

# Internationalisation and Localisation of a Wireless Response System for the Arabic Language

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**Abstract-** This paper presents the internationalization and localization of a Wireless Response System for the Arabic language. It outlines the reasons why Arabic was selected as the first language for localization. It states the methods selected for localization and why they were selected. The Arabic interface was tested using native Arabic speakers and the results and analyses of these tests are presented. The paper concludes with an examination of the future work required to improve the Wireless Response System, for people who use Arabic. This work will facilitate future localization of Wireless Response System into other languages.

**Keywords-** Arabic Language Translation; Internationalization; localization; M-Learning; Wireless Response System (WRS)

## I. INTRODUCTION

The Internet and computer technologies are changing the way teaching and learning are taking place [1]. Software and hardware technology are facilitating new ways of delivering education and testing students. This brings with it significant changes to the process of education, by making learning faster, cheaper and more interactive [2].

These changes are becoming more and more evident in the Arabic speaking countries. The adoption of new technologies requires new software tools to support them and the Wireless Response System (henceforth WRS) is one example of a software that can facilitate this change [3]. The WRS is a Mobile Learning (M-learning) technology which does not currently support the Arabic language. This paper presents the work done to solve this limitation and discusses the localization of the WRS for the Arabic language.

The WRS was developed using Adobe® AIR® runtime and Action Script® with Adobe Flash Builder 4.6. This enables it to run on a range of desktops, smart phones and tablets while using a client server configuration, as shown in Figure 1 below. The Web Server is Apache with (state PHP in full) PHP and a MySQL Database.

In the rest of this paper we introduce the WRS and place internationalization in context. We then discuss M-learning in the Arabic speaking world and present the methods used to create the Arabic interface for the WRS. Finally, we present the results of our tests of the WRS by Arabic speaking users.

## II. WIRELES RESPONSE SYSTEM (WRS)

The Wireless Response System (WRS) is an M-learning application. It enables the use, of mobile devices to respond and give feedback and in so doing, enhances the student and teacher interaction. M-learning is defined as Learning across multiple contexts, through social and content interaction, using personal electronic devices [4]. The XML Database and Information Retrieval (XDIR) research group at the University of Huddersfield [5] developed the WRS.

The WRS, like many M-learning applications, is a technology that is used in a wide range of platforms [6] including: PC's, Laptops, Tablets, and Smart Phones; this makes it convenient because it is accessible from virtually anywhere in the world. This technology only requires the user to have access to the internet and a suitable device and therefore offers a very interactive learning experience [7]. As it is portable and highly responsive for instructors and their students, M-learning accommodates the needs of an increasingly mobile student population [5].

The WRS empowers instructors, both in the classroom setting and in the field [8], for example, it enables the instructors to create learning material, while they are on a field trip to a museum, gallery or visiting a site. This then enables them to send the learning material to students and to get response instantly. In so doing, they are fully engaged in the learning activity. Teachers can monitor student responses and adapt the material, to cater for their needs. The ability to create learning material, on the spot and in the field, allows teachers to provide a more learner tailored Education [9]. This enables teachers to meet the specific needs of their students.

One of the limitations of the WRS is its English Language interface. Due to this, the need for internationalization and localization of WRS was identified. Internationalization was necessary because it enabled us to adapt the WRS to many different languages. It was a pre-requisite that enabled us to complete the localization for the Arabic language. The aim of this was to make WRS more accessible to a wider international community of teachers and students.

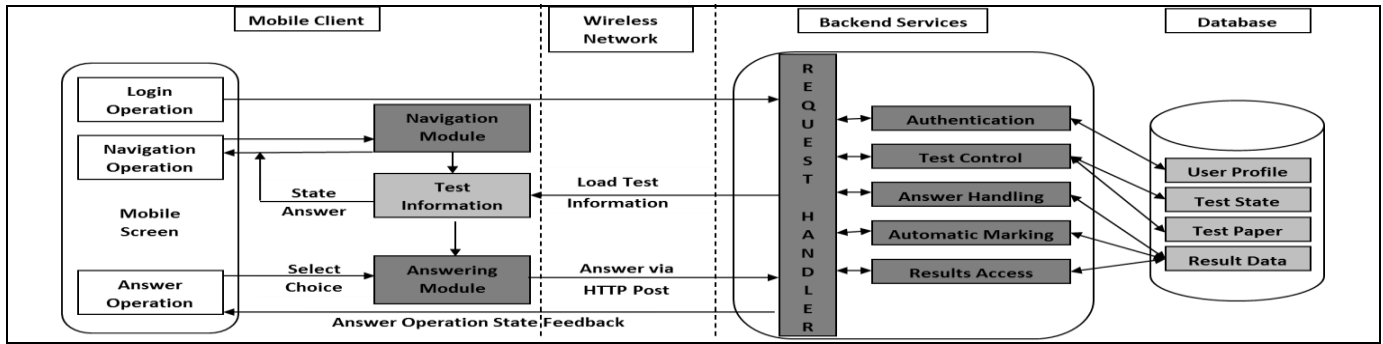


Figure 1. The Architecture of WRS [10].

### III. INTERNATIONALISATION I18N

#### A. Theory

The term Internationalization can be defined as “the process of generalizing a product, so that it can handle multiple languages and cultural conventions, without the need for redesign. Internationalization takes place at the level of program design and document development.” [10].

Internationalization is interrelated with translation, localization and globalization. Figure 2 below shows this relationship. It shows that translation is a core part of the localization process, whereas localization is central to internationalization [11]. It is important to understand that globalization manages the process of making software more widely accessible and usable, but internationalization is a process that makes the application available in worldwide markets. Moreover, localization is an essential step that adapts the application to specific linguistic and cultural differences of a given region [12] while translation is the process of recreating the source language text to a target language [13].

#### B. Technology

The i18n of software is a process of designing and coding software to support localization and translation, to various languages and locales [14].

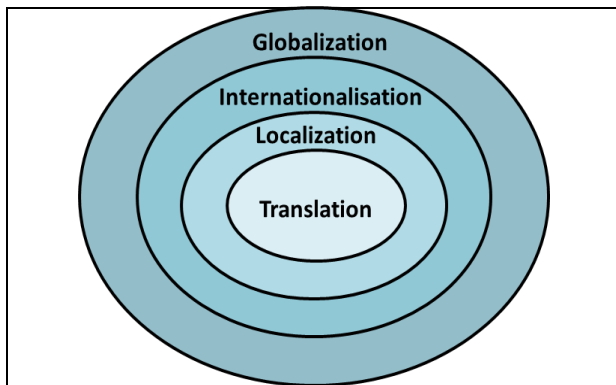


Figure 2. Interrelationship of Translation, Localization, Internationalization and Globalization.

The WRS was modified to support i18n and is now able to support multiple languages. This was achieved through changes to the software code which made it easier to insert additional languages, as need arises. Users are able to select the language of their choice from the interface after starting the application. This was implemented in the form of a drop down selection box on the home page.

### IV. LOCALIZATION L10N

The term localization has been defined as adapting a product to a particular locale [13]. A locale refers to a collection of people, who share a common language, writing system and any other properties, which may require a separate version of a particular product. This could be a region, a country, or just a language community [15].

The l10n is a process for tailoring software to a specific language or a specific region. This is done by adding locale specific features into the software such as currency, and date formats. A large part of this process is the translation of the text used throughout the applications interface [3]. The process of translation, in the context of interfaces, is defined as "Communicating the meaning of some data and information from the original language into another intended language" [16]. Kompf states that “translation affects the usability of the interface” [16]. Thus, if the translation is done successfully, it can increase the number of users of the software worldwide [3, 17].

The WRS has been translated into Arabic, Italian, Romanian and Indonesian. In the rest of this paper, we focus on the Arabic localization, with a close look at the interface and some of the challenges it presented.

### V. ARABIC LANGUAGE

The Arabic language is one of the world’s oldest languages. Currently, it is the fifth most used language worldwide. It is spoken by a significant percentage of the world’s population. More than 290 million people speak Arabic as their first language [17, 18]. As a result, Arabic is an important language on the Internet. This is partly due to the growing number of Arabic speakers online, many of whom are searching for Arabic content and applications online. Recent figures from the Internet World Statistics

show that there are 90 million Internet users from the Arab speaking world [3].

A. M-learning in the Arabic Speaking World

M-learning has become an essential tool used to enhance the learning process in the Arabic speaking world. This is reflected at the highest levels; in governments and policy making circles. In many cases, budgets have been allocated and policies implemented in order to enhance M-learning [19]. We give some examples from the Arab world below:

In September 2012, the Qatari government announced, that all the instructional content in the public schools would be stored in digital format by 2013; this work started in 2011. The Kuwaiti government also began rolling out the mobile learning products in middle schools, elementary schools and kindergartens. By October 2012, all the textbooks in Kuwait were digitized [20].

In June 2013, the UAE government indicated that they would equip all state run schools with learning platforms by 2015. The UAE Education minister announced that they were establishing a state of the art Information and Communications Technology (ICT) infrastructure in all the state schools. They would be publishing 7,000 e-lessons and e-contents. They stated that every student in the public schools would be using a personal device for learning by 2017 [20]. The UAE government launched a project to provide every student with an electronic tablet and access to high-speed 4G networks by 2017. It envisioned that over 20,000 personal learning devices would by then be distributed to the public schools and students [20].

Further to this, the government of the UAE launched the federal higher education mobile learning initiative. In this initiative, about 14,000 iPads were distributed to all first term students in the three federal universities. These tablets were preloaded with educational apps [20].

Another Arabic speaking country: Egypt has also announced a large-scale project, in which over 20 million tablets will be distributed to different schools in stages by 2018. This government had distributed over 10,000 tablets by August 2013 [20].

The Saudi Electronic University (SEU) was launched in August 2011 by the Saudi government. In 2013, the SEU launched their mobile-friendly site in HTML, which can be viewed on a smart phone [20].

In the last example, the Arab Open University makes extensive use of mobile learning, in their educational programs. They are a pioneer of mobile learning in the region, having launched a content library for java-enabled phones as early as 2007 [20].

These developments in the Arabic speaking world make a compelling case for why the WRS should be localized to the Arabic language.

VI. METHOD USED TO CREATE ARABIC INTERFACE FOR WRS

Two approaches were considered for translating the WRS interface: The first was to use online translation tools. Several of these tools were tested. Some of these tools were

discovered to be more widely used than others, for example Google Translate [3]. All the tools we tested presented problems in a number of areas. These included: grammatical structure, spelling, sentence clarity and logic [2] as a result, it was difficult to produce clear and understandable Arabic translations using this method. While some of these tools proved to be more useful than others it was clear that they would not be sufficient in themselves.

The second approach was to use a specialist in the Arabic language who was also a native speaker. This approach was preferred because it gave a more precise translation, with a more consistent style in the Arabic language and vocabulary.

Adobe Flex Builder 4.6 and Adobe Action Script® were used to code the application. This was used for the development work on the teacher interface. For the student interface, the PHP programming language was used.

To make the task of localization simpler and more manageable for developers, it was divided into two phases: the first phase was the translation of both the trigger side and response side of the WRS’s interface, and the second phase consisted of the testing and the evaluation of these two sides to understand how teachers and students experienced them.

A. Translation of WRS Interface

The translation Interface was broken down into three steps. The first step was to undertake analyses of the system; this was achieved by using the WRS in a practical session, with teachers and some students. It was done jointly with the developers and coders from whom we gained a deeper understanding of how the WRS works, for both teachers and students. Insight was also gained by using the WRS in the role of a teacher and a student on different devices. A valuable exercise at this point, was the production of the flow charts shown in Figure 3. It shows the different elements of the teachers interface. These helped in visualizing and understanding the system as a whole.

The second step required the extraction of all the English language text used in the interface. This was very useful as it served to highlight all the words and phrases used in the interface. A document was at this point produced to manage all the WRS’s interface text. An extract from this document is shown in Table I WRS Interface Text Translation. Language translators and developers maintain this document and it is used by developers to code the language into the WRS.

Developers add any new text used in the application to this document. The translators maintain the translations for each language. This makes it simpler to code each language into the localization files. A unique identifier (UID) is used to identify each pair of words or phrases.

TABLE I. WRS INTERFACE TEXT TRANSLATION

| UID | English                  | العربية                |
|-----|--------------------------|------------------------|
| 1   | Wireless Response System | نظام الاجابة اللاسلكية |
| 1_1 | Sign in                  | تسجيل الدخول           |
| 1_2 | Support                  | دعم                    |

The translation involves analyses of each word and its use in context. This helped us to produce a more accurate translation for the Arabic version.

The third step of this process required the table, to be coded into the application. Because the WRS will support several languages, each language will have its own folder and a file.

This file will localize the application to one locale. With this structure the WRS will be able to support any additional languages that are added in the future.

The final step of the translation process involved testing the Arabic interface. First a walk through test was done to ensure that all the English text was showing in the Arabic language.

Then, a side by side comparison was made to see how the two interfaces looked. Figure 4 shows the student interface side by side in the two languages. The same review process was done for the teacher interface and an example is shown in Figure 5.

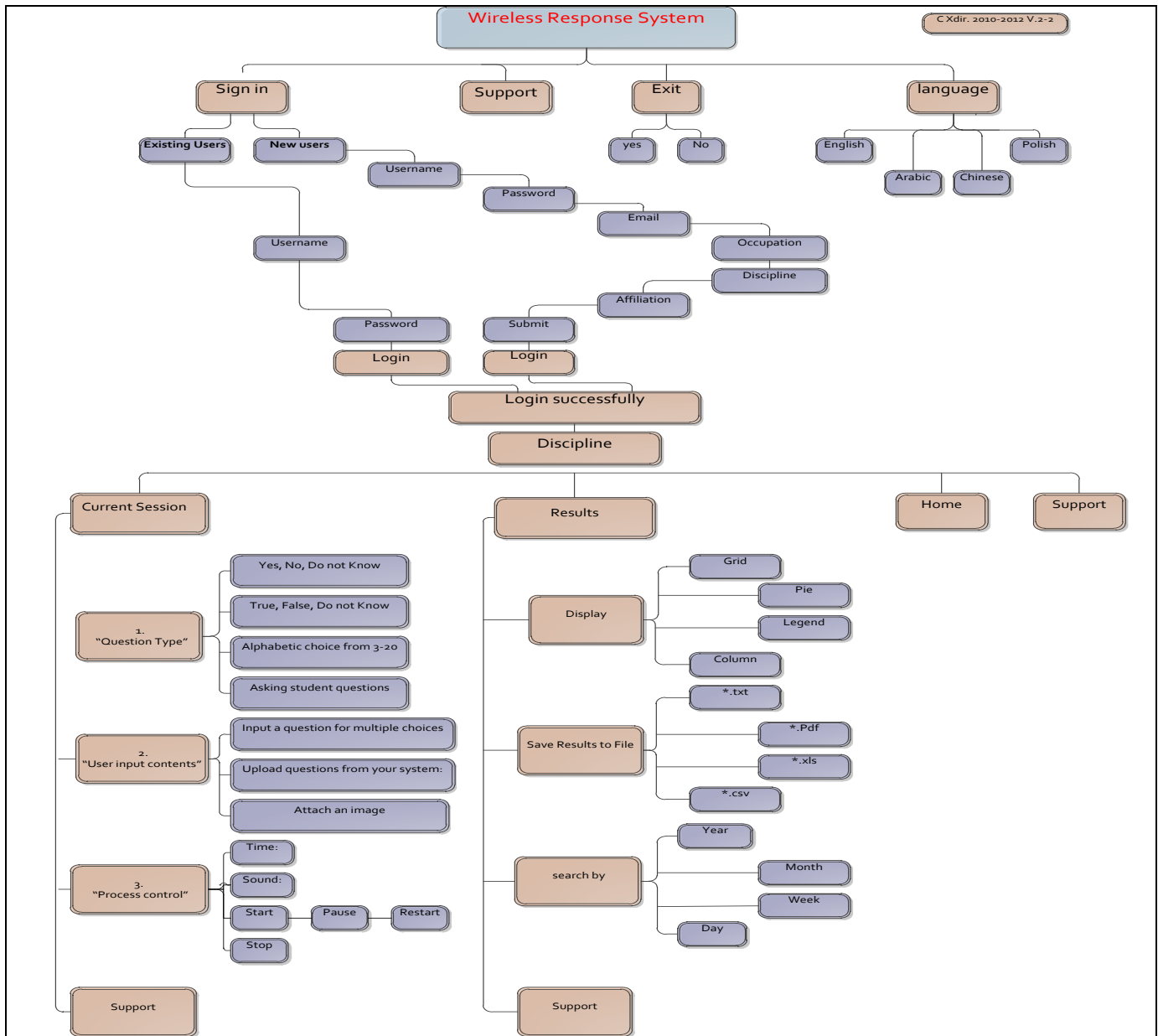


Figure 3. WRS Teacher Interface Elements .



Figure 4. WRS Student Interface English and Arabic.

B. Testing and Evaluation of the WRS

Both the student and the teacher Arabic language interfaces were tested. A sample of thirty Arabic speakers was used to test the WRS. These users were selected from the international student community at the University of Huddersfield. While all of them were students, some of them were also teachers in their home countries. This enabled them to understand and test the WRS from both the student and teacher perspective. All the testers were new to the WRS and had not used it before.

A test script was produced outlining several test cases, to test both the student and teacher interfaces. Each tester was asked to complete the test cases and provide feedback. Testers were asked for any comments or feedback they wished to make about the test they had just performed. The testers were also asked to evaluate the interfaces, in terms of their functionality and usability.

The testing environment consisted of a Laptop (PC or Apple), iPhone Smart phones, and iPod or iPad tablet computers.

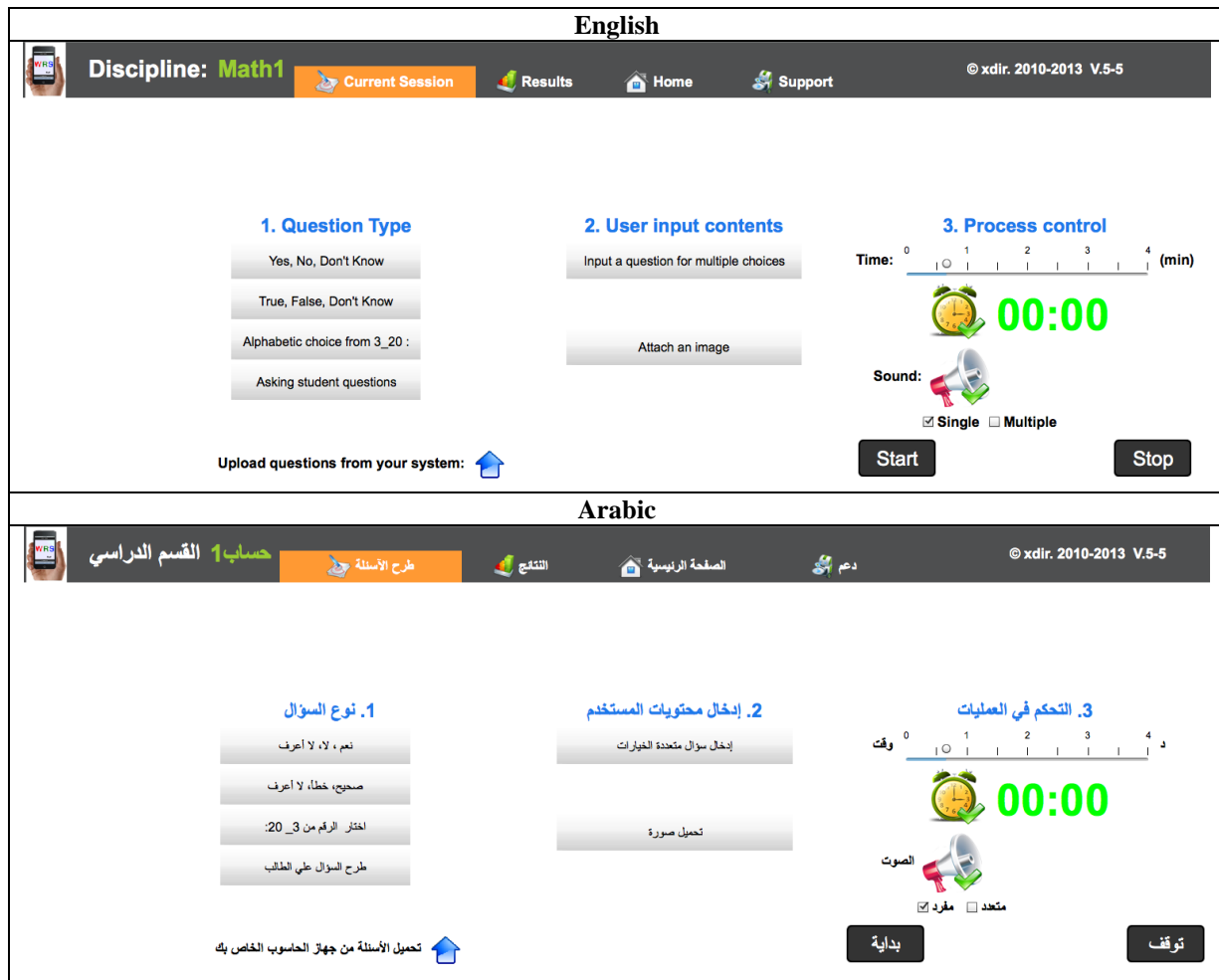


Figure 5. User Testing of WRS's Teacher Interface, Functionality and Usability.

C. Test Cases

We used test cases to test specific elements of the teacher and student applications. Table II shows the test cases we used to test the teacher interface. Some of the insights gained from this testing are shown in the test results column. Table III, on the other hand, shows the test cases used to test the student interface of WRS.

D. Testing the Teachers Application

In the teacher application interface, functionality and usability was tested. The results are presented in Figure 6 below. A few interesting points emerged from this testing. For example, on the results screen, testers found that the charts were very useful for viewing the responses from the students. However, they found that the date alone was not an efficient or effective way to search past tests and results. They rated this as below average and suggested that improvement could be made to facilitate better searching.

They also felt that teachers would benefit better if more data was collected for each test giving them greater insight into the progress attained by students and the effectiveness of the teaching material used.

All the users tested the functionality of the teachers' application. This included the installation and the launching of the WRS-Teachers Application, which was done successfully by all the testers. They gave this an average and an above average rating.

Signing in was also completed by all the testers. Some of the testers suggested the interface could be made simpler, by combining the two "Existing Users" and "New User" dialogue boxes into one box. Testers suggested that, as the "New User" interface would only ever be used once by a new user, it should not be shown separately or take up so much space on the screen. They pointed out that combining them would make the interface less cluttered.

TABLE II. TEST CASES USED TO TEST WRS ARABIC TEACHERS APPLICATION AND RESULTS

| No | Test Case          | Test Result   |
|----|--------------------|---|
| 1  | Application Launch | All the testers managed to successfully launch the application and select the Arabic interface.   |
| 2  | Sign In            | All the testers signed in successfully. Some testers noted that they could not recover usernames or passwords to their email addresses. Some of them also pointed out that the interface could be improved by combining the existing user and new user's login boxes into one box.  |
| 3  | Current Session    | Some of the users noted that the start and stop buttons on the current session screen, was Left-to-Right (LTR) and not Right-to-Left (RTL). It was also felt by many testers that this interface was a little confusing. Partly because of the mouse over action that brings elements into view. These are not shown by default. Some users had to use trial and error to discover how to navigate this screen. Also, they pointed out that the work flow in this screen was not intuitive, especially for the multiple choice questions. |
| 4  | Result             | Many of the testers commented on the graphs. They noted how it could rapidly inform the teacher of the student's comprehension. They felt this rapid feedback empowered the teacher allowing them to adapt the teaching material and testing to focus on specific areas.  |
| 5  | Home               | All the testers managed to complete this test case successfully.  |
| 6  | Support            | Testers commented that the font size was too small. The text was not aligned properly to the right hand side making it difficult to read.   |
| 7  | Exit               | This test case was completed successfully by all the testers. Some commented that the confirmation dialogue box was not necessary.  |

TABLE III. TEST CASES USED TO TEST WRS ARABIC STUDENTS APPLICATION AND RESULTS

| No | Test Case            | Test Result   |
|----|----------------------|---|
| 1  | Application Launch   | The student application was launched successfully by all the testers and the Arabic interface was selected from the language drop down box.   |
| 2  | Sign In              | All the testers signed in successfully. Testers suggested Discipline and Student ID was not secure enough for student logins and opined that a password would be more appropriate. They also rooted for an option for email recovery of lost passwords. |
| 3  | Respond to Questions | Testers found this simple and easy to use.  |

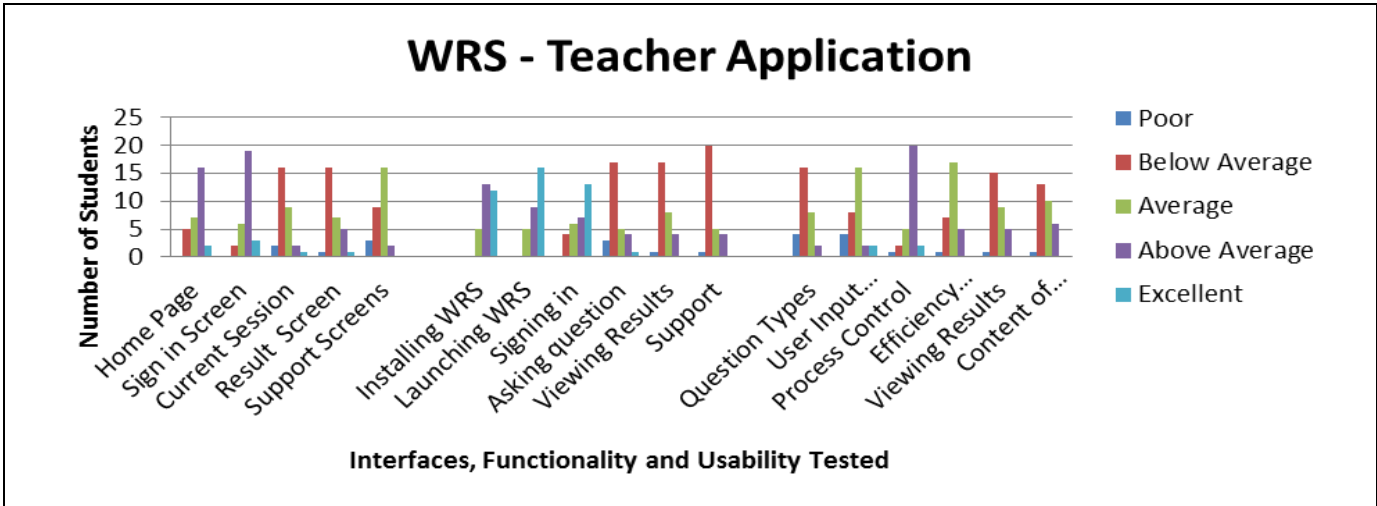


Figure 6. User Testing of WRS Teacher Interface, Functionality and Usability.

Testers found the functionality for asking questions was limited. They would have liked more question types and due to this, they rated it as below average. The testers also rated the functionality for “Viewing Results” as below average. They suggested it could be improved, to show results for a time period for example, one term or one academic year. This would enable them to see students’ progress over a period of time. Currently the “Viewing Results” only shows the result test by test.

Testers found Support in the application was minimal for the users. This was reflected in the below average rating they gave to this. Some testers found the font difficult to read. They also suggested more support text could be offered in the help text. Our Arabic testers also rated the usability of the “Question Types” as below average saying this part of the interface could be improved to make it more usable. A further suggestion was that the Arabic interface would work more effectively if the question was presented in the interface alongside the responses

The User Input Content was rated as average. Feedback from testers suggested that this could be made more efficient. Users found the process control simple to use, enabling them to control the time allocated for a response to the question. The usability of this was rated as above average. Users found this very usable and easy to understand.

Users rated the efficiency of this interface as average. The ability to paste multiple questions into the system it was noted would increase the interface efficiency, while the ability to save and reuse old questions or adapt them into new questions would also improve the efficiency.

Testers commented on Viewing Results, which they said could be improved. Many testers found the charts very useful. However, they commented that access to the historical results could be made easier and simpler, by giving users the option to search using additional criteria. Finally, the testing of the Content of Support in WRS identified

problems with the Arabic font. Many users found this font difficult to read.

*E. Testing WRS Student Application*

The student applications interfaces, functionality and usability, was tested on smart phones, tablets and PCs and the results are shown in Figure 7. Our testers rated the interface as above average on the smart phones and tablets. Some of our testers suggested the interface while interactive, could be improved and made more responsive. They suggested that the time remaining to answer the question could be shown on the interface.

Smartphone functionality was tested and the majority of testers found it was above average and excellent. All in all, testing showed that our users found the student interface could be used efficiently, effectively and interactively.

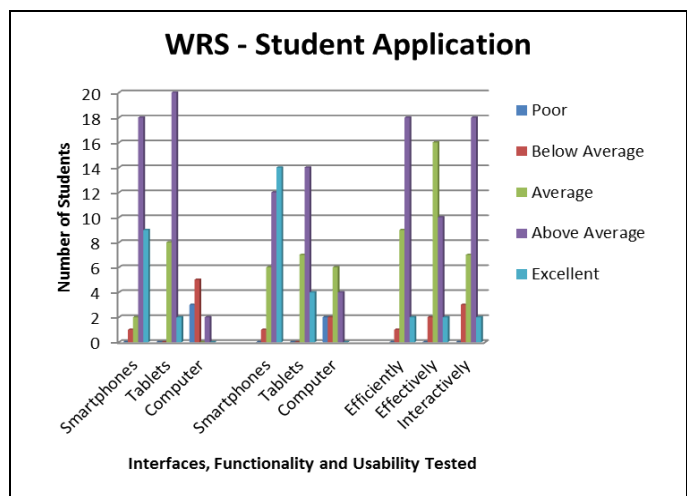


Figure 7. User Testing of WRS Student Interface, Functionality and Usability.



## VII. CONCLUSION AND FUTURE WORK

### A. Conclusion

Internationalization and localization of WRS to the Arabic language has made it accessible to new users. It has also provided a new insight into how the application itself could be improved.

Attention has been drawn to the following:

1. Testing showed that WRS Arabic interface was usable by both students and teachers.
2. Native Arabic users found the interfaces easy to use in the Arabic language.
3. Improvements need to be made to some parts of the interface to help improve the layout, login and searching for students' past test results
4. Testers found they needed more questions types to test students more effectively.
5. Users expressed a need for more application help to explain how each interface should be used.
6. Testers suggested that the students' interface should show a countdown of the time remaining to answer the question.
7. Student access to WRS could be made more secure by using a password in place of the current Student ID number.

This process, of localizing the WRS to Arabic, has helped to pave the way for localization to other languages. It has also highlighted ways in which future versions of WRS and interfaces could be improved.

### B. Future Work

Testing has been very valuable in providing feedback and insight into the WRS. The XDIR group will incorporate these into future versions of WRS. These will include:

1. More question types.
2. Improved interface layout and design in order to support RTL and LTR languages more effectively.
3. The WRS interface workflow will be improved to help and aid future localization.
4. The Current Session interfaces will be changed to only show what is needed when it is needed. This will improve WRS usability and aid future localization of the application and at the same time make the interface simpler to use.
5. Future versions of the WRS will also support more languages in addition to English and Arabic, these will include: Italian, Romanian, Turkish, Indonesian, Polish and Mandarin Chinese with other languages being added as required.

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