Development Web-based Arabic Assessments for Deaf and Hard-of-Hearing Students

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Summary
Arabic skills are the tools by which children are prepared for the educational procedures on which their life depends. Deaf and hard of hearing students (DHH), must be able to grasp the same Arabic terms as hearing students and their different meanings in a context of different sentences less than what they are supposed to be due to their inability. However, problems arise in the same Arabic word and their different meanings in a context for (DHH) students since the way of comprehending such words does not meet the needs and circumstances of (DHH) students. Therefore, researchers introduce web-based method for Arabic words and their meanings in a context prototype that can overcome those problems. Methodology: The study sample consists of 30 (DHH) students at Al Amal City of Palestine, Gaza Region (GR). Those participants that agreed to take part in this study were recruited using a purposeful sampling method. Additionally, to examine the survey information descriptively, the Statistical Packages for social Sciences (SPSS) version 24.0 was used. A sign language teaching movie is utilized in the prototype to standardize the process and verify that Arabic vocabulary and their implications are comprehended. The Evolutionary Process Model of Prototype technique was utilized to create this system. Finding: The findings of this study show that the prototype built is workable and has the ability to help DHHS differentiate between phrases that have the same letters but distinct meanings. The findings of this study are expected to contribute to a better understanding and application of Development of Web-based Arabic Assessments for (DHH) Students in developing countries, which will help to increase the use of Development of Web-based Arabic for (HDD) students in those countries. The empirical models of Web-based Arabic for (DHH) students are established as a proof of concept for the proposed model. The results of this study are predicted to have a significant impact to the information system practitioners and to the body of knowledge.

Keywords:
Deaf and Hard of Hearing (DHH), Special Educational Needs (SENs).

1. Introduction

The (DHH) constitute a distinct diverse community with their own language and culture in our society. It is fascinating enough to devote research to this topic because the individuals within this group share several distinct characteristics that distinguish them from hearing persons. There are still some unsolved questions about deaf people's cognitive processes and learning styles that need to be investigated further. DHH students have found it difficult to learn a spoken language because of the vague and unclear conclusions. There has been a lot of interest in exploring the integration of DHH students and other groupings with special educational needs over the previous two decades (SEN). It's critical to clarify the distinction between the terms 'Deaf' and 'deaf.' When the word 'deaf' is capitalized, it refers to those who are severely or completely deaf and communicate primarily using sign language, whereas 'deaf' with a small 'd' refers to people who have mild to moderate hearing loss and can communicate using a complete communication or oral method [1].

The difference, according to [2], is that the former idea symbolizes a Deaf community with common values, perspectives, and history, as well as a Deaf community whose primary language is sign language. After visiting DHH schools and meeting teachers from Al Amal City for Ability Development, a Palestinian Red Crescent Society-funded program (PRCS)

President Yasser Arafat opened the Al Amal City for Ability Development in 1996. It consists of the following parts:

- Ability Development College: The Ministry of Higher Education has accredited this University College. It is the only college in Gaza that offers a bachelor's degree in special education and rehabilitation for people with disabilities.
- A Rehabilitation Center: The goal of this center is to integrate disabled people into the community by increasing their abilities, designing general and rehabilitation curricula based on their requirements, and promoting their talents through participation in events, activities, and summer

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camps. Its goal is to improve collective work, integration and leadership as well as network and coordinate with relevant organizations and ministries to assist disabled people in obtaining their rights and finding suitable employment prospects. Persons with exceptional needs can get rehabilitation, therapeutic, and psychological treatments at the Center. There are various portions in it, including:

- For children under the age of five, there is a kindergarten and a nursery.
- A PRCS school is for students in grades from one to twelve. A section for hearing-impaired students and another for youngsters with learning disabilities are also available at the school.
- For children with mental problems, there is a Special Education Center.
- Home Enrichment Program: This program provides at-home services to those with serious mental illnesses.
- Production workshops: Embroidery, bamboo, frame, tailoring, and carpet workshops are among them.
- Therapeutic services: social and psychological professionals, as well as speech physiotherapists and therapists, provide therapeutic services in a variety of sectors.
- A variety of activities are available, including computer, music, painting, gaming, arts, libraries, choir, and a popular dance (dabkeh) group for the deaf.
- Open Studio: It provides rehabilitation services to the local community with the goal of assisting children in developing their imagination and expressing their thoughts through expressive story-telling, puppet shows, silent theatrical plays, drawing, and drama exercises.

There is a part for hearing challenged students and another for children with learning disabilities at a PRCS' School. Students in grades 1 to 12 are divided into two groups: first, those who are deaf, and second, those who are hard of hearing.

A word that shares the same written form as another word but has a different meaning called Homographs. Multiplicity of word meanings in Arabic language means that there is one word which has several different meanings. This is not a problem, because this issue is not in Arabic language only but in all the languages of the world. This group of Arabic words has different meanings for example:

- رأيت قط جميل.
- ما رأيته قط.

Sentences above have the same word "قط", but different meanings. DHH students have a problem in differentiating between the meanings of the same word in two sentences [1].

2. Research Background

The purpose of this paper's research is to describe and explain the background of significant concerns.

2.1 Technology-Enhanced Learning for the Deaf and Hard of Hearing

Information and communication technology (ICT) offers numerous benefits in a variety of fields. The importance of using ICT and incorporating it into the assessment of the deaf and hard of hearing has received a lot of attention from researchers. In terms of application, technologies have been employed and explored in relation to (DHH) learner, including the usage of web-based techniques [3].

2.1.1 Web-based

The advantages of using the world wide web for a variety of purposes with the having heard had been adopted in a variety of ways and regions. There are applications in training, learning, and education, as well as sign language-based networking sites [4].

In [5] proposed valuable e-learning applications that aim to facilitate the education of users worldwide. There is an urgent need to improve e-learning available to (DHH) people. This could make teaching and learning easier for both (DHH) teachers. The authors proposed an e-learning system that provides correspondence Arabic text in the language learning environment signal. The main purpose of the e-learning system is to ensure that deaf persons have equitable right to education.

A tool based on [6] research shows that using e-learning systems enables alternate methods of instruction to those utilized in traditional classrooms. Deaf people utilized an interactive e-learning environment to increase their computer literacy in the study reported in this article. The educational management system, which incorporates a sign language model, video streaming, and subtitles, is used to create these courses. There are numerous ways to adapt to e-learning for the deaf, and one of them should be the

creation of new standards for downloading and viewing video material. This can be shown in the case of the European (ECDL) course. With 116 participants, 22 of whom were deaf or hard of hearing, e-learning sessions for the target population were determined to be relevant and appropriate using both forms of assessment.

On the examples of social networking sites, in [7] demonstrated how to improve accessibility for DHH users (SNSs). The authors created a methodology for investigating the views and attitudes of DHH users of social networking sites (SNSs). Three identity-relevant aspects are included in the model: (1) membership in web - based Deaf communities, (2) communication affinity/preferences for sign and/or written language, and (3) the stigma connected with hearing loss.

A questionnaire was created based on these factors and used in a study with 46 participants. The findings demonstrated that motivation to communicate on SNSs is linked to involvement with electronic Deaf communities, an affinity for written language communication, and an affinity/preference for sign language communication. Reading comprehension abilities, which are important for written communication, are linked to fewer stigmatizing experiences with hearing loss. This study's approach and conclusions can be utilized to better understand DHH users' online social interactions and for educational reasons.

The high expense of captioning and transcribing services, according to [8] is a key barrier to delivering subtitles for Internet media. Furthermore, the article discusses two researches on multimedia accessibility for Internet users who were born deaf or turned deaf at a young age. An initial study was conducted to determine the top priorities for improving deaf accessibility. A total of 20 deaf and hard-of-hearing people were interviewed through videophone regarding their Internet use and the most annoying concerns. The most popular issue was dissatisfaction with the lack of internet news accessible. In the second study, 95 (DHH) participants graded various caption styles, many of which were generated using automatic speech recognition. The results of the second study show that captioning online videos improves deaf individuals' access to the Internet, even when the captions are generated automatically. Color-coded captions used to show confidence levels, on the other hand, were determined to be neither helpful nor harmful.

2.1.2 Sign Language Video

Many scolars from all over the world have employed sign language videos in internet sites or browser applications to help the Department of Health and Human Services explore and acquire data for the project or internet application. Adding sign language movies to text links enhances Deaf Signers' Web search effectiveness, according to [9] and [10] created an interactive website that offers users with smoking cessation material in American Sign Language.

A standardization of evaluation approach in sign language video will be used to confirm that non-bias assessment can be developed in our prototype. As a result, both parents and teachers who do not know sign language can use the sign language videos to assist the DHHS in comprehending the assessment tasks. Educators and parents can play the video again and again if the DHHS still do not comprehend the questions. The assessment method will be less exhausting for teachers and parents if done this manner rather than the conventional method, which requires a teacher who knows sign language to repeatedly convey the questions in sign language.

As the use of sign language will contribute significantly to the web-based evaluation, sign language videos will be incorporated to each direction in our prototype in this study.

2.2 The Use of Technology Importance

In [11] help deaf persons improve their social interaction and communication skills. Environment is a customized learning material system for teaching and learning sign language that generates multimedia courses. Deaf students can use these courses to study (or e-learn) sign language and hearing individuals can use them to converse with deaf people. These learning environments primarily use a web-based sign language interpreter.

In [12] recommended using 3D animated interactive software to help deaf youngsters improve their math and science ideas. To quantify the interface attractiveness, SMILE is evaluated in three ways: expert panel-based, formative, and summative. The authors conducted this study on 16 deaf pupils between the ages of 6 and 11. There were no issue effects in the interface comparisons; however an animated interface contributed in a faster task completion time when compared to static interfaces with and without sound and highlighting. Numerous features that influence software design are identified in the research.

2.3 Usability Testing

Usability is defined as " "The degree with which a concept may be employed by specific users to fulfill stated objectives in some kind of a defined environment with usefulness, accuracy, and satisfaction", according to the International Organization for Standardization (ISO) (1998: 2). The components of enjoyment, efficiency, and efficiency of the customer experience in interacting with an app are included in this definition. Standard ISO/IEC 1998 defines satisfaction as “how easy it is to meet functional

requirements while completing a task," efficiency as "the reliability of task execution," and effectiveness “defined as degree of accuracy and completeness with which tasks are completed"

A number of specialists have come up with comparable definitions for the phrase usability testing. Usability testing, according to [13], is "the process of evaluating the degree to which a product meets specified usability requirements using volunteers who are typical of the target community." Usability testing, according to [14], is "the way of learning about a product's usability from users by watching them use it." According to the literature, usability testing is defined as the observation of reflective user's interaction with a product.

3. Research Problem

Technology now plays a vital role in everyone's lives. The majority of people's daily activities, including web browsing, are reliant on technology. The internet isn't only for regular folks. Everyone, including individuals with disabilities, should be able to grasp the benefits of the internet. The benefits of utilizing the internet for various purposes with the deaf have been utilized in a variety of methods and regions. There are applications in teaching, learning, and education, as well as sign language-based online communication [4], [15], [16] and [17] found that using a web-based assessment system in team-taught courses is a far more efficient approach to conduct lecturer evaluations than using paper.

In [18] looked into how new technology can be used to offer online classes to university students who are (DHH), or hearing normal. They used Saba Centra software as the online resource for the synchronous presentation of curriculum, which also included Power point presentation recorded lectures, text chat options, and sign language-interpreted video. [19] built an online platform that gives users with information about quitting smoking in American Sign Language. According to [20]'s findings, (DHH) adolescents are more encouraged to utilize the internet than their hearing classmates. These studies have already demonstrated that hearing impaired people can benefit from the internet.

As many researchers successfully developed applications/software, as well as some scholars have even applied the benefits of utilizing the online services for various purposes for DHH students, the idea of developing software with web-based implementation in order to achieve a better e-Learning system than the latest traditional style has been brought to researchers' attention. As we mentioned above that the main problem faced the DHH students are homographs. There is currently a lack of research focus in promoting the same term with different meaning in Arabic language for DHH students.

4. Research Methodology

To produce a good system in a timely manner, a structured developing the system technique and discipline should be used. The method used to construct this system was prototyping. The process of prototyping is the creation of a workable system of a system [21]. This sample version is referred to as a prototype. Because the aim had already been specified, but the particular input, process, and production requirements were unclear at the time of the study, this model was chosen. Prototypes allow software developers and consumers to test products to determine whether it satisfies specified their requirements.

The communication phase is followed by fast modeling design, prototype production, and lastly deployment, delivery, and feedback. The Evolutionary Process Model - Prototype is depicted in Figure 1.

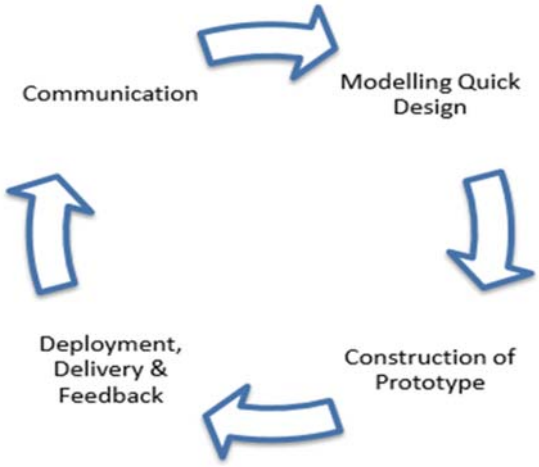

Fig. 1 Evolutionary process model - prototype (pressman 2004)

5. User Interface

This section including: Administrator Interfaces, Administrator Home Page, Administrator Courses List, Add Courses, Course Classification, add class, Exam management, Multiple choice questions and True/False questions as following:

5.1 ADMINISTRATOR INTERFACES

Fig. 2 Administrator home page

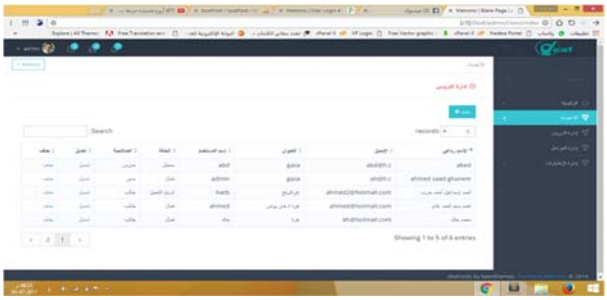

Fig. 3 Administrator courses list

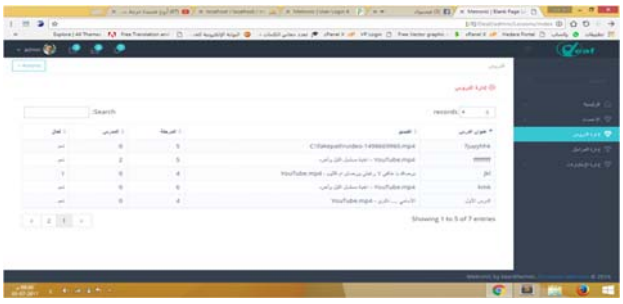

Fig. 4 Add courses

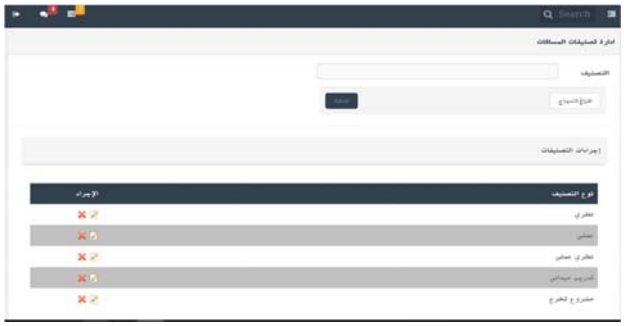

Fig. 5 Course classification

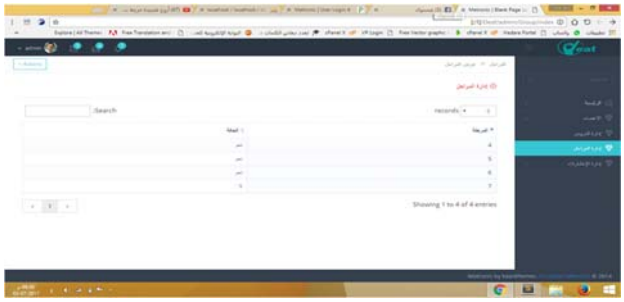

Fig. 6 Add class

Fig. 7 Exam management

Fig. 8 Multiple choice questions

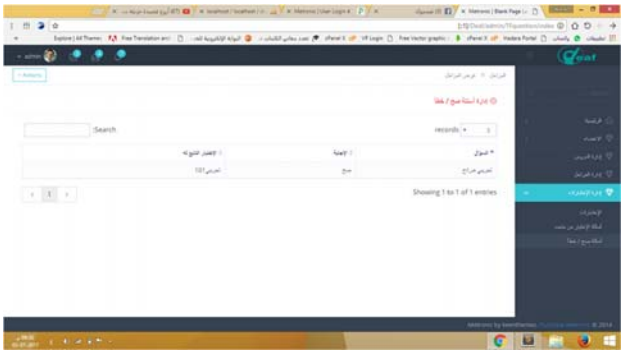

Fig. 9 True/false questions

6. Research Finding

The measuring model's reliability, convergent validity, and discriminating validity can all be evaluated. Particularly, the term "reliability" focuses on the internal consistency of a system.

6.1 Respondents

Table 1: characteristics of the Sample

Measure	*Frequency (%)*	*Percentage (%)*
Gender		
Male	22	73.3%
Female	8	26.7%
Age		
<10	18	60.0%
11-12	12	40.0%
Educational level		
KG1 Level	10	33.3%
KG2 Level	9	30.0%
Primary Level	11	36.7%
Total	30	100%

Overall, the first step of the evaluation revealed that our prototype is useful and that teachers are pleased with it. For 28 of the 29 items, the minimum mean is 4.33. The mean of 0 tem is 3.67. The average for the item which state that : " This system satisfies me. " is 4.83, putting it in the High category. All 29 entries have a cronbach's alpha of 0.975, according to the results of the reliability test analysis. DHH and teachers Students have a solid understanding of computers and sign language. Table 1.2 indicates that the average range of Understanding Factors in the Background is 3.67 to 6, with average of 5.03, putting it among High group.

Table 2: Knowledge background factor

Item	*Mean*
I enjoy working with computers.	6
I understand how to operate a computer.	5.67
I can communicate via sign language.	4.5
My students are enthusiastic about utilizing the computer.	5.33
My students understand how to operate a computer.	3.67
My students are able to communicate through sign language.	4.33
My students can understand a lot more with the use of sign language.	5.67
Average Score	5.03

Our prototype is practical, according to the findings. Table 3 demonstrates that the average range of the system usage Factor is 4.33 to 5.33, with an average score of 4.86, putting it in the High group.

Table 3: System use Factor

Item	*Mean*
Generally, I'm happy with how easy this system is to use.	5.00
This technique seemed straightforward to use.	4.83
I would efficiently assist my student through the evaluation process using this technique.	4.83
The auto marking benefit of this software is simple to use and effective.	5.00
This system's automatic marking feature allows me to mark more quickly and accurately more effective.	5.33
This system's sign language video makes it easier for me to convey the assessment direction to my learner.	5.00
This system makes me feel at ease.	4.83
It was simple to learn how to operate this device.	4.83
My students' interest in answering evaluation questions is piqued by the system.	4.67
This technique has the potential to increase my learners' motivation to complete evaluation questions.	4.67
This system makes my pupils feel at ease and delighted.	4.50
Average Score	4.86

The findings show that our prototype's interface quality is satisfactory. According to Table 1.4, the typical value of Design Feature is from 4.33 to 4.50, with an average of 4.38 putting it in the Moderate group.

Table 4: Factor of Design

Item	*Mean*
This system has a lovely user interface.	4.33
This system's interface is one of my favorites.	4.50
This system provides all of the features and capabilities that I had hoped for.	4.33
Average Score	4.38

6.2 Factor Evaluation (Validity Assessment)

Factor analysis, according to [22], is a generic term for a collection of methodologies whose primary goal is to characterize the underlying mechanism of a data matrix. The goal of factor analysis is to find the underlying variables, or factors, that describe the pattern of correlations among a set of observed data. In data reduction, factor analysis is frequently used to determine a small number of factors that describe the majority of the observed variation in a large number of manifest variables. Factor analysis, according according to [23], differs from many other data analysis techniques in that it is not intended to test

hypotheses or discover whether one group is statistically different from another.

Table 5: Result of construct assessment

Constructs	*Items*	*Factor loading*	*Mean ± SD*	*CR*	*Cronbach's α*	*AVE*
System Usefulness (SYSUSE)	SYSUSE1	0.787	3.815 ± 0.926	0.928	0.815	0.521
	SYSUSE2	0.786	3.816 ± 0.921			
	SYSUSE3	0.787	3.817 ±0.936			
	SYSUSE4	0.785	3.715 ± 0.826			
	SYSUSE5	0.784	3.712±0.976			
	SYSUSE6	0.883	3.855±0.926			
	SYSUSE7	0.874	3.813±0.928			
	SYSUSE8	0.812	3.815±0.922			
Information Quality (INFOQUAL)	INFOQUAL1	0.882	3.686±1.081	0.784	0.865	0.621
	INFOQUAL2	0.881	3.676±1.031			
	INFOQUAL3	0.883	3.688±1.019			
	INFOQUAL4	0.874	3.686±1.068			
	INFOQUAL5	0.754	3.971±0.972			
	INFOQUAL6	0.712	3.713±0.822			
	INFOQUAL7	0.796	3.715±0.971			
	INFOQUAL8	0.857	3.855±0.926			
	INFOQUAL9	0.841	3.687±1.083			
Interface Quality	IQ1	0.784	3.886±1.031	0.897	0.874	0.638
	IQ2	0.886	3.646±1.071			
	IQ3	0.787	3.623±1.021			
	IQ4	0.789	3.671±1.052			
	IQ5	0.885	3.685±1.067			
	IQ6	0.812	3.815±0.922			
	IQ7	0.873	3.716±0.931			
Intention To Use	ITU1	0.783	3.972±0.971	0.814	0.981	0.576
	ITU2	0.882	3.712±0.825			
	ITU3	0.784	3.713±0.974			

The prototype is useful and the teachers are satisfied, according to the results of the step of assessment at Center Al Salam of Education, Refah, with Arabic teacher's language and two levels of DHHS students. The prototype is easier to use, and the teachers are satisfied. The results of the evaluation phase indicate that the prototype is useful and has the ability to assist the DHHS in obtaining a systematic and comprehensive assessment of homographs in Arabic.

7. Research Contributions

As a result of the research, several conclusions emerge. Contributions such as empirical, theoretical, and practical contributions are included in these implications.

7.1 Methodological issues

The methodology, hypotheses, and measurement instruments established in the analytical section of this study provide a clear picture of the research's design and layout. In this study, the combination of the survey questionnaire and prototype design has been thoroughly and clearly presented. This study also justifies the decision to use the techniques chosen for this study's completion. The structural model was also validated using structural equation modeling (SEM). This work adds to the advancement of SEM research in the subject of technological adoption.

7.2 Practical contribution

However, four influencing elements of Improvement of Web-based Arabic Assessment for (DHH) Students have been discovered in this research was based on the level of analysis and the amount of adoption of technology in developing nations. These include the three elements described above, which have been changed to fit the unity of purpose of this study, as well as an additional variable, System Usability (SYSUSE). System Usefulness (SYSUSE) is thought to have a significant impact on the adoption of Web-based Arabic Assessments for (DHH) Students in underdeveloped nations, making it critical to this study.

In the instance of the adoption of Development of Web-based Arabic Assessments for (DHH) Students, the term of culture refers to the complex values that consumers have gathered through personal experiences [24]. Lack of trust by Deaf and Hard of Hearing Students is increasingly affecting the adoption of Web-based Arabic Assessments; Hacking has been all too common in recent years, and the fear of being hacked can deter consumers from conducting online assessments (IBM Corporation 1993). Only when students are confident enough to disclose their personal information and they will freely interact and take full benefit of Web-based Arabic Assessments possibilities if they trust that the information they offer will be treated properly and secured with sound privacy protection. There is a risk involved in the quality of the product that the students are assessing in Web-based Arabic Assessments, which has a dramatic impact on its acceptance.

8. Research Limitations

This study makes significant contributions in several domains; yet, as described in this part, there are still some limitations that need to be noted.

- Hard of Hearing and Deaf People The students that took part in this study came from a variety of universities. As a result, students who participate in open or online evaluations should be included so that a more thorough study may be conducted based on the type of education, whether traditional or open.
- Since the proposed model was tested using the Statistical Package for the Social Sciences (SPSS), model accuracy may be a concern. As a result, the researcher recommends that future studies use the Structural Equation Modelling (SEM) technique to obtain a more accurate model. This could contribute to the existing body of knowledge.

Despite these limitations, the researcher expects that the research has fulfilled its objectives and offered great understanding of the field of Web-based Arabic Assessments for (DHH) Students and Information Systems, particularly the relations between System Usefulness (SYSUSE), factors and Information Quality (INFOQUAL), and Interface Quality on the students' intention to use Web-based Arabic Assessments.

9. Conclusion

Web-based Arabic exams are an intriguing technique of evaluation. Furthermore, in the context of higher education, these have emerged as a new critical platform. In light of this, the current study looked into the requirements for Web-based Arabic uptake in a higher education setting. The factors impacting adoption were numerically measured and analyzed in this work, which used a quantitative research methodology. The results of this study were compiled using survey questionnaires.

The goal of the analysis was to see if the Development of Web-based Arabic Assessments for Deaf and Hard of Hearing Students was possible. Homograph in Arabic language as any other languages in the world, in this project, we cover the appropriate solution for homograph in Arabic language.by proposed a web-based application and evaluate the application in both teachers and students to found that our prototype was enhance the understanding of homograph of DHHS. The goal of this research is to create a web-based Arabic Assessment prototype for DHHS and assess its effectiveness. Some difficulties faced us in the first's phases in research such as lack of cooperation from Institutions of the Deaf and the Hard of Hearing. The findings of this study reveal that a variety of factors influence behavior intention to utilize a web-based Arabic Assessment prototype for DHHS in a higher education setting, indeed, DHHS's web-based Arabic Assessment prototype represents the future of education. This system, as seen by its features, has the ability to keep up with the rapid expansion of information technology. Furthermore, mobile wireless technology use in higher education will continue to grow, and it will be the learning environment of the future. This is consistent with several studies that employ technology to help children with special needs [25-27].

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