A Conceptual Framework on Self-Directed Learning for Tawaf Practical Mobile App Using Mixed Reality Serious Game

[1]Yuhanis Omar, [2] Syadiah Nor Wan Shamsuddin,
[1]Universiti Kuala Lumpur, [2] Universiti Sultan Zainal Abidin
[1]yuhanis@unikl.edu.my, [2]syadiah@unisza.edu.my

Abstract

Umrah is worship performed by Muslims in the Masjidil Haram to show obedience to Allah. Umrah has a set of rules that must be complied with by the pilgrims. One of the obligatory and pillars of umrah is to perform tawaf. In Malaysia, pilgrims need to attend face-to-face courses with selected and well-trained Ustaz or speakers before they go for umrah. The existing face-to-face courses run by umrah agencies still use the traditional method. For tawaf practical session, they need to bring equipment that will be assembled into a replica of Kaabah just to show how tawaf is performed. Furthermore, upon completion of the course attended, the umrah pilgrim was unable to review any of the important sections especially the tawaf practical part. The teaching and learning methods of umrah courses need to be improved by incorporating current technology and robust content preparation. In this modern world, mobile devices are a suitable alternative learning tool to fulfill the learner's needs. Hence, this paper presents a conceptual framework for the development of MR-Tawaf mobile app that focused on Self-Directed Learning (SDL) for tawaf practical using Mixed Reality (MR) environment, and Serious Games (SG) elements, motivational Flow Theory (FT) and user interaction (UI). The User Experience Design (UX-D) and Technology Acceptance Model (TAM) are applied to develop this mobile app. The involvement of motivational theory could help the learner engage with the app and motivate them to continuously use the app for tawaf self-learning. This app benefits those who conduct the umrah course, the pilgrims (learners), create a new idea of innovation to researchers and bring commercial value to Tabung Haji itself.

Keywords: Electrode, Current, Structure, Impact Strength, Arc.

I. INTRODUCTION

Umrah and hajj is the intention to visit the Baitullah Al-haram at any time to perform certain worship according to its terms. To perform hajj or umrah, pilgrims must know, understand the rules, tasks, practical steps which of course involved complex procedures [1]. Tawaf is one of the pillars and obligatory of umrah and hajj. Pilgrims need to attend the intensive course as preparation before performing the umrah or hajj. Although pilgrims are supplied with learning materials of Hajj and umrah, research has proven that Hajj and umrah supporting learning materials were not enough in giving clear understanding to the pilgrims especially for tawaf, sa'ei and stoning jamarat. In addition, it becomes less effective as all the learning materials are in a category of passive learning [1].

The existing supplementary learning materials for tawaf learning are lacking in constructing learners' own experiences [2]. Recently, there have been initiatives to make tawaf training more interesting, engaging and motivating, and much more comprehensive. This is actually true when users directly interact with an immersive training environment, where this is only offered by a virtual reality environment system [2]. Previously, research has been conducted to apply perceptual concepts of a 3D simulation application for the Hajj ritual [2]. The researcher has proposed the use of situated learning (SL) via a 3D virtual reality environment where an avatar is used to represent the hajj pilgrims [3]. He has developed a 3D simulation application for the Hajj ritual that offers a much more immersive experience through the use of virtual reality devices. Mohamad, Sunar, and Hanifa [4] have done research on tawaf simulation in a large crowd flows environment. This idea of implementing a virtual environment (VE) and multimedia technology in the hajj ritual training has transformed the passive to active learning. A result of a survey on identifying the components of the virtual umrah application has proven that the application needs to have a virtual reality environment, multimedia technology and user-centered design method [5]. This discovered that Virtual Hajj via Game Theory (3D game application), inspires the need for better courseware by giving the users a new medium to learn and

practice Hajj at home.

Another part is about user experience and user acceptance that is claimed lack in the impediment to the success of newly [6] implemented apps. In relation to this situation, a mobile app that uses Mixed Reality (MR) technology is built based on the proposed framework. The world is moving to radical changes as information technology alters how we learn, the systems or apps we use and the devices that serve us. Hence, there is a need on having an alternative way of learning tawaf which could help the facilitator or speaker and mutawwif during the tawaf practical learning session.

This paper will discuss the MR-Tawaf conceptual framework for tawaf learning by applying Self-Directed Learning (SDL), motivational Flow Theory, Serious Games (SG) concepts in a Mixed Reality environment which will be integrated with the use of User Interactions (UI) and User Experience (UX) attributes. The Technology Acceptance Model (TAM) will be used as a model that could show how the users come to accept and use the technology. This research develops the mobile app MR-tawaf which compounds a 3DCG (3-Dimensional Computer Graphics) image displaying a design proposal in a virtual environment (VE). Mixed Reality (MR) with the help of Augmented Reality (AR) technology by using Unity 3D software and SG elements has so far been developed as an effective means of designing the tawaf simulation in the training design field. This is a mobile app that will be used in a specific wide area. Mobility is required to use this app on-site. On the other hand, MR technology mixes and displays a video image and an AR image.

The Technology of Mobile Apps : The popularity of mobile apps nowadays is very influencing many people to perform everyday routine tasks via mobile phones [7]. New technology developments such as mobile technology, mobile apps, and the virtual world elements have engaged in increased interest in how these new developments may be effectively used by the users [7], [8] for learning purposes. A mobile app is a computer program that is designed to run on mobile devices and there are three different types of mobile apps; web apps, native apps and hybrid apps [9]. By using mobile apps technology, umrah course speakers and the pilgrims (learners) can assist and support themselves in the learning process [10].

Proposed Conceptual Framework for MR-Tawaf : This conceptual framework was built with a combination of SDL concept, MR technology, SG, motivational Flow Theory (FT) and User Interaction (UI). User Experience (UX) attributes for design and Technology Acceptance Model (TAM) are applied to develop this MR-Tawaf mobile app. The framework is shown in Figure 1 below :
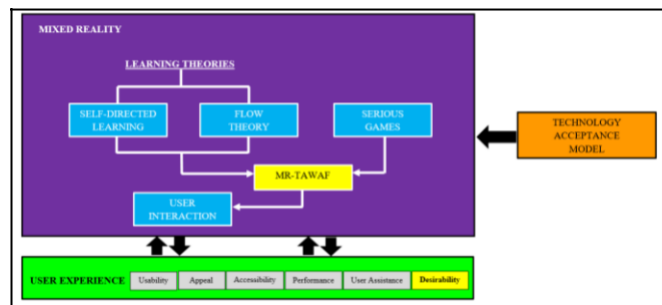

Fig. 1 : Conceptual Framework on Self-Directed Learning for Tawaf Practical Mobile Apps Using Mixed Reality Serious Game

II. THE COMPONENTS OF MR-

TAWAF *A. Self-Directed Learning (SDL)*

SDL is a self-study method that the learner is learning on her or his own and will not bother anybody [11]. There are two factors important in the development of self-directedness in learning: (1) The feelings of the learner who is being in-charge. Having a genuine impact on the learning situations is crucial for their "desire" to take responsibility [12], and (2) Responsibility feelings of being in-charge that connected to understand the demands of the learning context, user experience and getting feedback [13] from the system. MR-Tawaf allows learners to feel the process of SDL in which a learner controls their means and learning objectives in order to meet personal goals of learning or the perceived demands of their personal context [14]. In an era where social contextual conditions are changing rapidly [14], SDL has been positioned as a critical competency for adults living in our modern world. Sawatsky man
[15] have   identified   that   scholarly conceptualizations of SDL commonly emphasize one or more of three dimensions. So in MR-Tawaf, the three dimensions are :

(1)   the process of learning (the content management of tawaf

       process)
(2)   personality characteristics (the pilgrim/learner), and/or
(3)   factors within the learner's context (influencing the

       possibility for learners to undertake SDL).

Using the SDL approach, the learner of MR-Tawaf can construct their personality, ability, confidence and create motivation in themselves. This is because, based on the interview with the speaker (Ustaz) of the umrah course, tawaf is one of the popular topics where he received many questions from the learners. Thus, these speakers need a tool to help them in conveying the content of the topic in a different interesting way where the learner has the disposition to engage in learning activities, takes personal responsibility for developing and carrying out learning endeavors in an autonomous manner without being prompted by others [16]. SDL involves the learners' motivation and this shows that the combination of SDL with the motivational FT in MR-Tawaf components is truly important.

In the existing tawaf learning processes, learners want to know the preparation before performing the tawaf, how the knowledge or skill may be useful to them in umrah worship, an individual self-objective, a deep psychological need to be self-directed as in reality they need to perform tawaf on their own. Here, user experience is of high value to them in the learning process - learners will put an effort to learn in order to cope effectively with real-life situations [17]. Those facts fulfilled the SDL elements;

(1) motivation - a significant role in the initiation
       and maintenance of effort
(2)   Self-monitoring - monitoring the repertoire of learning

       strategies as well as an awareness (addresses metacognitive and cognitive processes)
(3)   Self-management - the control over the management   of

       learning tasks between learners and a 2D mutawwif   in

       MR-Tawaf (cooperative process) [27].

B. *Motivational Flow Theory*

Positive psychology that emerged around the turn of the millennium [18] has emphasized the positive qualities of life like happiness, fulfillment and optimal experience [19]. That qualities are important for all activities including game playing in MR-Tawaf. The enjoyment and knowledge that is applied in the serious games in MR-Tawaf offers are crucial factors in determining whether a learner will engage in the game, enjoy the game and achieve the objectives [20]. Csikszentmihalyi has introduced flow conditions through the study of people who involved in activities [21]. This is important because we need to know which kind of motivation elements could motivate and engaged the learners with the games. Motivational Flow Theory has been applied in several different domains including, such as work, education, human interaction, computers, arts and sports [22]. In MR-Tawaf, the process of motivation and SDL has a deep connection. This is referring to the FT "that a state of absorption or complete involvement in a particular activity in which one does not include all irrelevant emotions and thoughts" [23].

Since we know that the pilgrims always feel worried about their tawaf or umrah completion, during the optimal user experience, a person will be in a positive psychological state. Learner (pilgrims) is so involved with the goal-driven activity - nothing else seems to matter. The games activity in the apps that produces such experiences is so pleasant that the learners might not notice they are now engaged with the apps. This is one of the important elements in motivational FT. This intrinsic motivation is so important especially in serious games because it requires a different cognitive or physical investments compared to entertainment games [20]. MR-Tawaf applied the FT conditions include clear goals, challenge-skill balance, immediate feedback, and reward element in the SG. The FT was chosen due to the study made by Csikszentmihalyi exploring how engaging and enjoyable the game was. The FT elements was used as a game quality measurement for enjoyment and engagement. A strong connection between Flow and learning has been found [24]. Game preferences vary a lot among learners because the Flow is a subjective experience. Hence, studying the meaning of individual differences is needed for future goals. This is to achieve a better understanding of the Flow phenomenon in serious games.

Motivation in MR-Tawaf can be an attribute that encourages direction, energy, movement and reasons for our behaviour [25], [26], [27] and [28]. It always gives learners positivism to accomplish the tasks

(seven rounds of tawaf) to the end and succeed in it no matter how difficult it is. The level of motivation of the MR-Tawaf learners will reflect on their engagement and participation in a learning environment. Active learners with high motivation will continuously involve in SG activities in MR-Tawaf without expecting any rewards [29] from the app (although it is provided). The importance of "reward" in a form of "marks in the "MR-Tawaf SG is to encourage and to convince a low motivated learner to participate in activities in the MR-Tawaf. There are five factors that endorse motivation in MR-Tawaf; challenge, curiosity, control, competition, and recognition where many of which are present in the SG [29]. This will create a new attribute for UX - "desirability" that can motivate the learners' behaviour for an incentive (reward) or enrichment [30] from the SG in the app. This means the learner will be motivated to continuously use the app because of "desirability" and yet at other times, their behaviours are passionate for external rewards. This will also create the maximum level of eagerness [29], [31] or encouragement to engage to MR-Tawaf. In MR-Tawaf, it involves extrinsic motivation.

Extrinsic motivation depicts external activities [25], for example; a reward [32], [33], [34] of marks after the learner completes every single round of tawaf, compulsion [35], [36] (if the learner did not achieve certain level of round or if they made a mistake that related with those prohibited actions while in ihram), and punishment [35] - the "dam" if they done certain related to prohibited actions in ihram. A self-learner who is extrinsically motivated will receive marks for reward [35]. This extrinsic motivation provides a high level of will power and engagement. MR-Tawaf using only a simple kind of reward process to ignore the habit of students to perform only to gain the rewards and not for their own sake or to mastery skills or knowledge (if they are continuously motivated through the use of external rewards or compliments) [28].

C. Serious Games

Serious games in MR-Tawaf are made to help learners develop efficiently specific skills. The learner will be engaged and enjoy playing the SG in MR-Tawaf and achieve the objectives of the game [37]. SG are used in various domains such as education, army, and advertising. SG has the

advantage of offering virtual environments. The idea of simulating different kinds of mistakes done by the learners will enforce them to develop their professional skills [38]. MR-Tawaf SG also has the power to immerge learners into a world where they have to prepare and think intellectually and mentally to progress the SG, face challenges (due to the mistakes that the learners might do when they perform tawaf) or accomplish seven rounds of tawaf. SG also gives the opportunity to the learners to interact with the app and game dimensions; such as reward, role-playing or challenge [37].

MR-Tawaf can help them out by doing most of the repetitive activities (perform seven rounds of tawaf). A guide in the form of 2D mutawwif will appear on the screen to give certain guidelines before the learners play the game. This will give the learner enough time to start the MR-tawaf SG on his mobile app. The MR-tawaf really could be explained by the fact that adult learner has a hard time [39] to attend the face-to-face umrah course. In MR-Tawaf, to play the SG, "is to engage in activity directed towards bringing about a specific state of affairs [40] (tawaf practical learning), using only means permitted by specific rules [40] (obey what has been listed in prohibited actions while in ihram), where the means permitted by the rules are more limited in scope [40] (to perform tawaf umrah or hajj) than they would be in the absence of the rules [40] (the prohibited actions in ihram) and where the sole reason for accepting such limitation is to make possible such activity [40] (to obey the rules - before and while in ihram").

D. User Interaction

UI in a social context is concerned with design as a means for creating a meaningful interaction through the use of objects [41]. MR-Tawaf has a systematic approach to understand the dynamics and effects of interaction between the learner (user) and the app. A set of user requirements has been studied and established in design activities, followed by the design stages done iteratively. Finally, the evaluation process involving a group of users to ensure the MR-Tawaf helps the learners in achieving their goal [42]. In MR-Tawaf, the app interacts with the learners by giving a checklist for them to check as preparation before they continue with the SG MR-Tawaf. The learners need to respond by clicking the checkbox to highlight that they have done what has been listed. Another example, there is a 2D mutawwif in the app highlighting the learners the

total marks they collected after completed every round of tawaf, and also he will appear when learners did a prohibited action while performing the tawaf (in a form of SG simulation).

E. *Mixed Reality*

Most of the researchers see MR as a synonym for AR while some regard MR according to the definition by Milgram & Kishino, that is - MR is a superset of AR in terms of a "mix of real and virtual objects within a single display [43]." Others consider MR distinct from AR due to the sense that MR involves space, manipulating a scene in which AR could not do. AR is a sub-mode of MR which can provide an augmented workspace by inserting content from the virtual space. Here it will store and interact with the content into a predominantly physical space where we do our tasks. The need for AR techniques is most promising for engaging the learners of MR-Tawaf into augmented workspaces. MR-Tawaf used the approach of mixed reality boundaries which involves joining together distinct virtual and physical spaces by creating a transparent boundary between them [44]. By implementing this approach, the spaces are not overlaid. It is instead are distinct but adjacent.

MR-Tawaf involves boundary elements; situation. The situation concerns the spatial relationships between the mixed reality boundary, the physical and virtual spaces that it shows to the learners [44]. Here it involves the space of the boundary, whether this space is fixed or whether the boundary is segmented. Location here means the placement of the object boundary (in this case Kaabah object) within the allowed spaces. Mobility in MR-Tawaf describes whether the boundary assumes static Kaabah location or not. A mobile boundary is one that the participants can steer through the displayed spaces or which follows a pre-programmed trajectory. Segmentation in MR-Tawaf space is a boundary that can be segmented in terms of its floor spatial location. The system will read the floor space with enough light rays of light. These connected spaces provide to some extent a unified frame of reference. It covers the position, orientation, distance, and consistent perspective. The learner may move along the boundary of Kaabah and change their viewing angle. It will still retain the same view (the connected space).

MR-Tawaf SG is referring to the mini game-shells that allow the learners and mutawwif to

sense the feeling of 'presence' experience. Presence is one of the elements of the motivational FT under a novel MR educational learning framework for both VR and AR - formal and informal learning. The VR (former) allows for the feeling of 'being there' in the virtual world. The AR (latter) blends virtual and real elements (learners). This is to enable the 3D virtual elements is registered accurately in the real world. Hence, learner will interact freely via mobile phone displays. This approach is to increase learners' engagement and motivation to continuously use MR-Tawaf. In MR-Tawaf, games were developed using Unity 3D.

F. *User Experience*

User experience (UX) becomes a key aspect of the MR-Tawaf. We achieve many potential advantages such as reduced development time and product support costs but still increase customer satisfaction [45]. The aspect of UX is important because none of the umrah pilgrims were agreed to buy the additional devices if we include the Natural User Interaction (NUI) additional components such as AR glasses, 3DRudder foot motion, VR Box II and many more. The task of designing MR-Tawaf requires a very detailed understanding of the context of tawaf itself and the people who will use MR-Tawaf. UX has gained greater attention among people in the industry. These UX design (UX-D) models could guide to improve the design. It also helps to determine the quality of interactive apps. UX is dynamic, subjective and context-dependent. It evolves during the interaction of learners with the system. The attributes for UX in MR-Tawaf conceptual framework involves:

(1) Usability - learners know where and when to start, where
    they are, what to do, accomplish or incomplete the   task
    (tawaf practical learning), need training or not.

(2) Appeal - what will make MR-Tawaf is useful or valuable
    in the learner's eyes, what can you give them that F2F
    umrah course don't give.

(3) Accessibility - where and how will people use MR-Tawaf
    (mobile phone, laptop, desktop or any other devices?),
    does MR-Tawaf function efficiently and

effectively,   the
   features offered in the MR-Tawaf, and user
interface   scale
   appropriately.

(4) Performance - speed equals responsiveness in the
   minds   of users, how
         responsive is the MR-Tawaf, does
MR-Tawaf
   loads and responds to quickly.

(5) User Assistance or Help - what happens when
something
   unexpected happens, is help available helpful?

and a newfound attribute;

(6) Desirability - goes beyond just usability, how we
candrive a user to take action through design,
   provides a
certain
   "wow factor" that motivate the learners engaged
with   the
   app, compelling them to keep using the
MR-Tawaf
   because it offers them pleasure in SG, which is a
reward   as
   a motivation to them.

Nowadays, UX has been commonly accepted in the
field of HCI [46]. The outcome of this tawaf
practical learning is the actual UX [47].

G. Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) is one of the
most influential and commonly used theories to
describe the user's acceptance of systems [48]. As
TAM closely related to the usability of the systems,
TAM involves two major variables: Perceive
Usefulness (PU) and Perceived Ease of Use (PEOU)
to determine the attitudes towards using the MR-
Tawaf. PU is the extent to which a user believes that
using an information system will improve his or her
learning performance while PEOU is a measure of a
user's perception regarding a system's ease of
implementation. The MR-Tawaf environment could
be designed to bridge the gap between theoretical
learning in formal instruction provided in F2F
course and the real-life application of the content in
the virtual reality environment. In MR-Tawaf, TAM
aims to explain user acceptance towards the mobile
app itself.

III. RESULTS AND CONCLUSION

The end result of this research is the formation of a
conceptual framework for designing the mixed
reality self-directed learning for tawaf practical
training via serious games. Serious games are not
about a hundred percent entertainment and
enjoyment, but it is more to educate users regardless
of using the fun elements which can motivate and
engage the user to this mobile app. The MR-Tawaf
is the prototype that could validate the conceptual
framework of MR-Tawaf. The following figures
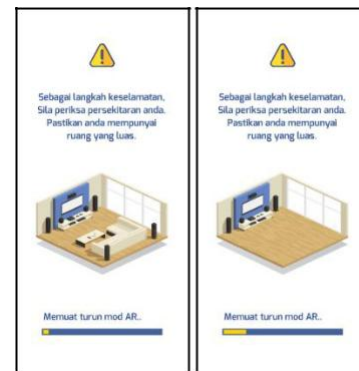show the some of the interfaces of MR-Tawaf :

Fig. 2 : Loading and Safety Warning 1

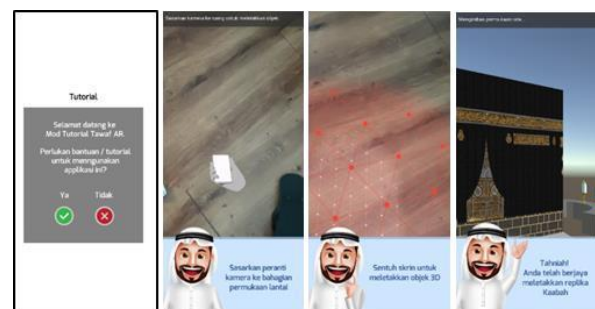Fig. 3 : Loading and Safety Warning 2

Fig. 4 : Tutorial on how to place the Kaabah
object and the floor space factor

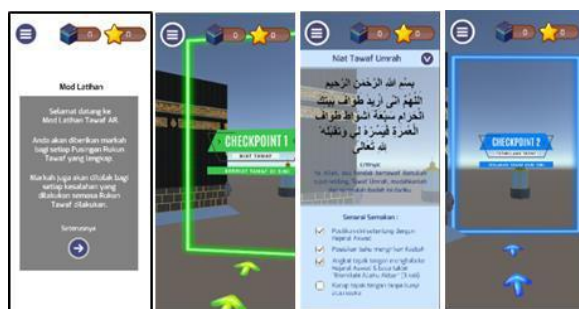Fig. 5 : The guideline to the Hajarul Aswad corner

Fig. 6 : Checkpoint 1

Fig. 7 : The process of completing tawaf using MR-Tawaf

Figures 2 and 3 show the loading and safety warnings 1 and 2. Here, UX-D is applied to guide the users on what to do for precaution before especially the floor space to be read and the movement style using the MR-Tawaf.

For Figure 4, users are allowed to display the tutorial or not. If the users agreed to view the tutorial first, the MR-Tawaf will display the tutorial.

Figure 5 is the guideline to the Hajarul Aswad. It is an important point where the user will read certain duá to start the tawaf. The element of UX (User assistance is applied here).

Figure 6 is the checkpoint 1 where the Hajarul Aswad is located. There are few others checkpoint as a guidelines to users.

Figure 7 shows the interface in completing the tawaf. From here we can see the SDL is applied and the rewards in a form of marks will be calculated and displayed on your device. Assuming that this an SG for the MR-Tawaf, it is created with certain challenging format to motivate and engage the users to continuously use the MR-Tawaf.

MR is a promising advanced technology for the education industry and religious related matters. AR can reduce the time and cost by augmenting these activities with digital content. UX is about technology that fulfils more than just instrumental needs and a consequence of a user's internal state (motivation, needs, presence, mood, etc.), a new attribute for UX has been identified; desirability, and the context of environment (location, situation, segmentation) within which the interaction occurs. The combination of the SDL, motivational FT, SG, UI, UX attributes and TAM are very important in the MR-Tawaf conceptual framework because it provides effective practical learning to students and Ustaz especially for those who directly or indirectly involved in the preparation of umrah especially performing tawaf. This creates innumerable design and UX opportunities. MR-Tawaf mobile app has been successfully designed and it is hoped that through this application, it can provide a more enjoyable experience to encourage the learners to engage to MR-Tawaf and good motivation in learning. For future work, MR-Tawaf will be evaluated for its usability to obtain perception from different learners.

REFERENCES

[1] M. F. Yusuf, A. N. Zulkifli, and N. F. F. Mohamed, Virtual hajj (V-Hajj)," *IEEE Conference on Open Systems (ICOS2011)*, 2011, 250 –255.

[2] Zuraifah, N., Othman, S., Shafry, M., Rahim, M., & Ghazali, M., "*Integrating perception into V-Hajj : 3D Tawaf Training*," 2011, 79–92.

[3] Yasin, A. M., Darleena, Z., & Isa, M. A. M., "Avatar implementation in virtual reality environment using situated learning for tawaf," *Procedia - Social and Behavioral Sciences*, 2013, *67*, 73–80. https://doi.org/10.1016/j.sbspro.2012.11.308.

[4] Mohamad, S., Sunar, M. S., & Hanifa, R. M. (n.d.)., *"A review on tawaf crowd simulation," 2017,* 119–123.

[5] P. Wilkinson., "A brief history of serious game," In Entertainment Computing and Serious Game, Springer, 2016, pages 17–41.

[6] Yusoff, R. C. M., Ibrahim, R., Zaman, H. B., & Ahmad, A., "Evaluation of user acceptance of mixed reality technology," *Australasian Journal of Educational Technology*, *2011,* (8), 1369–1387.

[7] N Pindeh, NM Suki, NM Suki, "User acceptance on mobile apps as an effective medium to learn kadazandusun language," Procedia Economics and Finance, Elsevier, 2016.

[8] Kim, J., Jones, D.R., Baker, J., Chin, W.W., "Application discoverability and user satisfaction in mobile application stores: An environmental psychology perspective," Decision Support System, 2014, 59(2014), 37-51.

[9] Budiu, R., "Mobile: native apps, web apps, and hybrid apps," Retrieved from http://www.nngroup.com/articles/mobile-native-apps/

[10] Fernandez-Lopez, A., M.J. Rodriguez-Fortiz, M. L. Rodriguez-Almendros and M. J Martinez-Segura, "Mobile learning technology based on iOS devices to support students with special education needs," Comput. Educ., 2013, 61(1):77-90.

[11] C. Sile´n and L. Uhlin, "Self-directed learning and learning issue for students and faculty!," Teaching in Higher Education, 2008, Vol. 13, ISSN 1356-2517 print/ISSN 1470-1294.

[12] C. Sile´n and L. Uhlin, "Between chaos and cosmos a driving force for responsibility and independence in learning. The power of problem based learning," PROBLARC, The 3rd Asia Pacific conference on PBL, December 912, in The University of Newcastle, Australia.

[13] C. Sile´n and L. Uhlin, "Responsibility and independence in learning : what is the role of the educators and the framework of the educational programme. In Improving student learning," - Theory, Research and Practice, ed.

C. Rust, Oxford: The Oxford Centre for Staff and Learning Development, 2014, 249-62.

[14] T. H. Morris, "Facilitating self-directed learning in adult and vocational education," PhD Thesis, Technischen Universität Kaiserslautern, Kaiserslautern, März 2019.

[15] Sawatsky, A. P., Ratelle, J. T., Bonnes, S. L., Egginton, J. S., & Beckman, T. J., "A model of self-directed learning in internal medicine residency: A qualitative study using grounded theory," BMC Medical Education, 2017, 17, 1-9. doi:10.1186/s12909-017-0869-4.

[16] Smith, H. A., & Segbers, T., "The impact of transculturality on student experience of higher education," Journal of Experiential Education, 2018, 41, 7589. doi:10.1177/1053825917750406.

[17] Tan, C., "A Confucian perspective of self-cultivation in learning: Its implications for self-directed learning," Journal of Adult and Continuing Education, 2017, 23, 250-262, doi:10.1177/1477971417721719.

[18] Swann, C., Keegan, R. J., Piggott, D., Crust, L., "A systematic review of the experience, occurrence, and controllability of flow states in elite sport," Psychology of Sport and Exercise, 2012, 13(6), 807-819, https://doi.org/10.1016/j.psychsport.2012.05.006.

[19] Seligman, M. E., Csikszentmihalyi, M., "Positive psychology: An introduction," American Psychological Association, 2000, (Vol. 55, No. 1, p. 5).

[20] A. Perttula, K. Kiili, A. Lindstedt, P. Tuomi, "Flow experience in game based learning – a systematic literature review," International Journal of Serious Games, 2017, ISSN: 2384-8766, Volume 4, Issue 1, http://dx.doi.org/10.17083/ijsg.v4i1.151.

[21] Csikszentmihalyi, M., "Beyond boredom and anxiety: Experiencing flow in work and play," Jossey-Bass, San Francisco, 1975.

[22] Kiili, K., de Freitas, S., Arnab, S., Lainema, T., "The design principles for flow experience in educational games," Procedia Computer Science, 2012, 15, 78-91, https://doi.org/10.1016/j.procs.2012.10.060.

[23] Csikszentmihalyi, M., "Flow: The psychology of optimal experience, Harper Perennial, New York, 1991.

[24] Kiili, K., "Content creation challenges and flow experience in educational games: The ITEmperor case," The Internet and Higher

Education, 2005, 8(3), 183-198, https://doi.org/10.1016/j.iheduc.2005.06.001.

[25] R.M. Ryan and E.L. Deci, "Intrinsic and extrinsic motivations: Classic definitions and new directions", Contemporary Educational Psychology, 2000, 25,1,54-67.

[26] M. Ainley, and J. Ainley, "Student engagement with science in early adolescence: The contribution of enjoyment to students' continuing interest in learning about science," Contemporary Educational Psychology, 2011, 36, 1, 4-12.

[27] S.C. Broussard and M.E. Garrison, "The relationship between classroom motivation and academic achievement in elementary-school-aged children", Family and Consumer Sciences Research Journal, 2004, 33, 2,106-120.

[28] V. Gopalan, J. A. A. Bakar, A. N., Zulkifli, Asmidah Alwi and R. C. Mat, "A Review of the motivation theories in learning, The 2nd International Conference on Applied Science and Technology, 2017, AIP Conf. Proc. 1891, 020043-1–020043-7; https://doi.org/10.1063/1.5005376, AIP Publishing. 978-0-7354-1573-7.

[29] E.A. Skinner and M.J. Belmont, "Motivation in the classroom: reciprocal effects of teacher behavior and student engagement across the school year", Journal of educational psychology, 1992, 85, 4, 571.

[30] K. Cherry, "Are actions motivated by a desire for rewards?," 2017, Retrieved from https://www.verywell.com/theincentive-theory-of-motivation-2795382/(2017).

[31] A. Bandura, "Self-efficacy: toward a unifying theory of behavioral change", Psychological review, 1977, 84, 2, 191.

[32] F. Yardimci, M. Bektas, N. Ozkutuk, G.K. Muslu, G.O. Gerceker, and Z. Basbakkal, "A study of the relationshipbetween the study process, motivation resources, and motivation problems of nursing students in different ducational systems," Nurse Education Today, 2017, 48,13-18.

[33] L.Legault,"Intrinsicandextrinsic motivation," Springer International Publishing, 2016, 1-4, AG , doi:10.1007/978-3-31928099-8_1139-1.

[34] E.L. Deci, and R.M. Ryan, "Optimizing students' motivation in the era of testing and pressure: A selfdetermination theory perspective," Springer Singapore, 2016, 9-29.

[35] H. Tohidi and M.M. Jabbari, "The effects of motivation in education", Procedia-Social and Behavioral Sciences, 2012, 31, 820-824.

[36] S. Riaz, D.R.A. Rambli, R. Salleh, and A. Mushtaq, "Study to investigate learning motivation factors within formal and informal learning environments and their influence upon Web-Based Learning," iJET, 2010, 5, 4, 41-50.

[37] I. M. Schottman, S. George, F. T. Bernard, "Tools and methods for Efficiently Designing Serious Games", 4th Europeen Conference on Games Based Learning ECGBL2010, Copenhagen, Denmark, 21-22 October 2010, pp. 226-234.

[38] De Freitas, S. and Neumann, T. "The use of exploratory learning for supporting immersive learning in virtual environments," Computers and Education Journal, 2012, 52(2), pp 343-352

[39] B. Sawyer, "Serious Games für die," Informations,-und Wissensvermittlung.Retrieved from http://www.b-i-t-online.de/daten/BIT_Innovativ_28_Auszug.pdf

[40] Caulfield, C. , Maj, S. P., Xia, J., & Veal, D. R., "Shall we play a game?," Modern Applied Science, 2012, 6(1), 2-16, http://ro.ecu.edu.au/ecuworks2012/436.

[41] Niedderer, K., "Designing mindful interaction: the category of performative object," Design Issues, Winter, 2007. Vol 23. No.1.

[42] Forlizzi, J., Zimmerman, J., & Evenson, S., "Crafting a place for interaction design research in HCI," Design Issues. 2008. Volme 24, Number 3 Summer.

[43] M. Speicher, B. D. Hall, M. Nebeling, "Human Factors in Computing Systems," Proceedings, May 4–9, 2019, Glasgow, Scotland, UK, https://doi.org/10.1145/3290605. 3300767.

[44] S. Bodker, M. Kyng, and K. Schmidt (eds.). Proceedings of the Sixth European Conference on Computer-Supported Cooperative Work, 12-16 September 1999, Copenhagen, Denmark © 1999 Kluwer Academic Publishers. Printed in the Netherlands.

[45] M. Rajanen, D. Rajanen, "Usability benefits in gamification," GamiFIN Conference, 2017, Pori, Finland, May 9-10.

[46] Law, E., Roto, V., Hassenzahl, M., Vermeeren, A. & Kort, J., *"Understanding, scoping and defining user experience," Proceedings Of The 27Th International Conference On Human Factors In Computing*

Systems   -   CHI   09.
doi:10.1145/1518701.1518813.

[47] M. Hassenzahl and N. Tractinsky, User experience – a research agenda, Behaviour & Information Technology, Vol. 25, No. 2, March-April 2006, 91–97, ISSN 0144-929X print/ISSN 1362-3001 online ª 2006 Taylor & Francis, DOI: 10.1080/01449290500330331.

[48] Y. Lee, K.A.Kozar, K.R.T. Larsen, "The Technology acceptance model – past, present and future," Communications of the Association for Information Systems (Volume 12, Article 50) 752-780