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Information technology for learning, education and training — Nomadicity and mobile technologies

Technologies de l'information pour l'apprentissage, l'éducation et la formation — Nomadisme et technologies mobiles

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 36, *Information technology for learning, education and training*.

This first edition cancels and replaces ISO/IEC TS 29140:2020, which has been technically revised. The main changes are as follows:

— the list of definitions has been extended;

— the number of mobile learning applications has been expanded;

— recent references from the mobile learning literature have been included.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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Introduction

Since ISO/IEC TS 29140-1:2011 and ISO/IEC TS 29140-2:2011 were published, there have been many technological innovations and increasing use of mobile technology in learning, education and training as indicated in many of the review and meta-analysis studies on mobile learning[1][2][3][4][5][6]. These two documents were updated and replaced by ISO/IEC TS 29140:2020, which has now been replaced by this document. The growth in active mobile-broadband subscriptions has increased significantly, with penetration rates increasing worldwide from 4,0 subscriptions per 100 inhabitants in 2007 to 69,3 in 2018.7 The number of active mobile-broadband subscriptions have increased from 268 million in 2007 to 5,3 billion in 2018[7]. In addition, almost the entire world population, or 96 %, now lives within reach of a mobile cellular network. Furthermore, 90 % of the global population can access the internet through a 3G or higher speed network[7]. This is placing a sense of urgency to revise the standards for the use of mobile technology in learning, education and training.

At the same time, the technology, and the application of the technology, is changing at a fast rate. For example, 3D glasses are being used for virtual reality, augmented reality and mixed reality; and voice input and output are being used for language training. In 2020, a bibliometric review of 450 articles was conducted on mobile earning in higher education research using bibliometric methods. The results indicate that use of mobile learning is increasing[8].

As schools, governments, organizations and businesses around the world design information for access by mobile devices, there is increased need to set standards for how information should be designed for delivery on mobile technologies to support learning, education and training. This increased need is heightened by demand for learning and training materials that can be shared easily between organizations and learners and made available to those in any geographical location. Mobile learning has the potential to provide learners with enhanced access to information and learning materials and guidance and support from anywhere rather than from a specific geographical location at a certain time. When mobile learning is implemented thoughtfully and well, it has the potential to increase efficiency and productivity for learning, education and training within different sectors (e.g. public, private, voluntary).

Mobile technologies, in addition to being a communication device, provide easy access to unlimited learning materials at any time and any place, which allows for student-centred learning and provides learning according to individual differences and needs[5].

Mobile learning has the potential to provide learners with new opportunities to connect with other learners, to interact with teachers and trainers, and to co-create collaborative learning environments. This is a critical issue for learners who live in remote locations lacking wired connections[9][10].

There are a number of research teams in organizations and communities who are working on mobile learning. Many research studies and projects have been completed on the use of mobile technology in education and training. Additionally, work is already in progress in various countries around the world on related topics such as learning in different contexts, learning while on the move and the use of hand-held computers in learning.

It is important that the design, development, implementation and evaluation of mobile learning within learning, education and training environments takes place in a manner that is seamless, flexible and integrated. In short, mobile technology needs to be seamlessly integrated into teaching and learning activities that are supported by information and communication technology (ICT) in general. A review of models and frameworks for designing mobile learning experiences described different learning strategies for using mobile technologies in learning[11]. These include:

a) context-aware learning where learners can learn in their own context using wireless connection, global positioning systems, satellite connection and mobile apps;

b) seamless and ubiquitous learning on the go and learning from anywhere because of the portability of mobile technologies; this learning strategy is important for the nomadic learners who move from one location to the next;

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c) game-based learning where learners are presented with different scenarios and challenges during the learning process;

d) mobile computer-supported collaborated learning where students use mobile technologies to interact to complete learning activities in groups.

In the past, use of mobile technologies, because of their small size and portability, have been beneficial to nomads; however, the current mobile technologies are more powerful and they are being used in different locations and different contexts for learning. For example, mobile technologies can be used in a classroom to teach school-age children about disease transmission patterns; in medical education to support students learning about bedside clinical practice; in an industry to train employees how to maintain a piece of equipment; in a museum to give students a virtual presentation of a historical event; in a college to give students a virtual tour of an archaeological site, etc. The potential use of mobile technology is unlimited; its use will depend on the creativity of the instructional designer, teacher or trainer. An analysis of 113 global research studies on mobile learning in pre-kindergarten to Grade 12 levels found that 62 % of the studies reported positive outcomes, meaning that the majority of studies found that the use of mobile devices in a learning activity resulted in increased student learning[3]. It also reported that the majority of the studies (50 %) took place in formal educational contexts while a setting composed of both formal and informal settings accounted for 27 % of the educational contexts, and the remaining 23 % of the studies took place in informal settings.

Mobile devices have been around for many years but are becoming more sophisticated. At the same time, there remain limitations and challenges when using mobile devices. For example, some learners find that the screen size is small when reading information and the keyboard too small for entering information. To help with these limitations, researchers are developing mobile devices with virtual screens and keyboards and voice input and output options, which will help to overcome some of these challenges and limitations. In addition, 3D glasses have been developed to address the issue of screen size and data entry.

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Information technology for learning, education and training — Nomadicity and mobile technologies

1 Scope

This document establishes a learner information model specific to mobile learning to enable learning, education and training environments to reflect the specific needs of mobile participants. It gives guidance on the use of a learner information model for mobile technology in learning, education and training (mobile learning).

This document can be used as a reference by software developers, implementers, instructional designers, teachers, trainers, automated systems and learning management systems.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
adaptive design
creation of multiple versions of a web page to better fit the learner's device rather than a single static page that looks the same on all devices

3.2
artificial intelligence
AI
branch of computer science devoted to developing data processing systems that perform functions normally associated with human intelligence, such as reasoning, *learning* (3.4) and self-improvement

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.234]

3.3
augmented reality
virtual objects superimposed upon or composited with the real world

Note 1 to entry: Virtual and real-world objects co-exist in augmented reality systems.

3.4
learning
acquisition of knowledge, skills or attitudes

[SOURCE: ISO/IEC 2382-36:2019, 3.1.1]

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3.5
learner information
recorded information associated with learners and used by *learning technology systems* (3.6)

Note 1 to entry: Learner information may be created, stored, retrieved, used, etc. by learning technology systems, individuals (teachers, trainers, learners, etc.), and other entities.

[SOURCE: ISO/IEC 2382-36:2019, 3.7.1]

3.6
learning technology system
LTS
information technology system used in the delivery and management of *learning* (3.4)

3.7
mixed reality
display continuum in which both real and virtual images are combined in some way and in some proportion

Note 1 to entry: *Augmented reality* (3.3) and *virtual reality* (3.16) are considered to be on the mixed reality continuum.

3.8
mobile learning
m-learning
m-learn
learning (3.4) using information and communication technologies in *mobile contexts* (3.9)

3.9
mobile context
learning (3.4) that can occur in any location because of the portability of the *mobile technology* (3.10)

3.10
mobile technology
lightweight devices that learners can conveniently take anywhere to learn and mobile network that learners can access from anywhere

3.11
massive open online course
MOOC
free open online course that is available for anyone to enrol and complete

3.12
nomadic learner
learner who moves from one location to another with relative frequency

Note 1 to entry: The learner has to access the learning materials from different locations, varying time zones and within another environment during a single learning episode.

3.13
responsive design
method for web page construction to detect the user's screen size and orientation and dynamically change the layout accordingly

3.14
seamless learning
learning (3.4) in different contexts using multiple devices

3.15
ubiquitous learning
learning (3.4) that is stimulated and supported through diverse channels and always readily accessible

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3.16
virtual reality
artificial environment presented using computer technologies

Note 1 to entry: Virtual reality has a high level of immersiveness, fidelity of information representation and degree of active learner participation compared with other forms of *mixed reality* (3.7).

4 Abbreviated terms

AI	artificial intelligence
ICT	information and communication technology
ITLET	information technology for learning, education and training
LMS	learning management system
LCMS	learning content management systems
MALL	mobile applications for language learning
MOOC	massive open online course
OS	operating system

5 Examples of mobile learning applications

5.1 Online student use of mobile devices for learning

A longitudinal and cross-sectional mixed methods study employing the community of inquiry (CoI) and framework for the rational analysis of mobile education (FRAME) models to examine the use of mobile devices among graduate students at one online North American university. See Reference [12].

5.2 Fluent speaking in English/fluent reading

Mobile learning applications can be used to train learners to improve their English-speaking skills. A recent meta-analysis study examined the overall effectiveness of using mobile devices on language learning. The meta-analysis was based on a synthesis of 84 separate studies from different sources. The medium-to-high overall effect size for mobile devices on language learning achievement confirms the positive benefits of using mobile devices in language learning. See Reference [13].

5.3 Digital textbook for innovative learning

The Ministry of Education in South Korea and the Korea Education and Research Information Service (KERIS) developed and implemented digital textbooks in an advanced form that overcome the limitations of paper textbooks, improve classroom lessons, and enable personalized teaching and learning. The digital textbooks can be accessed by mobile technologies. See Reference [14].

5.4 Mobile learning technology among final year medical students

A cross-sectional descriptive study conducted among final year undergraduate students at the University of Nairobi, College of Health Sciences. This study aimed to assess the use of mobile learning technology as well as exploring the challenges that impede adoption of mobile learning technology in the target population. See Reference [15].

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