WEB INTERFACE DESIGN PRINCIPLES FOR ADULTS' SELF-DIRECTED LEARNING

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ABSTRACT

One of the most important features which e-learning tools and environments must possess within the scope of lifelong learning is self-directed learning, which can be considered as a form of self-learning. The aim of this study was to determine, based on the views and recommendations of experts, interface design principles for the development of educational web interfaces that will support the self-directed learning of adults. This descriptive study was conducted with the contribution of 12 academicians specializing in interface design and self-directed learning. Within the scope of the study, new interfaces features were identified based on an evaluation of the literature on interface designs for self-directed learning, and the views of subject experts. Based on the study results, it was determined that interface designs supporting self-directed learning must possess five basic features, which include being user-directed, ensuring variety, being supported by learning analytics, being motivational, and being sharing-oriented.

Key words: Open and distance learning, self-directed learning, adult education, e-learning, interface design.

INTRODUCTION

Given that computers began to be used in education approximately 20-25 years ago, the current availability of e-learning methods in thousands of universities around the world indicates the pace of improvement provided by e-learning tools. The number of universities that offer e-learning opportunities increases daily. In this context, file sharing platforms such as Dropbox, presentation software such as Prezi, and office packages such as Microsoft Office, could be listed among the most frequently used e-learning tools of today. Adobe Connect, Blackboard, WebCT, and Moodle could also be listed among the content management systems (CMS) and learning management systems (LMS). There are certain features that e-learning tools and environments should possess within the scope of lifelong learning. The most prominent feature is self-directed learning, which could be considered in terms of adult training and self-learning (Murray, 2015).

Self-Directed Learning
In the Open University, which is based on the self-learning of individuals independent from time and place, learners are expected to benefit from the available environment, tools, and

resources under their own control. Therefore, having the major compulsory competencies of self-learning and self-directed learning is essential for Open University students (Volery and Lord, 2000; Irizarry, 2002). Self-directed learning, which is an individual learning approach where learners plan their own learning experiences, implement their plans and evaluate their own learning experiences, accordingly, has an important role in the Open University practices.

Despite the absence of a universal definition, self-directed learning is used instead of self-learning in the literature, which is a concept where the learner is responsible for his/her own learning experiences (Caffarella, 2000; Hiemstra, 2000; Merriam and Caffarella, 1999; Murray, 2015). In this respect, it would be appropriate to define self-learning as an individual learning approach where learners plan their own learning experiences, implement their plans and evaluate their own learning experiences. According to Garrison (1997), self-directed learning occurs as a result of an effective integration among self-direction (contextual control), cognitive self-control in terms of self-monitoring (cognitive responsibility), and motivation in terms of willingness to learn. As the definition also indicates, the self-directed learning approach has a critical importance in the Open University practices. Figure 2 summarizes the relationship between the dimensions of self-directed learning.
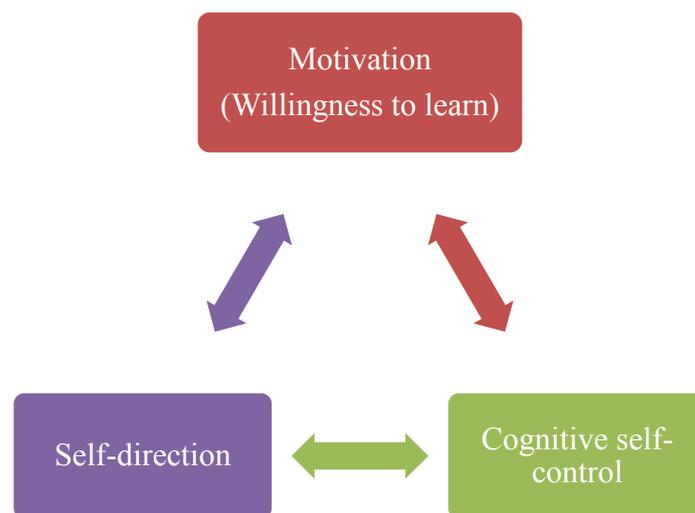
Figure: 1
Dimensions of self-directed learning.

As displayed in Figure 2, self-direction, which is one of the dimensions of self-directed learning, could be considered mainly as a concept related to the control of learning tasks. Accordingly, the main focus in self-direction is on the application of learning targets both socially and behaviorally. However, in cognitive self-control, cognitive and metacognitive processes are discussed. Additionally, learning strategies are followed and there is a requirement for awareness and competence in thinking to think. Learners with cognitive self-control make their own learning plan, modify the plan according to their requirements, and review their thoughts about learning goals and tasks within the learning process (Hammarlund, Nilsson and Gummesson, 2015). Learners with cognitive self-control have the responsibility of establishing individual meanings such as the integration of new concepts and ideas into the previous knowledge. Cognitive self-control, which is also known as self-inspection, reflects the obligation of establishing meanings through critical

thinking, cooperation, and approval. Motivation reflects the value and expected learning achievement that is perceived throughout the learning process, which starts between content (control) and cognition (responsibility).

Widely used e-learning tools and environments are presented to learners with the help of educational Web interfaces. In order the learners to benefit from these available environments, tools and resources, they should be competent in utilizing technology; more importantly, they should be able to learn through self-direction. In other words, e-learning tools and environments should be supportive of learners' self-directed learning. Self-directed learning naturally based on self-control skills of adults. Therefore, adult education and self-directed learning commonly mentioned together.

Adult Education

According to Siebert (2003), andragogy, also known as adult education, should be adapted as a part of educational science. Some of the principles that have been frequently emphasized in the literature regarding adult learning could be listed as follows (Knowles, 1970; Knowles, 1984; Merriam, Caffarella, and Baumgartner, 2012):

  - ➢ Adults are better at learning certain aspects that are related to their experiences and lives.
  - ➢ Adults are conscious learners.
  - ➢ The duration of adults' reactions to stimulus increases directly in proportion of their age.
  - ➢ Reliability and participations facilitates the teaching of adults.
  - ➢ Adults learn about the solution of an existing problem rather than simply learning.

Learning always starts with human experiences (Kolb, 1984). Therefore, while considering the andragogy model and certain environments that are appropriate to this model, the past life experiences of adults should be taken into consideration. In other words, the nature of adults should be considered in all activities regarding adult training. The concept of lifelong learning, which is related to the life experiences of individuals, also emphasized this phenomenon. Adult training, which has been shaped according to the studies of researchers and pragmatists since the 1980s, could be presented through the following five basic features (Knowles, 1970; Knowles, 1984):

  - ➢ Adult students are self-directed.
  - ➢ The life experiences of adults are the main source of their education.
  - ➢ The perceived requirements of adults play a prominent role during their learning
  - ➢ The education of adult is oriented towards current events and cases.
  - ➢ The motivation of adults towards learning primarily depends on the requirements.

Considering the characteristics of adult learners along with self-learning and andragogy, it could be concluded that they would like to be educated in relation to real life, which is self-directed, includes active participation, and is based on their own life experiences. Figure 1 shows that such characteristics of adults could be taken into account in educational environments created for adults.
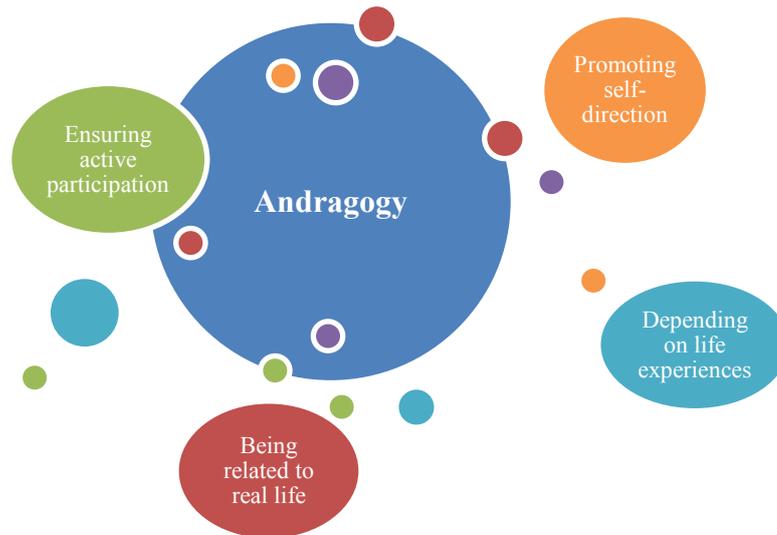
Figure: 2
Four basic characteristics that could be taken into account in adult learning environments.

It could be concluded that educational environments that are created based on the principles of the andragogy model about adult learning should be related to the real life, promote self-directed learning, ensure active participation, and be based on the life experiences of the learner. In this respect, e-learning environments and tools prepared for adult training are also expected to be related to the real life, promote self-directed learning, ensure active participation, and be based on the life experiences of the learner. With the growing concern about the use of ICTs in adult education, educational researchers, instructional designer and interface developer start to focus on developing successful educational interface designs for adults. It is possible to access different research and publications.

LITERATURE REVIEW

The review of the literature involved the examination of various studies describing conceptual frameworks regarding self-directed learning and interface designs. A study performed by Cennamo and Ross (2000), for instance, considered possible strategies for supporting self-directed learning among learners in a web-based course. In this context, they proposed nine different self-directed learning strategies, such as the holding records, monitoring, reviewing notes, and teacher support. Similarly, a study performed by Kashihara and Hasegawa (2003) evaluated potential strategies for forming self-directed learning environments on the web. To this end, they proposed a Learning Bench framework, which included a library as well as components for tracking user navigation. The library served to facilitate the learner's transition from one subject to another, while the navigation tracker was developed to allow the learner to track his/her own learning path and web navigation.

In another study, Fischer and Sugimoto (2006) focused on supporting the self-control of learners in socio-technic environments. To this end, they created a conceptual framework that presented four new innovative concepts. These innovative concepts included effect-oriented design environment, system criticism, design, and exploratory cooperation. Based on the results of this study, Fischer and Sugimoto described various difficulties that can be encountered during system development and evaluation, and in the use of technologies to support learning.

The literature review we performed showed that studies discussed the necessary characteristics for educational web environments that support self-directed learning mainly within the frame of socio-technic, navigational and design models, and of components such as libraries. However, we were not able to find any studies that presented holistic design principles for use in the design of education web interfaces supporting self-directed learning among adult learners. Also Eyitayo, (2013) underline the requirement of future research on adult learning principles about learning in ICTs. In this context, we believe that the current study might contribute to filling this gap within the literature.

In this study, self-directed learning is defined as learners' control in cooperation with individual responsibility, cognitive processes, and contextual processes with the aim of establishing and confirming meaningful learning outcomes. However, common e-learning tools and environments could be quite complicated structures for learners. In this respect, it is believed that creating familiar, meaningful, and guiding educational Web interfaces would have important contributions to self-directed learning of learners. In addition to the well-designed e-learning tools, in order for learners to learn through their self-control, self-motivation and self-direction, and educational Web interfaces, which could support self-directed learning, are required. These requirements have also been emphasized by Kinshuk, Chang, Dron, Graf, Kumar, Lin and Yang (2011).

PURPOSE

The current study aimed to determine the interface design principles that could be used in developing educational Web interfaces, which could support adults' self-directed learning, through expert opinions and suggestions. In light of this aim, answers to the following questions were sought:

1. What are the opinions of experts in interface design and self-directed learning about the features that interface designs supportive of self-directed learning have, as described in the literature?
2. What are the opinions of experts in interface design and self-directed learning about the features that interface designs supportive of self-directed learning should have?

METHOD

This descriptive study investigated the views and suggestion of experts on interface design principles supporting adults' self-directed learning by both qualitative and quantitative data. Participants, data collection tool and data analyses process given under this section.

Participants

Participants were determined through the purposive sampling method and the study was conducted with six experts with a doctorate degree, who actively design Web interfaces, along with six academicians, who perform studies on self-directed learning. Demographic information about the participants is presented in Table 1.

Table: 1
Demographic Information

Qualification	Frequency (f)
Title	
Professor	2
Associate Professor	1
Assistant Professor	5
Research Assistant	4
Gender	
Female	4
Male	8
Fields of Study	
Self-directed learning	6
Interface design	6

As displayed in Table 1, all experts who participated in the study had doctorate degrees. Furthermore, it was observed that the number of male field experts was twice the number of female experts. Additionally, an equal number of experts participated in the study with respect to the fields of study in self-directed learning and Web interface design.

Data Collection Tool

In the determination of the interface design principles required for developing educational Web interfaces that are supportive of self-directed learning, an expert evaluation form was used (Appendix-1). In order to determine the data collection tools, interface design principles that could be used in developing educational Web interfaces supportive of self-directed learning were reviewed in the literature. Principles that were found through the literature review are presented in Table 2.

Among the 16 items obtained from the literature review, two were combined due to the fact that they had the same meaning, and one was removed since it was not related to interface design. As a result of this, 13 items were obtained. Additionally, certain items were changed in terms of their expressions according to the expert opinions and suggestions. A draft expert opinion form was evaluated by four field experts for the face and content validity. The form took its final form according to the feedback obtained. The first section of the expert evaluation form, which consisted of two sections, included the evaluation of the principles obtained from the literature review; and in the second section, experts were requested to suggest their own principles.

Table: 2
Principles Found in the Literature Review

Theme	In interfaces supportive of self-directed learning;
User-directed	1. It should be ensured that learners are able to keep track of their own improvement.
	2. It should be ensured that learners are able to perform self-evaluation.
	3. It should be ensured that learners are allowed to add or remove the components of interfaces.
Supportive	4. Previous learning should be recalled.
	5. Regular studying should be promoted.
	6. Self-learning should be supported.
	7. Time management tools should be provided.
	8. Relevance to real life should be ensured.
	9. Multimedia environment support should be provided.
Open-ended	10. Content and design variety should be ensured.
	11. Varied learning resources should be included.
Sharing-oriented	12. Components that enable learners to communicate with other learners should be included.
	13. Components that enable learners to share should be provided.
Motivating	14. Entertainment aspects should be included.
	15. Variable and mobile components should be included.
	16. Components that learners could regulate according to their own interests and requirements should be included.

Data Analysis

Data obtained from the first section of the expert opinion form were analyzed through descriptive statistics. A content analysis was performed from the data obtained from the second section of the form. In this method, which was developed by Osgood, Suci, and Tannenbaum (1957), the direction and intensity of the attitudes towards a subject were determined through the data obtained. Data obtained from the participants were encoded in accordance with the evaluative content analysis. In order to increase the level of reliability for the codes, expert opinions were obtained. Data obtained from the second section of the expert opinion form were analyzed according to the thematic analysis. Thematic analysis could be defined as a method that is used to determine, analyze, and report the themes within the data (Braun and Clarke, 2006). The aim of the thematic analysis was to obtain interface design principles identified by the participants as supportive of self-directed learning.

FINDINGS

This part of the study includes findings obtained from the evaluation of the self-directed learning interface design principles that were found in the literature review as well as the findings obtained from the opinions of the experts about the same topic. Firstly, the principles obtained from the literature review were analyzed and 13 basic principles were found. Principles obtained are displayed in Table 3.

Table: 3
Interface design principles

Principles	Resources
1. It must be ensured that learners are able to keep track of their own improvement. 2. Learners should be supported in terms of regular studying. 3. Previous learning should be recalled. 4. Learners should be enabled to add and remove interface components. 5. Components that could be regulated by learners according to themselves should be included. 6. Learners should be enabled to evaluate themselves. 7. Self-learning should be promoted. 8. Time management tools should be provided. 9. Clues that could establish a relationship with real life should be presented. 10. Image, video, and graphic support should be provided. 11. Design variety should be ensured. 12. Varied learning resources should be included. 13. Components that enable learners to communicate should be included.	Knowles, 1970; Knowles, 1984; Garrison, 1997; Fischer and Scharff, 1998; Siebert, 2003; Merriam, Caffarella and Baumgartner, 2012

As displayed in Table 3, 16 self-directed learning interface design principles that were obtained from the literature review were reduced to 13 items. These items were later submitted to 12 experts for their opinions. Opinions of experts about interface design features in the literature that were supportive of self-directed learning are presented in the next section.

Opinions Regarding Interface Design Features Supportive of Self-Directed Learning

The aim of the first section of the expert opinion form was to determine the opinions of experts about the interface design principles obtained from the literature review. Experts scored the features between 1 and 10. The total score of each item is displayed in Table 4.

Table: 4
Opinions of Experts/Specialists Regarding Design Principles for Interfaces

Features	Total	Average
It must be ensured that learners are able to keep track of their own improvement.	118	9.8
Self-learning should be promoted.	118	9.8
Image, video, and graphic support should be provided.	113	9.4
Components that enable learners to communicate should be included.	112	9.3
Components that could be regulated by learners on their own should be included.	111	9.3
Design variety should be ensured.	111	9.3
Learners should be allowed to add and remove interface components.	110	9.2
Learners should be enabled to evaluate themselves.	110	9.2
Varied learning resources should be included.	109	9.1
Time management tools should be provided.	105	8.8
Previous learning should be recalled.	103	8.6
Learners should be supported in terms of regular studying	102	8.5
Clues that could establish relationship with real life should be presented.	95	7.9

According to Table 2, the two items with the highest scores were: "It must be ensured that learners are able to keep track of their own improvement," and "Self-learning should be promoted." These two items were both related to the cognitive self-control dimension of self-directed learning. The item that received the lowest score was: "Clues that could establish a relationship with real life should be presented," with an average of 7.9. This item was related to adult training and the motivation dimension of self-directed learning. An evaluation of the mean scores given by the experts indicates that all of the items received, on average, a score of 8 or above out of 10. This reflects the fact that the field experts largely supported the design principles identified in the literature.

The Features which Interface Designs Supportive of Self-Directed should Possess

Opinions of academicians and experts about the features that interface designs supportive of self-directed learning should have were obtained through an open-ended question in the second section of the expert opinion form. In the analysis of the qualitative data obtained, inductive content analysis was used and the themes were found. Expert opinions and the themes obtained are displayed in Table 5.

Table: 5
Expert opinions and themes obtained

Direct quotes	Themes
"It must be ensured that instant feedback could be provided. All modules should be structured automatically according to the user preferences in the previous modules." *"Students should be able to receive feedback about their states in the interface whenever they wish."* *"[They] should be able to see where they are within the whole. [They] set targets about how far they could go in the next study and the system should be able to save this target."*	**User sensibility**
"There could be certain tools such as references and an index. That is how an individual could find whatever they are looking for quickly." *"Learners should be able to access any component they wish at all times (it should be under the control of the learner)."*	**Ease of access**
"Access from varied tools (tablet, pc, smartphone, etc...) should be enabled."	**Compatibility**
"The learning environment should include a large group of current Web 2.0 technologies in an embedded or accessible form."	**Social Web-support**
"In order for learners to plan their learning experiences, they should be able to access experiences or learning methods of other learners; and in order to achieve a certain learning goal, learners should be able to access the systems that could provide a list of the most appropriate or alternative activities..." *"Interface analytics should be presented in order for learners to evaluate the process, determine the learning methods, set goals and targets, and monitor their own learning processes."*	**Analytics**
"... such components that could create curiosity and willingness to learn by the learner should be added."	**Motivation**

Expert opinions showed that there were six themes with respect to the characteristics that Web designs should possess in order to ensure self-directed learning. According to these themes, a Web interface design, which is supportive of self-directed learning, should be user sensitive, ensure ease of access, be compatible in diverse environments, provide social web support, make use of learning analytics, and be motivating.

DISCUSSION

This study concluded certain significant findings. The most important finding was the determination of the interface design principles for self-directed learning, which was obtained through field expert opinions. Principles obtained from the literature review and expert opinions are listed in Table 5 below.

Table: 6
Comparison of interface design principles for self-directed learning

Literature Principles	Expert Principles
1. It must be ensured that learners are able to keep track of their own improvement.	1. It should be user-directed.
2. Self-learning should be promoted.	
3. Image, video, and graphic support should be given.	2. It should ensure ease of access.
4. Components that enable learners to communicate should be included.	
5. Components that could be regulated by learners on their own should be included.	
6. Design variety should be ensured.	3. It should be compatible in varied learning environments
7. Learners should be allowed to add and remove interface components.	
8. Learners should be enabled to evaluate themselves.	
9. Varied learning resources should be included.	
10. Time management tools should be provided.	4. It should provide social web support.
11. Previous learning should be recalled.	
12. Learners should be supported in terms of studying regularly.	5. It should make use of learning analytics.
13. Clues that could establish a relationship with real life should be presented.	
	6. It should be motivational.

Table 6 shows that the interface design principles obtained from the literature, which are supportive of self-directed learning, were parallel to the principles obtained from the field experts. The principles deemed parallel to each other were presented in the same color in the table. Principles that were not highlighted in a color were combined under the motivation principle. Accordingly, through the combination of the principles obtained from the literature review with those obtained from the field experts, the study concluded with six principles. Since ease of access could be considered alongside the user-directedness principle, these two principals were combined. Compatibility in diverse environments was changed to "variety" in order to include design, media, and platform support. Social Web support was referred to as "being sharing-oriented," while being relevant to real life was considered within the scope of the "motivation" principle.

In light of these findings, interface designs, which are supportive of self-directed learning, should possess five major characteristics, namely being user-directed, ensuring variety, being supported by learning analytics, being motivational, and being sharing-oriented. The five major principles are displayed in Figure 3.

With respect to the user-directedness and being supportive, the selection of task and purposes (including the learning opportunities provided) should be performed by the user and the support provided by the system should simultaneously be related to the user tasks. Interface design should be open-ended, complicated, and varied to the extent that the user should face certain challenges. That is how users could attribute meanings to the system, cope with the challenges faced, and learn from these experiences. Learning analytics are essential for the users in terms of monitoring their own improvement as well as comparing their learning process to that of the others. Furthermore, the inclusion of certain clues relevant to real life and those that create curiosity could be useful in promoting learner's motivation. Finally, in interfaces supportive of self-directed learning, the provision of communication and sharing platforms where all stakeholders could learn from each other are quite essential.
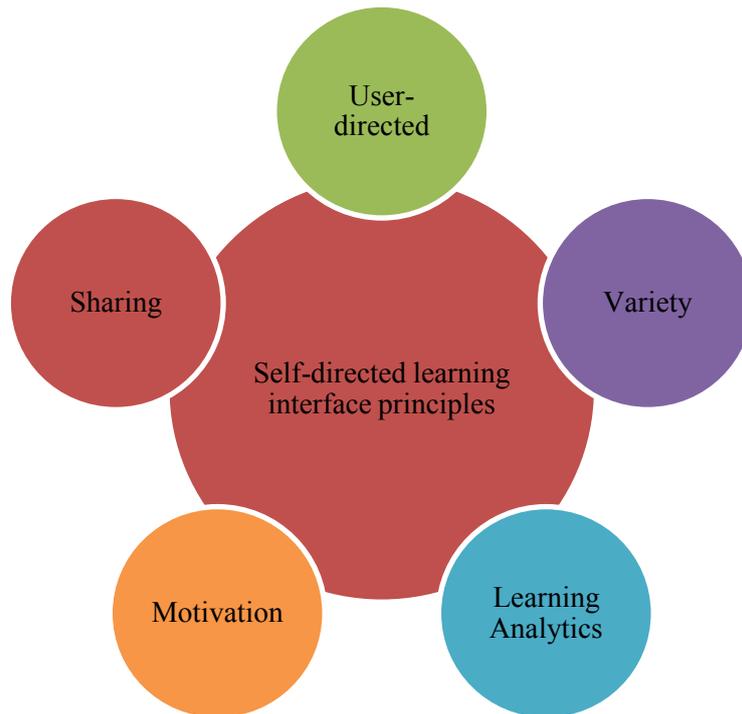
Figure: 3
Interface design principles for self-directed learning

CONCLUSION AND RECOMMENDATIONS

The current study, which is about the development of educational Web interfaces that support self-directed learning, is essential for the learners who take the responsibility for self-learning as well as the educational Web interface designers. Therefore, it is believed that the interface design principles determined in this study would be used in various fields. In addition to the interface design principles that are supportive of self-directed learning, certain new characteristics about self-directed learning were also identified in light of the opinions obtained from the expert participants. Among these characteristics, being user-directed, ensuring variety, being supported by learning analytics, being motivational, and being sharing-oriented stood out. These characteristics are generally in line with the characteristics determined by Fischer and Scharff (1998). In addition, support by learning analytics is similar to Kashihara and Hasegawa's (2003) finding that components tracking user navigation in the web environment are necessary for self-directed learning.

Web interfaces are used in presenting e-learning tools and environments that are developed for learners. Thus, it is believed that the findings of this study would contribute to the self-directed learning of adults in e-learning environments provided that these applications are performed in line with the principles determined. Based on the study results, it was determined that the design of an interface supporting self-directed learning should present the following features:

- ➢ The selection of tasks and goals should be left to the preference and requirements of the learner.
- ➢ The components should be open-ended, complex and diverse only to the extent that the users would encounter few difficulties.
- ➢ The learner should be able to follow his/her progress and compare his/her learning process with others through learning analytics.
- ➢ The interface should provide cues relating to real life that arouses the learner's curiosity.
- ➢ The interface should provide communication and sharing environments that allows the learners/stakeholders to learn from one another.

The presentation of e-books, e-activities, e-tests, educational simulations, and virtual classrooms, which are commonly used within the scope of e-learning opportunities, within educational Web interfaces that are supportive of self-directed learning, contribute to the e-learning tools and environment in achieving their goals. Further studies are recommended to work with a more comprehensive group of participants and to update the required characteristics for the interface designs supportive of self-directed learning. Additionally, experimental research could be conducted in order to determine whether the interfaces, which are designed according to the principles determined within the scope of this study, actually contributed to self-directed learning.

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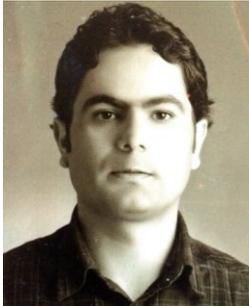
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1. Expert Evaluation Form

EXPERT EVALUATION FORM FOR THE INTERFACE DESIGN PRINCIPLES SUPPORTIVE OF SELF-DIRECTED LEARNING

Dear Expert,

Self-directed learning is defined as an individual learning approach in which individuals plan their own learning experiences, implement their plan and evaluate their own learning experiences. In this study, it is aimed to determine the characteristics that the interface designs supportive of self-directed learning should possess. In the light of this aim, an expert evaluation form consisting of two sections has been created; the first section of the expert evaluation form involved the evaluation of the principles, which were obtained through the literature scan. In the second section, experts are expected to suggest their own principles with respect to interface designs supportive of self-directed learning.

Thank you for your contribution!

SECTION I

Please choose the best option that reflects your opinion about the appropriateness of each principle to interface designs that are supportive of self-directed learning through scoring the numbers on the right for each principle described below.

In interfaces that are supportive of self-directed learning;	Poor					Strong				
	1	2	3	4	5	6	7	8	9	10
It must be ensured that learners are able to keep track of their own improvement.										
Learners should be supported in terms of regular studying.										
Previous learning should be recalled.										
Learners should be enabled to add and remove interface components.										
Components that could be regulated by learners according to themselves should be included.										
Learners should be enabled to evaluate themselves.										
Self-learning should be promoted.										
Time management tools should be provided.										
Clues that could establish a relationship with real life should be presented.										
Image, video, and graphic support should be provided.										
Design variety should be ensured.										
Varied learning resources should be included.										
Components that enable learners to communicate should be included.										

SECTION II

Please write your personal suggestions for principles about interface designs supportive of self-directed learning.