

A training system on smart phones to develop fashion and textile concepts for the female students with severe hearing impairment

Textile concepts for the female students

Shadia Salah Salem and Amaal Abdulqader Basaffar
Fashion and Textile, King Abdulaziz University, Jeddah, Saudi Arabia

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Abstract

Purpose – The purpose of this study is to present a training system on smart phones to develop fashion and textile concepts among the female students with severe hearing impairment and then to determine the effectiveness of the training system in developing fashion and textile concepts among the female students with severe hearing impairment.

Design/methodology/approach – The analytical descriptive methodology and experimental methodology were used to examine the training system in developing fashion and textile concepts among the female students with severe hearing impairment.

Findings – The findings of this study indicate that the training system on smart phones was effective in developing fashion and textile concepts among the female students with severe hearing impairment.

Research limitations/implications – This study has some limitations such as limited sample size, lack of control group and lack of long-term.

Practical implications – This study provides practical implications for educators, researchers and practitioners in terms of using smart phone applications in educational processes for people with disabilities.

Social implications – This study has social implications for people with disabilities as it provides them with access to education through smart phone applications which can help them develop their skills in fashion and textile design.

Originality/value – This study presents an original model of a training system on smart phones for developing fashion and textile concepts among the female students with severe hearing impairment, which can be used as a reference for other studies related to this field.

Keywords Training system, Smart phones, Fashion and textile terminology, Students with hearing impairment

Paper type Research paper

Introduction of the research

Large amount of behavioral cues we receive from the surrounding external environment are felt through our five senses and become experiences from which we learn, think and direct our behavior toward. The entire senses are important, but hearing comes first in terms of importance.

The individual is affected by the hearing impairment more than the eyesight impairment, as its impact on the individual characteristics appears to be stronger, represented in several characteristics such as the sociolinguistic, psychological and academic areas (Al-Dalaan, 2012). On the other hand, hearing impaired students can compete with other individuals for

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the same educational and vocational skills and excel in them thereof (Youssef, 2007, p. 53). This is confirmed by the researchers in the field of deaf education assuring that the deaf have normal mental abilities and may surpass the normal levels for some healthy individuals (Mustafa & Al-Sherbiny, 2013). They showed that despite the existence of some problems due to the hearing impairment, the deaf had the same level of intelligence as their healthy peers.

The system for caring for the determination category in the Kingdom of Saudi Arabia, issued by the royal decree, guarantees the protection and promotion of human rights, especially the rights of the determination persons, whose article defines the general framework for a full range of services that the state must provide for this special group in several fields, the most prominent of which are the field of education and health, which includes providing education and educational services at all levels of education, from pre-school education to higher education, and promoting their enrollment in a way that responds to the capabilities and requirements of persons with disability (Human Rights Commission - Kingdom of Saudi Arabia, 2019).

According to the comprehensive educational goals launched by the Ministry of Education in the National Transformation Plan (Kingdom of Saudi Arabia, 2016), one of the national programs which are thriving to achieve the vision of the "Kingdom of Saudi Arabia (2030)", it seeks to strengthen and develop the educational environment; such as the learning and assessment methods, as well as ensuring the quality of education and ensuring the equal opportunities for all categories of students, especially those with special disability.

Recently, find that there are crucial challenges facing educators and the educational process in light of the vast knowledge available and the information society, including but are not limited to the diversity of knowledge sources and the continuity of learning. Innovation has become a high-speed one which in turn has created an urgent need for the academic content in the classroom to be in line with developments and changes. That is, there is a need for direct communication and collaboration between teachers and course content designers for research, discussion and quick and prompt feedback.

The Ministry of Education stated in a report published on its website that the knowledge explosion led to the emergence of novice forms of education systems, including mobile education systems or (Mobile Learning), which is considered a novice form of e-education, as mobile learning means the ability to learn anywhere and anytime, through the use of mobile devices that have the ability to communicate wirelessly (<https://www.okaz.com.sa/local/na/1661648>).

Mobile learning aims at providing an interactive environment for the learner through numerous applications. Mobile phones have spread in a rapid manner, and their types and operating systems varied, such as the Android system and the IOS system. This, in turn, helped in the spread of mobile learning, which depends on such mobile devices and their applications. Among such applications are synchronous and asynchronous chatting programs such as WhatsApp and Skype, which have already spread widely and have become an essential feature of mobile learning (Trivedi, 2022a, b). Thereon, those applications are considered the best example of use within e-learning, because those applications have greatly contributed to the application of crucial practical opportunities for distance learning and training without being restricted by political and geographical borders, as they work to achieve E-learning which is spread in a successful and effective manner due to the fact that they allow (video conferences) that include audio, image and text chat, allowing learners to participate and contribute to the activities and effectiveness of the meeting, present different points of view, send short messages and even conduct phone conversations as well as the ability to make free calls and share files between participants in the meeting (Pombo and Marques, 2019).

The use of smart phone applications in education is considered one of the most important goals of mobile learning. due to its advantages and capabilities that contribute to managing learning systems, managing educational content, managing and planning educational

courses through the web technology and freedom to learn and to have training inside and outside the walls of the educational institutions and training rooms. They provide content anywhere and at any time and improve the interaction between the learner and the teacher, by asking specific questions or exchanging views and information between the teacher and the learner or vice versa, before, during and after the school day, through the Student-Centered learning processes (Batmetan and Palilingan, 2018).

In addition, mobile learning facilitates collaborative learning between learners through synchronous and asynchronous communication, as well as providing personal support for learning, motivating and pushing it towards learning and providing a brief content capable of reaching the learner on a regular basis anytime and anywhere (Pombo and Marques, 2019).

The students have positive opinions about the use of social networks via mobile phones, in strengthening communication between them, as they contribute to Increase relationships and good communication between the student and the teacher in an interactive learning environment. This will assist the students and motivate them to write, form opinions, analyze information, make decisions and solve problems and provide solutions and not to limit them to only memorizing (Katz, 2020). However, rather developing the thinking skills of learners according to the scientific foundations to strengthening participatory learning in a safe environment for communication and cooperation and increasing effective intervention which, in turn, further enhances self-confidence among students and eliminating social isolation that was considered one of the weakness aspects of e-learning, as well as the speed in streaming, uploading and downloading videos, photos and graphics, and the inclusion of comments using text and audio that make online conversations appear to be clear, expressive and easy as if they were conducted in a traditional classroom between classmates associated with teacher's guidance (Lai, 2020).

Mobile learning improves the level of students in Arabic and English, by using the technology of smart phone applications. Several students have already shown positive attitudes towards mobile learning. A set of results indicated that there is possibility of applying the proposed models, after testing them on the students (Chen, 2022).

The Ministry of Education added in its report that a score of studies related to the impact of the mobile education application indicated that 70% of the students use social networks in the educational process. Likewise, statistics pointed out that 45% of the students are Facebook users, and 55% of Twitter users are students too. Likewise, 30% of faculty members found that those networks are suitable for use in the educational process at universities and colleges alike. <https://www.okaz.com.sa/local/na/1661648>.

Several studies (Batmetan and Palilingan, 2018; Pombo and Marques, 2019; Chen, 2022) recommended the necessity to focus programs and training courses catered to students on the competencies of using mobile e-learning technologies and encouraging designers to provide applications offering the same, along with the necessity to hold training courses for both students and faculty members, to train them on using mobile phone applications on the Internet, with generalizing the use of smart phone applications in teaching the various courses and conducting more studies on the use of smart phone applications in learning and cooperation with design and communication companies, with the aim to develop a vision for more educational smart phone applications and to focus on electronic communication patterns in interaction and communication between learners with each other on the one hand and between them and their teachers on the other hand at any time they desire, which increases their motivation and achievement, due to their impact on the development of students' scientific thinking skills and their various skills as well. In addition, paying attention to developing courses and integrating modern technologies and electronic communication platforms and reorganizing their content, in line with the nature of the informatics and technological era, with the inclusion of the tools and patterns of electronic communication as tools for interaction and sharing between the

teacher and the learners and between the learners themselves in conducting the educational activities and tasks.

With regard to the use of the educational mobile applications in education, the role of mobile applications with regard to teaching the hearing-impaired students' category may be a catalyst for understanding the terminology and concepts of the fashion and textile specialization. The Fashion Industry Program is the only unique program in the Kingdom of Saudi Arabia with the specialization of clothing and textile which is directed to the category of female students with severe hearing impairment. Since the persons with hearing impairment are affected in their cognitive development and academic achievement as a result of the dependence of the academic and achievement aspects on linguistic development mainly; this explains the low level of academic achievement progress for the hearing-impaired students who have a tardiness in linguistic development and difficulties in understanding and linguistic expression. Accordingly, they will inevitably have a decrease in their writing and reading abilities and spoken language (Al-Hayek, 2010). Thus, the hearing-impaired students of all categories are lower than normal people in the advanced aspects of academic achievement. So, they need special educational methods that make use of their remaining senses, such as the sense of sight, taste, touch and smell (Suleiman, 2015). It is worth pointing out the results of the study of (Shaaban, 2018) which proved that there is a negative relationship between all aspects of psychological stress experienced by the hearing-impaired students and their academic achievement, in other words, the lower the level of psychological stress experienced by the hearing-impaired students, the higher their academic achievement rate.

Due to fashion and textile specialization having several and various concepts and terminology that may seem new and strange to this hearing-impaired students' category, especially at the beginning of their joining the program, it was imperative to think about an interesting and attractive learning method to enrich such concepts.

The Ministry of Education concluded its report by emphasizing that the institutional use of smart phones in the educational process is a crucial requirement and an urgent need that should be invested in aiming to improve education quality and achieve positive participation among the entire parties to the educational process.

Problem of the research

Whereby the researcher's work at the Department of Fashion and Textile, College of Human Sciences and Design, King Abdul-Aziz University, she observed that the department still uses traditional methods in the educational process for the female students with severe hearing impairment. Likewise, the used hybrid system lacks modern technology such as mobile applications for dealing with hearing-impaired patients.

The researcher also observed that there is a decrease in the concepts of fashion and textile among the female students of the fashion industry program for those with severe hearing impairment. With the aim to ascertain the problem of the research, the researcher conducted an exploratory study on a sample of the female students (7 female students) from the Department of Fashion and Textile, the Fashion Industry Program, regarding the concepts of fashion and textile. It was found through this sample that the female students lacked several concepts related to fashion and textile.

The research problem can be identified in the lack of university institutions, especially King Abdul-Aziz University, for a training system on smart phones to develop the concepts of fashion and textile among the female students with severe hearing impairment and their dependence on the traditional teaching methods, despite the wide spread of smart phone applications and the expansion of their scope of use. Therefrom, the idea of the research

emerged in the production of a training system on smart phones to develop the concepts of fashion and textile for the female students with severe hearing impairment. Accordingly, the research problem was formulated in the following main question:

Textile
concepts
for the female
students

How can a training system be built on smart phones to develop fashion and textile concepts for the female students with severe hearing impairment?

From this main question of the research, the following sub-questions are branched out:

- (1) What are the steps for building a training system on smart phones to develop concepts of fashion and textile for the female students with severe hearing impairment?
- (2) What is the effectiveness of a training system in developing concepts of fashion and textile among the female students with severe hearing impairment?

Objectives of the research

This current search aims to:

- (1) Provide a training system on smart phones to develop fashion and textile concepts for the female students with severe hearing impairment.
- (2) Determine the effectiveness of a training system in developing the concepts of fashion and textile among the female students with severe hearing impairment.

Significance of the research

The significance of this current research stems from the importance of its topic, which is related to building a training system on smart phones to develop the concepts of fashion and textile among the female students with severe hearing impairment. It may also contribute to achieving the following:

- (1) Overcoming several problems resulting from traditional learning in university institutions.
- (2) Directing university faculty members towards the use of smart phone applications in the educational process.
- (3) Providing the educational designers with a model of a training system on smart phones to develop the concepts of fashion and textile for the female students with severe hearing impairment, which can be used in the development of similar systems.
- (4) A novice addition to Arab studies that addressed the use of training systems on smart phones.

Limitations of the research

This research is limited to the following:

- (1) **Objective limitations:** This research was limited to producing a training system on smart phones and measuring its effectiveness in developing some fashion and textile concepts for the female students with severe hearing impairment.
- (2) **Spatial limitations:** This research was applied to the Department of Fashion and Textile, College of Human Sciences and Design, King Abdul-Aziz University.

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- (3) **Temporal limitations:** This research was applied in the academic year 1443 AH.

Methodology of the research

This current research used two methodologies; they are follows:

- (1) **The descriptive methodology:** It is used to analyze the category of the female students with severe hearing impairment and study their learning characteristics, analyze and address the theoretical framework of the research, build research tools, determine the appropriate statistical methods for the research and to interpret the results of the research.
- (2) **The research used the experimental methodology:** It is used to produce a training educational system on smart phones and to measure its effectiveness in developing some fashion and textile concepts for the female students with severe hearing impairment.

Variables of the research

- (1) **The independent variable:** a training system on smart phones.
- (2) **The dependent variable:** some concepts of fashion and textile for the female students with severe hearing impairment.

Tools of the research

- (1) The scale of the efficiency of the proposed training system.
- (2) A cognitive achievement test to measure the cognitive aspects related to the concepts of fashion and textile for the female students with severe hearing impairment meant to be developed.

Experimental design of the research

In light of the nature of this current research, the experimental design known as the pre-post design was relied on using two equal groups, one is the experimental group and the other is the control group, where a pre-application of the research tools (cognitive achievement test) will be conducted on the two groups (control and experimental), then conducting processing on the experimental group and presenting training content in the traditional manner for the control group. Then conducting a post-application of the research tools (cognitive achievement test) on the two groups (the control and the experimental ones).

Table 1 shows the experimental design of the research:

Sample of the research

The sample of the research consisted of (20) female students from the fashion industry program with severe hearing impairment, Department of Fashion and Textile, College of Human Sciences and Design, King Abdul-Aziz University. They were randomly divided as follows:

- (1) An experimental group comprising (10) female students.
- (2) A control group comprising (10) female students.

Hypotheses of the research

- (1) There is a positive attitude towards the efficiency of the proposed training system from the perspective of the specialists in M-learning design.
- (2) There are no statistically significant differences between the mean scores of the female students of the control group and the experimental group in the pre-measurement of the cognitive achievement test.
- (3) There are statistically significant differences between the mean scores of the female students of the control group and the experimental group in the post-measurement of the cognitive achievement test, in favor of the experimental group.
- (4) There are statistically significant differences between the mean scores of the experimental group female students in the pre and post measurements of the cognitive achievement test, in favor of the post measurement.

Statistical analysis measures

The chi-square test will be used to confirm the first hypothesis. Also use the *T*-test to ensure the validity of the rest of the hypotheses.

Terminology of the research

1. Training system on smart phones.

Training system on smart phones (M-learning) is a form of learning in which learners use mobile devices to access learning materials and resources and to participate in learning activities through wireless technology (Wu *et al.*, 2012).

2. Fashion and textile:

The art of fashion and textile design refers to the process of designing and adding aesthetic and creative touches to fashion through multiple stages, including drawing the design, selecting fabrics, taking measurements, using the computer to create designs and coping with the latest fashion attitudes.

3. Hearing Impairment:

It is a hearing loss of up to 25 decibels or more in both ears, so that the affected person becomes unable to hear with the same hearing quality as people with normal hearing. Hearing loss ranges from the mild level to the severe level, which is a term that refers to both hearing impairment and deafness (World Health Organization, 2023).

Group	Pre-measurement	Dependent variable	Post-measurement
Control Group	Cognitive achievement test application	Presenting training content in the traditional manner	Cognitive achievement test application
Experimental Group		Presenting the proposed training system	

Source(s): Table by authors

Table 1.
Experimental design of
the research

Designing the tools of the research

First -the scale of the proposed training system efficiency

The scale of the proposed training system efficiency was built on several stages, as follows:

1-Purpose of the scale: The researcher prepared the scale of the efficiency of the proposed training system in its final form, in light of the research concepts and terminology. It included (15) phrases divided into three main themes (training content - interface design - software competence) that measures the level of efficiency of the proposed training system and the arbitrators of the proposed system will answer it regarding the proposed system. The response of the scale is determined according to the triple rating (available, sometimes available, not available) on a continuous scale (1, 2, 3), (3, 2, 1) according to the direction of the phrases (positive - negative). Quantum degrees were placed for the responses of the arbitrators. The highest score was (45), while the lowest score was (15).

Validity of the scale: This current research depended on verifying the validity of the scale in two ways:

A- Validity of the content: To make sure of the validity of the content, the scale was presented in its initial form to 7 arbitrators specialized in the field of fashion and textile with the aim to get acquainted with their opinions regarding the scale in terms of the accuracy of the linguistic formulation of the scale's vocabulary, the integrity of the content, and the affiliation of the phrases included therein, and the sufficiency of the phrases contained in each theme to achieve the goal for which it was set. The arbitrators agreed (92.4%), on the validity of the scale for use. The researcher made the aforementioned amendments to the wording of some phrases and deleted some phrases; thus, the scale was subjected to the validity content.

B- The validity of the internal consistency: To calculate the validity of the internal consistency of the scale, it was applied to an exploratory sample of 7 arbitrators. After monitoring the results, they were processed statistically and the Pearson Correlation Coefficient was calculated between (the themes - and the total score), and [Table 2](#) the following table shows this:

It is evident from the previous table that the values of the correlation coefficient of the scale themes are statistically significant values at the level of significance of 0.01, which indicates the homogeneity of the scale themes and its overall score and can be used in this current research.

Reliability of the scale: The reliability coefficients for the scale were calculated using the Alpha Cronbach methodology, and the following [Table 3](#) shows this:

It is evident from the previous table that the values of the reliability coefficient (Alpha) for the dimensions and the scale as a whole are high, which confirms the reliability of the scale and its validity for application in this current research.

Second: cognitive achievement test:

In light of the general procedural objectives and the training content of the proposed system, a cognitive achievement test was designed and built. The achievement test went through the following stages in its preparation:

Scale of the efficiency of the proposed system	Number of phrases	Correlation coefficient
Training content	5	0.804*
Design interface	5	0.816*
Software competence	5	0.776*

Note(s): Significance level 0.01 **

Source(s): Table by authors

Table 2.
Correlation coefficients
of the scale of the
efficiency of the
proposed system

Determining the purpose of the test. The achievement test was prepared with the aim of measuring the achievement of a sample of the female students of the fashion industry program for those with severe hearing impairment, in the cognitive aspects related to fashion and textile to be developed, by pre and post application.

2-Determining the type of test vocabulary and formulating them. After reviewing the literature and studies that dealt with the evaluation methods and tools in general, and objective tests in particular, it was found that tests that depend on multiple choice and true and false are among the most appropriate types of achievement tests, due to their flexibility, ease of obtaining the correct answer and speed of correction, in addition to their characterization by objectivity in correction and accuracy in measurement. The type of test vocabulary was determined by the pattern of multiple test questions. Cognitive achievement test was presented with two types of media: texts; where the question was written in Arabic and was portrayed in the sign language by a sign language specialist.

In light of this, the vocabulary of the cognitive achievement test was initially formulated to cover all the cognitive aspects in the development of the proposed training system. The number of its vocabulary was (15) items comprising the multiple-choice questions and true and false questions, and they were classified as in [Table 4](#).

3-Formulating test instructions. It is a guide for the student to use so as to be able to perform the test properly, and it includes the following:

- (1) A brief introduction to the test: It should be clear, precise and brief.
- (2) Test time.
- (3) The number of test vocabulary.
- (4) The total score of the test.
- (5) How to answer multiple choice questions.

The following points were taken into account when formulating the achievement test questions:

- (1) The questions should be objective and direct.
- (2) The questions should be closely related to the objectives and content of the program.

Efficiency scale of the proposed website	Number of phrases	Coefficient alpha
Training content	5	0.901
Design interface	5	0.902
Software competence	5	0.882
Total	15	0.898

Source(s): Table by authors

Table 3.
Reliability coefficient
for the efficiency scale
of the proposed system

Question	Number of vocabulary
Multiple choice	10
Right and wrong	5

Source(s): Table by authors

Table 4.
cognitive achievement
test questions

- (3) The questions were chosen in accordance with the characteristics of the female students with hearing impairment and their weak linguistic output, which does not suit the nature of the essay questions.
- (4) Attaching several photos as the study category depends primarily on the sense of sight.
- (5) The questions were formulated in a specific, short and simplified manner to enable us to measure them objectively.

Method of correcting the test. The test includes (15) questions. The female student gets one point for each question she answers correctly, and gets zero for every question she leaves out, or answers with a wrong answer. Thus, the total score for the test is equal to the number of test vocabulary (15) degrees, and the system calculates the scores of the students, and a report is presented to the student with her name, her percentage and the time taken, as soon as she finishes answering the test questions.

Validity of the test. With the aim to determine the validity of the test, it was presented to a group of arbitrators specialized in the fashion and textile (9 professor), with the aim of obtaining their opinions regarding the following:

- (1) Comprehensive coverage of the cognitive test for each of the cognitive objectives included in the program.
- (2) Ease, clarity and accuracy of questions.
- (3) Correctness of the linguistic formulation of the questions.
- (4) Measuring the different levels of the set cognitive goals.

The researcher presented the test to the arbitrators with a table of specifications and a list of objectives. The arbitrators agreed with an agreement percentage of (94.7%) on the validity of the cognitive achievement test for use, according to the points they were questioned about. The arbitrators' remarks were about rephrasing some questions, and modifications were made, with the aim to reach the final version of the test.

Reliability for the achievement test. The reliability of the test means that it gives almost the same results if it is re-applied more than once on the same individuals under the same conditions. Alpha Cronbach method was used to calculate the reliability coefficient for the achievement test and the following [Table 5](#).

It is evident from the previous table that the values of the reliability coefficient (Alpha) are high, which confirms the reliability of the test and its validity for application.

7-Calculating the difficulty coefficients for the vocabulary of the achievement tests. The aim of calculating the difficulty coefficient for the test vocabulary is to delete the extremely easy vocabulary, which their difficulty coefficient is (0.8) or more and the infinite in difficulty, which is less than (0.2) ([Abdelbadie, 2020](#)).

By calculating the difficulty coefficient for each vocabulary of the cognitive achievement test, it was found that the least difficulty coefficient was (0.42), and the highest difficulty coefficient was (0.76). Such results are within the limits allowed for the test to accept the vocabulary and include it therein.

Table 5.
Coefficient of reliability
of the cognitive
achievement test

Number of phrases	Coefficient alpha
15	0.889
Source(s): Table by authors	

1- Calculating the discrimination coefficients for the vocabulary of the achievement test: The aim of calculating the discrimination coefficient for the vocabulary of the cognitive achievement test is (to identify the ability of each item of the test to distinguish between high performance and low performance of the members of the experiment group. The ability of the vocabulary to discriminate was calculated using the vocabulary discrimination coefficient equation, where (the ability of the item is considered non-discriminatory if its discrimination coefficient is less than 0.2).By calculating the discrimination coefficient for the test vocabulary, it was found that it ranges between (0.44:0.83), which is within the acceptable limits. As the minimum discrimination coefficient in a good test is (0.2).

After making amendments to the cognitive achievement test in light of the opinions of the arbitrators, and after verifying the validity and reliability of the test, the test was produced electronically.

Designing the proposed training system

The proposed system was developed in the light of the model of Muhammad El-Desouki (2015, pp. 189-190) because it is compatible with the educational tools and interactions that can be provided to the proposed system, as it is a comprehensive model that includes all educational design and development processes and is suitable for its application at all levels, starting with From the development of a full course or units thereof to the design of an integrated educational or training environment, it is also characterized by the interaction between all components through the processes of formative evaluation, feedback, modification and continuous improvement, and it contains a special aspect of comprehensive quality standards, and then it is considered one of the The most appropriate design models.

First: stage of study and analysis:

1 – Determining the problem: The idea emerged from defining the general objective of the research in the use of smart phones in designing a training system on smart phones to develop the concepts of fashion and textile for the female students with severe hearing impairment and a program that follows the traditional training method and measuring which is more effective in developing such concepts.

2 – Determining the requirements and capabilities that must be available: It includes studying the reality of the available resources and then determining the requirements and capabilities necessary to produce the proposed training system. This is done by identifying and preparing the programs and devices thereof and specifying the facilities, restrictions and training and administrative determinants, to produce the elements of the proposed training system.

3 – Determining the characteristics of the trainees: With the aim to ensure the success of the trainee in the training system, we must define their characteristics and capabilities as an individual. The characteristics of the trainees were determined according to the following:

(1) **Sample of the research:**

A control group comprising (10 female students), an experimental group comprising (10 female students), from the students of the fashion industry program for those with severe hearing impairment, Department of Fashion and Textile, College of Human Sciences and Design, King Abdul-Aziz University.

(2) **Variables of the research:** Not all the female students were exposed to any training content related to the research variables.

4 – *Determining the concepts of fashion and textile*:. The researcher examined and analyzed the content of fashion and textile, and the concepts to be developed through the proposed training system were identified as follows:

- (1) Terminology for drawing and design.
- (2) Terminology for knitting tools.
- (3) Terminology for clothing fabrics.
- (4) Terminology for the knitting machine.
- (5) General terminology for clothing.

5 – *Determining the training method*:. The study process for the proposed training system is conducted according to the principles of programmed learning, which is a type of training individualization, where the training process depends on the interaction between the trainee and the system, which will be presented through the Internet, whereby each trainee has an independent device (mobile) through which they can receive their training.

Second: stage of design and preparation:

1 – *Preparing the training content of the system*:. The training material was prepared by analyzing the basic tasks of fashion and textile concepts and deriving content elements from the previously identified objectives so that the content covers the objectives and achieves them thereof. The content was selected and formulated in light of the following criteria:

- (1) The content should be related to the concepts of fashion and textile.
- (2) The content takes into account the needs of the trainees and their educational capabilities.
- (3) The ability to formulate content in multimedia templates

2 – *Designing the digital content of the system*:. The concept was presented with two types of media:

- (1) **The first type**: texts; where the concept was written and defined in Arabic and English.
- (2) **The second type**: video; where the concept was portrayed and defined in the sign language by a sign language specialist.

The following principles and criteria were taken into account when designing the digital content, which will be displayed within the training system:

- (1) The design is based on the concept of the spiral approach and its dependence on the system approach philosophy based on inputs, processes, outputs and integrated and interactive feedback in building curricula.
- (2) Dependence of design on the learning process in a collective manner, or in an individual manner based on the individualization of education that is based on the idea of self-learning and taking into account the individual differences among the learners by providing a set of educational options and resources.
- (3) Dependence of design on some technical foundations in designing digital content, as follows:

- The manner the content is presented and organized is interesting.

- The content should be based on electronic tools and multimedia.

3 – *Choosing the surfing style*: The proposed training system was based on the branching design. Branching within the system means its ability to move forward, backward, or go to any point in the program based on the request of the user.

Third: the stage of coding and programming:

4 – *Designing the interaction interfaces of the training system*:

The basic principle when designing the interaction interface is simplicity and not to overdo it in decoration with the aim not to lose its training objectives, as well as taking into account the spots of media elements such as text, video, images, etc., when designing, so that such elements appear on the screen in an organized manner.

5 – *Producing and programming the elements of the training system*:

The researcher used a set of programs to build the elements of the smart educational system, as follows:

- (1) Flutter; A programming language used to design mobile applications.
- (2) MySQL: Structured Query Language, used to design and build system databases.

6 – *Linking the system on the internet*:

The proposed training system was uploaded to Google Play Store at the following link:

<https://play.google.com/store/apps/details?id=com.nouf.projects.clothingtermsdesign>.

Table 6 shows some samples of the application screens:

Results of the research:

1 – *Results related to the first hypothesis*:

The first hypothesis states that: “There is a positive attitude towards the efficiency of the proposed training system from the viewpoint of the specialists in M-learning design to develop the concepts of fashion and textile among the female students with severe hearing impairment”.

With the aim to validate the hypothesis statistically, Chi-Square test was used. Tables 7, 8 and –9 show Chi-Square values for the frequencies of experts and specialists’ responses their number is 7 to the questionnaire items for evaluating the proposed system.

It is evident from the previous table that there are statistically significant differences between the options (available - sometimes available - not available) to formulate standard phrases (training content) in favor of the option (available) in the entire phrases. This indicates the extent of high agreement among the arbitrators regarding.

It is evident from the previous table that there are statistically significant differences between the options (available - sometimes available - not available) to formulate the phrases of the (Interface design) criterion, in favor of the option (available) in the entire phrases. This indicates the extent of high agreement among the arbitrators regarding the quality of the (interface design) criterion.

It is evident from the previous table that there are statistically significant differences between the options (available - sometimes available - not available) to formulate the phrases of the (programming competency) criterion, in favor of the option (available) in the entire phrases. This indicates the high level of agreement among the arbitrators regarding the quality of the (programming competency) criterion.

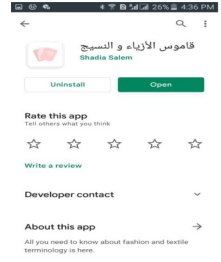
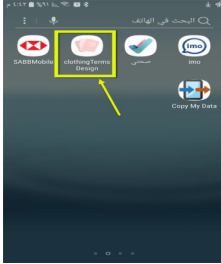





Description	Webpage
<p>The main page of the application on Google Play Store, and it contains the following lists: • “Install” button: to install the application on the mobile phone. • “Uninstall” button: to uninstall the application from the mobile phone. • “Open” button: to open the application after installing it on the mobile</p>	 <p>The main page of the application on Google Play Store</p>
<p>Shows the shape of the application icon after installation on the mobile, and the application is launched by simply clicking on the application icon</p>	 <p>application icon</p>
<p>The main screen of the application after opening the application, the main categories of fashion design appear</p> <p>An image expressing the main classification of fashion design concepts, below which is the name of the classification. To access the classification, click on the image or design name</p>	 <p>Application home screen</p>
<p>The main screen of the classification after accessing the classification, the main concepts of the chosen classification appear.</p> <p>To access the concept, click on the concept name</p>	 <p>Classification home screen</p>

Table 6.
Examples of the proposed application screens

(continued)

Description	Webpage
<p>The main screen of the concept after accessing it. The name of the concept appears in Arabic and English, and under each of them is the definition of the concept</p>	 <p style="text-align: center;">Concept screen</p>
<p>A video clip is shown to illustrate and define the concept in the sign language</p>	 <p style="text-align: center;">Sign language video screen</p>
<p>A screen about the application, showing the message, and an introductory profile of the researcher and the work team for the proposed application</p>	 <p style="text-align: center;">A screen about the application</p>

Source(s): Table by authors

Table 6.

It is also evident from the previous tables that all the values of Ka^2 were significant at the level of (0.05), which confirms the agreement of the arbitrators on the availability of all the necessary specifications in the training system on smart phones to develop the concepts of fashion and textile among the female students with severe hearing impairment and its usability and its applicability. **Thus, the first hypothesis is accomplished.**

Results related to the second hypothesis:

The hypothesis states that: “There are no statistically significant differences between the mean scores of the female students of the control group and the experimental group in the pre-measurement of the cognitive achievement test.”

With the aim to verify the validity of this hypothesis, the researcher used the (Mann-Whitney) test for the control group and the experimental group, for the non-parametric statistics, in the pre-measurement of the achievement test.

The following table shows these results:

It is evident from the results shown in [Table 10](#) that there are no statistically significant differences between the mean scores of the female students of the control group and the experimental group in the pre-measurement of the achievement test, where the calculated "U" value was (44), which is a non-significant value, and this result indicates the homogeneity of the sample. **Thus, the second hypothesis is completely accomplished.**

Table 7.
ka² values for the frequencies of the arbitrators' response to the (training content) criterion

Phrase number	Available		Sometimes available		Unavailable		ka ²
	#	%	#	%	#	%	
1	6	85.71%	1	14.29%	–	–	8.86*
2	7	100%	–	–	–	–	14*
3	7	100%	–	–	–	–	14*
4	5	71.43%	2	28.75%	–	–	5.43*
5	6	85.71%	1	14.29%	–	–	8.86*

Note(s): * 0.05 level – degree of freedom 2
Source(s): Table by authors

Table 8.
ka² values for the frequencies of the arbitrators' response to the (design interface) criterion

Phrase number	Available		Sometimes available		Unavailable		ka ²
	#	%	#	%	#	%	
1	6	85.71%	1	14.29%	–	–	8.86*
2	7	100%	–	–	–	–	14*
3	6	85.71%	1	14.29%	–	–	8.86*
4	7	100%	–	–	–	–	14*
5	7	100%	–	–	–	–	14*

Note(s): * 0.05 level - degree of freedom 2
Source(s): Table by authors

Table 9.
ka² values for the frequencies of the arbitrators' response to the (programming proficiency) criterion

Phrase number	Available		Sometimes available		Unavailable		ka ²
	#	%	#	%	#	%	
1	7	100%	–	–	–	–	14*
2	7	100%	–	–	–	–	14*
3	6	85.71%	1	14.29%	–	–	8.86*
4	7	100%	–	–	–	–	14*
5	6	85.71%	1	14.29%	–	–	8.86*

Note(s): 0.05 level – degree of freedom 2
Source(s): Table by authors

The results related to the third hypothesis:

The hypothesis states that: "There are statistically significant differences between the mean scores of the female students of the control group and the experimental group in the post-measurement of the cognitive achievement test in favor of the experimental group."

With the aim to validate this hypothesis, the researcher used the (Mann-Whitney) test for the control group and the experimental group, for the non-parametric statistics, in the post-measurement of the achievement test. [Table 11](#) shows these results:

It is evident from the results of the previous table that there are statistically significant differences at the level of (0.05) between the mean scores of the female students of the control group and the experimental group in the post-measurement of the achievement test, where the calculated (U) value was (0.000), which is statistically significant at the level of (0.05), in favor of the experimental group, where the arithmetic mean was (14.2), which is the largest mean. This result indicates that the proposed training system helped to improve the level of the female students of the experimental group in the concepts related to fashion and textile for the female students with severe hearing impairment. **Thus, the third hypothesis is completely accomplished.**

The results related to the fourth hypothesis:

The hypothesis states that: "There are statistically significant differences between the mean scores of the experimental group female students in the pre and post measurements of the cognitive achievement test, in favor of the post measurement."

With the aim to validate this hypothesis, the researcher used the (Wilcoxon) test for the related groups in the case of the non-parametric statistics, then calculated the mean and standard deviation of the scores of the control group female students in the pre and post applications of the achievement test and calculated the (Wilcoxon) value, as shown in [Tables 12 and 13](#) as follows:

It is evident from the results of the previous table that there are statistically significant differences at the level of (0.05) between the mean scores of the experimental group female students in the pre and post measurements of the achievement test, in favor of the post measurement, where the calculated (z) value was (-2.831), which is statistically significant at the level of (0.05), in favor of the post-test, where the mean was (14.2), which is the largest mean. This result indicates that the proposed training system helped to improve the level of

Group	Number	Mean	Standard deviation	Rank average	Rank aggregate	(U) Value	Significance level
Control(pre)	10	3.8	1.033	11.1	111	44	0.636
Experimental (pre)	10	3.6	0.966	9.9	99		Non-significant

Source(s): Table by authors

Table 10. Mann-Whitney (U) test results for the second hypothesis

Group	Number	Mean	Standard deviation	Rank average	Rank aggregate	(U) Value	Significance level
Control(post)	10	6.9	0.876	5.5	55	0.000	<0.001
Experimental (post)	10	14.2	0.919	15.5	155		significant

Source(s): Table by authors

Table 11. Mann-Whitney (U) test results for the third hypothesis

the female students of the experimental group in the concepts related to fashion and textile for the female students with severe hearing impairment. **Thus, the fourth hypothesis is completely accomplished.**

6 – The effectiveness of the proposed training system:

The effectiveness of the system means the percentage of the female students in the experimental group who achieved the required level of learning for each objective of the system, through their scores on the achievement test. With the aim to measure the effectiveness of the system, the researcher used Black’s modified gain equation. Black determines this percentage between (1-2) so that there is an acceptable effectiveness of the system.

Table 14 shows the calculation of Black’s modified gain percentage for the achievement test.

It is evident from the previous table that the percentage of the modified gain for Black is (1.64), which is between the percentage set by Black, as it indicates the high percentage of the female students who benefited and achieved the required level, which in turn confirms the effectiveness of the proposed system related to the field of research.

Recommendations of the research:

In light of the research results, their discussion and their interpretation, the researcher recommends a set of recommendations, as follows:

- (1) Using the smart phone applications in developing the training systems.
- (2) Paying attention to the cloud computing infrastructure and providing the universities with the internet services.

Table 12.
Results of the descriptive statistics for the fourth hypothesis, n = 10

Group	Mean	Standard deviation
Experimental (pre)	3.6	0.966
Experimental (post)	14.2	0.919

Source(s): Table by authors

Table 13.
Value of (z) and its statistical significance for the differences between the pre and post measurement of the experimental group n = 10

Ranks	Ranks number	Ranks mean	Ranks aggregate	Value of (z)	Significance level
Negative	zero	zero	Zero	<i>-2.831</i>	<i>0.005</i>
Positive	10	5.5	55		

Note(s): The italicised values indicate the average differences between pre and post measurement. This favors post measurement resulting in higher scores
Source(s): Table by authors

Table 14.
Calculating the modified gain percentage for the achievement test

Pre application	Post application	Total score	Modified gain
3.6	14.20	15	1.64

Source(s): Table by authors

-
- (3) Applying the proposed system to other training packages.

Conclusions

In this paper, developing a training system on smart phones to develop fashion and textile concepts for the female students with severe hearing impairment and then to determine the effectiveness of the training system in developing fashion and textile concepts among the female students with severe hearing impairment.

The results showed the effectiveness of using mobile reminder tools in organizing learners' information and inquiries related to the learning premises, in addition to having a positive impact on the development of critical thinking skills. The results also showed an increase in the level of learning among the students who used mobile phones and their applications, with the necessity of providing electronic curricula and training for teachers and students on the use of smart phone applications in learning, as one of the requirements of mobile learning while ensuring providing an effective and robust internet network that helps facilitate learning processes.

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Corresponding author

Shadia Salah Salem can be contacted at: sssalem@kau.edu.sa