense, I adopted Hancock and Algozzine (2016) frame to synthesize the large amounts of data generated from different resources. They argued that answering the following questions may facilitate this process:

- What information from different sources goes together?
- Within a source, what information can be grouped?
- What arguments contribute to grouping information together?
- What entities bounded by space and time are shared?
- How do various sources of information affect findings?
- What information links various findings together?
- What previous work provides a basis for analysis?
- What questions are being answered?
- What generalizations can be made? (Hancock & Algozzine, 2016, p. 63)

To answer these questions, I followed a process of four steps (Ary et al., 2010, p. 565) which included:

Stage 1, ***data reduction.*** I printed out all the qualitative data, sorted them by questions, and color-coded them by theme. I gathered similar ideas and comments and used relevant quotations from participants to support the emerging themes.

Stage 2, ***data display.*** I displayed the quantitative data in percentages to enable readers to immediately recognize, compare and contrast the data. Qualitative data was displayed in a thematic manner where a concept or a theme was introduced, and description followed.

Stage 3, ***data consolidation.*** I combined both sets of data quantitative and qualitative to create a new set of findings.

Stage 4, ***data integration and reporting.*** I integrated the data and interpretations into a coherent whole.

I journaled my thoughts and decisions and synthesised them with other instructors and program coordinators to determine if my thinking became too driven by the framework. Finally, I established for bracketing my understanding of the phenomenon - as much as I could - throughout the different stages of data analysis by consciously subduing the tendency to integrate the descriptions by research participants into existing theoretical structures, and by giving a clear description of the process of analysis to allow the reader to evaluate the attempt to achieve bracketing (Ashworth & Lucas, 2000).

Table 3.1 below summarizes how the research questions were handled in terms of data collection and data analysis.

Research Questions	Sources of Data	Data Analysis Plan
• To what extent and how can mobile devices play a role in developing job-related skills at an industrial training workplace? • What are the key dynamics, aspects, and features of M-Learning environments at VTET contexts? • What are the potential enhancements of M-Learning environments at VTET contexts?	• Semi-structured online questionnaires for instructors and trainees. • Observation of behaviour of trainees and practices inside and outside the classrooms. • Semi-structured interviews with trainees and instructors. • Program documents such as internal evaluation reports and screenshots of the internally developed content and evaluation videos.	• Qualitative data was analysed using theme analysis or thematic coding. • Quantitative data was analysed using descriptive statistics and introduced in percentages. • Consolidation of analysis was done through the seven-stage conceptualization of mixed method analysis.

Table 3.2: Research Questions and Data Collection and Analysis Plan, 2018.

3.7. Confirming the Case Study Findings and Achieving Trustworthiness

As with other research methods, in order to ensure the rigor and trustworthiness of case study research, researchers have to adopt specific strategies for establishing as much as possible of credibility, transferability, dependability, and confirmability.

Baxter and Jack (2008) introduced the following as general guidelines for critically appraising case study research.

> … researchers have a responsibility to ensure that: (a) the case study research question is clearly written, propositions (if appropriate to the case study type) are provided, and the question is substantiated; (b) case study design is appropriate for the research question; (c) purposeful sampling strategies appropriate for case study have been applied; (d) data are collected and managed systematically; and (e) the data are analyzed correctly. (Baxter & Jack, 2008, p. 556)

I have meticulously followed these guidelines in addition to employing the following strategies recommended by Hancock and Algozzine (2016), Baxter and Jack (2008), Russell, Gregory, Ploeg, DiCenso, and Guyatt (2005), Mays and Pope (2000), Forchuk and Roberts (1993), Krefting (1991), Knafl and Breitmayer (1989), Lincoln and Guba (1985), and Guba (1981).

- Sufficient details about the context of study, chosen research design, and data collection and analysis were provided so that readers can assess the validity or credibility of the work.
- Appropriate sampling strategies were applied for different data collection methods.
- Data was collected and managed systematically and in an organized manner.
- Data was analysed methodically, and in accordance with regulations of qualitative research.
- Triangulation of data sources and data types was applied by using questionnaires, interviews, observations, and documents as methods for data collection. This combination of different data types made the data more synergetic as they informed each other.
- As data was collected and analysed, I integrated the process of member checking, where my interpretations of the data were shared with 3 study participants, who had the opportunity to discuss and clarify the interpretation and contribute new or additional perspectives on the topic under study. “This activity extends the intent of the researcher’s ethical obligation to debrief participants in the study. The goal of gaining feedback from those studied is to gather their perceptions of the plausibility of the findings based on the information that the participants themselves provided” (Hancock & Algozzine, 2016, p. 66).
- I employed the process of double coding where a set of data was coded, and then after a period of time, I returned and coded the same data set and compared the results.
- I compared obtained outcomes to previously published research findings.

3.8. Summary

In this chapter, the research design for this study was presented. I have given a detailed account on the employed research methodology, case study. In addition, I clarified my philosophical stance and my role in this study by presenting my ontological and epistemological positions for this study. After that, I presented a detailed account on the design and implementation of the case study. I explained how I used multiple data collection methods for this study, including online semi-structured questionnaires of Likert scales and open-ended questions, semi-structured interviews, field observations, and program documents and evaluations reports. I also presented the adopted sampling methods and the strategies I used for data synthesis and analysis. Finally, I introduced the measures of confirming the case study findings and achieving rigor and trustworthiness.

4. Chapter 4: Findings

In this chapter, I will introduce the findings of this research based on the data collected from the questionnaires, interviews, onsite observations, and program documents. Findings of this research have been categorized in three main themes:

- The role of M-Learning in Developing Trainees' Employability and Job-Related Skills.
- Key Aspects, Dynamics, and Features of M-Learning Environment.
- Potential Enhancements of M-Learning Environments.

These themes and the other sub-themes have been presented with supporting qualitative and quantitative evidence collected from the research data, and in a way that helped me to answer the research questions: *To what extent and how can mobile devices play a role in developing employability and job-related skills for trainee at an industrial training workplace?* and *What are the key aspects, dynamics, and features of M-Learning environments at VTET contexts?*

4.1. The Role of M-Learning in Developing Trainees' Employability and Job-Related Skills

Findings of this research indicated that M-learning plays an important role in the development of many employability and job-related skills for trainees at an industrial training environment. In fact, it is very difficult to draw clear lines between these skills, though, as they intertwine and impact each other. For example, it is not possible to discuss the development of presentation skills without touching on ICT skills, creativity, typing, searching, and perhaps teamwork and collaboration skills. There is always a degree of inter-relationship and mutual impact amongst these skills. However, for clarity and academic discussion, these skills will be introduced separately.

4.1.1. Safety Skills

The majority of research participants indicated that M-Learning plays an important role in developing trainees' safety skills. For example, of 133 trainees who responded to the questionnaire (trainee-respondents), 100 (75%) think that mobile technologies helped to improve their safety skills more easily while 7 (5%) do not think so. Likewise, of 29 instructors who responded to the questionnaire (instructor-respondents), 19 (65.5%) think that mobile technologies helped trainees to improve their safety skills while 3 (10.5%) do not think so. The remainder of participants adopted a neutral position.

Likewise, various comments from the interviews, questionnaires, and onsite observations support this finding. For example, chances of *trainees' exposure to interactive and entertaining safety videos and tutorials* have increased with the use of

mobile technologies. Instructor 3 from the Basic Operations Training Unit (BOTU) shared this example:

> I can easily get an enjoyable safety video on YouTube, which I think is relevant to the topic in hand and airdrop it to the trainees or email it to them. It is true that I could do this in the past, but in the past, how would I share it with them on their personal devices so that they can take it home and watch it at any time?

In addition, mobile technologies facilitate the *access to many exciting safety videos that were produced by top specialized institutions as well as documentaries and series of investigations* done on safety incidents inside and outside the classrooms. Such documentaries and series of investigations capture trainees' attention and increase their awareness and knowledge about safety. Instructor 6 from the Mechanical Training Unit (MTU) gave the following example:

> Being job skills trainers, we are dealing with operating equipment. We are disassembling and reassembling the equipment, and we have to do it safely and to teach our trainees to do it safely. There are lots of safety videos made by top specialized institutions that allow us to share them with our trainees, and they can play them in the classroom and outside the classroom.

Moreover, mobile technologies facilitate *the provision of various types of training resources (such as information, images, videos, and stories)* which help trainees to develop their safety presentations and projects. Trainee 1 from the Process Control and System Technician Unit (PCSTU) said:

> Every morning, one of the trainees has to deliver a small presentation about a safety topic to the class. The iPad is really helpful for them to prepare the slides easily and with rich content. In addition, previously we could only share our daily safety messages on the interactive whiteboard, but with the iPad, we can share all safety messages, projects, and files instantly on each other's device.

In more than one classroom observation I attended, the instructors asked trainees to find a safety message and share it with the rest of the class. Trainees appeared to be *engaged with various online resources on their devices,* and within a few minutes, a trainee was able to find and share a safety message with the rest of the class. This was followed by a whole class discussion on the safety message.

Therefore, it is the features of *easy access to enjoyable, engaging, and interactive learning materials and the easy sharing of them* that make the role of mobile technologies noticeable as indicated by study participants and as observed in the

context of study. Until recently, such learning resources used to be available on the stationary computers at the computer laboratories, but they were accessible only during the breaks, unlike now when trainees can access these resources at anytime and anywhere. Trainee 3 from the PCSTU said:

> With the iPad, you can see the safety messages at any time. It's not just one time only when see them on the board and you forget them. So, having these massages on the iPad reminds me of safety all the time and increases my knowledge about it.

Conversely, some study participants doubted the impact of mobile technologies on the development of safety skills. They explained that *safety is a living thing that needs to be promoted during real work, not via online videos*. Instructor 8 from the PCSTU shared the following argument:

> The best places to give trainees safety awareness are the workshops and labs where we can really teach them and force them to wear safety equipment and deal with operational equipment safely. Learning about safety and building the habit of working safely has to be in the workshop, not on the iPads.

Other participants argued that the newly-developed digital *content sometimes misses some important safety videos and tips, which makes it obligatory for instructors to fill these gaps using 'non-standard' videos*. A questionnaire respondent (instructor) commented:

> There are some materials on the iBooks about safety, but they do not cover much. Therefore, I have to look for some online resources. This takes a lot of my preparation time, and I may end up getting some tutorials that do not meet Saudi Aramco standards or specifications.

Indeed, some researchers found that mobile technologies can raise safety awareness through the various videos, presentations, and documentaries they can provide (Douphrate & Hagevoort, 2015; Reychav & Wu, 2014; Kenny, Park, Van Neste-Kenny, Burton, & Meiers, 2009); however, practicing safety onsite will remain critical to ensure safe operations. Other researchers such as All, Plovie, Castellar, and Van Looy (2017), Douphrate and Hagevoort, (2015), and Tichon and Burgess-Limerick, (2011) confirmed that mobile technologies can give workers and trainees the opportunity to engage and interact with interesting and enjoyable safety training materials and to retain more information, allowing them to apply it effectively to their jobs.

4.1.2. Teamworking, Cooperation, and Collaboration Skills

The majority of participants of this research indicated that M-Learning plays an important role in developing trainees' teamworking, cooperation, and collaboration skills. Of 133 trainee-respondents, 112 (84%) think that mobile technologies helped them to improve their teamworking skills while 3 (2%) do not think so. Likewise, of 29 instructor-respondents, 19 (65.5%) think that mobile technologies helped their trainees to improve their team working skills while 2 (7%) do not think so.

In addition, numerous comments from the interviews, questionnaires, onsite observations, and program documents support this finding. For example, mobile technologies provide *more opportunities and innovative tools that enable trainees to work together more than before*. They can *share their projects, answers, notes, and resources more than before*. Instructor 11 from the Academic Section gave the following example:

> If a trainee writes good notes, he can easily send them to someone on the other side of the room to help him understand better. If a trainee finds a good website, he can send the link to the other trainees. The iPads help them more to work together.

Besides, mobile devices *facilitate group work* in many ways. Trainees *divide the work and agree on their roles* in the projects, presentations, and tasks. They develop and revise their work together more easily on the groups which they create, and present it together through airdropping features or by mirroring their device screens on the class board. Instructor 3 from the BOTU elaborated on this: "there is more collaboration on working with the iPad as trainees develop their presentations together, revise them, and present them together".

Furthermore, *mobile technologies are handy and portable*. They do not obtrude conventional face-to-face interaction. Therefore, trainees can cooperate and collaborate face-to-face like they used to in the past (Figure 4.1), but with the extra features and platforms on the mobile devices which allow them to work together more whether at the training centres or at home. Trainee 6 from the Electrical Training Unit (ETU) said:

> …even if we are not physically present, we can still work together. Let's say, for example, we are working on a presentation together. I can handle part of the presentation, and my friend can handle the other, and we can just share our input by email or other instant messaging applications.

In fact, several studies came to similar conclusions with regards to the propensity of mobile devices to foster teamwork, collaboration and cooperation skills. For example, Naismith, Sharples, Vavoula, and Lonsdale (2004) argued that

> Mobile devices can easily communicate with other devices of the same or similar type, enabling learners to share data, files and messages. They can also be connected to a shared data network, further enhancing possibilities for communication. These devices are also typically used in a group setting, and so interactions and collaboration will tend to take place not just through the devices but also at and around them as well. (p. 15)

Other studies highlighted the role of social media applications in introducing new channels of communication, facilitating social interactions through various user-friendly platforms, and providing tools for collaborative and cooperative activities (Hsu & Lin, 2017; Kim et al., 2016; Martiniello & Paparella, 2016).

However, some study participants confirmed that *instructors' interventions to make cooperation and collaboration happen is critical*. Many trainees will be inclined to work on the devices by themselves even if the activities were designed to be completed in pairs or groups. Therefore, unless the instructor asks his trainees to work together and sees an evidence of this happening, the level of team working, corporation and collaboration will not be satisfactory. Instructor 15 from the Academic Section said: "Almost every page of the iBook will ask trainees to work in pairs or in groups, but this takes an intervention from the instructor to force it happen".

Furthermore, some participants raised another concern. *Some trainees became more alone and more isolated than before and tend to learn arbitrarily on their own.* Their interaction together is not as it used to be, and there is less conversation and collaboration amongst them. Instructor 5 from the MTU commented:

> I have noticed that I have got more trainees now who are less interactive with the others verbally; especially, in the workshop! In the past, they would approach each other or me to ask about the meaning of a word for example. Now, they have online dictionaries and many other applications like YouTube. Isolation or aloneness in the classroom has its negative implications on the workshop, which is worrying me because they should be working together. They should communicate because they are working with live equipment or heavy equipment.

In light of this, participants highlighted the role of *proper training and awareness* campaigns for both trainees and instructors to learn and implement the skills of working together. Trainee 12 from the MTU said:

> There has to be more awareness for instructors and trainees with regards to how to best use the iPad and its content; especially when

it comes to group and pair activities. There are some activities on the iBooks which have been designed to be completed in pairs or in groups, but trainees just do them individually, and instructors do not stop them from acting like that.

Similarly, other researchers argued that accepting learners' autonomy in technology-enhanced learning environments does not mean that instructors can let learners learn anything arbitrarily (Liu, Wang, Liang, Chan, Ko, & Yang, 2003). Naismith et al. (2004) argued that "learning is a continual conversation; with the external world and its artefacts, with oneself, and also with other learners and teachers" (p. 15). Hence, facilitating and ensuring classroom conversation and collaboration is taking place amongst trainees is an important role that instructors should carefully note (Naismith et al., 2004). This is grounded on the principle that mobile devices can provide "another means of coordination without attempting to replace any human-human interactions" (Naismith et al., 2004, p. 17).

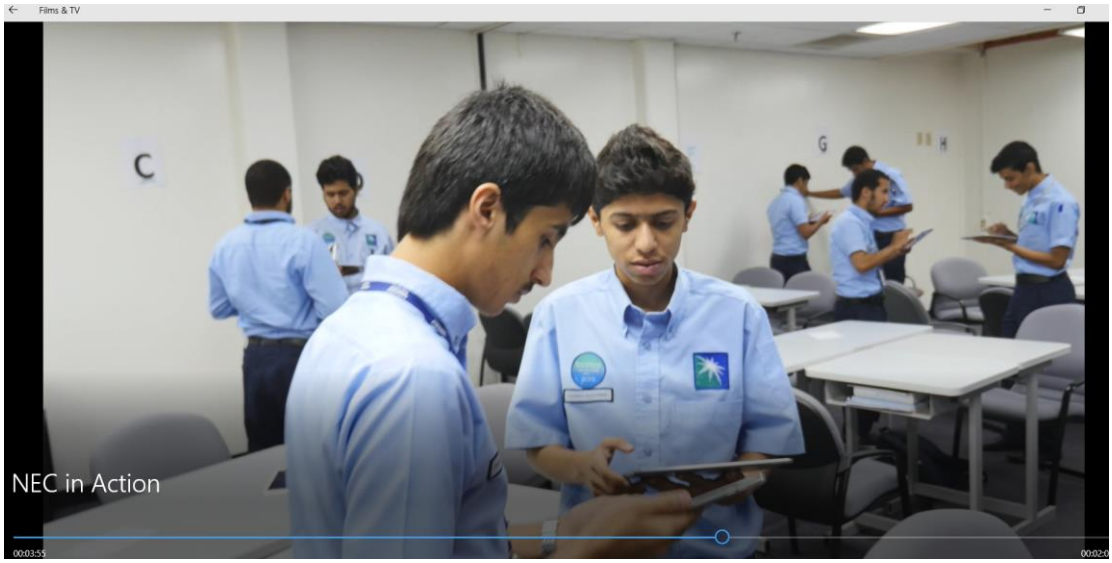

Figure 4.1: Trainee Face-to-Face Collaboration with Mobile Devices, SAITC, 2018.

4.1.3. Craftsmanship Skills

The majority of participants of this research think that M-Learning plays an important role in developing trainees' craftsman skills (discipline-specific skills). Of 133 trainee-respondents, 95 (71.5%) think that the mobile technologies helped them to gain new technical skills more easily while 5 (3.5%) do not think so. Likewise, of 29 instructor-respondents, 18 (62.5%) think that mobile technologies helped their trainees to gain new technical skills more easily while 2 (7%) do not think so.

Comments from the interviews and questionnaires indicated that mobile devices play an important role in developing both theoretical and practical technical skills. On the

theoretical technical knowledge, participants highlighted that mobile technologies, unlike textbooks and stationary computers, *facilitate the provision of simplified and interactive resources such as tutorial videos and animated models and designs* inside and outside the classrooms. Instructor 4 from the MTU shared this example:

> When it comes to the theoretical part, the iPad has made a big difference. The iPad does provide better graphics and better access to other tools such YouTube videos. We did not have constant access to these resources and tools before the iPad.

These simplified, interactive, and various resources are argued to help trainees gain new knowledge more easily. Perhaps this is because they are provided in a medium that appeals more to the learners, meet different trainees' learning styles, and/or allow for more innovative tasks/activities to happen. In a similar sense, Clark and Luckin (2013) and Goodwin (2012) argued that mobile technologies provide access to a wealth of *online resources* and enable a wider range of functions and learning activities to routinely occur in the classroom, which were not conceived before using those devices.

Besides, mobile technologies - with the *multimodal and especially the animated representations of learning materials - can facilitate the comprehension and retention of technical processes*; especially for entry-level trainees. This feature cannot be achieved by textbooks, which would introduce the information in text only, or - in the best scenarios - with some images. Instructor 2 from the BOTU shared this example:

> It is not easy to explain some specific equipment or processes to someone who does not have a technical background. With traditional textbooks, the trainees may be sitting there shaking their heads and saying that they understand, but in fact, they may not really understand how the equipment functions. Now with the iPad, I go on YouTube and show my trainees how a pump or any other piece of equipment works. I show them exactly what they need to see and learn, and they really learn more quickly from that!

On the practical technical skills, of 133 trainee-respondents, 91 (68.5%) think that the mobile technologies increased their job skills performance while 5 (3.5%) do not think so. Likewise, of 29 instructor-respondents, 24 (82.5%) think that mobile technologies increased their trainees' job skills performance while 2 (7%) do not think so. Interview participants also provided similar insights. For example, Trainee 8 from the ETU said:

> Unlike textbooks, when I sometimes have to read many pages about a process, the iPad introduces compressed, simple information in an interactive way which guides me through the process itself. I am not

> reading about the process; I am already working on the process in a safe manner before the practical application.

Highlighting learning from *'compressed information'* and from different resources and *'nodes'* (Siemens, 2004) explains the argued purpose of learning within technology-enhanced environments which, according to Kimmons and Hall (2016) "has shifted toward improving access between the learner and information sources" (p. 57). This is impactful on the role of the instructors as they have to facilitate learning within indefinite and unclear environments of various shifting elements which are not under their control (Siemens, 2004).

The emphasis on preparing trainees for the hand-on training is a core objective at the training institute, and the role that mobile technologies can play in this regard has been highlighted by study participants. For example, of 133 trainee-respondents, 101 (76%) think that the mobile technologies helped to prepare them for the practical work in workshop while 2 (1.5%) do not think so. Participants confirmed that mobile technologies help to prepare trainees for the practical work in workshop in several ways. For example, the *mental preparation through the visual aids and continuous exposure to tutorial videos and animated models play a massive role* in improving trainees' hands-on performance. Instructor 3 from BOTU gave this example:

> In practical operations, trainees use their hands, but before that, they watch a lot of videos on the tasks that take place in the plant and see what is expected from them. This makes them learn better and make fewer mistakes during the practical part of their jobs.

Likewise, Trainee 1 from PCSTU shared this example:

> On the iPad, you have many drawings, many videos, many animations, so when you go to the lab or to the practical part, you have already seen what you are going to do. You are not facing a new thing for the first time.

I observed a high level of trainees' motivation to using the different resources that mobile technologies offer in learning different skills, tasks, and processes all through the interviews. Understanding that these resources *facilitate trainees' learning of complex technical processes and tasks* requires enormous efforts from the curriculum designers, program administrators, and instructors so as to incorporate more interactive, engaging, and multimodal resources that can best fit with the training program objectives and the specific corporate standards and regulations. Furthermore, the involvement of trainees in the creation of learning materials and supplementary resources has to be considered, perhaps as a form of experiential learning. In this respect, Dyson et al. (2009) argued for the use of mobile applications "which support authentic learning activities, including student use of the multimedia capabilities of

mobile devices for developing digital narratives, the gathering and analysis of field data, concept mapping, and student production of podcasts" (p. 253). Finally, it can be argued that the conversion of the currently in-text-only lessons into standardized, high-quality videos and animated models may increase the impact that mobile technologies have on job skills training.

4.1.4. Creativity, Problem-Solving, and Critical Thinking Skills

These skills have been used in this research in light of the definitions below which have been obtained from literature and based on how they used to be taught at the co-curricular program courses at the context of this study. *Creativity* is the procedure whereby learners go beyond limitations and produce their own original ideas or solutions, *problem-solving* refers to reaching specific goals by finding ways to overcome barriers between a given state and the desired goal, and *critical thinking* is more evaluative and analytical in nature, and it refers to the cognitive strategies that are essential to improve students' decision making, critical judgment, and self-reflection (Iqbal, 2016; Akcaoglu & Koehler, 2014; Lai & Hwang, 2014; Zeng, Proctor, & Salvendy, 2011; Lazakidou & Retalis, 2010; Yang & Cheng, 2010).

In this respect, most participants of this research think that M-Learning plays an important role in developing trainees' creativity, problem solving, and critical thinking skills. For example, of 133 trainee-respondents, 85 (64%) think that mobile technologies helped them to improve their creativity skills while 29 (22%) do not think so. Also, 83 (62.5%) think that mobile technologies helped them to improve their problem-solving skills while 18 (13.5%) do not think so. Finally, 48 (36%) think that mobile technologies helped them to improve their critical thinking skills while 35 (26%) do not think so. There are 50 (37.5%) trainees who took a neutral position in this area, and they can change the data significantly if they are added to either of the respondents who agree or disagree.

In this respect, comments from the interviews and questionnaires support this finding. For example, mobile devices can ignite original and fresh ideas and help trainees in handling issues and problems in an analytical style. They can encourage trainees to ask more questions, and thus, *curiosity is accommodated* because trainees are more confident that whatever questions they raise, they may find their answers, or clues to the answers in the *rich resources available on their devices instantly and at anywhere*. Trainee 7 from ETU shared this view:

> We certainly ask more questions now because we know we will find the answers handy and available on Google and Wikipedias. We are not stuck between covers as in studying with textbooks. The various resources can help us to find or create better solutions to all problems we might face.

Besides, the *ubiquity and connectivity features of mobile technologies encourage trainees to look for innovative and 'other methods' of doing things*, which means there is a higher level of curiosity developed with these devices. Trainee 13 from MTU commented:

> I am more curious with the iPad! Sometimes I look for some information that is not available on the iBook, or - even though it may be available - I go online to see how this specific issue or topic is being handled differently in other contexts.

Having the confidence that they will find answers or clues to answers of whatever questions they raise, trainees are more inclined to adopt an *active role* in the learning process and to understand that the instructor is not the sole source of knowledge; thus, promoting a more learner-centred environment. Kilis (2013) came to similar conclusions as she argued that mobile technologies have the potential to support individualized and self-directed learning.

Also, study participants indicated that *learning from different resources and from others' experiences* - which mobile devices facilitate access to - may sharpen creativity, critical thinking, and problem-solving skills. *Searching for and using new applications and websites* that help trainees to *design their own drawings and learning materials* impacts these skills positively. Trainees can develop lots of routine activities in a creative and appealing way on their devices. Trainee 9 from MTU gave this example:

> The iPad helps us to be more creative because it widens the scope of learning from different resources and it facilitates downloading applications that help us design new things in new ways. Also, many individuals, organizations, and companies share how they handled specific issues or problems innovatively. We learn from these and sometimes try to adapt them to suit our needs in a creative way.

Similarly, Trainee 1 from the PCSTU explained how the iPad helped him with improving his creativity and critical thinking skills through the various applications on the device:

> Now I am studying a course about electrical circuits. So, when the instructor tells me to do an electrical circuit, there is a website that I access on the iPad where I can do any electrical circuit easily and without wasting a lot of time. Drawings and connecting things together are made easier, and we are more creative and accurate.

Existing literature that investigated the role of mobile technologies in promoting creativity, problem-solving, and critical thinking skills came to similar findings. For

example, in their study to investigate the effect of M-Learning on the critical thinking skills, Cavus and Uzunboylu (2009) found that the students' creativity improved significantly with the use of mobile technologies for extended periods of time. Likewise, Garwood (2013) confirmed that new technologies can enable students "to learn to use a more advanced skill set including the ability to process the ever-increasing amount of available information, become flexible thinkers and creative problem-solvers" (p. 25). In this respect, curriculum developers and instructors have to incorporate more exercises, resources, applications, and activities that can increase learners' curiosity, creativity, critical thinking, and problem-solving skills. Perhaps more challenging and interactive game-based lessons, scenarios, and situations can be developed for this purpose.

4.1.5. Presentation Skills

According to Alshare and Hindi (2004), the importance of trainees' presentations in the classroom originates from the fact that employers demand "graduates with excellent communication (written, oral, and listening) skills" (p. 6). In the context of this study, delivering individual and group presentations on specific topics is part of the assessment of some courses, modules, and units since this skill has been regarded as a core skill for trainees to develop.

Considering this, most participants of this research think that M-Learning plays an important role in developing trainees' presentation skills. Of 133 trainee-respondents, 92 (69%) think that mobile technologies helped them to improve their presentation skills while 16 (12%) do not think so. Also, numerous comments from the interviews, questionnaires, and onsite observations support this finding.

Study participants identified three key factors that mobile technologies avail and which positively impact the presentation skills; namely, the *availability of different applications for creating presentations*, *the device portability*, and *the direct access to the required resources for content development* (such as learning materials, images, and videos).

Unlike stationary computers, mobile technologies have made it easier for trainees to steadily develop their presentations due to the portability feature of mobile devices which make *taking notes and adding up to the content* of the presentation possible at any stage of the presentation, at any time and anywhere. Additionally, *the constant access to information and other resources* facilitates the development of the presentations content. Trainee 7 from ETU shared this example: "I find it easier to prepare my presentations on the iPad. Whenever I have an idea, I always have the iPad with me, and I add it to my presentation immediately". Also, Instructor 15 from the Academic Section shared this experience:

> All the presentations I have seen with the new curriculum using the iPads are much better than the old curriculum. The information is more easily accessible now. Trainees use their iPad to develop fine content for their presentations right there, instead of going to use computer.

Besides, trainees' *delivery of numerous presentations* - which is facilitated by the iPads - as part of their ongoing assessment played a positive role in developing their presentation skills. It has also raised their self-confidence and class participation. Instructor 3 from the BOTU explained how these presentations with iPads impacted trainees' confidence and class participation.

> I remember a trainee who was totally introvert and always by himself. If you get a word or two out of him, that would be an achievement. But over time, this trainee broke out of his shell and became someone who is comfortable with his colleagues and able to come in the front and make good presentations and even a few jokes.

From the onsite classroom observations, I can confirm that the quality of trainees' presentations - in terms of content and delivery - has improved with the use of mobile technologies for extended periods of time. Accordingly, perhaps curriculum designers and developers of training programs adopting M-Learning should explore how to incorporate more presentations in the training programs as a means of ongoing assessment where assessment for learning rather than assessment of learning can be emphasized (Maki, 2010, p.1-15).

Finally, study participants have indicated that *doing and delivering presentations* on mobile technologies instigates them to be more creative in different ways. Instructor 3 from the BOTU shared this example:

> The way the trainees lay out their presentations, the placing of the words, the picture selection, and annotations... all great! It is like presentations you would deliver to directors and managers. Without the iPads, this may be unlikely to happen, at least as frequently.

Indeed, other studies reported similar findings. For example, Wilke and Magenheim (2017) and Simona (2015) argued that technology facilitates the process of preparing for different types of presentations and plays an important role in delivering interesting, attractive presentations. Simona (2015) confirmed that mobile technologies particularly offer "models of effective academic, business and technical presentations, helping the students to prepare their own presentations" (p. 74).

However, although many participants confirmed that trainees' skills of developing, producing, and delivering presentations improved with the introduction of mobile technologies, others confirmed that both *presentation content and delivery are still not impacted very much*. They think that *cosmetics such as presentation backgrounds, and animations have truly been improved*, but a lot more work which is not related to the devices is still needed. Instructors' guidance in developing content, utilizing body language, and employing voice techniques are examples of areas that the mobile technologies cannot help with. Instructor 14 from the Academic Section elaborated on this: "The iPad helps to create very beautiful notes and presentations with fancy animations and relevant stuff, but the actual content, and the actual delivery, I don't think these devices help very much". Also, existing research highlighted similar challenges. For example, Simona (2015) argued that mobile technologies are disadvantageous, particularly, with low-achieving learners who tend to copy/paste content from the internet without considering copyright issues, reproduce the information they find online, and focus more on the visuals and less on learning the content or message that they have to deliver.

4.1.6. Communication Skills (Verbal and Written Communication)

Communication refers to "the skills required to work with people, including confidence, presentation ability without anxiety, and emotion control ability" (Lai & Hwang, 2014, p. 277). As an identified lifelong learning skill at the context of this study, it is incorporated in the training program with focus on verbal communication (such as function-based dialogues, delivering presentations, and reporting incidents) and written communication (such as writing email messages, memos, and reports).

In light of this, most participants think that M-Learning plays an important role in developing trainees' communication (verbal and written) skills. Of 133 trainee-respondents, 92 (69%) think that the mobile technologies helped them to improve their written communication skills while 22 (16.5%) do not think so. Likewise, 106 (79.5%) think that the mobile technologies helped them to improve their verbal communication skills while 10 (7.5%) do not think so.

Besides, numerous comments from the interviews and questionnaires support these findings. For example, numerous participants argued that communication skills are often interrupted because trainees may not know the meaning or the translation of a word; especially since English is not their first language while it is used as the medium of communication at the company. Now with the *quick access to online dictionaries* on their mobile devices, trainees can find the meaning or translation of new words faster, and thus explain themselves in a better way. Instructor 3 from the BOTU gave this example:

> We are teaching technical subjects in BOTU. Some of the words are not clear to the trainees because English is not their first language.

> This impacts their oral communication negatively. Now, the trainees look up the meanings of these words on their iPads quickly. We as trainers would not be able to explain to them as easily sometimes.

Moreover, participants indicated that mobile devices avail more opportunities for improving trainees' communication skills through *the social media and online chatting rooms and platforms*. Trainee 3 from the PCSTU shared this example:

> One of my teachers actually gave us a website that helps us to communicate with people who want to learn Arabic, and in the same way, you have a mutual interest because you improve your communication skills using videoconferencing or online chatting rooms. I use it a lot, and I find it really helpful. I communicate with many people orally and in writing.

Furthermore, features of mobile technologies such as *audio and video recording impact trainees' communication skills positively*. Trainees record themselves, evaluate their outputs, and re-record themselves. This continuous cycle shows themselves to themselves when communicating; especially with regards to how they sound and look. Trainee 5 from the PCSTU said:

> The iPad helps to improve our oral communication skills; especially with the feature of voice recording and sharing these recordings either for fun or as part of our speaking assessment. Of course, before we share such recordings, we play them to see if they are good enough; otherwise, we record them again. With time, we find that our oral communication skills get better.

The *various online groups* that trainees create on *instant messaging applications* appear to make them feel more connected and in a state of constant communication, whether to discuss ideas or share files and information. Arguably, mobile technologies are distinguished over the other technologies because they make trainees *connected all the time*. They can talk or chat with their classmates even if they are outside the premises. Trainee 9 from the MTU elaborated on this:

> We have different modes of communications among classmates and our trainers. For example, we communicate through the iMessenger. At once, I wanted to get more information about my specialization, and my trainer sent me a lot of information on the iMessenger. He also shared with us the best techniques when working and learning in the workshop as well as the best learning and studying methods.

Finally, the *increased amount of watching and listening to movies, songs, and online news* on mobile devices improves trainees' communication skills because, in addition

to learning new ideas and vocabulary, they learn how to convey their ideas. Trainee 8 from the ETU shared this example:

> I watch more movies, series, and songs on YouTube using my iPad. I learn how words are pronounced correctly. Then when I speak properly, my teacher would say: "Yes, that's more like the accent of a native English speaker".

However, although many study participants have given a good account on the role mobile devices can play to improve trainees' written communication skills, some have their *doubts on the role they play to develop the verbal communication skills*. Some instructors reported that mobile technologies make trainees more isolated and, thus, worse communicators. Instructor 13 from the Academic Section said:

> For the writing, yes, they write and write, and I think that has definitely improved their written communication skills. As for speaking, I don't know. There's more stimulus, more pictures, more activity types built into the curriculum, and you can also do videos, I think that does help. But definitely for writing, slightly less for speaking.

In fact, some participants explicitly raised significant concerns on mobile technologies with regards to verbal communication and emphasized the importance of *instructors' intervention to make communication happen* in M-Learning classes. Instructor 15 from the Academic Section elaborated on this:

> As for verbal communication, I don't think the iPads help trainees so much. It takes a lot of intervention from the teacher to encourage them to speak because they are just more engaged with and focused on their iPad the whole time.

Interestingly, several studies came to similar findings about the role of mobile technologies in developing communication skills. For example, Lai and Hwang (2014) argued that "integrating more mobile learning activities in the students' regular classes could facilitate improvement in their communicating abilities" (p. 286). Ng et al. (2016), Nie (2015), and Parsons, Ryu, and Cranshaw (2007) claimed that mobile technologies have the potential to improve the communication skills for the current learners; especially since they have been more involved in networked activities and tend to prefer them and gain more from the personalized, perpetual, and improved communication chances on their mobile devices. Conversely, existing literature also warned against too much involvement with the devices in a way that increases withdrawal and affects communication negatively (McNaughton and Light, 2013).

Arguably therefore, one implication of these findings for curriculum developers and instructors is to develop strategies and teaching methods that ensure more oral communication and encourage trainees to speak. Presentations, recorded dialogues, and other communication-based activities have to be more incorporated in the training programs.

4.1.7. Independent, Self-Development, and Lifelong Learning Skills

The majority of participants of this research think that M-Learning plays an important role in developing trainees' independent learning, self-development, and lifelong learning skills. Of 133 trainee-respondents, 102 (76.5%) think that the mobile technologies helped them to improve their independent learning skills while 19 (14%) do not think so. Additionally, of 29 instructor-respondents, 26 (89.5%) think that mobile technologies helped their trainees to improve their independent learning skills. Similarly, 23 (79.5%) instructors think that mobile technologies increased their trainees' learning opportunities outside the classroom while 2 (7%) do not think so. Likewise, 85 (64%) - of 133 trainees - think that the mobile technologies helped them to improve their lifelong learning skills while 38 (28.5%) do not think so.

Study participants identified four key aspects of mobile technologies that make them impact the development of independent learning, self-development, and lifelong learning skills; specifically, *digital content design*, *portability*, *resourcefulness*, and *constant connectivity*.

Initially, the way the *digital content* is designed on mobile technologies helps trainees to refer to it at any time when they need to *study, prepare, or review their learning materials independently*, without having to contact their instructors or other trainees for clarifications. The *rich and interactive digital content with the aid applications and supplementary resources such as translators, videos, calculators, and other learning-based tools* help trainees to work more independently. This appears to instil the basics of self-development, and lifelong learning skills in their minds. Instructor 9 from the ETU shared this insight:

> All the practical skills and the tasks are available on the iPad in the form of videos, animated pictures, and 3D designs. So, I show the trainees a video about how to perform a specific job or how to behave while doing a task. In the future, the trainees do not have to refer to me! They refer to their iPads if they forget any information.

Moreover, the digital *content features of auto-correct* and *auto-check* enable trainees to proceed with their learning without waiting for teachers to verify their work; the thing which used to - according to participants - demotivate high achievers who wanted to advance with their learning activities or embarrass slow learners who were subject to continuous criticism in front of their colleagues. In this respect, Trainee 2

from the PCSTU shared this example: “With the auto correct/check features, I don’t need to wait for the lesson in the classroom. I can complete the lesson and do the exercises and correct myself even before the class starts”.

In addition, some trainees confirmed that the mobile devices, with their features of portability, resourcefulness, and constant connectivity, enable them to proceed with their learning by themselves in different ways. They can independently and at their convenience *refer to many online tutorials and resources* if they do not understand a specific topic. There is no compelling need to refer to their instructor or another trainee with the rich resources which mobile devices provide. This appeared significant especially for shy trainees. A questionnaire respondent (instructor) elaborated on this:

> There was a big problem in the past with shy trainees who would feel embarrassed to ask the same question several times if they did not understand. This shyness could come from peer pressure or from the short time that instructors have to cover the learning materials. Now with the iPad, the trainee can go online, translate something which he does not understand or get more materials about it, and he catches up with his classmates.

Furthermore, some trainees confirmed that they already started *completing some formal and informal courses online*, and that using mobile devices helped them to access the learning materials at their convenience at the training centre or at home. For instance, Trainee 4 from the PCSTU confirmed this: “I am already doing a self-study online course on electricity. You know I like electricity, and I like to get more knowledge about it, and this is why I started doing this course”. Also, Trainee 3 from the PCSTU shared this example:

> Actually, there are a lot of websites and online organizations that give you a diploma degree by participating in some online classes and taking the course tests online. There are a lot of chances of learning by yourself with the iPad; especially since you can have it at any place and at any time.

Another indication of the way in which mobile devices facilitate independent learning is trainees’ emphasis that they would start *completing some required courses as self-study while working on a full-time basis* to increase their chances of promotion. They have found the mobile devices useful as they present the learning materials in interactive forms and facilitate access to them at anytime and anywhere. Trainee 6 from the ETU elaborated on this idea of self-study course completion:

> When I graduate from this training centre, the last English level I will have completed will be level 5, so I guess as a requirement to

> get a promotion, I will have to complete English level 6. As you know, you can do it in two ways, you may do it as a regular trainee or as self-study. I have decided to complete all the courses as self-study as I have all the resources on the iPad, and I have time to learn by myself.

Finally, the use of mobile devices opens new horizons in terms of effective utilization of training resources. Study participants suggested that these devices can help high performing trainees to proceed with their learning at a faster pace, which means that they can finish their training program in a shorter period if they are given the chance to. In this respect, Trainee 4 from the PCSTU gave this suggestion:

> I think the ITC should provide a track for those who are interested in learning at home and then come to the ITC for the test. In fact, I would not have this conviction if we were taught with textbooks because there would be things I would not understand.

Evidence is suggestive of similar findings regarding the impact of mobile technologies on improving learners' independent learning, self-development, and lifelong learning skills. For example, Abfalter et al. (2004), claimed that new technologies are argued to support this type of learning since they "offer the opportunity to learn and study at anytime and anywhere in different ways - according to the user's preferences" (p. 4). Lyddon (2016), Liu (2015), and Ayres, Mechling, and Sansosti (2013) concluded that mobile technologies and the new media technologies have the potential to open new possibilities in terms of the exercise of learner autonomy and self-instruction through the access to various kinds of mobile learning resources. Similarly, Sharples (2000) argued that features of mobile technologies such as portability, ubiquity, ease of use, and adaptability to evolving skills and knowledge can support independent learning. However, Ricky and Rechell (2015) argued that full exploitation of mobile technologies for independent and lifelong learning "requires learners to have a higher degree of self-directness, self-management, persistence and independency" (p. 98). Arguably therefore, I recommend that program designers explore the possibility of providing specific courses, units, modules, or lessons as self-study parts of the training program.

4.1.8. Searching Skills

The majority of participants of this research think that M-Learning plays an important role in developing trainees' searching skills. Of 133 trainee-respondents, 122 (91.5%) think that mobile technologies helped them to improve their searching skills while 4 (3%) do not think so. In addition, numerous comments from the interviews and questionnaires support this finding. For example, some respondents suggested that this generation of learners who are intensively *engaged with mobile technologies* already master searching skills. Instructor 3 from the BOTU said: "I do not think

these trainees need any focus on these skills. They already master these skills. If they can work on a mobile phone, they can work on iPads and navigate easily". Likewise, a questionnaire respondent commented: "Now I don't use my laptop anymore. It is easier to use my iPad to search for any topics or any information. We know which applications to use and which websites to visit for specific information".

Other respondents confirmed that searching skills can be further improved with mobile technologies as *trainees tend to look for extra learning materials and navigate different websites more*. Besides, *instructors' guidance and the employed teaching methods* play an important role in honing trainees' searching skills even further. Instructor 1 from the BOTU shared this example:

> I look for videos that will help me with my lesson, but I do not share them with my trainees. I take notes of their titles, and I ask the trainees to look for them. I do not give the trainees the titles word by word. If they say they cannot find the videos, I give them a couple of words as a hint to find the right video. They learn how to use their brains and how to improve their searching skills.

Although there appears to be a lack of research on how mobile technologies play a role in developing learners' searching skills, some researchers have come to similar conclusions as above. For example, Domingo and Gargante (2016) argued that one of the various impacts of learning with mobile technologies is "improving information searching skills" (p. 25). Arguably, more focused research on this skill and how mobile devices play a role in developing it has become of paramount importance; especially with the explosion of knowledge and information (Lewis, 2016) and with the rise of new learning theories such as connectivism and navigationism which advocate learning as connecting nodes of information from different resources to build knowledge (Brown, 2006; Siemens, 2004).

4.1.9. Information and Communication Technologies (ICT) Skills

Sarkar (2012) argued that ICT "consist of the hardware, software, networks, and media for collection, storage, processing, transmission and presentation of information (voice, data, text, images), as well as related services" (p. 32). ICT courses have been incorporated in the company training programs as standalone courses since ICT has been identified as a fundamental skill that trainees must have, at least, the basics of.

In this respect, most participants of this study indicated that M-Learning plays an important role in developing trainees' ICT skills. For example, of 133 trainee-respondents, 66 (50%) confirmed that they did not have experience using the iPad before they joined the training centre. However, 122 (92%) think that they are now confident in their ability to use the iPad while 3 (2%) trainees think that they are not

confident enough. In addition, numerous comments from the interviews and questionnaires support this finding. For example, some study participants confirmed that the *availability of the devices around the clock* and the con*stant engagement with them* help trainees to develop their ICT skills more quickly than before when they had limited access to computers. *Trainees learn more about the software and the hardware of their devices and about information collection, storage, processing, and presentation*. Instructor 13 from the Academic Section said the following: "In the past, we had one computer only in the classroom, and it was for the teacher. Whereas now you have twenty trainees with twenty iPads. The scope of learning through and about ICT is much higher!"

Also, the *frequent downloading, trying, and using of different applications on the devices* make trainees advance quickly with their ICT skills to the extent that they often exceed their instructors' expectations. Instructor 15 from the Academic Section commented:

> There is a lot of improvement in their general IT skills, which is surprisingly useful these days if you are setting up an app, or logging in, or storing passwords. These kinds of IT topics and computer literacy skills get way improved with time.

Existing research, although limited in this area, also confirmed that mobile technologies can play an important role in the development of ICT skills (Mac Callum & Jeffrey, 2014 and 2013). Considering this, I argue *more in-depth research on the type of relationship between mobile technologies and ICT* skills has to be conducted; especially in light of the hypothesis that good ICT skills may play a role in the success of training programs that are based on mobile technologies.

4.1.10. Typing Skills

Most participants of this research suggested that M-Learning plays an important role in the development of trainees' typing skills. Of 133 trainee-respondents, 121 (91%) think that the iPad helped them to improve their typing skills while 3 (2%) do not think so. In addition, numerous comments from interviews and questionnaires indicated that mobile technologies can play an important role in developing trainees' typing skills, and more importantly, typing in English skills.

For instance, some participants confirmed that mobile technologies make trainees learn to type faster because, simply, they have to *type all day on their devices*. They *type notes, emails, and answers to questions and exercises*. Trainee 5 from the PCSTU elaborated on this:

> The iPad is very helpful when it comes to improving the typing skills. Actually, the hard keyboard that the ITC management has

> provided to us as an attachment to the iPad helped me a lot. The more I use the keyboard and the iPad screen, the faster I recognize all the letters, and this makes my typing faster.

In addition, there is an indication that trainees*' typing in English skills* further improved with the use of the iPads. Trainees may excel in typing in their mother language, Arabic, but they used to find it challenging to type in English. Now, with the iPads' keyboard set in English only, *typing in English* has improved over time. Trainee 7 from the ETU also elaborated on this: "I was used to typing fast in Arabic, but I was very slow in typing in English. I was typing a letter by letter, using one finger. Now I can type much faster than before".

However, some study participants confirmed that there is an inherent problem with typing on mobile devices, which is the auto-correct feature of the keyboards. They claimed that this feature increased their typing speed but *impacted their spelling skills negatively*. Trainee 12 from the MTU shared this example:

> The 'auto-correct' feature of the iPad helps me to improve my speed in typing; however, it does not help me to improve my spelling. Alternatively, I wish the system can alert me if there is a misspelled word. In this case, I can choose and learn the correct spelling in a better way.

Arguably, several other studies reported disadvantages of typing on touch screens; more with devices with small screens such as mobile phones, and less with devices with larger screens such as tablets (Rodrigues, Carreira, & Gonçalves, 2016; Cumming, Strnadová, Knox, & Parmenter, 2014; Rahmati & Zhong, 2013). At the context of this study, trainees are provided with physical keyboard and mouse attachments to their iPads; thus meeting all trainees' preferences and providing more opportunities to use different types of keyboards. Arguably therefore, this may present a good model that can be introduced and adopted at similar M-Learning environments.

4.1.11. Summary of the Main Themes of Each Skillset

The table below (Table 4.1) summarizes the main themes relating to each of the above skillsets.

	Skillset	Extent participants felt M-Learning plays an important role in the development of each skillset	Key Themes
1	Safety Skills	• 75% trainee-respondents and 65.5% instructor-respondents think that mobile technologies **(MTs)** helped to improve trainees' safety skills more easily.	• Trainees' exposure to interactive and entertaining safety videos and tutorials. • Access to various exciting safety videos that were produced by top specialized institutions. • Access to documentaries and series of investigations done on safety incidents inside and outside the classrooms. • Easy development of safety presentations • Provision of various types of training resources in different modalities such as information, images, videos, and stories. • Easy and constant access to enjoyable, engaging, and interactive safety content and learning materials and the easy sharing of them. **Debates:** • Safety is a living thing that needs to be promoted during real work, not via online resources. • Content sometimes misses some important safety videos and tips, which makes it obligatory for instructors to fill these gaps using resources which do not - sometimes - meet the corporate standards.
2	Teamworking, Cooperation, and Collaboration Skills	• 84% trainee-respondents and 65.5% instructor-respondents think that MTs helped trainees to improve their teamworking skills.	• More opportunities for trainees to work on collaborative and cooperative activities through interaction and teamworking on innovative tools and online platforms. • More resource sharing on various different online platforms. • Flexible division of work roles. • Device portability, which does not obtrude conventional face-to-face interaction. **Debates:** • Instructors' interventions to make cooperation and collaboration happen is

			critical. • Some trainees became more alone and more isolated than before and tend to learn arbitrarily on their own. • Proper training and awareness for trainees and instructors on how to promote teamworking skills through using MTs is required.
3	Craftsmanship Skills	• 71.5% trainee-respondents and 62.5% instructor-respondents think that MTs helped trainees to gain new technical skills more easily. • 68.5% trainee-respondents and 82.5% instructor-respondents think that the MTs increased trainees' job skills performance. • 76% trainee-respondents think that the MTs helped to prepare them for the practical work in workshop.	• Provision of simplified and interactive resources such as tutorial videos and animated models and designs motivate trainees to learn. • Multimodal online resources and animated representations of learning materials facilitate comprehension and retention of technical processes. • Learning from 'compressed information' and from different resources and 'nodes' increase trainees' content knowledge • Mental preparation through the visual aids and continuous exposure to tutorial videos and animated models play a massive role in facilitating trainees' learning of complex technical processes and tasks.
4	Creativity, Problem-Solving, and Critical Thinking Skills	• 64% trainee-respondents think that MTs helped them to improve their creativity skills. • 62.5% trainee-respondents think that MTs helped them to improve their problem-solving skills. • 36% trainee-respondents think that MTs helped them to improve their critical thinking skills (37.5% took a neutral position).	• Curiosity is accommodated on MTs as trainees are sure to find answers or clues to answers of whatever questions they may raise. • Learning from different resources and from others' experiences increases trainees' higher order thinking skills. • Trainees play more active roles when using MTs, which increases creativity, problem-solving, and critical thinking skills. • Searching for and using new applications and websites enhances these skills. • Trainees' designing their own drawings and processes using different applications helps them to be more innovative. • Instant and rich resources which are available at any time and at anywhere promote problem-solving. • Ubiquity and connectivity encourage trainees to look for innovative and 'other methods' of doing things.

5	Presentation Skills	• 69% trainee-respondents think that MTs helped them to improve their presentation skills.	• Availability of different applications for creating presentations. • Device portability facilitate data collection and development instantly. • Taking notes and adding up to the content of the presentation possible at any stage of the presentation, at any time and anywhere • Constant access to the required resources for content development (such as learning materials, images, and videos). • Doing and delivering presentations on MTs enhances this skill and makes trainees more creative. • Cosmetics such as presentation backgrounds and animations have been improved. **Debates:** • Presentation content and delivery are still not impacted very much with the introduction of MTs.
6	Communication Skills: Verbal and Written Communication	• 69% trainee-respondents think that the MTs helped them to improve their written communication skills. • 79.5% trainee-respondents think that the MTs helped them to improve their verbal communication skills.	• Quick access to online dictionaries and translators facilitate communication as trainees can find the meanings of words they do not know more easily. • The easy access and engagement on social media, various online groups, online chatting rooms and platforms, and instant messaging applications make trainees more connected and provide them with more opportunities for communication. • Audio and video recordings help trainees to reflect on their communication styles and skills. • The increased amount of watching and listening to movies, songs, and online news on MTs develop trainees' communication skills. **Debates:** • Doubts on the role they play to develop the verbal communication skills • Instructors' intervention to make communication happen
7	Independent, Self-Development, and Lifelong Learning Skills	• 76.5% trainee-respondents and 89.5% instructor-respondents think that the MTs helped trainees to improve their independent learning skills.	• The digital content design – with its interactive multimodal features – facilitates independent learning by helping trainees to study, review, or prepare their lessons and learning materials independently. • Content features of auto-correct and auto-check enable trainees to advance with their learning independently. • Resourcefulness - the aid applications and supplementary resources such as tutorial

		• 64% trainee-respondents and 79.5% instructor-respondents think that the MTs helped trainees to improve their lifelong learning skills.	videos, translators, calculators, and other learning-based tools help trainees to proceed with their learning independently and instill the concept of lifelong earning in their minds. • Constant connectivity and resourcefulness make facilitate completing formal and informal courses online by helping trainees to access the learning materials at their convenience. This has encouraged trainees to decide to complete some required courses as self-study while working on a full-time basis.
8	Searching Skills	• 91.5% trainee-respondents think that MTs helped them to improve their searching skills.	• Constant searching for and engagement with online resources, extra learning materials, and information through navigating different websites and applications further enhance trainees' searching skills. **Debates:** • There is a need for more in-depth research on how MTs play a role in developing searching skills.
9	Information and Communication Technologies (ICT) Skills	• 92% trainee-respondents think that their ICT skills have improved with the use of MTs.	• The availability of mobile devices around the clock and the constant engagement with them help trainees to develop their ICT skills. • Trainees learn more about the software and the hardware of their devices and about information collection, storage, processing, and presentation due to the constant engagement with the devices. • Frequent downloading, trying, and using of different applications on the devices improves trainees ICT skills. **Debates:** • There is a need for more in-depth research on the type of relationship between MTs and ICT.
10	Typing Skills	• 91% trainee-respondents think that the iPad helped them to improve their typing skills.	• Typing answers to questions and exercises, notes, emails, and chatting messages all day on mobile devices improves trainees' typing skills. • Setting the devices on typing in English only improves trainees' skills of typing in English. • The auto-checking and auto-correct features of the keyboards help trainees to type faster. • Disadvantages of typing on touch screens; more with devices with small screens such as mobile phones, and less with devices

			with larger screens such as tablets are absent when trainees are provided with attachment physical keyboards. **Debates:** • The auto-correct feature of the keyboards impact spelling skills negatively.

Table 4.1: A Summary of the Main Themes Relating to Each Skillset, 2018.

4.2. Key Aspects, Dynamics, and Features of M-Learning Environments

The data collected for this study has provided a unique view of the aspects, dynamics and features of M-Learning environments in an industrial learning context. As discussed above, mobile technologies play an important role in the development of many employability and job-related skills, but this has to be presented within the frame of the learning environment which includes most of, if not all, learning and teaching specifics. In this respect, the following are the major aspects, dynamics, and features identified in a M-Learning environment.

4.2.1. The Rise of Distraction Versus the Fall of Destruction

A major feature of a M-Learning environment is that there is - in a general sense - a rise in trainees' *distraction* which refers to using social media, video games, and non-standard applications as opposed to a fall in *destruction* which refers to horse playing, shouting, and other unwanted behaviours.

Arguably, a high percentage of the questionnaire instructor-respondents confirmed that most trainees do not get distracted during the lessons. Of 29 instructors, 20 (69%) think that mobile technologies do not distract trainees from learning while 5 (27%) think they do. However, interview participants confirmed that some trainees tend to drift to social media and non-standard applications during the lessons for various reasons. Instructor 3 from the BOTU gave the following simile:

> The iPad is like a candy store for them! They love to go there, pick a piece of candy and run! Certainly, there is some distraction going on, but I think we can do something to utilize their love to this store.

According to Figure 4.2, of 133 trainees-respondents, those who never or rarely engaged with distractions during the lessons ranged between 44 (33%) and 112 (84%) trainees, yet a high percentage of respondents confirmed that they were engaged with distractions during the lessons as indicated below.

Interestingly, a lot of studies reported that technology-enabled distraction is a notable problem. Fang (2009) confirmed that this is "a problem that no educator can afford to ignore as ubiquitous computing and mobile learning environments become

commonplace" (para. 3). Similarly, Mingyong (2015) reported that one of the main negative effects of mobile technologies is that they "might distract students' attention from the main focus of the teaching process because students might use those devices for other purposes in and outside classroom" (p. 505).

Which of the following activities do you engage in on your iPad? How often?					
	Never	**Rarely**	**Sometimes**	**Often**	**Always**
Sending and receiving personal emails	46.6% (62)	20.3% (27)	21.8% (29)	5.3% (7)	6.0% (8)
Scheduling appointments or tasks	23.3% (31)	17.3% (23)	26.3% (35)	18.0% (24)	15.0% (20)
Reading an online newspaper	27.8% (37)	15.0% (20)	23.3% (31)	21.8% (29)	12.0% (16)
Playing video games	47.4% (63)	19.5% (26)	17.3% (23)	11.3% (15)	4.5% (6)
Watching videos on YouTube for fun	34.6% (46)	24.8% (33)	21.8% (29)	11.3% (15)	7.5% (10)
Surfing Internet	12.8% (17)	20.3% (27)	27.1% (36)	23.3% (31)	16.5% (22)
Using Social networks (such as What's app, Facebook, snapchat, twitter, LinkedIn)	59.4% (79)	12.0% (16)	19.5% (26)	3.0% (4)	6.0% (8)
Reading sports news	51.9% (69)	14.3% (19)	18.8% (25)	6.0% (8)	9.0% (12)
Participating in blogs, forums and wikis	72.2% (96)	12.0% (16)	9.8% (13)	2.3% (3)	3.8% (5)
Listening to music	51.1% (68)	15.8% (21)	20.3% (27)	6.8% (9)	6.0% (8)

Figure 4.2: Trainee Engagement with Distractions and Non-Standard Applications, 2018.

An interesting observation in the context of this study is that trainees are much quieter and more engaged with their devices, but less engaged with each other. This phenomenon is observed in a wide sense; especially during the breaks. There is less physical and social interaction amongst trainees as opposed to increased engagement with the device. This finding is not only based on onsite observations, but on comments from the interviews and the questionnaires as well. Instructor 6 from the MTU shared this example:

> In the past, when I walked around, I could see trainees chatting, talking, and joking with each other. Nowadays, I walk by classrooms or corridors, and I see trainees watching something on their iPads with full attention. They are not interacting with each other as they used to.

Trainees are no more interacting together at the same level as before. There are often faint smiles on their faces while having their earphones on and probably watching fun videos or engaged with someone else via chatting applications as opposed to the loud giggles and shouts that used to be heard from trainees socializing and challenging each other in the corridors and the rest halls. Also, trainees are no longer seen passing pencils, books, or notebooks in an improper or unsafe way, throwing them across the room. Instructor 12 from the Academic Section elaborated on this phenomenon:

> In a textbook-based environment, misbehaviours can happen because some trainees complete their tasks or activities earlier than the others, and, thus have free time to do nothing but cause class troubles. Now, they can finish the assigned tasks and go ahead for some more interesting tasks to do on the iPads.

In this regard, it is observed that discipline in a M-learning environment is characterised as less demanding because many behavioural issues that used to require corrective and disciplinary actions from the instructors and management are disappearing. Some study participants attributed this change in trainees' behaviours to their increased engagement with their devices. Instructor 2 from the BOTU gave the following example: "The iPad is motivating to the trainees, and it has actually changed some bad behaviours. For example, there is no sleeping in class anymore".

Thus, it can be concluded that conventional misbehaviours have been more replaced with distractions, but the question that needs due attention is: if engagement with non-standard applications is seen by practitioners as creating a trouble-free and a more comforting environment, how is it affecting the learning process? Do learners take these distractions into the lessons?

Ostensibly, non-standard applications and websites are taken into the classroom, but they impact the learning process in different ways. Based on the data collected from key personnel, trainees, and instructors at the context of this study, it can be argued that non-standard applications and websites turn to be a mixed blessing depending on the distance between them and the topic under study. The more proximate and relevant to the prescribed or mandated learning materials and course objectives they are, the more positive their impact on the learning process can be as they may form *learning attractions* for trainees. Conversely, the more distant and irrelevant to the prescribed learning materials they are, the more negative their impact on the learning process can be as they become *learning distractions*. Hence, it can be concluded that

what describes a M-Learning experience as effective is the level of learners' desire to and experience in searching for and integrating enriching learning materials to the topic under study as represented in Figure 4.3 below.

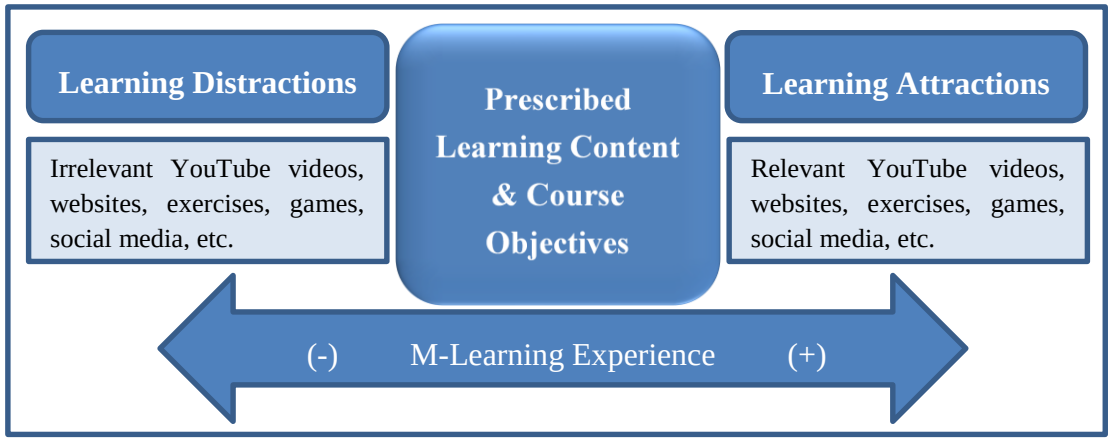

Figure 4.3: Interaction with Non-Standard Applications and Websites, 2018.

Engagement with supplementary materials and online resources to enrich lessons inside and outside the classroom has been reported as an important feature of M-Learning environments. Of 133 trainee-respondents, 92 (69%) used other resources such as YouTube videos to better understand their lessons on their iBooks. Likewise, of 29 instructor-respondents, 28 (96.5%) used various extra resources and materials on the iPads to enhance their lessons.

In addition, various comments from the interviews and questionnaires suggest that mobile technologies provide various types of supplementary resources that can enrich the lessons and make them easier to learn. Instructor 7 from the PCSTU shared this example:

> I was giving my trainees a short course on troubleshooting today. There is a company called "Synoptic" which creates and develops a lot of troubleshooting scenarios, fully animated, fully interactive, real cases as if you are already in the plant and you have some equipment which is not functioning. Trainees feel very enthusiastic to do such challenging and interactive activities, and with the iPad, they can visit these learning materials inside and outside the classroom and learn more by themselves.

Through a different lens, the richness, interactivity, and appeal of the learning materials in the mandated content play an important role in determining the level of trainees' drifting from the prescribed content. Besides, instructors' ability to orchestrate the lessons and adopt effective teaching and monitoring techniques in addition to trainees' commitment levels can all control the direction of engaging with the non-standard applications and websites. For example, it has been observed that

lessons which have been designed with rich, interactive, and appealing materials are more likely to keep trainees focused on the lesson at hand. Trainees tend to leave the prescribed content when they are either bored or feel unaccomplished. It is then when they move to the other applications and websites as either learning *attractions* or *distractions*.

Arguably therefore, leaving the standard or prescribed content, and drifting to other applications may be a call for change to curriculum designers, educators, and practitioners. Some trainees are very smart, and they can judge on the usefulness of the materials being delivered to them; especially, since some of the trainees are vocational college graduates with previous experience on vocational training. If the learning materials or the instructors' teaching methods are deemed ineffective or inefficient, they will look for other sources of learning. In this respect, Fang (2009) argued that these types of *'distractions'* are actually opportunities for change in the classroom.

> With many of the world's best professors sharing their video lectures through educational portals…, students have access to the best lectures online in many subject areas. These might be the real "distractors" for professors if they do not reform their teaching. (Fang, 2009, para. 16)

Furthermore, *distractors* may fill the time for trainees who finish their tasks quickly, and thus can abolish the feeling of boredom and demotivation which may result from the prolonged time that other slower trainees consume for their task completion. Indeed, some researchers argued that moving back and forth between applications and activities may provide 'mental breaks' which have the potential to increase focus. Weslake and Christian (2015) argued that "these brain breaks may or may not involve movement and generally take the form of a learning game, or similar activity" (p. 3). Nevertheless, the counter argument is that people are fatiguing - not refreshing - themselves with the too much engagement with technologies and multi-tasking. Richtel (2010) argued that "when people keep their brains busy with digital input, they are forfeiting downtime that could allow them to better learn and remember information, or come up with new ideas" (p. 1).

Conversely, the abundance of resources and applications that trainees have access to can be confusing to them. Trainees appreciate having various types of resources, but they wish they had one toolbox or platform in which can all learning resources (such as dictionaries, videos, chatting rooms, bolls, quizzes, and other learning-oriented tools) can be saved. Some participants confirmed that searching through too much information may cause information overload and thus distract rather than guide them. A questionnaire respondent (instructor) commented:

> When searching for information we do get an information overload and most material is not moderated, i.e. it could range from elementary information to PhD level. Trainees can be distracted easily, and a lot of time could be wasted just sifting through the vast amounts of information.

Besides, other participants highlighted that YouTube videos - which are referred to by trainees as the most valuable source of information to them - may introduce information and ideas that are not matching the corporate standards; especially since selecting these videos is usually left to the discretion of the instructors and trainees. A suggested solution is developing sufficient company specific videos that explain its processes and sharing them on one handy platform, thus decreasing confusion and distraction. A questionnaire respondent (trainee) commented: "Shooting videos on Saudi Aramco sites with employees doing real tasks and having them on the iBooks rather than getting general or irrelevant videos would help a lot".

Arguably therefore, more intensive research on the issue of distractions need to be conducted to explore whether the term itself is accurate and to explore possibilities of turning *distractions* into real effective learning *attractions*. However, distractions - as their name suggests and as they are mostly used in literature now - are correlated with unwanted practices and behaviours, and thus, require effective classroom management and novel monitoring techniques to ensure learning is happening and to prevent learners from losing focus. This becomes critical; especially since measuring the usefulness of trainees' engagement with the non-standard applications and websites is not an easy job for instructors and administrators. The decision to control trainees' access to the non-standard applications and websites in the classrooms in order to neutralize their impact has always been a safe, effective, and a less demanding option.

In this respect, the data collected for this study suggest that effective monitoring in a M-Learning environment happens at three levels; instructor monitoring, trainee self-monitoring, and device monitoring.

Instructors' monitoring requires a change in the instructors' position inside the classroom. They are moved more to the back of the classroom where they have to teach more from behind the trainees or at least from a shoulder-to-shoulder position. This change has been reported as a chief result of the instructors' need to see the screens of his trainees' mobile devices. Instructors' suspicion about trainees' engagement with distractions, passing answers of exercises and quizzes, and turning screens into an idol mode have all been reported as major reasons for instructors to change their positions. Instructor 5 from the MTU shared this example:

> The trainees send messages to each other during quizzes. I find that I'm teaching from the back of the class as opposed to teaching from

> the front. I want to see their screens. I want to see what they are doing, whether they are watching videos, and whether they are sending messages.

Furthermore, the instructors' ability to keep trainees engaged in the learning activities through the implementation of effective group/pair work activities and through empowering trainees to lead the teaching of each other minimizes trainees' deviation to the distractions. It has been observed that group work in which trainees are assigned specific roles to play such as group leader, monitor, reporter, notetaker, for example, enables instructors at M-Learning classes to orchestrate their lessons more effectively and keep trainees more focused on the learning materials.

Another technique that helps instructors to control distractions is through **device monitoring applications** which can lock trainees from using social media and other non-standard applications and websites (Figure 4.4). Instructor 11 from the Academic Section elaborated on this:

> In addition to walking around, I am currently using a fantastic App. called 'Classroom' to control my trainees' gadgets. I can see all of my students' iPad screens at all times. If I see something that I do not want to see, I just touch a button and block it.

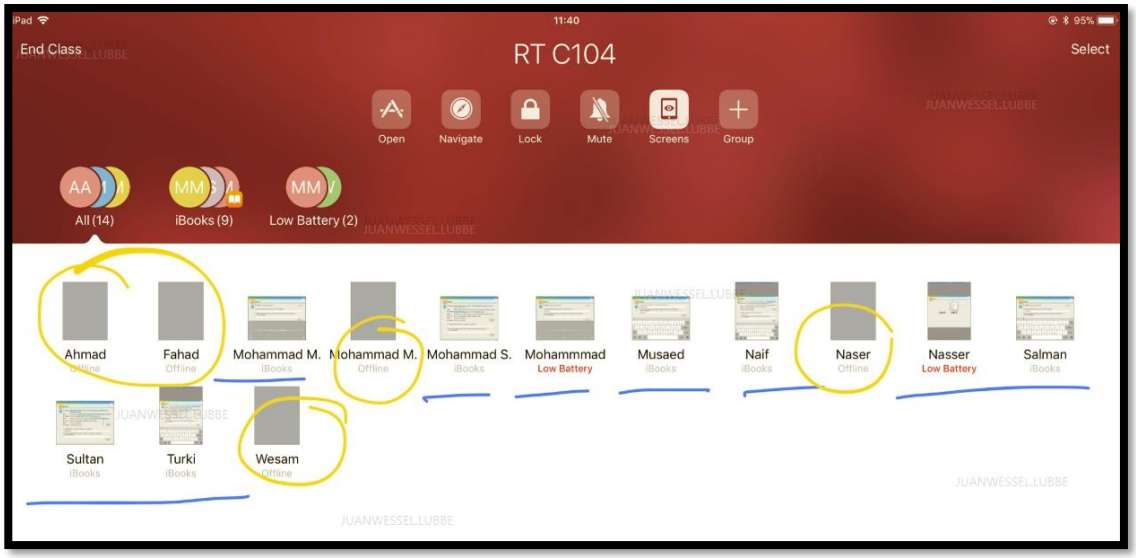

Figure 4.4: Mobile Monitoring Applications, SAITC, 2018.

Finally, **trainees' self-monitoring,** which originates from trainees' sense of commitment and responsibility for managing their learning and completing their training program, as well as understanding that they still can visit all social media and non-standard applications during their free time. Trainee 3 from PCSTU said: "If I watch movies during the class, of course the teacher will know and catch me.

Moreover, we know that everything in the company is trackable. It is our responsibility to learn and respect the company's rules".

These three monitoring techniques have been reported as effective and helpful in minimizing classroom issues and keeping trainees focused on their learning. Arguably therefore, program administrators and staff development experts may need to consider these three methods when training novice instructors on the dynamics and requirements of running M-Learning classes.

4.2.2. Learning Versus Task Completion

Another prominent feature of M-Learning environments is related to how trainees advance with the learning materials, activities, and exercises on their mobile devices. Of 133 trainee-respondents, 115 (86.5%) think that mobile technologies helped them to complete their learning activities and tasks more quickly than textbooks while 5 (4.5%) do not think so. Likewise, of 29 instructor-respondents, 19 (65.5%) think that mobile technologies helped their trainees to complete their learning activities and tasks more quickly than textbooks while 7 (24%) do not think so. However, it has been observed that trainees shift between engaging in real learning activities and going for a mere task completion. The devices make trainees complete their learning activities and tasks more quickly than before, yet also make them more inclined to check complete their tasks and exercises without real learning or acquisition of new knowledge or skills to spare more time for various reasons.

One feature that helps trainees to complete their learning activities and tasks more quickly is that they can get the scores/answers for the exercises they do promptly through the auto-check and auto-correct features (Figure 4.5).

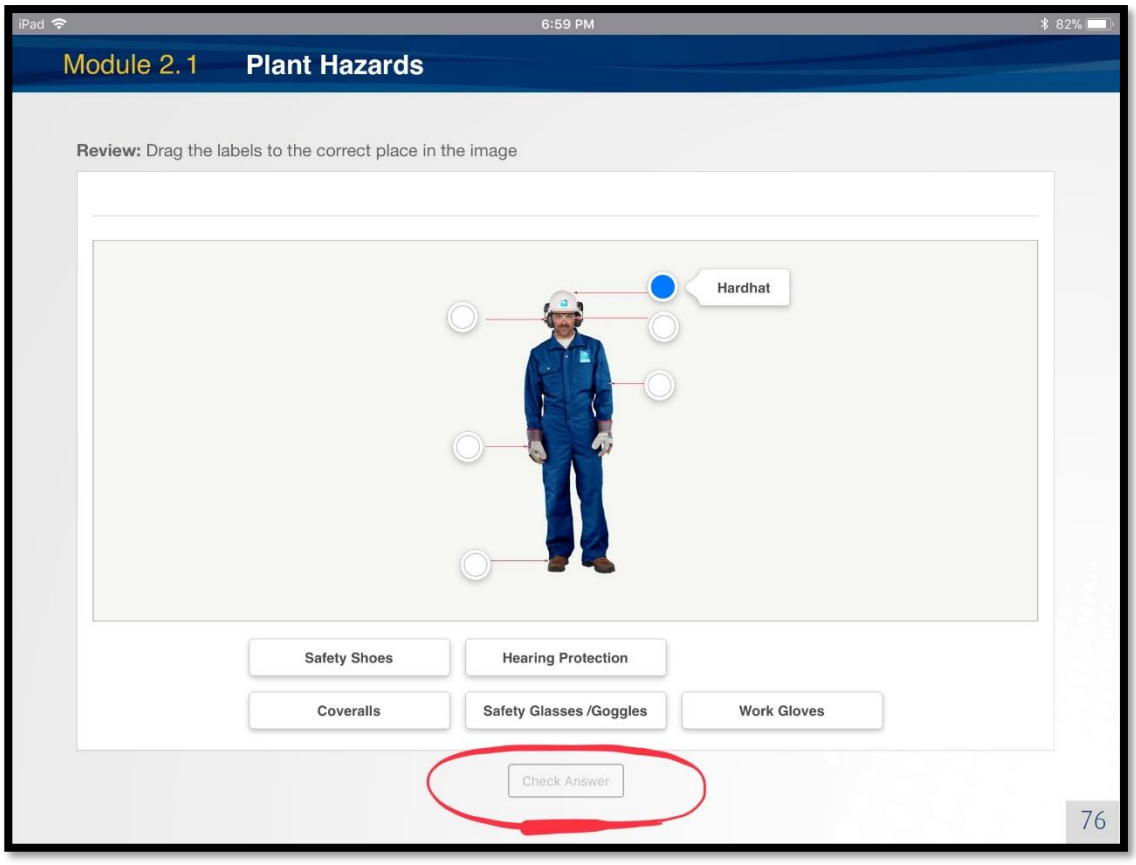

Figure 4.5: Answer Auto-check Features, Saudi Aramco iBooks, 2018.

Although these features have the potential to encourage independent learning, help high-performing trainees to advance with their tasks without having to wait for the instructors to check their work, help low-performing trainees to avoid losing face in front of their colleagues due to repeated incorrect answers, these features may be misused by some trainees. For example, some trainees may want to know the correct answers quickly without real learning of the new information or skills in order to spare more time for themselves to relax or to visit the non-standard applications or websites. Other trainees may do this because they are looking for more self-esteem. Trying different options until having the correct answers gives them the confidence to raise their hands more in the classroom and to share and participate in the dynamics of the learning environment. Instructor 13 from the Academic Section elaborated on this:

> Some of the activities are multiple-choice based, and this is fine. But the problem is they have self-correction feature and one student will get it, and say: Done, teacher! Actually, in this situation you are not sure whether they have done it before the class, or they have actually done by themselves, or one of them has got it right and shared it with them!

However, advancing through the tasks and activities may be based on real learning. There are numerous trainees who are self-motivated, autonomous, and high-

performing, and would not advance to the next activity without learning the tasks and processes in hand. They would only advance to pace themselves well; especially for difficult exercises, and maybe to maintain a high ranking as well. Instructor 11 from the Academic Section gave the following example:

> There is a trainee at the moment whom I often see on the next page, but he is generously producing good work. For him, I think he likes to do it for two reasons: 1) he doesn't want to wait, 2) by going to the next page, he will have more time to focus on the activity and develop his answers.

In a typical classroom, instructors have an average of twenty trainees to check their work. It has been observed that some trainees complete their tasks or exercises more quickly than others, and when the instructors check their answers, they feel eager to advance with their learning. They do not wait for the rest of the classmates to catch up with them. They autonomously move to the next pages of the iBooks, preparing for or completing the following activities. By doing this, they spare themselves more time to complete the more difficult activities and exercises in the following pages. Lyddon (2016) elaborated on this feature by arguing that "as technological artifacts can be considered extensions of our physical and mental faculties, mobile technologies open up promising new possibilities in terms of the exercise of learner autonomy" (p. 306).
In this respect, instructors adopt various pedagogical considerations to control their trainees' tendency to go for task completion rather than learning. These include adopting effective comprehension check techniques; especially the techniques that require more participation from the learners such as peer checking. These also include employing effective activity/exercise control methods such as close monitoring of trainees' self-pacing during the activities/exercises by using timers and countdown clocks and redesigning the activities to different levels of complexity. Instructor 15 from the Academic Section shared the following example:

> To avoid 'task completion' and ensure real learning in place, it takes a lot of monitoring by the teacher and implementation of concept and comprehension checking. Personally, towards the end of each lesson, I apply a kind of group or class review to check their comprehension of the topic.

4.2.3. Compiled Learning Materials and Activities: easy access to all versus danger of losing all

Another feature of a M-Learning environment is that all learning materials are compiled in one device. In conventional learning environments, trainees are given their textbooks only after successfully completing their previous levels, and as observed and reported by study participants, they used to get rid of the level materials upon moving to the following levels. At least, they would not bring them to the

training centre with the new level textbooks. Now, all training materials are installed on the trainees' devices in the form of a digital content (iBooks).

This is an important aspect of M-Learning for many reasons. Past and future learning materials, in addition to being well-designed, interactive, and in multi-modal formats, are always available for trainees and can be visited at anytime and anywhere. These features facilitate trainees' review of old lessons at their own pace and in light of their perceived needs. It also helps them to evaluate the difficulty of future materials, and, thus, take proper actions towards learning them. Trainee 9 from the MTU provided the following example:

> We used to hear from senior trainees that the unit about 'Bearings' is very difficult, and that many trainees failed the final unit test because of that module. Thanks to having all the learning materials in our iPads, we navigated forward, looked at the videos, and even searched for supplementary materials on YouTube, and this has turned it to an easy module for us. We would not be able to do that with textbooks!

Arguably, these features have the potential to promote individualized learning and increase learners' overall achievement. Evidence suggests that other studies reported that M-Learning allows trainees to pace learning at their own pace, which supports individualized learning and impacts learners' achievement positively (Kilis, 2013; Grinager, 2008).

Besides, the availability of all learning materials (mandated curriculum and supplementary materials) in one device all through the training program can save instructors a considerable amount of class time and effort to maintain equity between high performing and low performing trainees' needs, preferences, abilities, and skills. It can also leverage personalized learning and help to unlock the full potential of trainees as they have their own unique paths of mastering the target knowledge and skills through navigating different trajectories which have been made available by mobile technologies. Participants of this study and onsite observations confirmed that in addition to the linear process of the instructor introducing new material, followed by students practicing the new skill, taking a test to demonstrate understanding, and moving forward regardless of how many trainees actually mastered the material, mobile technologies provide opportunities for delivering materials at an optimal pace that serves each trainee's interests, aspirations, and skill needs and abilities. This feature of optimal pace - exercised at anywhere and at any time - provides opportunities for trainees to work on different areas without affecting the learning of their peers. High performing trainees may proceed with the learning tasks and activities while low performing trainees who are struggling in particular areas can take the time they need to review and master them. In this respect, Whittenberger (2013) confirmed that technology impacts and improves individualized learning as

"students can interact with the technology at their own pace and review material when necessary to aid understanding or memory" (para. 14).

However, there is a downside of having all learning materials in one device. There is a danger of losing some important notes and materials if the device is lost or if it has to be formatted for any technical reason. The formal content (iBooks) could be reinstalled, but still, the trainee will probably lose all his notes, created projects, saved answers, and other informal materials. A questionnaire respondent wrote:

> Everything is on my device now; all the books, the notes I wrote, the hand-outs that our instructors gave us, and exercises and quizzes. It is easy to find any materials I used on my iPad; however, I will lose them all if I lost my iPad.

Perhaps, one implication of these findings for curriculum developers and content designers is to identify a list of challenging topics at the beginning of each module and level for learners to note, and thus may start to learn about them earlier if they are willing. In addition, various interactive, personalized, easy-to-use, focused on improving learning outcomes, and engaging activities that meet different trainees' needs and preferences should be incorporate in the learning content. Finally, a system for backing-up trainee's learning materials and personal input may be developed to help retrieve their work and data in case of a device loss or damage. These actions may help to create a good M-Learning environment.

4.2.4. Physical Isolation Versus Virtual Connection

Another prominent aspect of a M-learning environment is that there is a tendency for a higher degree of physical isolation accompanied with a higher degree of virtual connection amongst learners. Trainees may look isolated, alone, and unsocial most of the time; however, they can really be active online at various levels. They can be active interacting with online materials or communicating and collaborating with others (trainees, instructors, other online instructors, and in online groups and communities). They exchange ideas, files, and feedback, and perhaps have fun joking and interacting virtually in the same way as they used to do face-to-face, but it is in text this time, and over the distances. Instructor 7 from the PCSTU shared the following example:

> It is true that trainees look isolated and only engaged with their devices, but, actually, they share a lot of information and files via the iPad. I also share with them various problems to solve in teams on their iPads, and we discuss lots of things on the iMessenger.

The importance of interaction, conversation, and collaboration in the learning process - and the role of technology in mediating it - has been grounded in the pedagogical

research. Wang and Hwang (2012) reported that "computer-supported collaborative learning (CSCL) plays an important role in learners' performance. For example, it has been suggested that CSCL helps students to facilitate high order cognitive processes and to create new knowledge" (p. 679). Similarly, Kearney, Schuck, Burden, and Aubusson (2012) emphasized that social interaction, conversation, dialogue, and collaboration are essential to learning from a socio-cultural perspective as people engage in negotiating meaning. The affordances of mobile technologies highly support this argument.

> M-learners can enjoy a high degree of collaboration by making rich connections to other people and resources mediated by a mobile device. This often-reported high level of networking creates shared, socially interactive environments so m-learners can readily communicate multi-modally with peers, teachers and other experts, and exchange information. (Kearney et al., 2012, p. 10)

However, learners' heavy involvement online may be due to other reasons than social interaction, conversation, dialogue, and collaboration. Some trainees are not satisfied with the level of teaching/learning they receive at the training centre, and they tend to look for extra tutorials online. They watch other people teaching and providing more information about various topics, machines, and equipment. They become eager to listen to those '*alternative'* instructors. A questionnaire respondent (Trainee) commented: "I spend more time watching videos explaining topics and machines that we learn about at the ITC. Sometimes, I find it more compressive and introduced in a better way."

In this context, it is worth mentioning that mobile devices still do not stop trainees from interacting and communicating face-to-face. Features of portability and unobtrusiveness allow face-to-face communication and interaction to happen spontaneously. In fact, mobile devices facilitate additional types of interaction and communication. A questionnaire respondent (instructor) wrote:

> Of course, some trainees need to chat, talk, and discuss the content to understand it. The iPad helps in both ways. If you would like to chat with classmates, you can do that whether face-to-face or online, and if you want to continue by yourself, you can go ahead, and you will find all resources to illustrate more on the content available online.

According to other studies, mobile technologies have become truly pervasive and ubiquitous (Marinagi, Skourlas, and Belsis (2013), and their ability to mediate various face-to-face and on-line forms of interaction, conversation, and collaboration results from the distinguishing feature of portability - as well as other features and multimedia capabilities - that traditional stationary technologies lacked. These

features and capabilities can enable new possibilities for learning. They can support different types of social activities and "integrate old with new learning tools: book, paper, pencil, camera, video camera, radio, computer, and telephone, to support learning that is personal, contextualised, and controlled by the learner" (Marinagi et al., 2013, p. 489). They can also facilitate distributed cognition through their ubiquity. Cope and Kalantzis (2009) argued that a characteristic of ubiquitous learning is to "connect one's own thinking into the social mind of distributed cognition" (p. 581). Cognition has always been distributed through libraries and experts, but "today there is an immediacy, vastness and navigability of the knowledge that is on hand and accessible to the devices that have become more directly an extension of our minds" (Cope & Kalantzis, 2009, p. 581).

However, instructors need to be aware of the level of face-to-face disconnection inside the classroom and at the workshops. They have to push trainees to utilize their presence for more face-to-face social interaction. In light of this, Instructor 14 from the Academic Section shared this example:

> If you walk around, you may see trainees sitting in groups, but they are all looking at their own devices and not talking to each other. They may be sharing things with each other. However, I think the instructor has to push the trainees and remind them to talk to each other, ask each other questions, and compare answers and feedback.

In conclusion, instructors' perceptions that learners are interacting less, the thing which they base on their perception that trainees are more isolated and mostly silent, is not very accurate. Trainees are actually doing a lot of synchronous or asynchronous forms of interaction and communication. Hence, it can be argued that mobile devices change the physical ways of interaction; and thus, instructors not only need to change their perceptions of what interaction is, but also revise their curriculum to adopt these changes. Conversely, educators have to investigate how these alternative types of interaction and communication impact learners' engagement and what role they play in developing independent and lifelong learning.

4.2.5. Trainee Engagement and Performance

Another key feature of a M-Learning environment is the increased level of trainees' engagement and performance, which are critical for the development and mastery of employability and job-related skills.

In a general sense, performance can be defined as the action or process of performing a task or function; that is why it implies practice and application of the theoretical knowledge gained in the classroom and is tied with the concepts of engagement and production. Picciano (2002) characterises performance as "a multivariable phenomenon effected by study habits, prior knowledge, communications skills, time

available for study, teacher effectiveness, etc." (p. 22). Performance may take the form of exercises, written assignments, testing, the completion of individual and group projects, and it can be measured through different ways such as grades, course completion, course withdrawals, and other measures including "how well" or "how much" students have learned (Picciano, 2002, p. 22). Performance, in this sense, requires confidence, skills, and abilities. Morgeson, Delaney-Klinger and Hemingway (2005) argued that "individuals with higher levels of ability will perform at a higher level" (p. 399). However, in the context of this study, performance has an additional meaning. It refers to the hands-on training at the workshops or engaging with specific learning activities and exercises in the classroom in the route to building new knowledge or skills and preparing for the final tests. Hence, performance is a means of developing the trainees' knowledge, abilities, and skills.

Interestingly, of 133 trainee-respondents, 85 (64%) think that mobile technologies made them more engaged with the learning tasks and activities than the textbooks while 29 (22%) do not think so. Likewise, of 29 instructor-respondents, 26 (90%) think that mobile technologies made their trainees more engaged with the learning tasks and activities while 1 (3.5%) does not think so. Moreover, of 133 trainee-respondents, 113 (85%) think that the mobile technologies enhanced their job skills performance while 9 (6.5%) do not think so. Also, of 29 instructor-respondents, 17 (58.5%) thought that mobile technologies increased their trainees' job skills performance while 7 (24%) do not think so.

Furthermore, comments from the interviews, questionnaires, and onsite observations support this finding, and attributed the surge in trainees' engagement and performance to various reasons, one of which is the increased level of trainees' motivation. Similarly, Shannon (2016), Yang (2012), and Laurillard and Pachler (2007) argued that in M-Learning environments, motivation is increased by an association with the social and entertainment features of the device when learners are engaged in authentic learning tasks, and when task-based assignments are availed to learners. These conditions are available at the context of this study. Trainees are given the most up-to-date technologies with interactive content specifically designed for their training program which is also based on hands-on training at the workshops. Instructor 6 from the MTU elaborated on this:

> I think the motivation of the trainees is much better than before because the iPads make them feel that they are using the latest technology out there, unlike using the classic textbooks which make them feel bored, or at least not as motivated.

Signs of engagement with the device, instructor, and other trainees are observed daily from outside the classrooms. Almost every time I passed by a classroom where trainees were learning with the iPads, I saw trainees engaged with their devices as in Figure 4.6. Program coordinators and senior ITC management staff highlighted this

observation in several meetings, and numerous participants in this study had similar viewpoints.

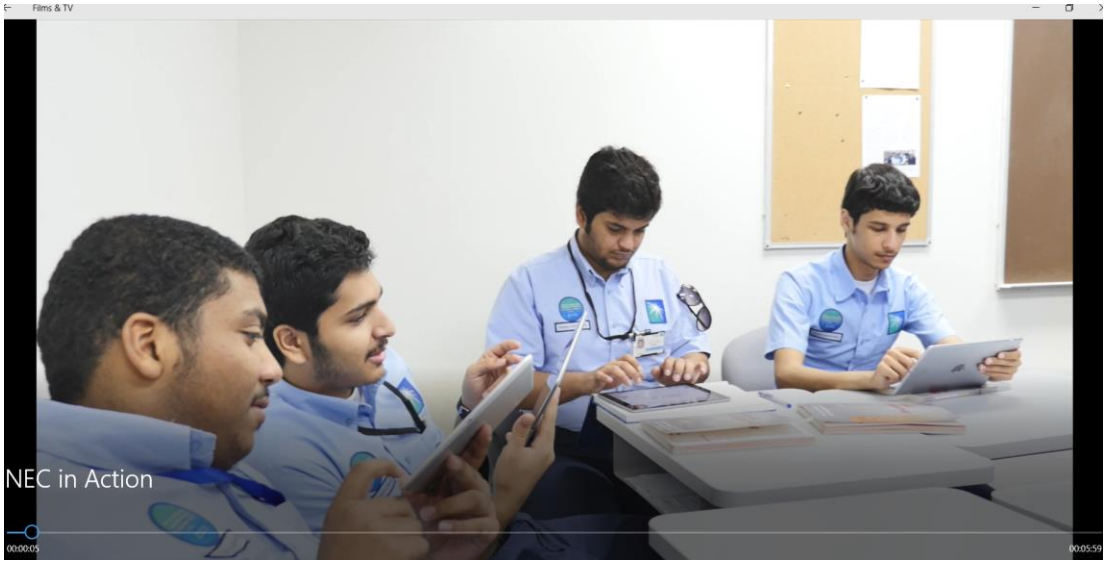

Figure 4.6: Engagement with Mobile Devices, SAITC, 2018.

Besides, the inclusion of interactive materials in different modalities on the devices attracts trainees and makes them more engaged, entertained, and motivated to learn. Trainee 1 from the PCSTU gave this account:

> We are positively engaged with our devices and the learning materials because the iPad system is very entertaining, and it is not like the textbooks. The pictures, animations, and resources available on the iPad attract us and make us more focused on the topics we are studying.

Study participants confirmed that mobile technologies facilitate the provision of a huge spectrum of activities, tasks, and exercises which are developed, practiced, and completed in a highly rich context of multi-modal, social, and cultural aspects; all of which have the potential to motivate trainees, meet their various learning styles, and provide effective learning opportunities. West (2015) reported a similar view:

> Mobile devices with cellular connectivity improve learning and engage students and teachers. Wireless technology provides new content and facilitates information access wherever a student is located. It enables, empowers, and engages learning in ways that transform the learning environment for students inside and outside of school. (p. 1)

Furthermore, it has been observed that trainees are more motivated and interested in preparing for their future lessons; especially the parts which are introduced in a video

format or in interactive animations, models, and games and, also, in reviewing the learning materials which they find challenging to fully understand in the classroom. This observation is also supported by the questionnaire results. Of 133 trainee-respondents, 114 (85.5%) do more lesson preparation on the iPad while 19 (14.5%) do not. Likewise, 120 (90%) trainees do more lesson reviews on the iPad while 13 (10%) do not. This extended level of engagement with the learning materials outside the classroom has been reported as a positive feature of M-learning environments by other researchers such as Chen and Denoyelles (2013) and Mueller, Wood, De Pasquale, and Archer (2011).

Arguably though, participants of this study reported that mobile devices have the potential to increase learners' engagement and performance as they facilitate the creation of a student-centred learning environment and promote experiential learning as will be discussed below.

4.2.5.1. Student-Centred Learning

A significant feature of a M-Learning environment is the promotion of a student-centred learning culture where the learner plays an active role in the learning process as an independent learner, an active participant and member of a learning community or communities, a sharer of knowledge, and a co-creator of content. Most trainees and instructors confirmed that teachers teach less and talk less while trainees produce more with the iPad than with textbooks. Of 133 trainee-respondents, 73 (55%) think that teachers talk less with the iPad than with textbooks while 24 (33%) do not think so. Similarly, of 29 instructor-respondents, 24 (82.5%) think that teachers teach less with the iPad than with textbooks while 2 (7%) do not think so. In addition, 86 (64.5%) trainees think that they produce more with the iPad than with textbooks while 11 (8%) do not think so.

In addition, onsite observations and comments from the interviews and questionnaires confirmed that the affordances of mobile technologies such as ubiquity, portability, resourcefulness, constant connectivity, instant feedback, entertainment, and novelty play an important role in increasing trainees' autonomy and sense of responsibility for their learning. These features facilitate the creation of a more learner-centred environment where the trainees take the lead in the learning process (Figure 4.7). Instructor 15 from the Academic Section elaborated on this: "The iPad has allowed me to create a more learner-centred environment because it gives trainees more autonomy to take more responsibility for their own learning."

Arguably, Mobile technologies help teachers to become more of facilitators and guides than lecturers and knowledge agents. Trainees do more of the work by themselves with their mobile devices. Instructor 3 from the BOTU gave the following example:

Once I deliver the materials, my role changes from a trainer to a facilitator. I get trainees clustered into groups, and they nominate a group leader. One group takes one module and discuss it amongst themselves. They have to build a presentation and deliver it to the rest of the class, and then we discuss it together. They search for more information about their project on the internet and use suitable applications to present their work. They do most of the work by themselves.

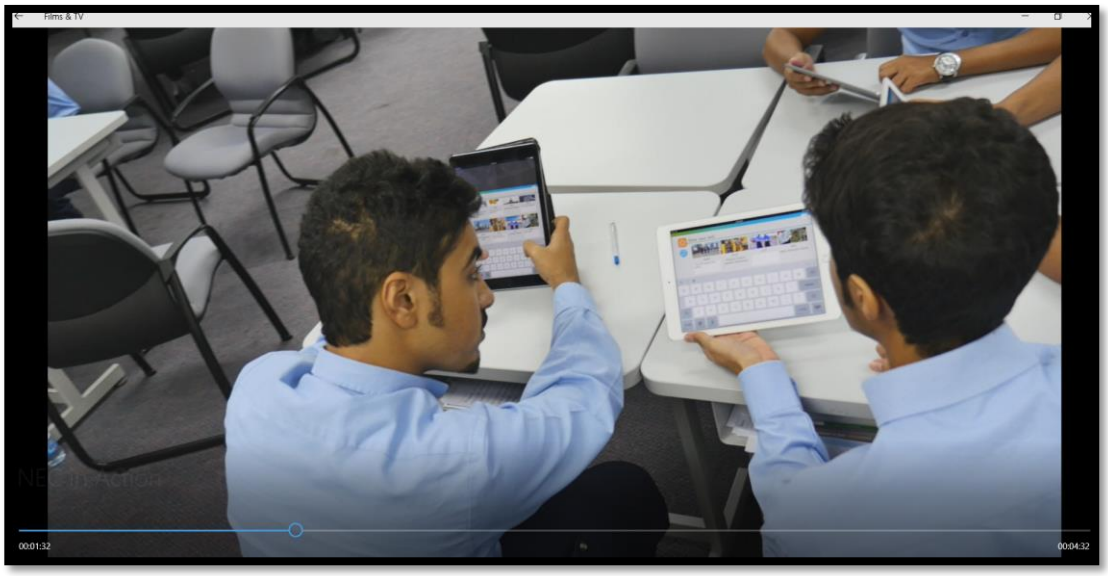

Figure 4.7: Trainees Take the Lead in their Teaching, SAITC, 2018.

Additionally, in order for trainees to accomplish some of their tasks, presentations, and projects, they create online groups; the thing which allows for unremitting engagement and interaction. This feature allows them to be active community members and to remain engaged in content learning and content creation as well as in receiving ongoing instant feedback and guidance; all of which help to promote learner-centeredness. Trainees participate as community members by discussing the roles and responsibilities of each group member, by sharing ideas, instructions, suggestions, and resources, and by presenting the data which they collected and their conclusions. Developing presentations and other projects such as topic summaries, models, and prototypes collaboratively and cooperatively (which is part of the ongoing assessment at the context of this study), trainees take a more active role in their learning. They lead the process of content adaptability, which is made easier by mobile technologies as 79% of the instructor-respondents confirmed in the study survey. They do this by taking the prescribed content one step further towards more enriched, more developed, and, perhaps, more focused learning content. They act as co-authors of the learning content by creating additional learning materials in the form of digital projects. Lecturing and traditional instructor-led teaching styles find no place in such an environment.

Besides, it was introduced earlier in this chapter that instructors are moved more to the back of the classroom in M-Learning classes, as they have to teach more from behind the trainees or at least from a shoulder-to-shoulder position. It was argued that this change was a chief result of the instructors' need to see the screens of their trainees' mobile devices as an emerging monitoring technique. However, there is another perspective of this phenomenon. Instructors go to the back of the classroom more because mobile technologies promote learner-centeredness and independent learning. The instructors no longer have to stand near the board in front of the class only. Instructor 5 from the MTU elaborated on this: "I used to be in the front and talk too much in front of the trainees. Now, I go back to monitor them and ensure good classroom management while the trainees take care of their own learning independently".

Hence, instructors' mobility has increased with these devices more than ever, a feature which facilitates the positive change in the instructor's role. While trainees are engaged with their learning materials, the instructor's role changes mainly to a guide and a facilitator who can reservedly offer support and orchestrate the activities when needed. A questionnaire respondent (Instructor) commented:

> The instructor's mobility is promoted now. In the past, I used to stand beside the board. I had a stylus or a piece of chalk, and I was basically stuck at the board to explain and teach. Now with the iPad, I can mirror my and my trainees' screens on the board, write on the iPad while standing at any corner of the room, and the students can see what I am writing.

Besides, not only trainees do more of the work by themselves, but also accomplishing specific tasks and role assignments is made easier by the affordances of mobile devices. Instructor 4 from the MTU gave the following example:

> I ask a trainee to look for a specific YouTube video which explains a specific process or equipment and ask him to share it with me and everyone. This is followed by a discussion on his choice. I find this very learner-centred! In the past, we used to get trainees who did not know that there are good resources which they could use by themselves rather than depending on the instructors all the time.

Furthermore, based on the onsite observations, participants' comments and available documents, another key feature of mobile devices that nurture learner-centeredness has to do with the design of the prescribed digital content. Designing interactive activities, tasks, and exercises to be completed by the trainees themselves makes the learning environment more trainee-centred. Instructor 12 from the Academic Section elaborated on this:

> It is also the way that the iBooks have been developed. There is more focus on trainees taking the initiative. With the iBooks, I just focus on the trainees to do the work by themselves, and they get feedback either by me, their colleagues, or through the auto-correct features.

At the context of this study, the creation of the new digital content with rich multimedia (Figure 4.8) and on collaborative and socio-constructivist basis (Figure 4.9) promotes interaction between the trainees and content, the trainees and their tutors, and the trainees and other trainees. This feature has been highlighted by all study participants as a prominent feature of the iBooks which facilitates the implementation of learner-centeredness. In light of this, Pimmer and Pachler (2013) argued that "from a pedagogical perspective, the learner-centred creation and sharing of content such as multimedia materials in the form of text, audio, images and video is much more promising" than simple repackaging of existing classroom materials to be read or played on mobile devices (p. 195).

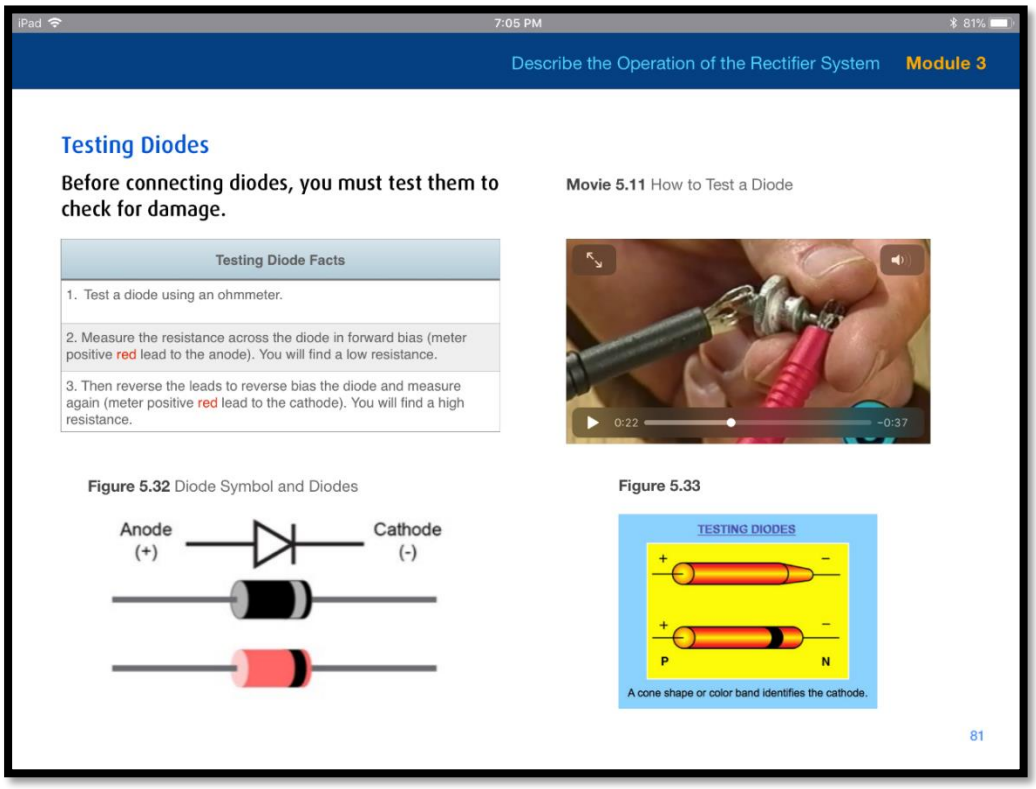

Figure 4.8: Content with Enriching Multimedia, Saudi Aramco iBooks, 2018.

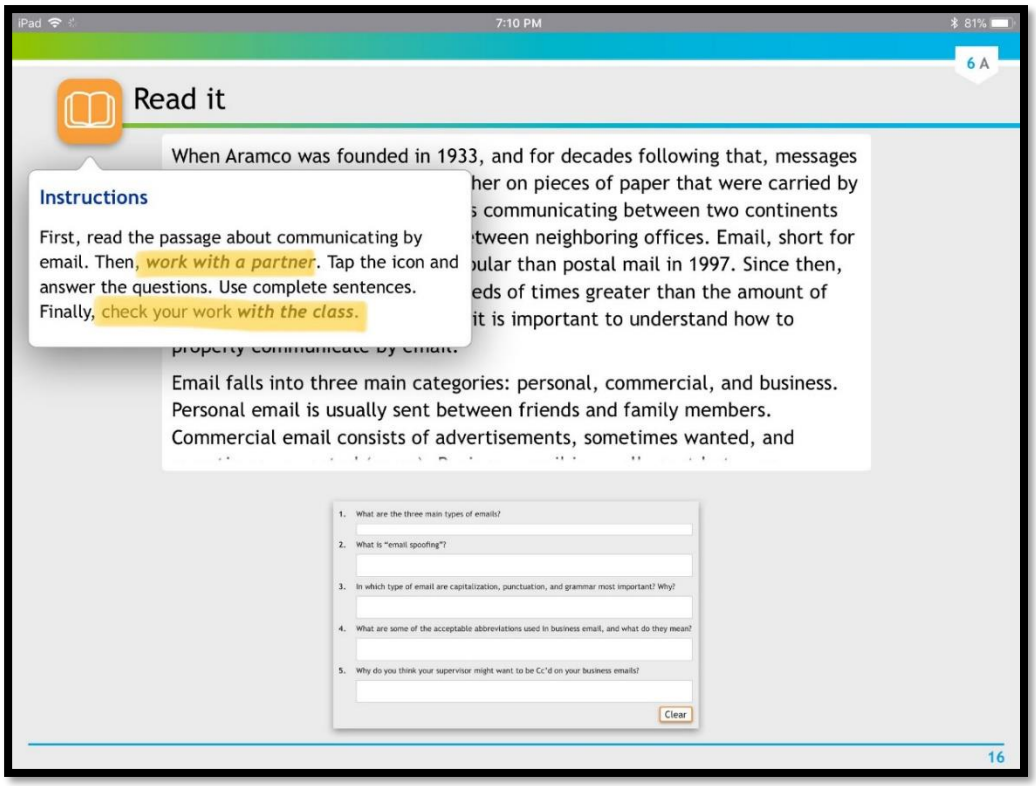

Figure 4.9: Activities Designed on Collaborative and Socio-constructivist Basis, Saudi Aramco iBooks, 2018.

Arguably, access to multi-modal resources as in Figure 4.8 above provides trainees with ample opportunities to enrich their own learning experience more in an individualistic and self-tailored manner. Trainee 4 from the PCSTU elaborated on this:

> On the iPad, I have the information in different modalities. They put the information in text, videos, audio, images, and animations unlike the old textbooks. This helps me a lot because I can choose how to learn a specific task or process.

Similarly, Ayres et al. (2013) argued that a very prominent benefit of mobile devices is their use for self-instruction.

> Today, when most individuals are confronted with a task that they do not know how to perform, they have the problem-solving skills (another feature of self-determination) to seek out resources, such as reading a reference manual, searching the Internet for instructions, or watching a YouTube video to help them complete the task. (p. 264)

Also, the feature of instant feedback, which is made easier by mobile devices, is beneficial for trainees' leading their learning. The auto-checking and auto-correct

features (as discussed in section 4.2.2.) help trainees to repeat and correct their mistakes as much as they want. In this respect, of 133 trainee-respondents, 115 (86.5%) thought that the instant feedback for the exercises encouraged them to repeat the exercises until they learned the correct answer(s). Study participants confirmed that providing instant feedback to trainees and sharing sample quality work with the rest of the class is made easier with mobile technologies. Instructor 14 from the Academic Section gave the following example:

> I walk around and say: Ah, the trainee here has written something amazing, and I should show it to the rest of the trainees. Then I ask the trainee to mirror his device, and everybody can look at the example on the board. Also, I can take a picture of it, put that picture on Explain Everything App., show it on the board, and then the trainees can come and write on it. Instant gratification is possible.

Similarly, in their study on instant feedback using mobile messaging technologies, El Sharkawy and Meawad (2009) reported that students liked seeing their comments displayed on the board instantly.

Finally, mobile technologies promote learner-centeredness by the portability feature. These devices do not constraint conventional collaborative and social activities and exercises as other technologies do. On the contrary, they add extra options and solutions to the development and implementation of such learning activities (Figure 4.10).

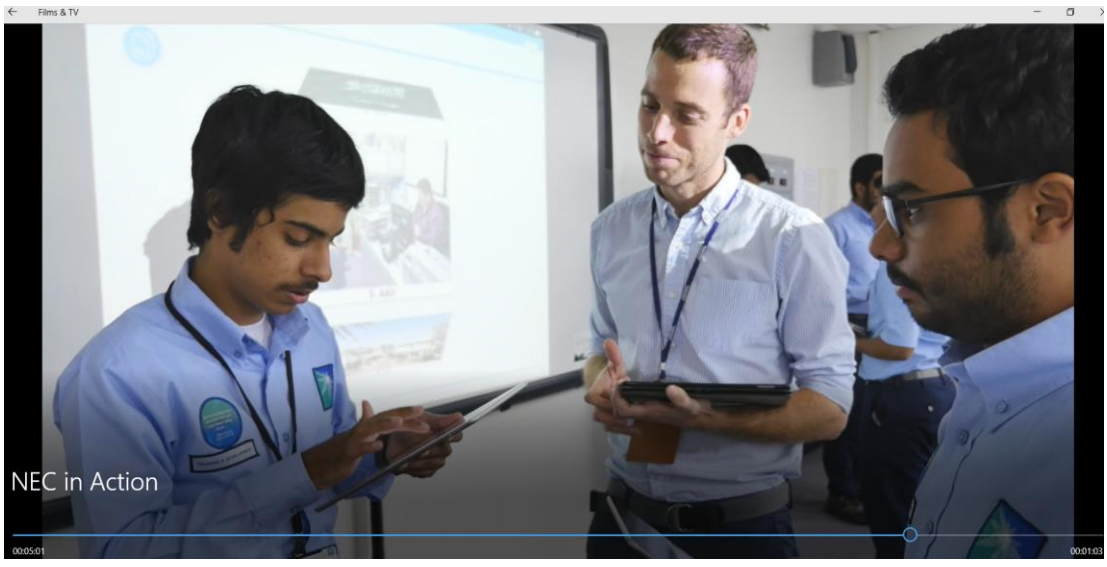

Figure 4.10: Social Activities with Mobile Devices, SAITC, 2018.

4.2.5.2. Promoting Experiential Learning

Petrovic, Babcicky, and Puchleitner (2014) argued that "in experiential learning courses, students acquire new knowledge through learning that takes place in real-life scenarios. By utilizing mobile devices to conduct observations outside of the classroom, learners can arrive at a broader and deeper understanding of their inquiries" (p. 271). This research suggests that mobile technologies promote experiential learning by providing real-time and authentic learning materials and experiences. In fact, what distinguishes mobile technologies at industrial contexts where potential hazards can stand as obstacles against physical presence is that they can provide opportunities for exposing trainees to safe virtual experiences and situations that may be deemed dangerous if done alive. Virtual realities, simulations, 3D models, and tutorial videos can avail opportunities for an induction to potentially hazardous real situations. Instructor 1 from the BOTU shared this example:

> Take for example one of the tasks for operators which is taking a sample for a dangerous chemical substance. To explain how to stand upwind and take the sample, I have to go traditional by telling the steps because, simply, I cannot take them to such a real place. However, the iBooks and YouTube videos demonstrate how it is done showing an actual person taking a sample while another person is narrating everything. This is a better and more creative way of teaching this task than the traditional way of telling the steps.

Furthermore, research participants confirmed that mobile technologies can support learning outside the classroom and relate classroom experience to job skills and workshop practices. Of 133 trainee-respondents, 101 (76%) think that mobile technologies enhanced their learning outside the classroom while 13 (9.5%) do not think so. Moreover, of 29 instructor-respondents, 20 (69%) think that mobile technologies helped their trainees to relate classroom experience to job skills and workshop practices while 1 (3.5%) does not think so.

In the context of this study, trainees use their devices to collect information and data for their presentations and projects which they have to submit as part of the ongoing formative assessment. They take photos, record videos and audio files, and collect live data as well as archived data online. A questionnaire respondent (Instructor) wrote:

> The iPad helps trainees to gain knowledge and skills by working to investigate, engage in, and face the challenges for specific tasks or projects. They collect or develop authentic materials for their projects, and they present their projects not only to people at the training center, but to the larger community through the social media. They develop a sense of ownership and love to the projects they create and share with others.

In this respect, Dyson et al. (2009) noted “the affordances that mobile technologies provide for experiential learning by allowing rapid “note taking” through photos, sound and video recording, and by supporting students through in field provision of learning materials and prompts to assist their development of abstract concepts” (p. 253).

Furthermore, the majority of research participants - 69% trainees and 76% instructors - confirmed that mobile technologies help to make complex processes at workshops easier to understand. Comments from the interviews and questionnaires support this finding in several ways. Previously, work processes and machine descriptions used to be in text, which was neither attractive nor interactive. With the insertion of multimedia, complex processes have been made easier. Presenting the industrial processes and the inner parts of the equipment in different modalities facilitates learning them, and thus has the potential to increase performance. Instructor 2 from the BOTU elaborated on this:

> In the past, I had to go more into details when I had to explain something because the trainees could not visualize what I was talking about. Now, with the iBooks and other visual aids, I just introduce the main idea, and they will see the details. The trainees are no longer puzzled or confused with complex processes and equipment.

Study participants also highlighted that their navigation between different and diverse learning resources - such as YouTube, Wikipediaes, other company websites, the formal iBooks - is based on the need to know more than what they already know, or what has been prescribed in the learning content. They seek more up-to-date knowledge through decisions on what to learn and from which resources. They no longer have to read lengthy pages of instructions or steps. They can collect pieces of information from diverse resources to create a more comprehensive and updated form of knowledge. Trainees develop the skill of distinguishing between meaningful and irrelevant information for a specific task or problem to be solved. They also produce new knowledge through the presentations and videos they create and share. Trainee 10 from the MTU said:

> The iPad helps me to learn from different resources and connect pieces of information from YouTube, Wikipedia, the iBooks, and the hands-on practical part in the workshops. The different visual aids make me absorb the information easily and retain it for longer. I think this is making our learning experience very unique.

Thus, although learning at a M-Learning environment starts from a formal constructivist content, it is not fully content-driven. It is actually content-enriched; that is, it starts from a formal or official content, and navigating other resources and

types of materials is still readily available (McLoughlin & Lee, 2008). Mobile technologies provide opportunities for trainees and instructors to enrich the learning content through connecting specialized nodes of information, facilitating continual learning environment, sustaining knowledge management activities, and encouraging trainees' decisions-making. Several researchers reported similar conclusions, for example, Brown and Mbati (2015), Appiah and Cronjé (2012), and McLoughlin and Lee (2008).

4.3. Potential Enhancement at Mobile Learning Environment

In addition to the common technical limitations of mobile technologies such as poor network connectivity, battery life and battery charging, and impact on health; especially eyes, there are some other key areas for improvement; especially with training programs that offer its complete curriculum on a digital content. There are other shortcomings related to trainees' orientation and digital awareness, and paradigm conflict between advanced training versus tradition work practices.

4.3.1. Content Design Enhancement

Study participants and program evaluation documents confirmed the appropriateness of the learning content, iBooks, in terms of design and selection of learning materials. The content was designed based on learner-centeredness and in a way that ensures an active role of the learner. However, study participants have confirmed that the content needs some further enhancements in order to optimize its design and shape, and the following is a list collected from the research participants:

- Spelling mistakes, videos that do not work, and videos that give wrong information have to be fixed.
- Incorrect answers to some exercises have to be corrected.
- Inaccurate information or incorrect sequence of processes must be fixed.
- The iBook should have the 'annotate' feature in all its parts.
- Font type, size, and colour have to be re-evaluated and standardized.
- Highlighting text in different colours has to be enabled.
- More details, more exercises, and more multi-modal materials have to be incorporated.
- Teachers' guide and answer sheets should be provided in order to avoid conflicting feedback and information from different instructors and to avoid uncertainty of teachers' answers.
- Compatibility between different file formats on the iBook should be ensured to avoid crashing and freezing of the iBook application.
- Print-view and file transfer to a PDF file format should be enabled for major processes and instructions.

- Individual trainee's auto backing-up of the iBooks to an online drive should be enabled in order to avoid loss of notes and data when having to format the iPad or obtain a new one.
- Adopting handwriting and handwriting recognition applications would be useful to improve hand writing.

4.3.2. Orientation and Digital Awareness

Although study participants highlighted the importance of sharing information and documents as part of the corporative and collaborative learning processes, malpractices such as cheating during quizzes and exercises by passing screenshots of answers have been highlighted. Proper and continuous trainee orientation on the danger of doing so as well as installing control applications is required. Instructor 8 from PCSTU elaborated on this: "I have to be extra vigilant and create different questions for my quizzes because if you are giving them collective questions, they may copy and cheat by just sharing screen shots of their answers with their friends".

From another perspective, trainees need to know what they can do to protect themselves when online. They spend most of the time engaged with their devices, and thus may be inclined to expose personal or confidential information due to lack of awareness. Instructor 10 from the Academic Section elaborated on this:

> We have to show trainees how to protect themselves from hackers, phishing, and viruses. We should teach them about the dangers of providing personal information or passwords to anyone on the Internet. Likewise, we have to teach them about the 'digital law': the rights and responsibilities governing technology use, and copyright issues.

4.3.3. Conflicting Paradigms: advanced training programs versus traditional work practices

A final area of improvement for consideration for M-Learning developers is to rethink the proper preparation of graduates with regards to specific work practices that are still done in a very traditional style. Trainees are being trained with simplified models and materials that are based on various modalities and color-coding techniques; things which may contradict with traditional workplace practices. This may cause frustration, mistakes, and delay; especially, for new graduates. Program developers have to think carefully of linking the learning practices with the workplace requirements. Instructor 4 from MTU gave the following example:

> We are training trainees on more advanced and better skills; however, when they go to their organizations, they may have to complete and read technical information on old-looking sheets. Now

information is simplified, classified and added lots of colours, 3-D models, graphics, but this is not the same with the old archives at work. Trainees may find it challenging to revert to the old paper-based technical drawings and text.

4.4. Summary

In this chapter, I introduced the findings of this study based on the research questions, which are: *To what extent and how can mobile devices play a role in developing employability and job-related skills for trainees at an industrial training workplace?* and *What are the key aspects, dynamics, and features of M-Learning environments at VTET contexts? What are the potential enhancements of M-Learning environments at VTET contexts?* The data collected for this study showed that mobile technologies may play an important role in the development of trainees' employability and job-related skills which include:

- Safety Skills
- Teamwork, Cooperation and Collaboration Skills
- Craftsmanship Skills
- Creativity, Problem Solving, and Critical Thinking Skills
- Presentation Skills
- Communication Skills (Verbal and Written Communication Skills)
- Independent learning, Self-development Skills, and Lifelong Learning Skills
- Searching Skills
- ICT Skills
- Typing Skills

In addition, the data indicated that there are unique aspects, features, and dynamics that distinguish mobile learning environments, and which act as a medium for the development of these skills. Finally, it generated some potential enhancements that can further improve M-Learning environments at VTET contexts.

5. Chapter 5: Discussion and Conclusion

5.1. Introduction

The purpose of this case study was to examine whether and how mobile devices can play a role in developing trainees' employability and job-related skills and to explore the key aspects, features, and dynamics as well as the potential enhancements of M-Learning environments at vocational and industrial training contexts. In this respect, this study addressed the following research questions:

- To what extent and how can mobile devices play a role in developing employability and job-related skills for trainees at an industrial training workplace?
- What are the key aspects, dynamics, and features of M-Learning environments at VTET contexts?
- What are the potential enhancements of M-Learning environments at VTET contexts?

Adopting a case study approach, qualitative and quantitative data was collected from 133 trainees and 29 teachers who were participating in an iPad-based training programme at SAITCs. The data was collected through semi-structured online questionnaires, interviews, onsite observations, and program documents. The data generated multiple perspectives towards understanding the impact of the mobile devices on developing vocational and job-related skills as well as a wide-ranging representation of the major dynamics and features of a M-Learning environment.

In this chapter, I am going to discuss how the research findings are related to existing literature on M-Learning at vocational and industrial contexts, specifically with regards to the development of employability and job-related skills. In addition, I will consider the contributions of this research to the field and the implications for theory, policy, and educational development practice. I will also comment on the extent to which the results of this study may be generalizable. Finally, I will present the research limitations, recommendations for future research, and study conclusion.

5.2. Summary of Research Findings

Three main findings emerged from this research as below:

- **M-Learning plays an important role in developing trainees' key employability and job-related skills, which include:**
  - Safety Skills
  - Teamworking, Cooperation, and Collaboration Skills
  - Craftsmanship Skills
  - Creativity, Problem Solving and Critical Thinking Skills
  - Presentation Skills
  - Communication Skills (Verbal and Written Communication)

- Independent Learning, Self-Development, and Lifelong Learning Skills
- Searching Skills
- Information and Communication Technologies (ICT) Skills
- Typing Skills

- **M-Learning environments are dynamic and may present great opportunities as well as big challenges for effective learning.** Some of the dynamics and features of M-Learning environments include:
  - The Rise of distraction versus the fall of destruction
  - Learning versus task completion
  - Easy access to all versus danger of losing all learning materials and activities
  - Increased physical isolation versus increased virtual connection
  - Aspects of Engagement and Performance
    - Student-Centered Learning
    - Experiential Learning

- **Potential enhancements at M-Learning environments**
  - Content Design Enhancement
  - Orientation and Digital Awareness
  - Conflicting Paradigms: advanced training versus tradition work practices

These findings helped me to provide answers to the research questions above.

5.3. The Role of M-Learning in Developing Trainees' Employability and Job-Related Skills

The data collected for this research indicated that M-Learning has the potential to play an important role in developing trainees' key employability and job-related skills. The features of mobile technologies such as portability, connectivity, resourcefulness, ubiquity, instant feedback, entertainment, and novelty together with a well-designed digital content provide ample opportunities for an effective learning environment. Textbooks and stationary computers can provide a medium of learning materials similar to mobile technologies; however, features of learning at anywhere and at anytime, immediate access to rich resources, interactive and engaging learning content, and the different types of social interactions made easier with mobile technologies are all features that make M-Learning stand distinguished; especially in the field of vocational and industrial training.

In fact, there is a lack of research on the role of M-Learning in this area although M-Learning is increasingly used in workplaces, museums, and schools; enabling a wide spectrum of possibilities (Lucas, 2014; Liu, Han, & Li, 2010). This makes the findings of this study unique and lays the foundations for more research in this field. However, existing literature supports the findings of this study in a general sense. For

example, Ricky and Rechell (2015) argued that "technology enhanced learning when combined with flexible delivery and situated learning would be able to promote students' cognitive and transferable skills, i.e. problem solving, analysis, reflection, learning to learn, self-management, collaboration as well as nurturing of life-long learning attitude" (p. 97)**.** The following is a discussion on the similarities and differences between this study outcomes and those of the work of others.

5.3.1. Safety Skills

This study suggests that mobile technologies can play an important role in developing safety skills as they have the potential to increase exposure to safety videos that were produced by top specialized institutions as well as documentaries and series of investigations conducted on safety incidents. These can increase trainees' awareness and knowledge about various safety concepts and practices. Similarly, Kenny, et al. (2009) argued that the impact of exposure to digital learning materials on mobile devices can increase trainees' confidence in their safety practice. Schofield, Hollands, and Denby (2001) confirmed that "the capacity to remember safety information from a three-dimensional computer world is far greater than the ability to translate information from a printed page" (p. 155).

Hence, it may be recommended that instructors at institutes running mobile training programs increase trainees' exposure to safety videos, documentaries, and series of investigations on safety incidents that were produced by specialized institutions. Such videos have the potential to entertain trainees and increase their awareness and knowledge about safety. However, Burke, Sarpy, Smith-Crowe, Chan-Serafin, Salvador, and Islam (2006) found that video-based safety training is the least engaging method. At this point, it can be argued that more research on engaging safety training methods and the role of videos and documentaries is required.

Moreover, this study suggested that mobile devices facilitate the provision of interactive safety tutorials which help trainees to retain more information. Likewise, Reychav and Wu (2014) and Douphrate and Hagevoort (2015) argued that mobile technologies' capability to present high quality multimedia is a factor that can attract learners of safety training programs and help them to retain more information; thus, improving their learning and performance and allowing them to apply the skill effectively.

Furthermore, this study suggested that mobile devices can positively impact trainees' safety culture over time as they facilitate trainees' access to safety tutorials, shares, and messages at anytime and at anywhere; a feature which can make trainees more connected with safety tutorials, discussions, and feedback. Likewise, Peters (2007) highlighted the significance of accessing safety information in a quick and efficient way on mobile devices as it may have a positive influence in changing the whole culture of safety. Zeng and Zeng (2017) reported that "students found the safety

shares to be a good way to introduce the importance of safety in the work place" (p. 34). Furthermore, Burke, et al. (2006) emphasised the importance of immediate feedback on safety training tasks received from computer-based instruction which included an entire gamut of workplace health and safety topics such as occupational safety, industrial safety, systems safety, fire protection, hazardous materials and waste disposal and storage, industrial hygiene, risk management, and safety engineering and design.

Although this account sets good expectations on the role of mobile technologies in developing trainees' safety culture, a more in-depth study on how trainees really change their safety convictions, and the role that mobile technologies can play in the process of behaviour modification is highly recommended. This research proposes that the use of mobile devices has the potential to increase trainees' safety awareness; however, there may be a better chance for an in-depth investigation of whether and how mobile technologies can play a role in modifying trainees' unsafe behaviours.

5.3.2. Teamworking, Cooperation, and Collaboration Skills

According to this research, mobile technologies can play an important role in developing teamworking, cooperation, and collaboration skills at VTET contexts. They provide opportunities for trainees to work together more than before because they provide additional platforms where different forms of interaction can be enabled. Many existing studies came to similar findings. For example, Ng et al. (2016) argued that mobile technologies allow VTET trainees to participate more in cooperative and collaborative activities and would share their views in their own time and spaces. They concluded that mobile technologies "enhance peer collaborative learning activities for information sharing, discussion and mutual supports" (p. 104). Likewise, Koole (2009a) argued that mobile technologies can support social technology which describes how mobile devices "enable communication and collaboration amongst *multiple* individuals and systems" (p. 34).

Hence, instructors at VTET organizations adopting M-Learning need to be encouraged to - and to encourage their trainees to - utilize the affordances of mobile technologies by creating platforms where more types of interaction and communication can be facilitated. These platforms may provide trainees and instructors with more opportunities to share their work and resources. According to Lin et al. (2008) instructors and learners can "interactively share their learning content by following methods of using M-Learning device: text messages, email, graphs/table making, self-made multimedia files: audio/video, on-line discussion, discussion forum, uploading electronic files of assignment, and on-line group report." (p. 3).

Furthermore, this study confirmed that mobile technologies - with their portability feature - do not constrain face-to-face types of interaction. Trainees can still cooperate and collaborate face-to-face as in conventional textbook-based environments, but with

the extra features that allow constant connectivity, they can work together more on the online groups and communities. Similarly, Naismith et al. (2004) argued that mobile devices can provide "another means of coordination without attempting to replace any human-human interactions, as compared to say online discussion boards which substitute for face-to-face discussions" (p. 17). Likewise, Nordin et al. (2010) clarified that "students' discussions, debates and prediction making are enhanced through the employment of mobile devices" (p. 136). Also, Osakwe, et al. (2017) highlighted the role of mobile technologies in enhancing synchronous and asynchronous learning as factors that can increase cooperation and collaboration.

Thus, it can be concluded that M-Learning environments facilitate more types of interactions than other learning environments (Figure 5.1). Conventional learning environments facilitate only face-to-face types of interactions, online learning environments facilitate only online types of interactions through the different synchronous and asynchronous tools, and blended learning environments facilitate both types of interactions (face-to-face and online) at limited timings and specific places such as the computer laboratories. But M-Learning environments facilitate all of these types of interactions at anytime and at anywhere; thus, enriching the learning environment with more dynamics and features. In this respect, Lai and Hwang (2014) confirmed that "the more time the students spent on mobile learning, the more effects of their collaboration abilities were on other competences" and that "collaboration involved in mobile learning activities can be considered as an empowering learning strategy for facilitating students' better learning performance" (p. 287).

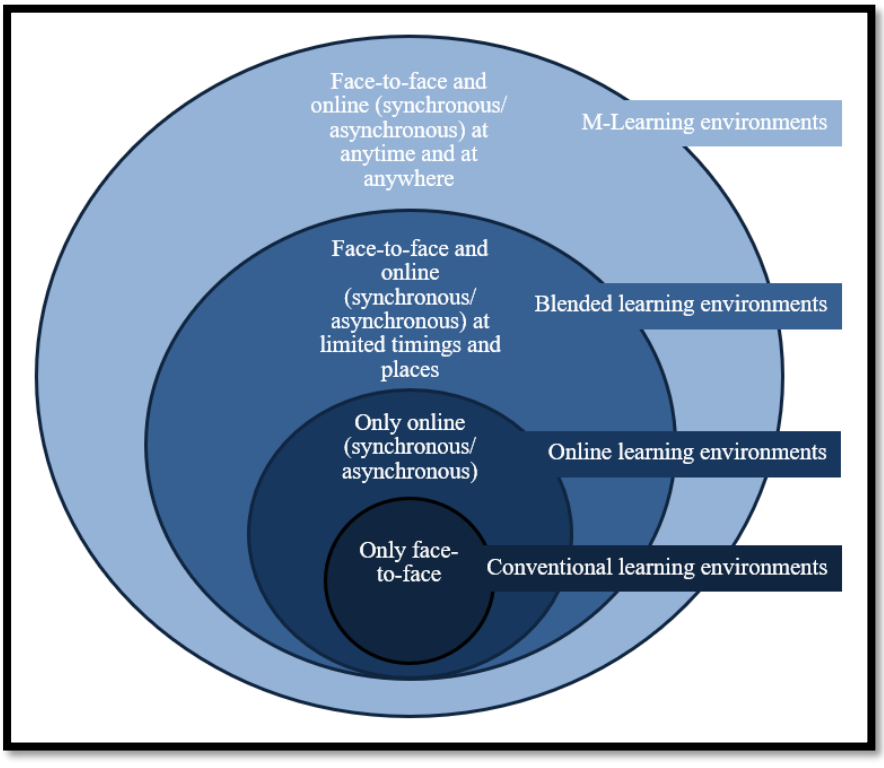

Figure 5.1: Types of Interaction at M-Learning Environments, 2018.

However, some study participants highlighted that instructor's intervention to make cooperation and collaboration happen is critical. Some trainees may tend to learn arbitrarily on their own, and some trainees are more alone than before. Therefore, unless the instructor asks his trainees to work together and sees an evidence of this happening, the level of teamworking, corporation and collaboration will not be satisfactory. This finding is also consistent with existing research. Naismith et al. (2004) argued that facilitating and ensuring classroom conversation and collaboration is taking place amongst trainees is an important role that instructors should carefully note. Accepting learners' autonomy in technology-enhanced learning environments does not mean that instructors can let learners learn anything arbitrarily. Instructors have to encourage and facilitate the occurrence of different forms of cooperation and collaboration, utilizing the affordances these technologies to optimize teamworking skills.

5.3.3. Craftsmanship Skills

This study showed that M-Learning plays an important role in developing trainees' craftsman skills (discipline-specific skills). Access to extra resources such as tutorial videos, 3D models, and animated designs can play a role in developing trainees' theoretical and practical knowledge about their specific disciplines. Other studies came to a similar conclusion. For example, Ng et al. (2016) and Ricky and Rechell (2015) reported that studies have found mobile and flexible learning best connects theories and practices to enrich situated learning experiences in VTET. They argued that effective means of pedagogies that take advantages of the mobile and flexible technologies can help trainees "to apply academic theories into practices and collaborate with peers and workplace mentors for a better understanding of tasks" (Ricky & Rechell, 2015, p. 97).

Thus, based on the findings of this research, it is recommended that program designers, curriculum developers, and instructors consider inserting and using as much as possible various kinds of media and multiple representations, such as 3-D models, animations, interactive dynamic visuals, graphs, and videos as they play an important role in developing theoretical and practical craftsmanship skills. Ng et al., (2016) reported that "using various kinds of media and multiple representations, such as text, graphs, tables, audio, videos, animations, and interactive dynamic visuals have become the most suitable strategies to enhance learning and teaching in VPET" (p. 104).

5.3.4. Creativity, Problem Solving and Critical Thinking Skills

This study showed that mobile technologies can play an important role in developing trainees' creativity, problem solving, and critical thinking skills. Some existing studies also came to similar findings. For example, in their study to investigate the effect of mobile learning on critical thinking skills, Cavus and Uzunboylu (2009)

found that the students' creativity improved significantly with the use of mobile technologies for extended periods of time. Likewise, Garwood (2013) confirmed that new technologies can enable students "to learn to use a more advanced skill set including the ability to process the ever-increasing amount of available information, become flexible thinkers and creative problem-solvers" (p. 25).

This study suggested that searching for and using new applications and websites that help trainees to design their own drawings, presentations, and projects impact their creativity, problem solving and critical thinking skills positively. Similarly, Holland (2014) concluded that "beyond replacing outdated texts and cumbersome notebooks, mobile devices enable students to create and share from anywhere and at any time, unlocking creativity and removing the limitations to what is possible" (para 13).

Furthermore, this study suggested that mobile technologies can ignite original and fresh ideas and help trainees in handling issues and problems in an analytical style. They can encourage trainees to ask more questions; and thus, curiosity can be accommodated because trainees are confident that whatever questions they raise, they may find their answers, or clues to the answers in the rich resources available on their devices and with a sense of immediacy. In this respect, Lin et al. (2008) argued that mobile devices have the potential to support seamless learning which means that trainees "could learn whenever they feel curious and be motivated to learn" (p. 1). Similarly, Osakwe et al. (2017) reported that "learners are curious during the interaction with mobile devices because of their innate propensity to explore" (p. 24). Hence, it can be concluded that mobile technologies can make trainees more inclined to adopt an active role in the learning process which positively impacts their creativity, problem solving and critical thinking skills.

Also, this study showed that learning from others' experience - through collaboration, cooperation, and sharing projects - sharpens creativity, critical thinking, and problem-solving skills. Similarly, Lai and Hwang (2014) argued that "more engagement in mobile learning activities could improve students' 21st century core competences, such as communication, complex problem-solving, and creativity" (Lai & Hwang, 2014, p. 287).

Thus, it can be concluded that there are three major features of M-Learning environments at VTET contexts that impact the development of creativity, critical thinking, and problem-solving skills. These are:

- Using and encouraging trainees to use more design applications and websites.
- Nurturing trainees' curiosity by encouraging them to ask questions and availing access to rich resources on their devices.
- Designing learning activities that allow for sharing knowledge, experience, and projects.

It would be interesting if more in-depth research on this area is conducted to explore the soundness of this finding.

5.3.5. Presentation Skills

According to this research, mobile technologies can play an important role in developing trainees' presentation skills. This finding goes in line with existing research, too. For example, Wilke and Magenheim (2017) reported that apprentices listed presentations and the use of PowerPoint as a skill that was improved with the use of mobile technologies. Likewise, Simona (2015) argued that technology facilitates the process of preparation of different types of presentations and plays an important role in delivering interesting and attractive presentations. She confirmed that mobile technologies particularly offer "models of effective academic, business and technical presentations, helping the students to prepare their own presentations (p. 74).

According to this study, there are three key features that mobile technologies possess, and which enable trainees to improve their presentation skills; namely, the availability of different applications for creating presentations, the device portability, and the direct access to limitless resources for content development. This means that the process of content creation of the presentations; whether individually or collaboratively, is facilitated and made ongoing by mobile technologies. In this respect, Motiwalla (2007) argued that mobile devices help with improving trainees' presentation skills because they help them to create personalized content as they can control or filter it and do collaborative projects as they can reflect and react to the information that they receive in a constructive and conversational manner.

Moreover, the research data showed that when delivering presentations as part of the training program or the assessment model, learners' presentation skills are further enhanced in terms of content, format, and delivery. Also, their roles in the training process change from passive recipients of knowledge to active participants in the creation of knowledge. Similarly, Yousafzai et al. (2016) argued that learners' presentations and reproduction of multimedia content in a different format from a previously produced single version is related to the idea of content adaptation. This is a feature that makes trainees co-authors of knowledge with an active role as knowledge producers rather than consumers. Based on this, perhaps it can be recommended that TVET institutes adopting M-Learning should increase the scope of presentations in the curriculum and assessment model as they become real chances for trainees to participate in the knowledge creation and content adaptation (Pimmer & Tulenko, 2016).

However, some study participants emphasized that both presentation content and delivery are not improved with the introduction of mobile technologies. They think that visuals such as presentation backgrounds and animations are truly improved, but

some trainees still read from the screens and do not interact with the audience during their presentations. Similarly, Simona (2015) argued that mobile technologies are disadvantageous, particularly, with low-achieving learners who tend to copy/paste content from the internet without considering copyright issues, reproduce the information they find online, and focus more on the visuals and less on learning the content or message that they have to deliver. Hence it can be argued that instructor's intervention and timely feedback on the trainees' presentations in terms of content, format and delivery of the presentations is also critical to the development of this skill.

5.3.6. Communication Skills (Verbal and Written Communication)

This study showed that mobile technologies can play an important role in developing trainees' written and verbal communication skills. Similarly, Sharples, Taylor, and Vavoula (2005) and Sharples (2000) argued that mobile technologies can mediate and improve communication and learning. Sharples et al. (2005) argued that "just as learning is now regarded as a situated and collaborative activity, occurring wherever people, individually or collectively, have problems to solve or knowledge to share, so mobile networked technology enables people to communicate regardless of their location" (p. 4).

According to this study, the features of audio and video recording together with the continuous access to social media and online chatting rooms and platforms help trainees to be better communicators as they have more chances to communicate at various levels inside and outside the classroom. Likewise, Kukulska-Hulme (2010) emphasized the role that M-Learning plays in developing effective communication practices inside and outside classrooms. Parsons et al. (2007) concluded that "one widely noted feature of mobile technologies is that they afford the possibility of perpetual contact. This sense of communication support tends to contribute to the other possibilities of M-learning in use" (p. 2).

Besides, the plethora of communication tools made available by mobile devices enable trainees to create various online groups where they can collaborate, discuss ideas, and share files and information. Similarly, Ng et al. (2016) found that mobile technologies can develop learners' communication skills as students preferred peer collaborative activities and social media chatting, and they prefer to establish various platforms for discussion and materials sharing.

Hence it can be argued that the impact on trainees' learning different skill sets and knowledge is positively impacted with the introduction of these different tools of communication which facilitate perpetual conversations and communications. This is in line with Naismith's et al. (2004) argument that "learning is a continual conversation; with the external world and its artefacts, with oneself, and also with other learners and teachers" (p. 15).

However, this study also showed that there are doubts on the role mobile technologies play to develop, especially, the verbal communication skills. Some study participants reported that the iPad made trainees more isolated and, thus, worse communicators. Similarly, some studies also warned against too much involvement with the devices in a way that increases withdrawal and affects communication negatively (McNaughton and Light, 2013).

Hence, it can be recommended that curriculum developers and instructors should develop strategies and teaching methods that ensure more oral communication and encourage trainees to speak. Presentations, recorded dialogues, and other communication-based activities have to be more incorporated in the training programs. In this regard, Holland (2014) concluded that "we may be doing our students a disservice if we ask them to communicate only via one or two mediums" (para 4).

5.3.7. Independent, Self-Development, and Lifelong Learning Skills

This study showed that the features of M-Learning environments support the development of trainees' independent learning, self-development, and lifelong learning skills in several ways. According to Abfalter et al. (2004), it is impossible to equip learners with all required knowledge and skills during the institutional education; therefore, lifelong learning has emerged as a complement to institutional education, and as an entire lifetime process. In this respect, mobile technologies are argued to support this type of learning since they "offer the opportunity to learn and study at anytime and anywhere in different ways - according to the user's preferences" (Abfalter et al., 2004, p. 4).

According to this study, this type of learning can be further supported with the way the digital content is designed. Content features that facilitate self-study and independent learning such as the incorporation of interactive materials and exercises that have auto-correct and auto-check capabilities extend learning beyond the classroom. Furthermore, mobile technologies provide trainees with a direct access to a plethora of online courses and resources that can enable them to learn additional subjects or enhance their standard learning materials. In a similar way, Ayres et al. (2013) concluded that a very prominent benefit of mobile technology is its use for self-instruction which is supported by abundant resources. Liu (2015) confirmed that students of Higher Vocational Colleges "are very much looking forward to the online course materials which they can obtain at anytime and anywhere. They expect their personal digital devices can play a role in learning outside the classroom" (p. 600).

Perhaps it can be argued here that program designers may consider shortening the training program period by converting some parts of the training program into a self-study mode. Fast tracks for high-performing trainees can be created; and thus, a more effective utilization of resources can be achieved. Also, high-performing trainees will

have better chances of quick promotion in the training programs; thus, creating a highly-motivating learning environment for them.

Furthermore, this study showed that mobile technologies can increase trainees' autonomy, which plays an important role in developing independent and lifelong learning skills. However, it is recommended that opportunities for more trainees' autonomy should be warranted in the design of the training programs and curricula; especially with the constraints that the institutional requirements of training organizations in terms of routine lesson assignments and the highly-structured training programs. Lyddon (2016) reported similar findings and recommendations. Also, Ricky and Rechell (2015) argued that full exploitation of mobile technologies for independent and lifelong learning "requires learners to have a higher degree of self-directness, self-management, persistence and independency" (p. 98). In light of this, it can be recommended that program developers and practitioners may consider appending lists of relevant online courses or training programs that offer additional professional development opportunities in different vocational specializations for trainees. This type of guidance has the potential to make trainees more focused and able to build the skills of independent and lifelong learning.

5.3.8. Searching Skills

This study showed that mobile technologies play an important role in developing trainees' searching skills. Existing studies came to similar findings. For example, according to Domingo and Gargante (2016), one of the various impacts of learning with mobile technology is improving information searching skills. Similarly, Baran (2014) argued that mobile technologies increased searching capabilities; which "have further increased their versatility by promoting situated learning experiences and allowing exploration within authentic settings, particularly supporting inquiry-based learning" (p.18).

According to this study, mobile technologies, with the continuous connectivity feature, may accelerate the development of trainees' searching skills; especially since they are in search for online materials most of the time. This is becoming more and more important for successful learning which results from learners being able to "solve contextual, real-world problems through collaboratively exploring, evaluating, manipulating and integrating available information from an array of sources, as opposed to passively acquiring information from texts selected by the teacher" (McLoughlin & Lee, 2008, p. 647).

Trainees of this study reported that they look for relevant and up-to-date information on Google, Wikipedia, YouTube, and on other platforms to further understand a topic under study or to create their own projects and presentation. Such practices need to be supported at M-Learning training programs as learning is no longer 'content-driven'; otherwise, it would lead to a disaster if it continues with the current situation of the

huge amount of available knowledge and information facilitated and availed by ICTs (Appiah & Cronjé, 2013 and 2012). Learners have to be equipped with the skills of searching for relevant and up-to-date information effectively (Brown & Mbati, 2015; Strong & Hutchins, 2009). They also have to be capable of expanding existing models of thinking and creating inferences and analogies. Furthermore, they "need to be able to make new connections through information analysis and synthesis and to create associations between thoughts, feelings, ideas, or sensations" (Armatas, Spratt, & Vincent, 2014, para. 7). This is where searching skills gain their importance.

However, according to this study trainees may have the basic searching skills, but they lack effective searching strategies. Hwang, Kuo, Chen, and Ho (2014) reported similar findings. Hence, it can be recommended that especial training courses for developing searching skills and strategies are required for trainees. The role of searching skills in developing effective learning and building knowledge in a world where knowledge doubles every 12 to 13 months is critical (Lewis, 2016; Egelhoff, 2014; Lundell, 2014).

Finally, there is a lack of in-depth research on the role mobile devices play in developing web searching skills and strategies. This is accompanied with a lack of studies on searching skills which adopted a developmental approach (Chu & Law, 2007). In this respect, further in-depth research on the role of mobile devices in developing web searching skills and strategies is needed (Domingo & Gargante, 2016; Baran, 2014; Chu & Law, 2007).

5.3.9. Information and Communication Technologies (ICT) Skills

This study showed that interaction with the devices for longer periods of time facilitated the development of trainees' ICT skills as they started to learn more about the software and the hardware of their devices and about information collection, storage, processing, and presentation.

In fact, there is also a lack of research on how the adoption of mobile technologies may enhance learners' ICT skills. Many researchers looked at the relationship between mobile technologies and ICTs from an opposite stance, which is how ICT literacy impacts the adoption of mobile technologies. Mac Callum and Jeffrey (2014) argued that "ICT literacy is the measure of an individual's ability to use digital technology, communication tools, and/or networks to access, manage and integrate digital resources" (p. 9). Likewise, Mac Callum and Jeffrey (2013) assumed that "the perceived ease of use and usefulness of mobile technology would mediate the relationship between ICT skills and the intention of students to adopt mobile learning" (p. 303).

Hence, it can be argued that the relationship between mobile technologies and ICTs is a dialectical one. That is, basic ICT literacy decreases ICT anxiety and helps both

instructors and learners to accept and adopt M-learning. Conversely, adopting M-Learning has the potential to enhance learners' ICT skills as they learn more about the software and the hardware of their devices and about information collection, storage, processing, and presentation. However, more research is required to explore this skill in more depth.

5.3.10. Typing Skills

According to this research, mobile technologies facilitate the development of trainees' typing skills. Trainees learn to type faster because they have to type all day inside and outside the classrooms on their mobile devices. In fact, it is because of this requirement - typing all day - that mastering this skill is indispensable as the ability and efficiency to type certainly impacts trainees' learning process. For example, it impacts their speed and accuracy in completing learning tasks and activities, and it impacts their answers in the tests and quizzes. In addition, mobile technologies have the potential to improve trainees' typing in English language; especially since the typing keyboard is set in English only as English is the medium of communication at the context of this study.

In this respect, I think this specific skill is rather neglected by researchers of M-Learning although I think it is a key skill for the success of mobile-based training programs. Trudeau, Catalano, Jindrich, and Dennerlein (2013) confirmed that "it has not yet been determined whether keyboard design affects performance and usability measures during functional tasks such as thumb typing (p. 2). However, there are a few studies that reported the difficulty of working on touch screens. For example, Rodrigues et al. (2016) indicated that touch screen devices have the disadvantage of "lacking the haptic feedback of physical buttons" (p. 393). Likewise, Rahmati and Zhong (2013) confirmed that tablets, with their bigger screen size than other devices such as smart phones, may overcome some of the problems such as buttons being too small, which may lead to improved typing skills. However, there should be more focus on "understanding and developing more appropriate solutions to improve typing performance on virtual keyboards for tablet devices" (Rahmati & Zhong, 2013, p. 1425).

In this regard, many of these difficulties were not identified by the participants of this study because each trainee was provided with - or was allowed to bring - a physical keyboard and a mouse as attachments to their iPads. In this sense, it could be suggested that providing these peripheries or allowing learners to have them in M-Learning environments may eliminate the limitations of typing on touch screens.

5.4. Key Aspects, Dynamics, and Features of M-Learning Environments

As discussed above, this study showed that mobile technologies have the potential to positively impact the development of many employability and job-related skills in training environments. Furthermore, the research data indicated that M-Learning environments have some unique dynamics, aspects, and features which support the argument about proposing the adapted LDSC Frame Model For M-Learning (Figure 5.2).

These dynamics and features which include the emerging behaviours of trainees, the new forms of communication and interaction, the models of learning and engagement, and the new opportunities for skill development are all results of the ongoing tension and interaction between the main aspects of the adapted LDSC Frame Model For M-Learning; namely, the learner, device, social, and content aspects. These aspects overlap and intersect at multiple levels and layers and, as discussed earlier, the primary intersection, a convergence of all four aspects, defines an ideal mobile learning situation and can be utilized as a guide model to design more effective mobile learning experiences (Koole, 2009a). For example, in the context of this study, the social aspect - in its different intersections with the learner, the device and the content - covers the argument about increased *distraction* versus decreased *destruction* and is also related to the finding of *physical isolation* versus *virtual connection*. Moreover, the intersection between the learner and the device from one side and the learner and the content from the other side is tied with the findings of emerging trainees' behaviours such as going for *real learning* versus *task completion* as well as the findings of *engagement with the device* versus *engagement with the learning content*. Furthermore, the intersection between the device and the content is linked with the research finding of *compiled learning materials* and activities in M-Learning environments. In the following section, a more in-depth discussion on each of the main findings of this section will be introduced.

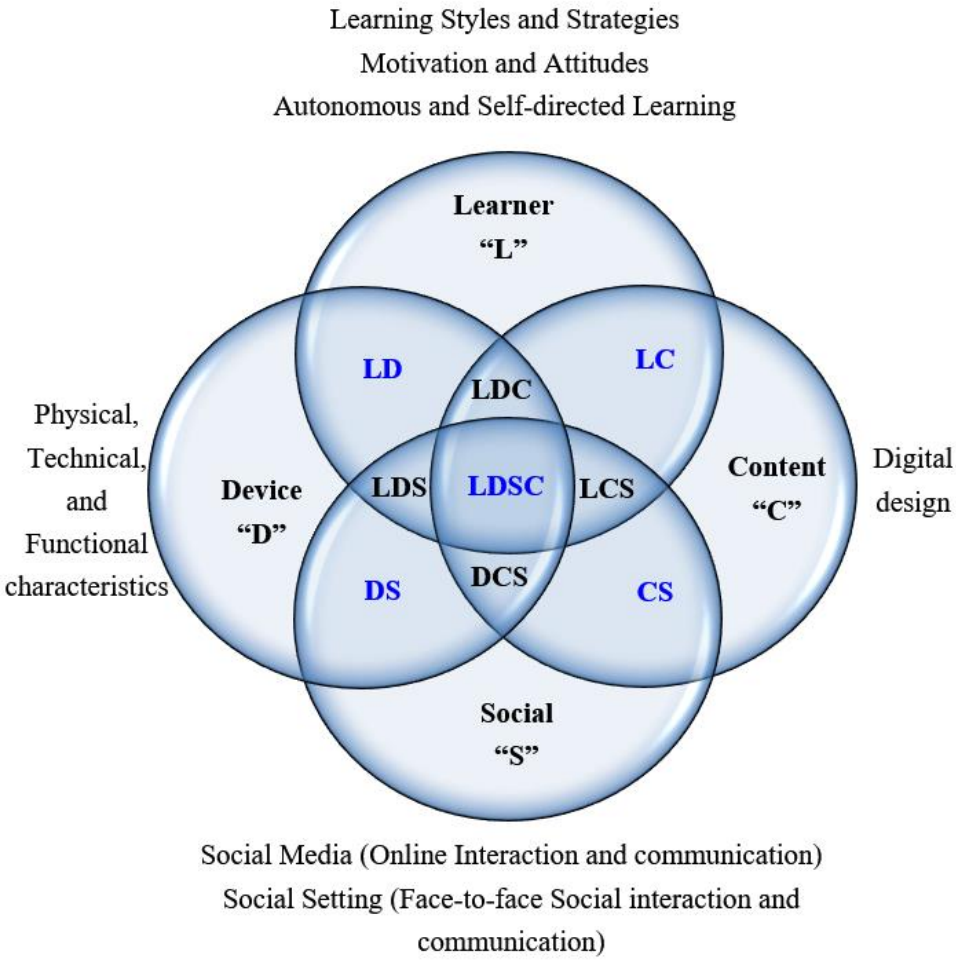

Figure 5.2: The learner (L), Device (D), Social (S), and Content (C) intersection (the LDSC Model, Adapted FRAME Model), 2018.

5.4.1. The Rise of Distraction Versus the Fall of Destruction

This study showed some interesting findings about trainees' use of non-standard applications and social media in M-Learning environments. In a general sense, it has been indicated that, as a prominent feature of a M-Learning environment, there is a rise in trainees' *distraction* which refers to using social media, video games, and non-standard applications as opposed to a fall in *destruction* which refers to horse playing, shouting, and other unwanted behaviours. There is less physical and social interaction amongst trainees as opposed to increased engagement with the devices and applications.

Existing studies reported similar findings on mobile learners' increased engagement with distractions. For example, Shannon (2016) concluded that "learners may be motivated by an association with the social and entertainment features of the device, as opposed to its opportunities for learning through portability" (p. 296). Similarly, Barker, Krull, and Mallinson (2005) found that learners are often surrounded by distractions with mobile learning and recommended that learning has to be engaging.

However, this study revealed some debatable concepts about trainees' engagement with the non-standard applications and websites. For example, the study showed that these applications and websites may be utilized positively by some trainees as time fillers when they finish their tasks quickly, and thus abolish the feeling of boredom and demotivation which results from the prolonged time that other trainees consume before they complete their exercises and tasks. In fact, existing studies reported contradictory findings in this area (Weslake & Christian, 2015; Toshalis & Nakkula, 2012; Richtel, 2010). Richtel (2010) argued that "technology makes the tiniest windows of time entertaining, and potentially productive" (p. 1). Nevertheless, the counter argument is that learners are fundamentally fatiguing - not refreshing - themselves with the too much engagement with technologies and multi-tasking. Richtel (2010) also argued that "when people keep their brains busy with digital input, they are forfeiting downtime that could allow them to better learn and remember information, or come up with new ideas" (p. 1). Hence, looking at the whole picture of the learning environment, and based on the finding of trainees' tendency to go for task completion rather than real learning (as explained in sections 4.2.2. above and 5.4.2. below), it is safe to argue against allowing trainees to have access to the non-standard applications as a method of providing mental breaks in the classrooms. Some trainees will misuse this authorisation, and they will lose focus in the learning objectives.

Equally interesting, this study showed that trainees' tendency to use non-standard applications to supplement the mandated content (in the form of online materials) or to find more interesting lessons (by following online tutors) challenges the concept that drifting from the prescribed content in M-Learning classes is always a distraction from learning. It has been suggested that drifting to useful applications such as YouTube videos, websites, exercises, translators, and calculators can lead to a more effective learning experience (Figure 5.3).

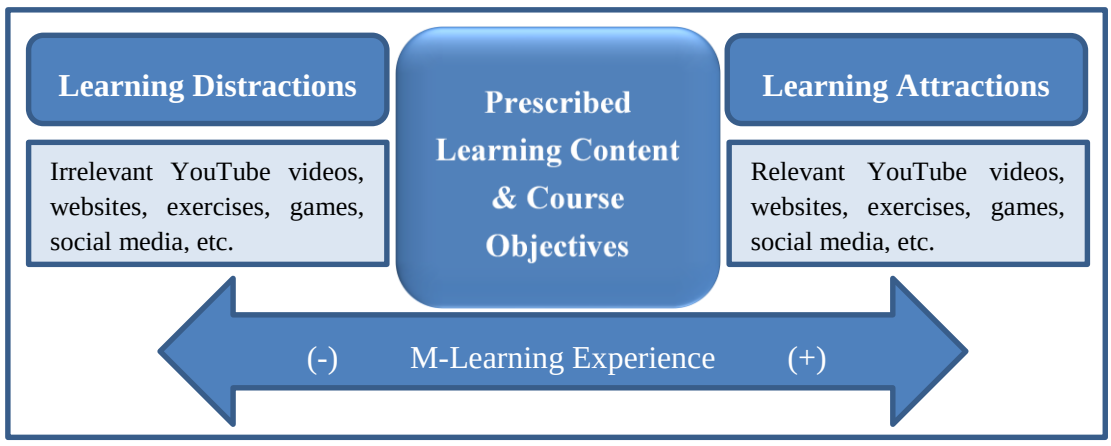

Figure 5.3: Interaction with Non-Standard Applications and Websites, 2018.

In fact, some existing studies reported on the benefits of accessing different types of online resources (Mango, 2015; Ouyang & Stanley, 2014; Laurillard & Pachler, 2007). However, this finding triggers another concept related to pedagogical practices and content design. It can be argued that leaving the standard or prescribed content application and drifting to non-standard applications is a call for change to curriculum designers, educators, and practitioners. Hence, the richness, interactivity, and appeal of the learning materials of the mandated content can determine the level of trainees' drifting from it. Also, instructors' ability to orchestrate the lessons as well as trainees' awareness levels can also control the direction of engaging with the non-standard applications and websites. Some trainees are very smart, and they can judge on the usefulness of the materials and the quality of teaching being delivered to them. If the learning materials or the instructors' teaching methods are deemed ineffective or inefficient, they will look for other sources of learning. Other researchers captured this idea, too. For example, Fang (2009) argued that these types of *'distractions'* are actually opportunities for change in the classroom.

> With many of the world's best professors sharing their video lectures through educational portals such as iTunesU, Academic Earth, and the recently launched YouTube EDU, students have access to the best lectures online in many subject areas. These might be the real "distractors" for professors if they do not reform their teaching. (Fang, 2009, para. 16)

But this does not mean that all trainees use non-standard applications in this positive manner. In fact, a good number of trainees confirmed that they were negatively engaged with distractions during the lessons. The core problem here is that engagement with non-standard applications and social media as well as multitasking distracted trainees' attention from the main focus of the teaching and learning experience as indicated by 27% of the instructors. Similarly, Mingyong (2015), Lee, Lin, and Robertson (2012), Kirschner and Karpinski (2010), Fox, Rosen, and Crawford, (2009), and Fried (2008) concluded that multitasking and engagement with distractions correlate negatively to student learning, performance, and achievement.

Now the question is: would it be possible to measure the usefulness of trainees' engagement with the non-standard applications and websites during lessons? As you may expect, no! It will require analysis of too much data collected from individual trainees' devices on their engagement with the different applications. Therefore, it is recommended to control trainees' access to the non-standard applications and websites inside the classroom to neutralize their impact.

In light of this, participants of this study identified three effective methods of controlling trainees' access to the non-standard applications and social media inside the classrooms; namely, instructor monitoring techniques, trainee self-monitoring, and

device monitoring. Perhaps, this is one of the contributions of this study which can help guide the practice at similar M-Learning environments.

This study showed that effective instructors' monitoring requires a change in the instructors' position inside the classroom accompanied with a change in their teaching philosophy. Instructors have to move more to the back of the classroom where they have to teach more from behind the trainees or at least from a shoulder-to-shoulder position so as to be able to see the screens of trainees' devices. This change should facilitate the process of monitoring trainees' engagement with distractions, passing answers of exercises and quizzes, and turning screens into idol.

Simultaneously, instructors need to keep their trainees engaged in the learning activities through the implementation of effective group/pair work activities and through empowering trainees to lead the teaching of each other. It has been observed that group work in which trainees are assigned specific roles to play such as group leader, monitor, reporter, and notetaker enables the instructors at M-Learning classes to orchestrate their classes more effectively and keep trainees more focused on the lessons at hand. Existing research also emphasized instructors' role as a monitor at M-Learning classes (Nedungadi & Raman, 2012; Shih, 2011). Lang (2017) argued that "most of us can shut out distractions when we are pursuing something that really matters to us. So if we want to deal with distractions in teaching, an obvious place to turn would be toward our goals for the classroom: Who creates them? How much do they matter? And how well do students understand them?" (para. 17). Thus, it can be argued that engaging trainees in the learning experience and the process of developing learning goals can be a good method to minimize or avoid the negative impact of distractions in the classroom.

Nonetheless, another question may arise here. What does it require to utilize the extra resources on the mobile devices positively or more effectively? The simple answer goes into two directions:

- First, the emerging role of instructors as selectors.
- Second, the collection of the extra resources.

Regarding the first point, I suggest that utilizing the resources to positively impact learning may require a more complex and emerging role of instructors at M-Learning classes which is the *selector* role. Instructors have to be equipped with the right knowledge and skills of how to guide learners' selection of learning tools and applications, and yet remove distractors in a way that ensures maximum and effective utilization of mobile devices. They also need to know which applications and resources can make their teaching more entertaining to their trainees. Existing research support this finding. For example, Toshalis and Nakkula (2012) argued that

> Faced with the noise of myriad digital distractions and their threats to productivity and cognitive complexity, teachers need to

> understand that classroom engagement is as much about selective disengagement - unplugging, as it were - as it is about the decision to focus attention and apply effort. (p. 22)

As for the second point above (collection of the extra resources), participants of this study highlighted the need for one toolbox or platform in which all learning tools and resources (dictionaries, videos, chatting rooms, bolls, games, quizzes, drawings, and other tools) can be saved. They also indicated that shooting more videos on the company worksites with employees doing real tasks and having them on the iBooks rather than getting general or irreverent videos from YouTube would be more useful as it would cause less information overload and make them less confused and less distracted. This is consistent with existing research (Wilke & Magenheim, 2017). Chen et al., (2008) argued that "providing too much information may produce a higher cognitive load and lead to irritation and a lack of concentration" (p. 93).

Another technique that helps instructors to control distractions is through mobile monitoring applications which can lock trainees from using non-standard applications and websites. Similarly, Henderson and Yeow (2012) argued that installing monitoring software on learners' mobile devices "allows teachers to have more control over their students to ensure they are staying on task and also not viewing content which they should not be" (p. 81).

Finally, trainees' self-monitoring which originates from their sense of responsibility for managing their learning to complete their training program and understanding that they still can visit all social media and non-standard applications during their free time. Toshalis and Nakkula (2012) recommended that *student voice programs* which demonstrate a commitment to the facilitation of student agency and to the creation of policies, practices, and programs that revolve around the students' interests and need be adopted.

In this sense, it can be concluded that benefiting from the extra resources that mobile technologies provide and turning them to *learning attractions* rather than *distractions* requires integrated actions from M-Learning stakeholders. While content designers and developers need to create and develop company specific resources (especially videos) that explain the company's processes and collect them in one handy platform, instructors need to use pedagogy and curriculum to integrate the technology effectively into learning and encourage trainees more to participate in the creation of policies, practices, and programs. Hence, I suggest that more intensive research on the issue of distractions need to be conducted to explore whether the term itself is accurate and refers to the practices conducted by learners, especially, inside the classrooms, and to explore possibilities of turning *distractions* to real effective learning *attractions*.

In light of this discussion, it can be argued that this theme (The Rise of Distraction Versus the Fall of Destruction) is linked with two basic aspects of the adapted LDSC model; namely the Learner (L) and the Device (D) as well as the intersection between them; namely, the LD aspect. The figure below (Figure 5.4) illustrates these elements on the adapted LDSC model.

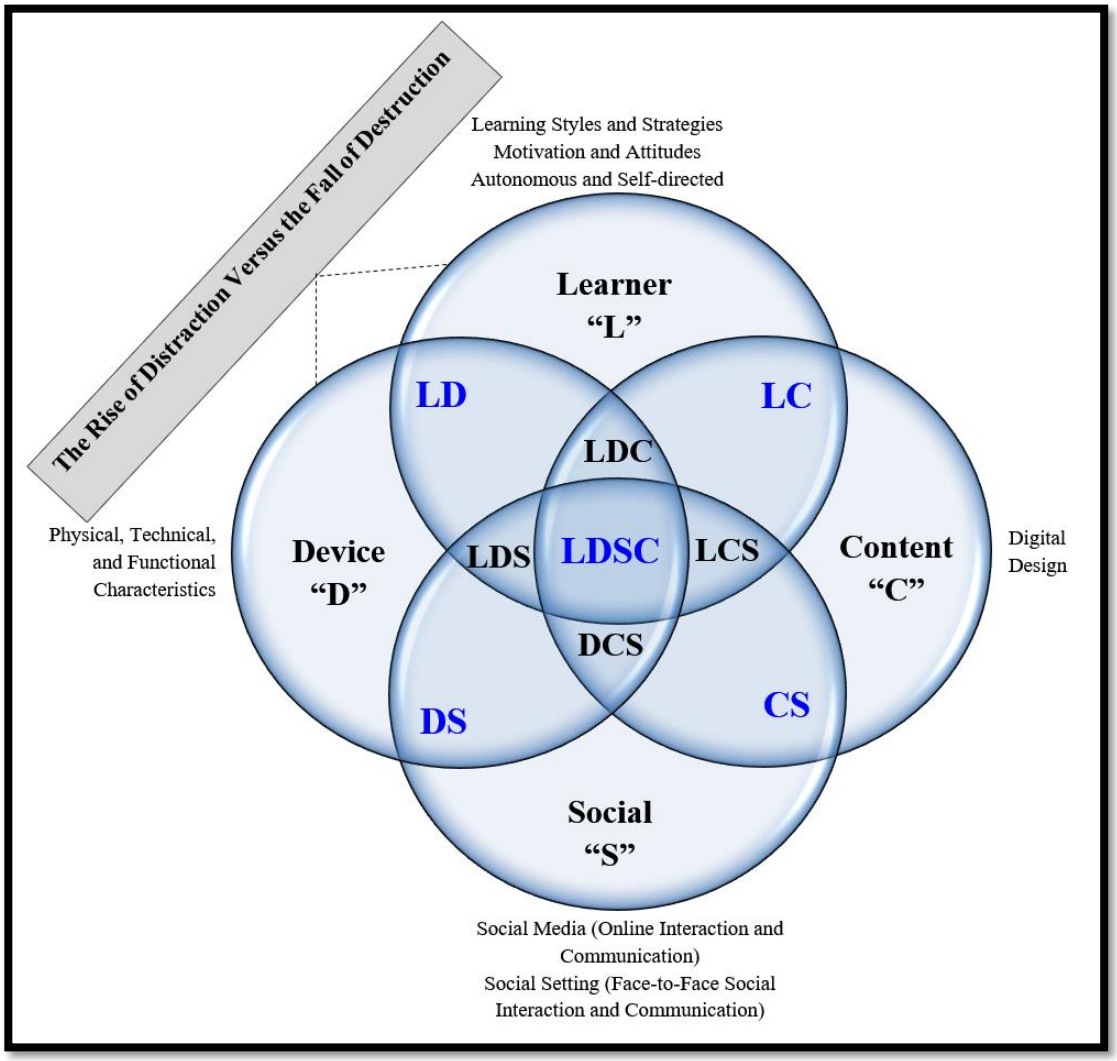

Figure 5.4: The Rise of Distraction Versus the Fall of Destruction on the LDSC Model, 2018.

5.4.2. Learning Versus Task Completion

This study showed that trainees shift between engaging in real learning activities and going for a mere task completion, marking another key feature of M-Learning environment. Mobile devices help trainees to complete their learning activities and tasks more quickly than before for several reasons. Initially, the digital content with its auto-check and auto-correct features helps trainees to advance with their learning independently by getting instant feedback on their answers and exercises. It also makes trainees more independent, autonomous, and self-motivated as indicated by

study participants. Some existing studies go in line with this finding. For example, Nordin et al. (2010) confirmed that mobile devices may be excellent for drill and practice exercises, especially when coupled with the fact that with mobile devices, feedback is almost immediate. Furthermore, the feedback received on spot from mobile applications can act as "a motivator to the students hence encouraging them to continue with the exercises given" (Nordin et al., 2010, p. 135).

Hence, it can be argued that these features help both high-performing and low-performing trainees in different ways. They help high-performing trainees to become more motivated to advance with their learning tasks without having to wait for teachers to check their work. Moreover, they help trainees to pace themselves well with the tasks and exercises to maintain a high achieving status. Likewise, Lyddon (2016), Keengwe (2014), Ayres et al. (2013), and Yang (2012) confirmed that mobile technologies increase learners' motivation and open up promising new possibilities in terms of the exercise of learner autonomy and self-instruction.

On the other hand, mobile devices help low-performing trainees to avoid losing face in front of their colleagues due to repeated incorrect answers. Other trainees may do this because they are looking for more self-esteem. Trying the answers until having the correct ones gives them the confidence to raise their hands more in the classroom to share and participate in the process of learning.

However, those affordances and features of mobile technologies may also be misused by some other trainees. For example, trainees may want to know the correct answers quickly - without real learning of the task in hand - just to spare more time for themselves to relax or to visit social media or other distractions. They target completing the task rather than real learning. These findings are also consistent with existing research in many ways (Ricky & Rechell, 2015). Robertson (2007) argued that students prefer using mobile devices and flexible technologies for entertainment to educational purposes.

Perhaps one implication of this finding is that curriculum developers should incorporate more exercises that require more written and constructive input from the trainees rather than checking boxes, true or false, and matching exercises. Also, in order to ensure real learning is happening as opposed to task completion, instructors have to employ effective questioning and comprehension-check techniques and methods. Moreover, activities have to be time-based, bound to be completed at a specific frame of time. Finally, activities should be designed in a way that builds on a scale of difficulty. If an activity is completed in less time than expected, a more challenging task should be given. These recommendations have the potential to increase learners' involvement and promote effective learning over task completion.

In light of this discussion, it can be argued that this theme (Learning Versus Task Completion) is linked with two basic aspects of the adapted LDSC model; namely the

Learner (L) and the Content (C) as well as the intersection between them; namely, the LC aspect. The figure below (Figure 5.5) illustrates these elements on the adapted LDSC model.

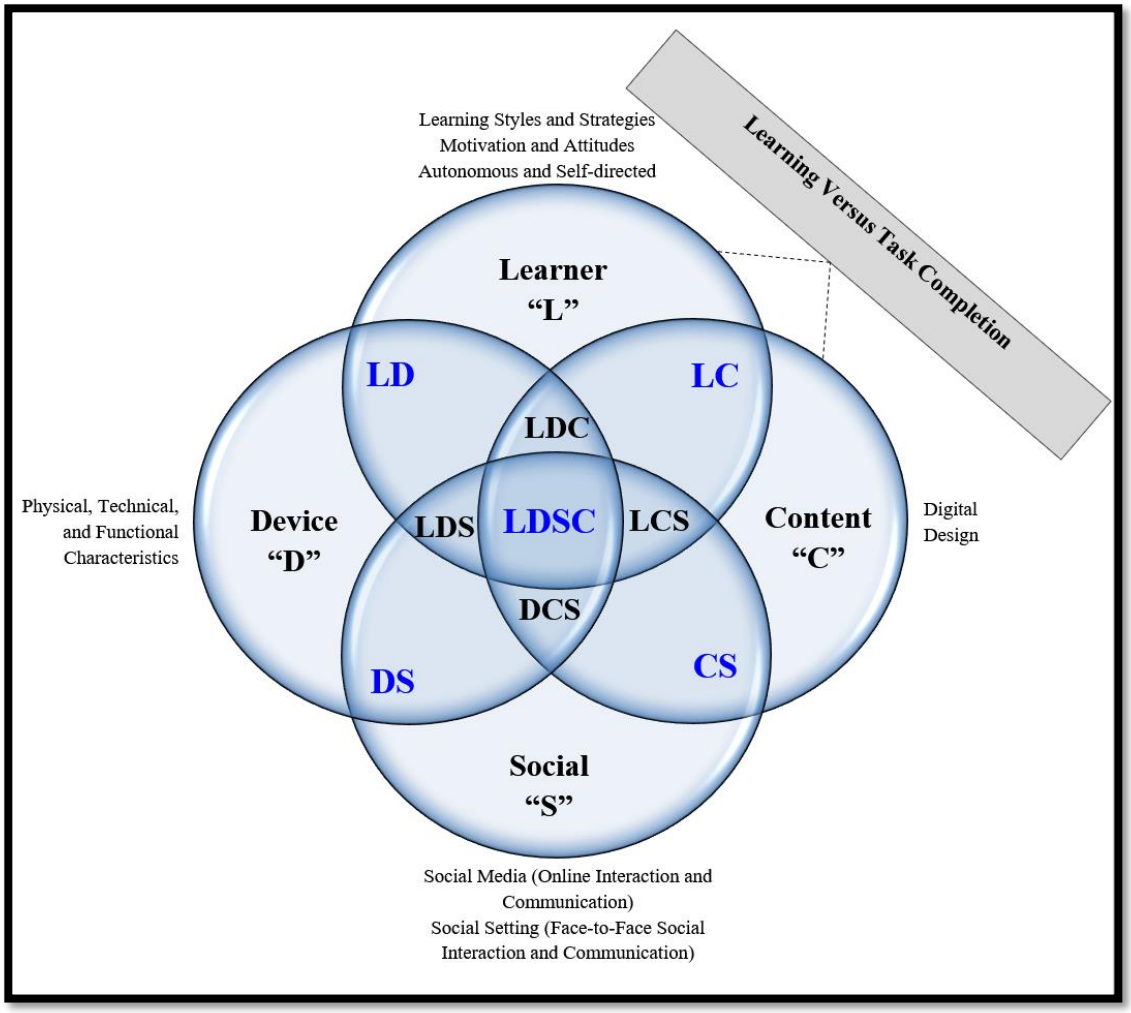

Figure 5.5: Learning Versus Task Completion on the LDSC Model, 2018.

5.4.3. Compiled Learning Materials and Activities: easy access to all versus danger of losing all

This study showed that, unlike in conventional learning environments, learners have all formal learning materials – past, present, and future - installed on their devices in the form of iBooks. Participants of this study reported that this feature is important as all learning materials can be visited at anytime and anywhere, thus supporting individualized learning. It facilitates trainees' revision of old lessons and enables them to evaluate the difficulty of future materials, and, thus, take proper actions towards learning them at a convenient self-pacing.

This finding also goes in line with existing literature. For example, Keengwe (2014) concluded that learners prefer to access their materials via the iPad/course App

interface, and they are also more motivated to learn and access a greater range of well-structured and organised material; the thing which "allows for flexible study as you can access all learning materials without having to carry lots of books and means you can study anytime anywhere" (p. 49).

However, participants of this research also reported that there is still a danger of losing some important notes, answers, and materials if the device is lost or if it has to be formatted for any technical reasons. The formal content (iBooks) could be reinstalled, but still, the trainee may lose all his notes and other informal materials. In light of this, program designers and curriculum developers must consider a method that can facilitate continuous learners' activity backing-up. Other studies highlighted other issues with having all learning materials compiled in one device. For example, Keengwe (2014) highlighted that there are disagreements over whether we should give learners all the 'required' materials and resources. He concluded that "some might argue that part of the nature of studying is sourcing your own readings and material" (p. 51). Chen, Hsieh, and Kinshuk (2008) highlighted the negative impact of providing too much learning materials for learners as it may cause cognitive overload.

Since all learning materials (past, present, and future) are installed on the trainees' devices; the thing which can encourage more independent and autonomous learning as trainees may decide to visit future units and lessons, one implication for curriculum developers and content designers is to identify a list of challenging topics at the beginning of each module for learners to note, and thus, may start to learn about them earlier if they are willing to. Of course, the impact of having all learning materials installed on trainees' devices can be maximized by incorporating various interactive, highly personalized, easy-to-use, focused on improving outcomes, and engaging activities that meet different learners needs and preferences. This may provide more opportunities for delivering material at an optimal pace that caters to each student's interests, aspirations, skill needs, and abilities

In light of this discussion, it can be argued that this theme (Compiled Learning Materials and Activities: easy access to all versus danger of losing all) is linked with two basic aspects of the adapted LDSC model; namely the Content (C) and the Device (D) as well as the intersection between them; namely, the CD aspect. The figure below (Figure 5.6) illustrates these elements on the adapted LDSC model.

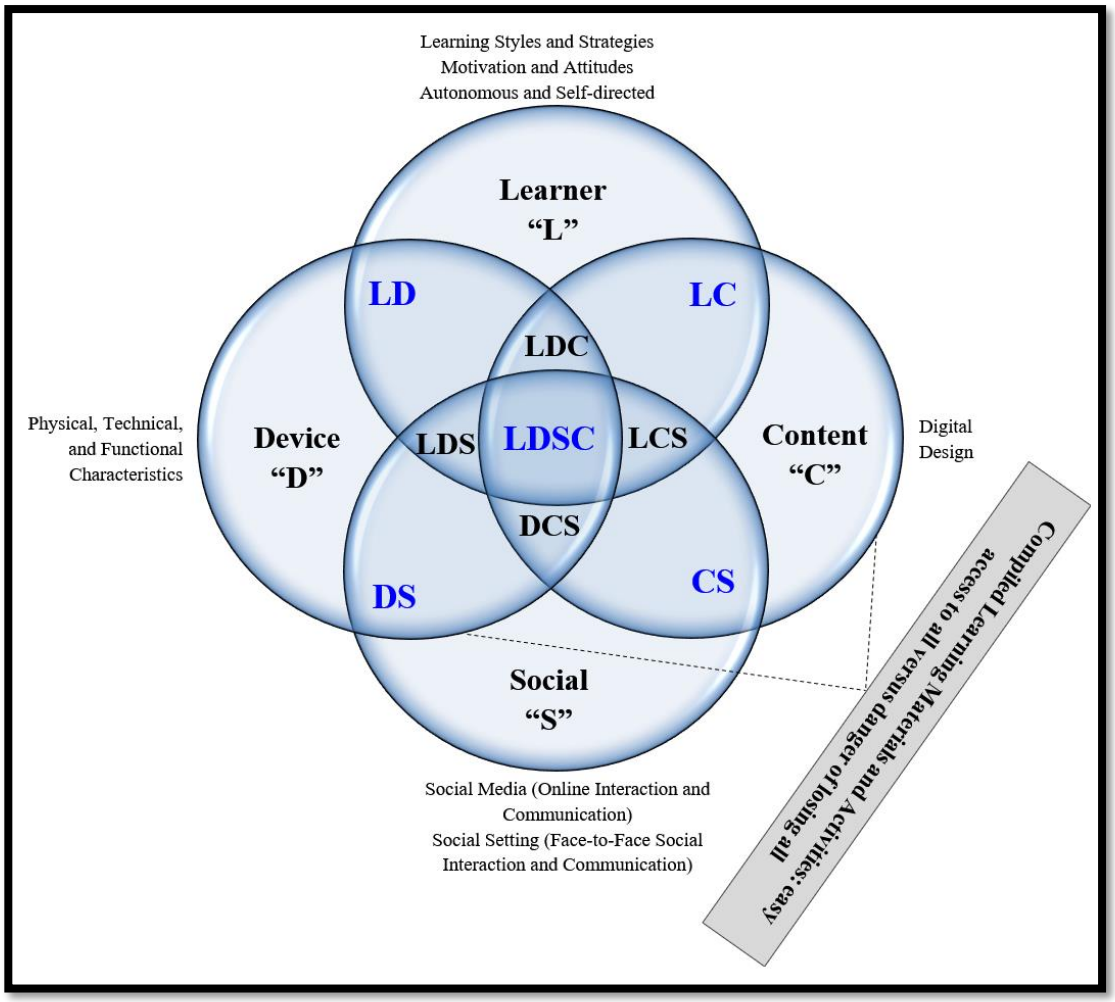

Figure 5.6: Compiled Learning Materials and Activities: easy access to all versus danger of losing all on the LDSC Model, 2018.

5.4.4. Increased Physical Isolation Versus Increased Virtual Connection

This study showed that there is a higher degree of physical isolation accompanied with a higher degree of virtual connection amongst learners at M-learning environments. Trainees may look isolated, alone, and unsocial, but they are genuinely active online at various levels. Although some researchers linked learners' love to intensively communicate and interact online with the nature of the current generation who grew up in an era of networked information (Nie (2015), others highlighted the affordances of mobile technologies in mediating online communication and interaction. For example, Ozdamli and Cavus (2011) indicated that mobile devices "eradicated geographical borders, enabling co-operative learning environments which have individual and group interaction in the education" (p. 940).

In the context of this study, participants reported several reasons for their heavy involvement in online communication and interaction. Some trainees are not very satisfied with the level of learning they receive at the training centre, and they tend to look for extra tutorials online. They watch other people teaching and providing more

information about various topics and industrial machines and equipment. In a similar way, Gikas and Grant (2013) and Chen et al. (2003) pointed out that technologies provide a wide range of tools and platforms which provided opportunities for more interaction, collaboration, and engagement in content creation and effective learning. It is argued that these features and dynamics can introduce potentials for transformational shifts in teaching and learning practices, "whereby learners can access peers, experts, the wider community and digital media in ways that enable reflective, self-directed learning" (McLoughlin & Lee, 2008, p. 649).

Trainees are often actively interacting with other trainees, their instructors, other online instructors, and in online groups and communities which they created or joined. They share information, tutorials, and resources amongst themselves while they look physically inactive. They exchange ideas and feedback, and perhaps have fun joking and interacting virtually in the same way as they used to face-to-face. Moreover, the portability feature of mobile devices does not obtrude face-to-face communication and interaction. Thus, mobile technologies provide additional and alternative types of interaction and communication. This is consistent with the findings of many researchers such as Hsu and Lin (2017), Kim et al. (2016), and Reychav and Wu (2015).

However, instructors need to be aware of the level of face-to-face disconnection inside the classroom and at the workshops. They have to push trainees to utilize their presence for more face-to-face social interaction. Similarly, Przybylski and Weinstein (2013) reported that evidence derived from their experiments indicated that the mere presence of mobile devices "inhibited the development of interpersonal closeness and trust, and reduced the extent to which individuals felt empathy and understanding from their partners" (p. 244). In this respect, Ng et al. (2016) recommended blending face-to-face teaching with e-learning or mobile learning as specific instructional strategies for VTET to further enhance student motivation and interaction.

In light of this, a deeper understanding of the nature of learners' emerging forms of interaction has to be realized by instructors; the thing which entails a change in their perceptions of what interaction is, but also revise their curriculum to adopt these changes. More effective use of trainees' motivation to participate in the online groups and communities can open up new opportunities for developing interaction, conversation, and collaboration, which are deemed essential to learning from a socio-cultural perspective as people engage in negotiating meaning (Kearney, Schuck, Burden, & Aubusson, 2012).

In light of this discussion, it can be argued that this theme (Increased Physical Isolation Versus Increased Virtual Connection) is linked with two basic aspects of the adapted LDSC model; namely the Learner (L) and the Social (S) as well as the

intersection between them; namely, the LS aspect. The figure below (Figure 5.7) illustrates these elements on the adapted LDSC model.

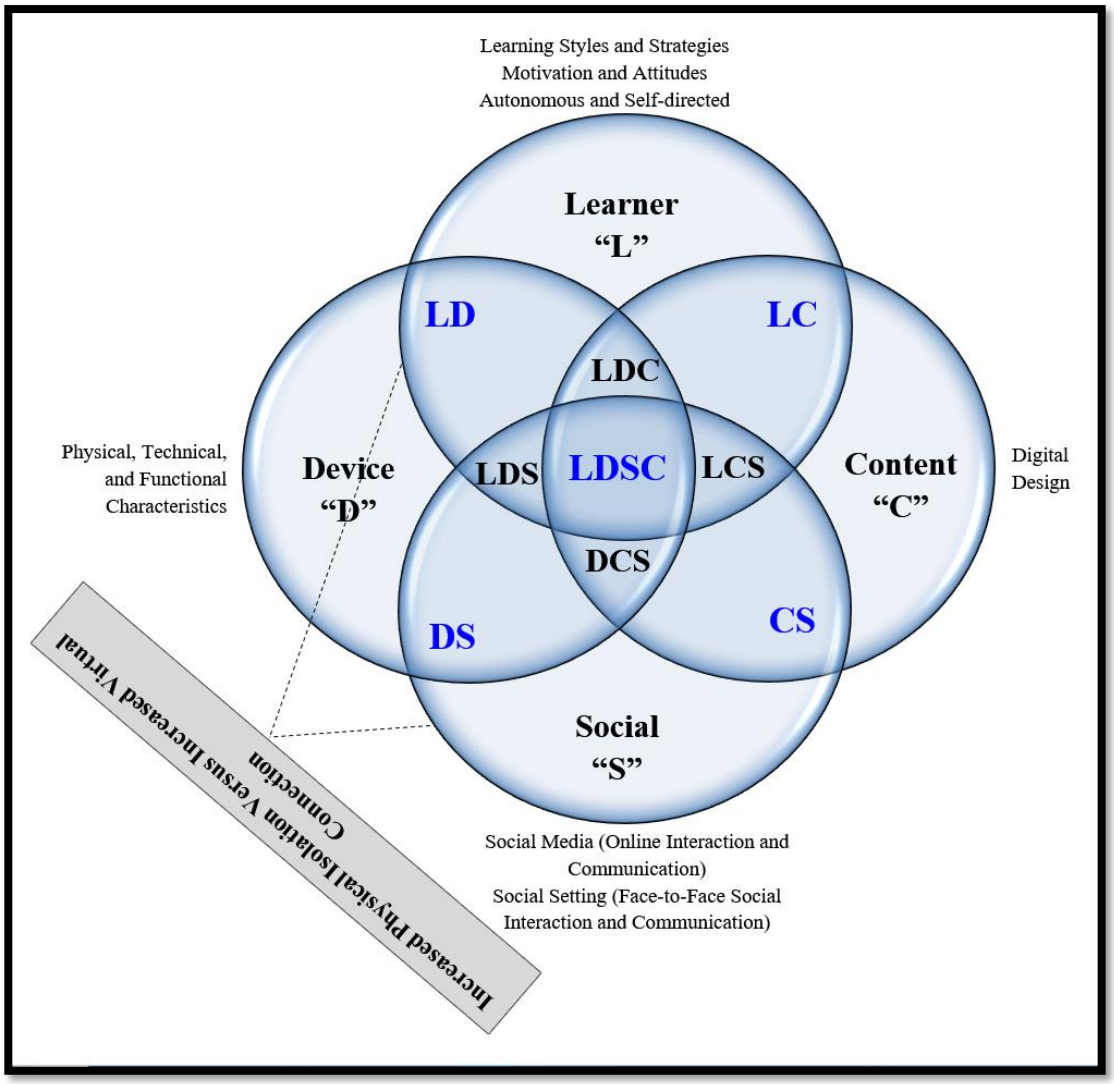

Figure 5.7: Increased Physical Isolation Versus Increased Virtual Connection on the LDSC Model, 2018.

5.4.5. Engagement and Performance

This research showed that mobile devices can increase trainees' engagement with the learning content and enhance their performance inside and outside the classrooms. Numerous studies reported similar findings such as Shannon (2016), Sung et al. (2015), Ozdamli and Cavus (2011), Liaw et al., (2010) and Passey (2010).

Multiple factors impacting trainees' engagement and performance are positively affected by the affordances of mobile technologies. On top of these comes motivation. Not only the possession of the most up-to-date technologies - versus textbooks - increases trainees' motivation, but also the interactive, social, and entertainment

features of the devices as well as the facilitated wide range of learning capabilities (e-learning, face-to-face learning, and blended learning) are all critical factors that increase trainees' motivation. Likewise, Ng et al. (2016), Shannon (2016), Sung et al. (2015), Yang (2012), and Heinrich (2012) argued that in M-Learning environments, motivation is increased by an association with the social and entertainment features of the device, when learners are engaged in authentic learning tasks, when face-to-face teaching is blended with e-learning, and when task-based assignments are availed to learners.

Another factor impacting trainees' engagement and performance is the development and use of especially-designed, interactive, digital content in different modalities. Likewise, Ng et al. (2016) found that "using various kinds of media and multiple representations, such as text, graphs, tables, audio, videos, animations, and interactive dynamic visuals have become the most suitable strategies to enhance learning and teaching in VTET" (p. 102).

A further factor that can be argued as vital to enhancing trainees' engagement and performance is the extra platforms for communication, cooperation, and collaboration that mobile technologies provide. The social aspects of mobile devices provide extra opportunities for trainees to be engaged in a continuous process of constructive learning and negotiation of meaning. These findings are consistent with existing research, too. For example, Kukulska-Hulme (2010) argued that "mobile technologies can engage learners, provide new means of communication and collaboration, and a way to connect 'lessons' (including lectures, tutorials, distance learning activities.) with what happens once the lesson is over" (p. 184).

Thus, it can be concluded that - in light of the above discussion - the aspects of learner, device, social, and content and the intersections between them support the concept behind the adapted LDSC Frame Model and validate its effectiveness in representing different dynamics at M-Learning environments. The figure below (Figure 5.8) illustrates these elements on the adapted LDSC model.

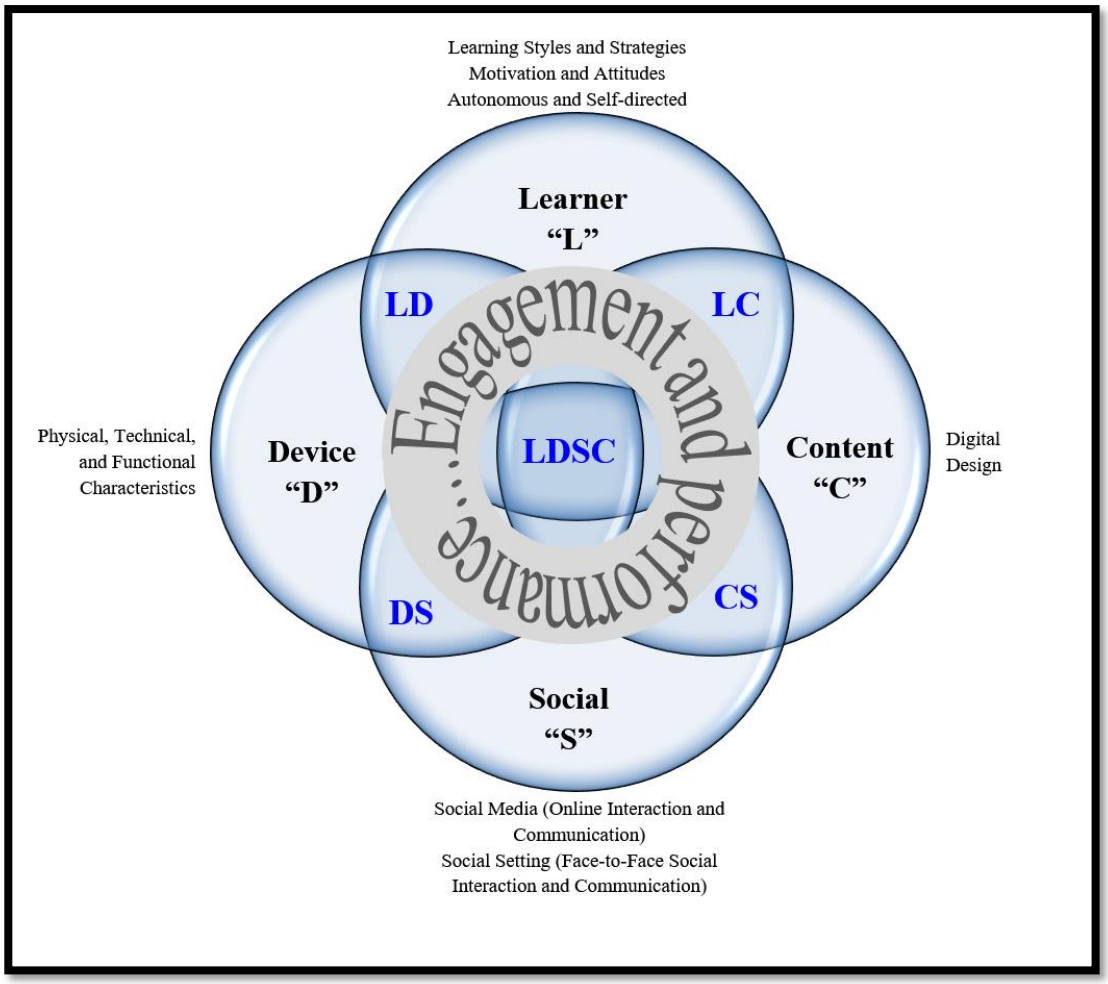

Figure 5.8: Engagement and Performance on the LDSC Model, 2018.

5.4.5.1. Student-Centred Learning

This study showed that a major feature of a M-Learning environment is the promotion of a learner-centred culture where the learner plays an active role in the learning process as an independent learner, an active participant and member of a learning community or communities, a sharer of knowledge, and a co-creator of content. They confirmed that trainees do more work inside and outside the class by themselves with the mobile devices. These results are consistent with other studies. For example, Sha, Looi, Chen, Seow, and Wong (2012) argued that "student-centred learning logically assumes that students are the agents (masters) of their own learning in some manner. Mobile learning environments provide a means by which students can exercise agency to manage their own learning" (p. 719). Similarly, Laurillard and Pachler (2007) argued that M-learning technologies provide stimulating new opportunities for teachers to place learners in learning environments which are challenging, and in which they can actively participate in the learning process by "making their own contributions, sharing ideas, exploring, investigating, experimenting, discussing…" (p. 174).

The change towards a more learner-centred environment requires a change in the roles of instructors and trainees with regards to knowledge production and learning/teaching direction. Instructors act more as facilitators and guides who can reservedly offer support and orchestrate the activities when needed rather than knowledge agents, and trainees take the lead in their teaching. In this sense, Laxman and Holt (2017) confirmed that instructors cannot remain *the fountain of knowledge any longer*.

> Learning within this open expanse of knowledge that a device can bring, may start from the same place but can deviate into many facets of learning that cannot be planned for in the traditional way, even the traditional timing of lessons needs to be adjusted as often the traditional answer that may have needed to be skimmed or scanned for within a book, can now be found in a matter of seconds (Laxman & Holt, 2017, p. 6).

Hence, instructors' mobility has increased with those portable devices, and thus, the direction of teaching changed (Baran, 2014). Traditionally, instructors had limited time and space to interact with learners. Now, instructors do not have to stick to the board in front of the classroom anymore or limit the teaching/learning time to the class period. The devices have extended the teaching/learning space and time within and beyond the classroom. This argument is consistent with existing research. For example, Baran (2014) argued that mobile devices "have the potential to enhance mobility in classrooms; fundamentally changing the way classrooms are organized" (p. 23).

However, it cannot be argued that the mere presence of the mobile devices guarantees these changes. Instructors' orientation and skills in integrating technology into pedagogy as a transformative technology is a key change factor. In this respect, the term and concept of transformation can be considered through Puentedura's (2006) SAMR model of technology adoption. Puentedura (2006) introduced four stages for technology adoption:

1- **Substitution**; in which the new technology replaces old technologies with no functional change.
2- **Augmentation**; in which the new technology replaces old technologies with functional improvement.
3- **Modification**; in which the new technology makes significant task redesign.
4- **Redefinition**; in which the new technology introduces new tasks and functions which were not previously conceivable.

Clearly, reaching the level of integrating mobile devices as a transformative technology requires a lot of preparation, training, and support for instructors (Vu, 2013). Teaching methods need to change significantly; otherwise instructors using

technologies in innovative ways will remain the exception; rather than the rule (Mullen, 2014; Beckerle, 2013).

Further to that, there are other factors that help to create a transformative learner-centred environment, and these include:

First, the design of the digital content plays an important role in creating an effective learner-centred environment. Study participants suggested that designing interactive activities, tasks, and exercises in different modalities and representations makes the learning environment more student-centred. This finding goes in line with existing research (Ng et al., 2016, & Koole, 2009a). Hence, an important implication here is that to create an effective learner-centred environment, a *'new'* especially designed digital content needs to be developed. Converting textbooks into PDF formats and putting them on mobile devices will just keep the technology at the first stage of Puentedura' (2006) SAMR model; namely, substitution. Similarly, Pimmer and Pachler (2013) suggested that from a pedagogical perspective, the learner-centred creation and sharing of content such as multimedia materials in the form of text, audio, images and video is much more promising, and that the full potential of mobile technologies for learning will not be realized "until we stop producing learning apps or mobile websites that simple repackage classroom materials to be read or played with on a smaller screen" (p. 195).

Moreover, the digital content should incorporate the features which were reported by the participants of this study as facilitating learner-centeredness such as features of instant feedback through auto-checking and auto-correct features. In addition, the design of the learning content should be based on collaborative and socio-constructivist basis to ensure interaction between the trainees and content, the trainees and their tutors, and the trainees and other trainees. Other studies came to similar conclusions. For example, Ciampa (2014) reported that the immediate feedback facilitated by mobile technologies encouraged many learners to keep working on difficult problems, see where it was that they were struggling or what they needed to do to correct it, tracked their progress towards desired goals, and stimulated their intrinsic motivation. Besides, the importance of the feature of immediate feedback to instructors is grounded in the principle that they can adapt their teaching content and methods in accordance with trainees' feedback and the problems they themselves find in the orchestration of the learning processes.

Second, guided access to extra and various resources on mobile technologies can promote learner-centeredness. It can give trainees opportunities to enrich their own learning experience more in an individualistic and self-tailored manner. This finding also goes in line with existing research. For example, Lin et al. (2008) argued that "compared with traditional approaches of books or illustrated handbooks, more multimedia forms can be supported by M-Learning device, the diversity, convenience and liveliness of learning content can attract students more. Learning efficiency

therefore be improved" (p. 2). Likewise, Brooks (2015), Liu (2015), and Chen et al. (2003) reported that mobile technologies can provide immediate and simultaneous connections to various course materials, applications, and resources, which they can obtain at anytime and anywhere, play a role in learning outside the classroom, and support learners to do non-linear, multidimensional, and flexible learning and thinking experiences. The challenge - as discussed above - will be to guide trainees' access to the extra resources; especially during the lesson and inside the classroom. Perhaps the monitoring techniques discussed above can help in this respect.

Third, the feature of connectivity is another key factor in promoting learner-centeredness at M-Learning environments. Mobile technologies allow unremitting engagement with the learning materials whether cognitively or socially by the continuous connectivity. Trainees are not only connected face-to-face, they are also connected through the various online groups which they create for themselves and their instructors. This constant connectivity allows them to remain engaged in content learning and content creation as well as in receiving instant and ongoing feedback and guidance, all of which are features that have the potential to promote a learner-centred environment. This finding also goes in line with existing research. For example, Prieto, Migueláñez, and García-Peñalvo (2014) claimed that the M-Learning designs must use "the connectivity and communication capabilities of the mobile technologies to carry out collaborative activities and facilitate the learners to share their contributions" (p. 29). Conversely, other researchers reported that maintaining connectivity is a challenge in M-Learning environments due to technical reasons. For example, Sampson (2006) reported that "bandwidth may degrade with a larger number of users when using wireless networks" (p, 63). From a different angle, other researchers reported that learners' connectivity is also impacted by other factors such as the immediacy of receiving feedback. Ng et al. (2016) reported that teachers and learners regarded timely feedback as important for continuous connectivity. These issues were not raised by participants of this study because the company provides high speed net connection, and IT services and maintenance are always provided immediately.

Fourth, the feature of portability of mobile technologies marks another key factor in promoting learner-centeredness at M-Learning environments. These devices do not obtrude conventional collaborative and social activities and exercises; on the contrary, they add extra options and solutions to the development and implementation of such learning activities. This is consistent with the findings of many researchers such as AlHajri et al. (2017), Kim et al. (2016), Reychav and Wu (2015), and Baran (2014). Sha et al. (2012) concluded that features of portability, ubiquity, anytime, anywhere, widespread, just-in-time, and when-needed enable "educators to facilitate and scaffold student-centred learning activities that encompass both formal and informal settings" (p. 719).

Thus, it can be concluded that designing interactive content, providing immediate feedback, availing open access to extra and various resources, ensuring connectivity, together with the portability feature of device are all factors that can facilitate the promotion of learner-centeredness at M-Learning environments. Again, the key aspects identified earlier; namely, the learner, device, social, and content, remain at play and prove the argument and validity of the LDSC Model, Adapted FRAME Model.

5.4.5.2. Experiential Learning

In experiential learning, students acquire new knowledge through learning that takes place in *real-life scenarios* in a cyclical process which consists of four phases; 1) the concrete experience, 2) reflective observations, where the learner observes and reflects on this experience, 3) abstract conceptualization, where the learner draws conclusions and makes hypotheses and generalizations on how this acquired knowledge can be used in other situations based on these observations and reflections, and 4) active experimentation, where the learner tests these hypotheses by experimenting and applying the acquired knowledge (Kolb, 1984).

In this regard, this study showed that mobile technologies can support types of learning outside the classroom and can help trainees to relate classroom experience to workshop practices. For example, trainees use their devices to collect data for the presentations and projects that they have to submit to their instructors as part of the ongoing formative assessment. They take photos, record videos and audio files, and they collect live data as well as archived online data for their projects. Similar to these findings, Petrovic et al. (2014) confirmed that "by utilizing mobile devices to conduct observations outside of the classroom, learners can arrive at a broader and deeper understanding of their inquiries" (p. 271). Likewise, Gikas and Grant (2013) confirmed that M-Learning has the potential to make learning "situated and context aware in which learning takes place in meaningful surroundings - most likely outside the classroom and in the student's surroundings or environment at a time appropriate for the learner" (p. 19).

However, learning that takes place in real-life scenarios may not sometimes be possible at vocational and industrial training environments due to safety and health reasons. Potential hazards can stand as an obstacle against physical presence in the workplace without enough experience or training. Hence, according to the findings of this study, mobile technologies can, not only facilitate experiential learning processes in real-time, authentic experiences, but they can also provide opportunities for exposing learners to safe virtual experiences and situations that may be deemed dangerous if done alive. Virtual realities, simulations, 3D models, and tutorial videos can avail opportunities for induction to potential hazardous real situations and enable the experiential learning cycle to occur safely. In a similar sense, Ouyang and Stanley (2014), Dyson et al. (2009) and Lai et al. (2007) reported that mobile technologies are

linked with experiential learning as they can provide authentic learning material and learning experiences and prompts for learners.

In this sense, it can be argued that mobile technologies provide another definition and perhaps an additional version of experiential learning which can be called *'safe experiential learning'* that typically suits vocational and industrial contexts. Hence, it can be concluded that in *'safe experiential learning'*, trainees acquire new knowledge through learning that takes place in virtual scenarios that simulate unsafe real-life scenarios.

Furthermore, this study showed that trainees no longer have to read lengthy pages of instructions, steps, or machine descriptions. They can collect pieces of information by navigating through diverse resources to create a more comprehensive and updated form of knowledge on their devices; thus, developing a sense of distinguishing between meaningful and irrelevant information for the specific task at hand or problem under examination. Mobile technologies help trainees to produce new forms of knowledge through the projects, presentations, and videos that they create during the training program; thus, enriching the learning process. Several researchers reported similar conclusions such as Brown and Mbati (2015), Appiah and Cronjé (2012), and McLoughlin and Lee (2008). Lin et al. (2008) concluded that learning space and time limited to a traditional classroom can be extended to irregular time with the use of mobile technologies, leading to more involvement in different types of learning activities.

Accordingly, although learning at a M-Learning environment starts from a formal constructivist content, it is not fully content-driven. It is actually content-enriched; that is, it starts from a formal or official content, and navigating other resources and types of content is still readily available (McLoughlin & Lee, 2008). In this respect, perhaps, one implication of these findings for curriculum developers and instructors is to include more activities in the content and tasks that require authentic input which can be collected by the trainees through the features of mobile devices such as the cameras and the recorders. Moreover, more virtual scenarios that simulate unsafe real-life scenarios should be incorporated as learning prompts for trainees. Besides, learners have to be equipped with the skills of effective searching for relevant and up-to-date information (Brown & Mbati, 2015; Strong & Hutchins, 2009). They also have to be capable of expanding existing models of thinking and creating inferences and analogies. Furthermore, they "need to be able to make new connections through information analysis and synthesis and to create associations between thoughts, feelings, ideas, or sensations" (Armatas et al., 2014, para. 7).

In summary of this section (Key Aspects, Dynamics, and Features of M-Learning Environments), it can be argued that the five main themes discussed above are linked with specific aspects and intersections of the adapted LDSC model as in Figure 5.9 below. Hence, and to reiterate, I argue that the stronger the recognition of the

qualities, specifications, and needs of each individual aspect and intersection, the more effective the M-Learning environment is.

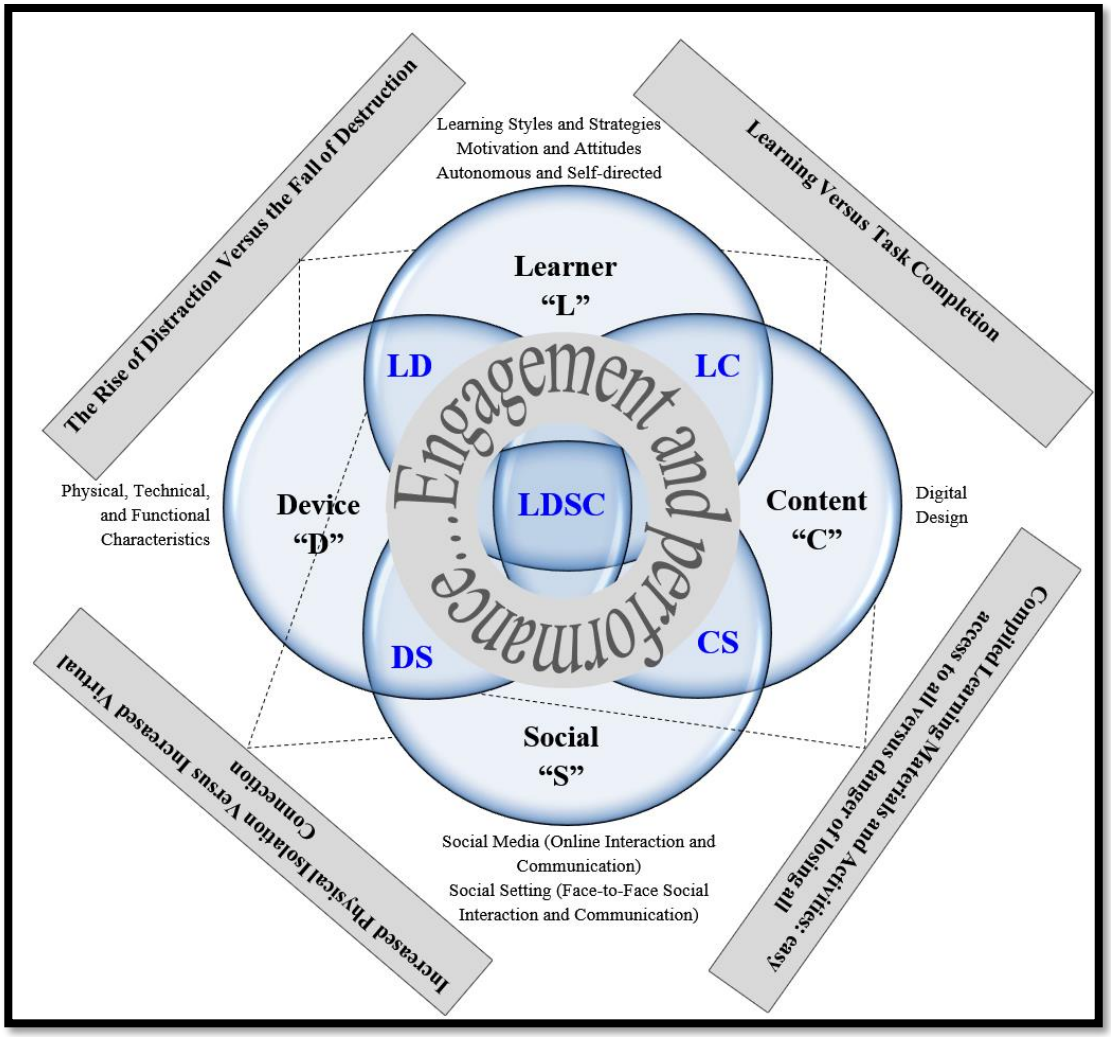

Figure 5.9: A Summary of the Key Aspects, Dynamics, and Features of M-Learning Environments on the LDSC Model, 2018.

5.5. Potential Enhancement at Mobile Learning Environment

This study showed that in addition to the common technical limitations of mobile technologies such as poor network connectivity, battery life and battery charging, and impact on health; especially eyes, there are some other key challenges; especially with VTET training programs that offer its complete curriculum on a digital content. Proper content design is fundamental to the success of training, and continuous content reviews and updates are critical to ensure an effective training experience. In addition, there are other shortcomings related to trainees' orientation and digital awareness, and paradigm conflict between advanced training programs versus traditional work practices. Some of these findings are consistent with existing research while others are contributions to this study. Mullen (2014), Henderson and Yeow (2012), and Luckin, Bligh, Manches, Ainsworth, Crook, and Noss, (2012)

reported similar findings about the common challenges of mobile technologies. They argued that these challenges may negatively influence the learners' attitudes towards learning and may increase tension inside the classroom. However, Heinrich (2012) argued that "such devices cannot be dismissed as mere toys or distractions and while they bring with them technical and management issues, these are far outweighed by increased student motivation, progress and collaboration" (p. 50).

In the following sections, I will discuss the major new challenges as shown by this study.

5.5.1. Content Design

This study showed that the formal digital content (iBooks) was properly designed on the basis of learner-centeredness in a way that ensures an active role of the learner. However, this study also showed that the digital content needs continuous evaluation to identify areas for improvement and implement corrections and enhancements in order to optimize its design and shape. Prieto et al. (2014) reported similar findings. Also, Ozdamli and Cavus (2011) argued that "learning content must enable a user to quickly zone into needed information. In addition, the content can be presented with interactive games or quizzes. Content should be supported with graphics video and other multimedia elements" (p. 940). Hence, content has to be treated as living thing that needs due care to grow and play an impactful role. Without establishing a robust system for continuous evaluation and feedback from both trainees and instructors on the learning content, the process of content development and optimization will not be effective.

In this respect, it is worth mentioning that meeting these recommendations and challenges is not easy due to the rapid changes in trade skills as "contents of VTET learning resources have to be constantly updated to meet the industry standards" (Ricky & Rechell, 2015, p. 99). This is even worsened by the "shortage of professionals for content development (programmers, instructional designers and animators) without mentioning experienced teachers and workplace mentors in specific subjects and trades" (Ricky & Rechell, 2015, p. 99).

5.5.2. Orientation and Digital Awareness

Although study participants indicated the importance of sharing information and documents as part of the corporative and collaborative learning processes, malpractices such as cheating during quizzes and exercises by passing screenshots of answers have been highlighted as a shortcoming of mobile training programs. Proper and continuous trainee orientation on the danger of doing so as well as installing control applications is required.

These results are consistent with existing research (O'bannon & Thomas, 2014; Asabere, 2013; Franklin, 2011; CommonSense Media, 2010). Franklin (2011) confirmed that there is an increase in "reporting misuse of digital content in the form of downloading music illegally, plagiarism, cheating using a cell phone on tests, YouTube videos of unauthorized recordings and cyberbullying of students through the use of email, social networking sites and text messaging" (p. 269). Similarly, Gao, Yan, Wei, Liang, and Mo (2017) reported that amongst the downsides of using mobile devices is "the ability to cheat on tests by using methods, such as surfing the Internet, or accessing previously stored information" (p. 14).

From another perspective, trainees need to learn how to protect themselves and their organizations when online. They spend most of the time engaged with their devices, and thus may be inclined to expose confidential information, whether personal or organizational, due to lack of awareness on cyber and digital security. Thus, protecting passwords, installing and activating anti-viruses, and accessing secure websites should be part of regular cybersecurity campaigns at M-Learning environments. Franklin (2011) also reported similar findings. In fact, some studies reported that more research is needed in this area. Yong (2011) confirmed that "as more and more e-learners are interested in using their portable devices to conduct their e-learning activities, the concerns on the security and privacy will generate more research and initiatives either on the technology perspective or on the management perspective (p. 308).

5.5.3. Conflicting Paradigms: advanced training programs versus traditional work practices

This study showed that that M-Learning environment developers have to reconsider the specific work practices that are still done in a very traditional style when designing the training programs. Trainees are being trained with simplified models and materials that are based on various modalities. This may cause frustration and mistakes when fresh graduates start working at old-fashioned workplaces. Program developers have to think carefully of linking the learning practices with the workplace requirements.

These findings need further investigations although they echo in existing research. From example, Ricky and Rechell (2015) confirmed that "although a number of studies showed promising results using mobile and flexible technologies to enhance learning and teaching in higher educational institutions, their effectiveness to facilitate the specific needs in Vocational Education and Training (VET) is still uncertain" (p. 97). Likewise, Ng et al. (2016) asserted that "there is a lack of in-depth study of VPET's students, and teachers' learning and teaching needs so as to review, develop and share innovative pedagogical practices, and trade-specific examples of VPET across institutions and industries" (p. 102).

Thus, further investigation on the technical and job-trade quality and orientation of novice employees who graduate from M-Learning programs may help to identify if there is a negative impact on their job performance and satisfaction as a result of the different specific work practices which are still done in a very traditional style versus the training programs which are smart and digital.

5.6. Contribution of This Study and Recommendations for Future Research

The key strengths of this study are its richness in the data collected, its context which is one of the largest, oldest, and most structured industrial training contexts, and in filling the theoretical gap in the literature about the role mobile technologies can play in developing vocational and job-related skills. More importantly, the scope of this study and the findings generated from it makes it stand as a reference for any organizations thinking of creating a M-Learning environment; especially through the representation of the dynamics, aspects and features of M-Learning environments introduced in this study. In this respect, this research makes the following contributions to the theory of mobile learning and to VTET

5.6.1. Contributions to the Literature on M-Learning:

The following are potential contributions to the literature on M-Learning at VTET and/or other contexts:

- **Extending the theory by investigating the role of M-Learning in developing key employability and job-related skills at industrial training contexts**

The original contribution of this thesis is extending the theory and practice of M-Learning in industrial training programmes; especially with regards to the development of vocational and employability skill. This study has paved the way towards more in-depth exploration of the role of mobile devices at vocational and industrial training institutes.

Moreover, this study highlighted some future directions for research into the use of mobile technologies for the development of the above skills at industrial training environments. It would be interesting to see if the results of this research were similar at other environments which offer different businesses, rather than the oil and petro-chemical business. Perhaps a cross-discipline or specialization study to identify which skills may be more impacted by mobile technologies can be recommended.

- **Extending the theory by identifying the key dynamics and features of M-Learning environments**

This research also contributes to current knowledge by identifying some of the key dynamics and features of M-Learning environments at industrial training contexts. These dynamics and features include the emerging behaviours of trainees, the new forms of communication and types of interaction, and the models of learning and

engagement. These are all results of the ongoing tension and interaction between the main aspects of the adapted LDSC Frame Model For M-Learning; namely, the learner, device, social, and content aspects. These aspects overlap and intersect at multiple levels and layers and, as discussed earlier, the primary intersection defines an ideal mobile learning situation and can be utilized as a guide model to design more effective mobile learning experiences (Koole, 2009a).

In light of this, it would be interesting to see if the adapted LDSC Frame Model For M-Learning is applicable in other contexts of research, and whether it can lead to an identification of similar dynamics and features of M-learning environments.

- **Extending the theory by discussing multi-tasking and the different types and sources of distractions at of M-Learning environments**

This research added to the academic discussion on multi-tasking and the different types and sources of distractions at M-Learning environments and the potential solutions to control them (Mingyong, 2015; Lee et al., 2012; Kirschner & Karpinski, 2010; Fox et al., 2009; Fried, 2008). It showed that distraction in M-Learning environments may appear due to various reasons which include learner's inclination to switch to social media and non-standard applications (Gikas & Grant, 2013), overwhelming learners with too much information and abundant resources (Chen et al., 2008), lack of standardization in learning aids and resources which have conflicting information, and lack of effective engagement with the learning materials. It has also been discussed that distraction may mean something else by learners. They may find more interesting 'learning attractions' somewhere online away from the prescribed lessons. Also, distractions may be used as a means of availing mental breaks that can refresh learners' minds or abolish feelings of boredom and demotivation. Finally, three methods of controlling negative aspects of distraction have been identified: Instructor Monitoring, Monitoring Applications, Trainee Self-Monitoring (Henderson & Yeow, 2012; Toshalis & Nakkula, 2012; Fang, 2009).

I think these arguments need further in-depth exploration; especially with regards to the different types of distractions, recommended control techniques, and the concept of *learning distractions* versus *learning attractions*.

- **Extending the theory by discussing the emerging roles of instructors at M-Learning environments**

Another contribution of this study is the discussion of the emerging roles of instructors at M-Learning environments and how the adoption of mobile devices may require a change in the instructors' positions inside the classroom. It has been argued that instructors are moved more to the back of the classroom where they have to teach more from behind the trainees or at least from a shoulder-to-shoulder position in order to see the screens of his trainees' mobile devices. Instructors' suspicion about trainees' engagement with distractions, passing answers of exercises and quizzes, and turning screens into an idol mode have all been reported as major incentives for

instructors to change their positions. Thus, instructors' role as a monitor of the learning process has been more emphasized at M-Learning environments (Nedungadi & Raman, 2012; Shih, 2011). Moreover, it has been argued that utilizing the features and resources of mobile technologies to positively impact learning may require a more complex and emerging role of instructors at M-Learning classes which is the *selector* role. Instructors have to be equipped with the right knowledge and skills of how to guide learners' selection of learning tools and applications, and yet remove distractors in a way that ensures maximum and effective utilization of mobile devices and the opportunities they can provide (Toshalis & Nakkula, 2012).

In light of this, it would be interesting to see focused studies on the changes of instructors' roles and positions in M-Learning classes and how they may impact the learning process and types of interaction inside the classroom.

- **Extending the theory by discussing the types of interaction at M-Learning environments**

Another contribution of this study is the discussion of the types of interaction at M-Learning environments. It has been proposed that there is an increased level of physical isolation in comparison with an increased level of virtual connection (AlHajri et al., 2017; Hsu & Lin, 2017; Kim et al., 2016; Nie, 2015). Thus, it has been argued that instructors' perceptions that learners are interacting less, the thing which they base on the fact that trainees are more isolated and mostly silent, is not very accurate. Trainees are certainly doing a lot of synchronous or asynchronous forms of interaction and communication (Gikas & Grant, 2013; Ozdamli & Cavus, 2011; Chen et al., 2003). Hence, it can be argued that mobile devices change the physical ways of interaction; and thus, instructors not only need to change their perceptions of what interaction is, but also revise their curriculum to adopt these changes.

In this respect, I think it would be valuable for educators to investigate how these alternative types of interaction and communication impact learners' engagement and what role they play in developing independent and lifelong learning.

5.6.2. Contributions to the Literature on VTET

The following are potential contributions to the literature on VTET:

- **Extending the theory by identifying a set of key employability and job-related skills at industrial training contexts**

A key contribution of this thesis is extending the theory and practice of VTET by identifying and exploring the key employability and job-related skills; specifically, safety skills, teamworking, cooperation, and collaboration skills, craftsmanship skills, creativity, problem solving and critical thinking skills, presentation skills, communication skills (verbal and written communication), independent learning, self-

development, and lifelong learning skills, searching skills, information and communication technologies (ICT) Skills, and Typing Skills (Ng et al, 2016; Ricky & Rechell, 2015; Lucas, 2014; Liu et al., 2010). These skills have been identified through the literature review and from the professional practice at the context of this study.

In this respect, it would be interesting to see if researchers at other contexts would agree on this list of skillsets or add further to it.

- **Extending the theory by discussing the role of interactive digital content and learning materials on the development of the required employability and job-related skills.**

Another key contribution of this thesis is extending the theory and practice of VTET by identifying and exploring the role of developing a digital content and other interactive learning materials specifically designed to help trainees develop the required employability and job-related skills. It has been argued that such interactive learning materials have the potential to create 'safe' learning experiences simulating hazardous work environments, help trainees to visualize the internal part of running equipment and machines, simply complex industrial processes, and increase trainees' retention of processes and work requirements. In this respect, it would be interesting to see if other researchers would confirm these findings in their research at other contexts.

- **Extending the theory by introducing a discussion on the conflict that may arise between training in smart, up-to-date devices at M-Learning environments versus traditional style working environments**

This study highlighted that M-Learning environment developers have to reconsider the specific work practices that are still done in a very traditional style when designing mobile training programs. The chasm between advanced training versus traditional working environment may cause dissatisfaction, inefficiency, or frustration to notice employees (Ng et al., 2016; Ricky & Rechell, 2015).

In this respect, a further investigation on the technical and job-trade quality and orientation of novice employees who graduate from M-Learning program may help to identify if there is a negative impact on their job performance and satisfaction as a result of the different specific work practices which are still done in a very traditional style versus the training programs which are smart and digital.

5.7. Implications for Practice

This study also has several implications for practice and those responsible for the design and delivery of VTET training programmes that adopt M-Learning. More

specifically, program designers, curriculum developers, and instructors should consider the following:

1. Insert and use as much as possible of various kinds of media and multiple representations, such as animations, 3-D models, interactive dynamic visuals, graphs, and videos as they play an important role in the development of theoretical and practical craftsmanship skills and they can sharpen creativity, critical, and problem-solving skills.

2. Increase exposure to safety videos that were produced by top specialized institutions as well as documentaries and series of investigations done on safety incidents to capture the attention of and increase trainees' awareness and knowledge about safety.

3. Focus more on the presentation skills since they may enable trainees to be more involved in the process of content creation and adaptation. This is a feature that makes trainees co-authors of knowledge with an active role as knowledge producers rather than consumers.

4. Develop strategies and teaching methods that ensure more oral communication and encourage trainees to speak. Presentations, recorded dialogues, and other communication-based activities have to be more incorporated in the mobile training programs.

5. Append lists of relevant online courses or programs that offer additional professional development opportunities for learners to support trainees' independent learning, self-development, and lifelong learning skills. Further to that, program designers may consider shortening the training program period by converting some parts of the training program to a self-study mode.

6. Develop a toolbox of commonly used applications such as calculators, dictionaries, Wikipedia, translators, quizzes, unit measurement apps, and other learning-oriented tools) on one platform in order to decrease confusion and time wasted looking for different applications and tools.

7. Create and develop more company specific videos that explain its processes and have them in one handy platform in order to avoid having confusing and contradictory information that result from accessing different sources of information (especially YouTube videos) that can provide incompatible information with the corporate standards.

8. Identify a list of challenging topics/lessons at the beginning of each module for learners to note, and thus may start to learn about them earlier; thus, taking the advantage of having all learning materials (past, present, and future) are

installed on the trainees' devices to increase more independent, self-paced and autonomous learning.

9. Create a system for backing-up trainee's learning materials and personal input to help retrieve their work and data in case of a device loss or damage.

10. Include more activities and tasks that require authentic input which can be collected by the trainees through the features of mobile devices such as the cameras and the recorders to promote more learner-centered and experiential learning at M-Learning environments.

11. Develop a *new* digital content rather than repackage current materials in the form of PDFs and, also, ensure continuous evaluation and updating the content.

12. Incorporate more exercises that require more written and constructive input from the trainees rather than checking boxes or matching exercises in order to ensure real learning is happening as opposed to task completion. Also, instructors have to adopt and employ questioning and comprehension-check techniques and methods. Moreover, activities have to be time-based, bound to be completed at a specific frame of time. Finally, activities should be designed in a way that builds on a scale of difficulty. If an activity is completed in less time than expected, a more challenging task should be given. These recommendations have the potential to increase learners' involvement and promote effective learning.

13. Incorporate more activities that require trainees to design their own drawings and learning materials using specific applications and websites.

5.8. Limitations of the Research

Perhaps one limitation of this research is the generalizability of the results. The context of this study (the whole training program) is really unique. Being conducted in a rich oil company - Saudi Aramco - which avails the most up-to-date technology for each trainee and instructor in the form of iPads and other technologies, developing and creating specialized digital content for its specific operations, and providing outstanding infrastructure and ongoing technical support makes this context of this study difficult to establish at other places. In this respect, generalizing and cross-checking results at other contexts may not be very easy, and it would be interesting to see if the results of this research would be similar at other environments which offer different businesses, other than the oil and petro-chemical business.

Another limitation of this study is related to the scope of research. This study presented quite a wide-ranging, holistic research which introduced many skills and various dynamics, aspects, features, and potential areas for improvement at M-Learning environments rather than focussing in-depth on particular skills or using inclusive measures validated in previous literature. Thus, it would be interesting to see further research exploring more in-depth each of these skills and aspects in a more focused style.

Finally, the identification of the dynamics, aspects, features, and potential areas for improvement at M-Learning environments which are related to the concepts of distraction, emerging roles of instructors and learners, types of interactions, and the roles of complied learning materials on one device were all based on the adapted LDSC frame model. Hence, it would be interesting to see if the adapted LDSC Frame Model For M-Learning is applicable in other contexts of research, and whether it can lead to an identification of similar dynamics and features of M-learning environments.

5.9. Conclusion

Overall, this study found evidence that mobile technologies have the potential to play an important role in developing trainees' key employability and job-related skills at an industrial training workplace. It also confirmed that learning with mobile devices occurs in an environment which is characterized by unique dynamics and features; all of which result from continuous interaction at multiple layers between four aspects: the learner, the device, the content, and the social setting.

The importance of this research lies in paving the way towards more in-depth exploration of the role and use of mobile technologies in vocational and industrial contexts. As discussed earlier, there appears to be limited research in this area (Lucas, 2014; Liu et al., 2010; Pimmer, et al., 2010).); the thing which makes the findings of this study very important for educationalists and researchers in the field of M-learning in general and VTET in particular. Previous studies have found mobile and flexible learning best connects theories and practices to enrich situated learning experiences in VTET (Ng et al, 2016; Ricky & Rechell, 2015); however, this research has provided some important illustrations on some conceptual issues in the research area by augmenting an existing model.

Hence, many studies reported on the affordances of M-Learning in general. McLoughlin and Lee (2008) argued that M-Learning affordances may "offer the potential for transformational shifts in teaching and learning practices, whereby learners can access peers, experts, the wider community and digital media in ways that enable reflective, self-directed learning" (p. 649). Chu (2014) claimed that during the processes of M-Learning, learners interact with "authentic contexts through words, pictures, sounds, animations, and images, all provided by the mobile devices. Compared with traditional instruction or conventional web-based learning, mobile or

ubiquitous learning scenarios could be much more complex for learners since they need to simultaneously deal with learning materials in both the real world and the digital world" (p. 332). Also, Tichon and Burgess-Limerick (2011) and Padgett, Strickland, and Coles (2005) concluded that digital media allow multiple sensory inputs to be presented in a format that is interesting, enjoyable, and attract learners; the thing which can make *'repeat and practice'* more feasible. However, this study identified some of the key features and dynamics of M-Learning environments at vocational and industrial contexts; an area which was not explored in-depth by researchers. In this respect, I think this study opens the door for practitioners to reflect on their practices and for educationalists and researchers think of the next step of exploring M-Learning at vocational and industrial training environments.

5.10. Autobiographical Reflection

Undertaking this research has been an invaluable learning experience for me for many reasons. Frist, I have gained a better understanding of the nature of research and of the cyclical, sometimes messy, nature of the research process. I have learned, for example, that conducting a study requires continuous reflection and flexibility in adjusting the working plan, and that research can be frustrating and sometimes tedious, yet at other times immensely rewarding and even exhilarating. The whole experience in general, and achieving this research in particular, has immunized the novice researcher in me against falling apart in the middle of future research projects.

Second, this research has resulted in some key ideas which have helped me to examine my own professional values, and guidelines for possible changes to my own future practice. Ideas related to M-Learning environments such as distractions, types of interaction with the device, communication, experiential learning and learner-centeredness, as well as other ideas will have their long-term impact on my professional practice.

Finally, the findings and recommendations for future research which this study generated have opened new horizons of research for me. A whole range of research topics and areas that I can start working on in a more in-depth has been provided by this research.

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Appendix One: Trainee Questionnaire

1. I had experience using the iPad before I joined the training center.....
    - Yes
    - No

For questions 2 to 33, please select:

a) Strongly agree b) Agree c) Uncertain d) Disagree e) Strongly disagree

2. I am not confident in my ability to use the iPad in the classroom now.
3. In addition to the iBooks, I use other resources such as YouTube videos and pictures to better understand my lessons.
4. The iPad enhances my performance inside the classroom.
5. The iPad does not make me more engaged with my learning tasks and activities than the textbooks.
6. The iPad facilitates my preparation of my new lessons.
7. The iPad facilitates my old lesson reviews.
8. I think teachers teach less with the iPad than with textbooks.
9. I think trainees produce more with the iPad than with textbooks.
10. I think teachers talk less with the iPad than with textbooks.
11. I repeat the exercises on the iPads to consolidate my learning.
12. I repeat exercises (even after successful completion) because the process is fun.
13. The iPad helps me to complete my learning activities and tasks more quickly than textbooks.
14. The iPad does not enhance my learning outside the classroom.
15. Using the iPad makes complex processes at workshops easier to understand.
16. The iPad helps me to improve my safety skills.
17. The iPad helps me to improve my written communication skills.
18. The iPad helps me to improve my verbal communication skills.
19. The iPad helps me to improve my creativity skills.
20. The iPad helps me to improve my problem-solving skills.
21. The iPad helps me to improve my critical thinking skills.
22. The iPad helps me to improve my presentation skills.
23. The iPad does not help me to improve my lifelong learning skills.
24. The iPad helps me to improve my internet browsing and search skills.
25. The iPad helps me to improve my team working skills.
26. The iPad does not help me to become an independent learner?
27. The iPad helps me to prepare for practical work in workshops.
28. The iPad helps me to improve my typing skills.
29. Using the iPad enables me to use different resources and materials that enhance my lessons.
30. The iPad helps me to gain new technical skills more easily.
31. The iPad increases my job skills performance.
32. The instant feedback for the exercises encourages me to repeat a task until I get the correct answer(s).
33. Which of the following activities do you engage in on your iPad during the lesson? How often?

	Never	Rarely	Sometimes	Often	Always
Sending and receiving personal emails					
Sending and receiving company emails					
Scheduling appointments or tasks					
Reading an online newspaper					
Playing video games					
Watching videos on YouTube for fun					
Using Social networks (such as What's app, Facebook, snapchat, twitter, LinkedIn)					
Reading sports news					
Participating in blogs, forums and wikis					
Listening to music					

34. How do you study with the iPad? (Please write your comments in English or Arabic in the boxes below)

35. How does the iPad play a role before your classes?

36. How does the iPad play a role after your classes?

37. What do you like the most about learning with the iPad? Explain.

38. What do you dislike the most about learning with the iPad? Explain.

Appendix Two: Instructor Questionnaire

For questions 1 to 15, please select:

a) Strongly agree b) Agree c) Uncertain d) Disagree e) Strongly disagree

1. The iPad helps my trainees to gain new technical skills more easily.
2. The iPad increases my trainees' job skills performance.
3. The iPad resources help my trainees to improve their safety skills.
4. The iPad helps my trainees to improve their team working skills.
5. The iPad helps my trainees to learn more independently.
6. I think the iPad increases my trainees' learning opportunities outside the classroom.
7. The iPad distracts my trainees from learning.
8. The iPad does not make my trainees more engaged with learning tasks and activities.
9. The iPad does not increase my trainees' performance inside the classroom.
10. Using the iPad enables me to use different resources and materials that enhance my lessons.
11. The iPad helps my trainees to complete their learning activities and tasks more quickly.
12. The iPad provides opportunities for adapting the learning content and tasks to my trainees' needs and capabilities.
13. I think teachers teach less with the iPad than with textbooks.
14. The iPad helps my trainees to relate classroom experience to job skills workshop practices.
15. Using the iPad makes complex processes at workshops easier.

16. How is teaching with the iPad different from teaching with textbooks? Does the iPad make your teaching style different? How? (Please write your comments in the boxes below)

17. Can you share with me some effective teaching practices and methods you use/practice when teaching with the iPad?

18. Do you think the iPad supports the learner-centered approach? Can you share a story or an example here?

19. Do you remember a moment when the iPad helped you to be more creative in teaching? Can you brief me on it here?

20. What do you like the most about teaching with the iPad? Why?

21. What do you like the least about teaching with the iPad? Why?

Appendix Three: Trainee Interview Questions

1. How do you study with the iPad? How is studying with an iPad different from studying with textbooks?
2. Do you think the iPad helps you to improve the following skills? (If yes, how does it do so? or show me or give me an example, or share with me a story or an experience)
    - safety skills
    - Technical skills
    - teamworking skills
    - communication skills
    - typing skills
    - searching skills
    - cooperation skills
    - vocabulary/ technical terminology
    - independent learning
3. Do you think the iPad supports you with your independent learning or learning outside the classroom? Can you give me some examples?
4. Do you remember a moment or an example when the iPad made you more engaged with your learning tasks and activities?
5. Do you think iPad helps you with the learning activities? Can you give me an example of how the iPad helped with the learning activities and tasks?
6. Does the iPad make complex processes at workshops easier to understand? Show me an example on your iPad?
7. Can you tell me how the iPad improves your job skills performance? Can you tell me show me on your iPad?
8. Do you think the use of the iPad helps you to deepen your content knowledge? Can you show me/ give me an example of how it does so?
9. Do you think the iPad helps you to be more creative? Do you remember a specific example?
10. Do you have examples, stories, or moments when you were frustrated with using the iPad for learning? Can you tell me or show me on your iPad?

Appendix Four: Instructor Interview Questions

1. If you have to choose between teaching with textbooks and teaching with the iPad, which one would you go for? Why? How is teaching with the iPad different from teaching with textbooks?
2. Do you think the use of iPad makes your teaching style different?
3. Which applications do you use most for teaching? Can you share with me some examples of why and how you use them?
4. Can you share some teaching practices and methods you used when teaching with the iPad? How did they impact the trainees' learning?
5. Does the iPad support learner-centered teaching /training? Can you share with me a story or an example?
6. Do you remember a moment when the iPad helped you to be more creative in teaching?
7. How do you think the iPad supports learning and performance inside and outside the classroom? Can you give me examples or share with me your observations and experience?
8. Do you think the iPad helps to improve the following skills for your trainees? How?
    - safety skills
    - Technical skills
    - teamworking skills
    - communication skills
    - typing skills
    - searching skills
    - cooperation skills
    - vocabulary/ technical terminology
    - independent learning
9. Do think the iPad helps your trainees to gain/improve any other skills?
10. What do you think are the key limitations to learning with the iPad at the ITC? Do you have examples, stories, or moments when you were frustrated with using the iPad for learning? Can you tell me or show me on your iPad?

Appendix Five: Sample Observation Log

Observation Number 1	
Date: January 2017 - June 2017	**Repeated Times: 17**
Time:	During the breakfast, lunch, and in-between-lesson breaks
Names of persons being observed	Individual persons
Positions of persons being observed	Trainees watching videos and simulations of machines that they will work on. They find it interesting to see how the inner parts work, how the parts can be dismantled and re-installed. They think the virtual experience prepares them well before the workshops.
Location of the Observation	In the corridors/ In front of classes and workshops
Specific activities and events related to the research questions	Watching YouTube tutorials and simulation videos on Job Skills
Comments and initial impressions and interpretations of the activities and events under observation	Trainees are deeply involved and very much focused on these activities. They actually look like they are separated from the real world with the earphones and the interesting videos running in front of them.

Observation Number 2	
Date: January 2017 - June 2017	**Repeated Times: 21**
Time:	During the breakfast, lunch, and in-between-lesson breaks
Names of persons being observed	Individual persons
Positions of persons being observed	
Location of the Observation	In the corridors/ In front of classes
Specific activities and events related to the research questions	➢ Taking photos ➢ Recording videos and audio files
Comments and initial impressions and interpretations of the activities and events under observation	