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Developing educational systems based on programming smartphone applications - the Bologna process as a model

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Abstract

The technological progress witnessed by the world has contributed to the development of education at all levels by providing multiple means to support the educational process. These means have shortened the effort and time of the teacher and the student in achieving the goal due to their ease of use, clarity and flexibility in dealing with problems, as well as their ease of availability to the user. These means include Windows applications, various web applications, mobile applications and various social networking applications, which mainly depend on the use of smartphones owned by all students. This study focused on identifying the strengths necessary to benefit from smartphone applications to develop the outcomes of the Bologna process, which depend on both the student and the teacher, as well as clarifying the possible mechanisms to achieve the greatest benefit by conducting various questionnaires for students and teachers to know their opinions on the possibility of achieving the maximum benefit from mobile applications in different educational systems. The study also focused on trying to know the interests of students and their thinking in developing smartphone applications in line with the global openness towards technology, which serves the educational process in a fundamental way. The study suggested developing smartphone applications specific to each scientific department that suit its requirements. Interactive learning is considered one of the best teaching methods because of its impact on the student, and one of the most prominent methods used in interactive learning is the use of smartphone applications, which receive students' attention because they save them effort and time and provide them with a suitable environment for education, as through them they can search for information and communicate with each other and exchange information.

Keywords: *Education system, mobile applications, Bologna system, teacher, smartphone*.

1. Introduction

1.1. Smartphone application programming

Smartphone applications are among the most popular applications among people due to the possibility of owning a smartphone and the ease of using most applications in addition to their low cost, which is often free [1]. Smartphone applications can be programmed by writing special codes in programming languages that support the implementation and operation of the application on the mobile phone with its various systems [2-3]. This application goes through several stages until it is ready for use by the user, and the most prominent of these stages are analysis, design, writing the code, then integration, testing, and finally development or maintenance.

Smartphone application programming can be used to develop the educational process, as these applications provide many tools and large spaces for searching for and obtaining information, as well as providing a large space for communication between the student and the teacher or between students with each other, which facilitates the process, allowing the student to find a solution to his problems, follow up on his educational path, diagnose errors and weaknesses, and address them [4].

Programming languages are the basis for creating a smartphone application, and it is necessary to determine the type of language and its suitability for the smartphone system in order to avoid problems in implementation [5]. The most prominent languages used in programming smartphone applications are:

1.1.1. Java

It is considered one of the oldest programming languages used in creating smartphone applications, noting that its applications work on the Android system only.

1.1.2. JavaScript

It is considered one of the most popular programming languages used in designing smartphone applications, and one of its advantages is that the application created using it works on both Android and iOS systems.

1.1.3. Kotlin

It is an object-oriented language and writing code using it is considered brief and faster compared to Java.

1.1.4. Objective-C

It is considered one of the oldest programming languages that specializes in creating smartphone applications that work on the iOS system.

1.1.5. Swift

It is a programming language that supports applications that work on iOS, macOS, watchOS, tvOS, and Linux systems [6].

1.2. Bologna digital system

It is an integrated digital system and is considered an important step in transforming the educational institution into smart institutions. The system deals with integrated information about the student, the university and the educational process [7]. The system includes various activities related to users starting from the ministry, universities and professors all the way to students. The system can save effort and time to manage the educational process and all its related matters in a professional manner by linking the various entities of the educational institution to a central database [8].

2. Related work

Many researchers have discussed the idea of developing the educational process using smartphone application programming and have put forward ideas and suggestions that serve the learner. Researchers confirmed in one of the studies that introducing smartphone applications into the educational process is directly linked to the group of elements that make up the educational process, such as administration, employees, student affairs, and others, and the necessity of activating and qualifying them to achieve the best results [9].
Other researchers confirmed that students responded well to the integration of smartphone applications into the educational process and that this method achieves better positive results for the student and the educational process [10].
Researchers have also confirmed that the effectiveness of education increases positively when using smartphones in learning, creating educational content, and communicating between the student and the educational institution [11].
A study has shown that the efficiency and effectiveness of education is improved by students using smartphone applications, which allow them to access educational resources, participate in classes, facilitate communication with teachers and other students, and review lessons independently [12].
Another study has shown that the use of smartphone applications has a positive impact on developing students' skills and motivating them, which greatly facilitates the educational process [13].
While one study showed an increase in students' motivation to learn through the use of smartphone applications, as it saves time and effort and makes it easy to access various scientific sources [14].
One study showed that the use of smartphone applications enhances students’ academic achievement and positively affects their performance [15].
In a previous study, we explained the practical benefit of using smartphone application programming in e-learning, the need for which arose after the spread of the Covid-19 virus [16].

3. Methodology

The study was conducted on 200 students as a miniature model to know what students prefer from mobile applications with the Bologna system and what are their suggestions for developing the process by conducting different questionnaires [17]. Since the system was first applied to the colleges of engineering and science, the samples were distributed according to gender and college. The results of the questionnaires were carefully reviewed to reach the best results [18]. The following table and following chart show the method of distributing the study samples.

Table 1: study samples.

College	Gender		Total	Percentage
	males	females		
Engineering	62	53	115	57.50%
Science	48	37	85	42.50%
Total	110	90	200	100%

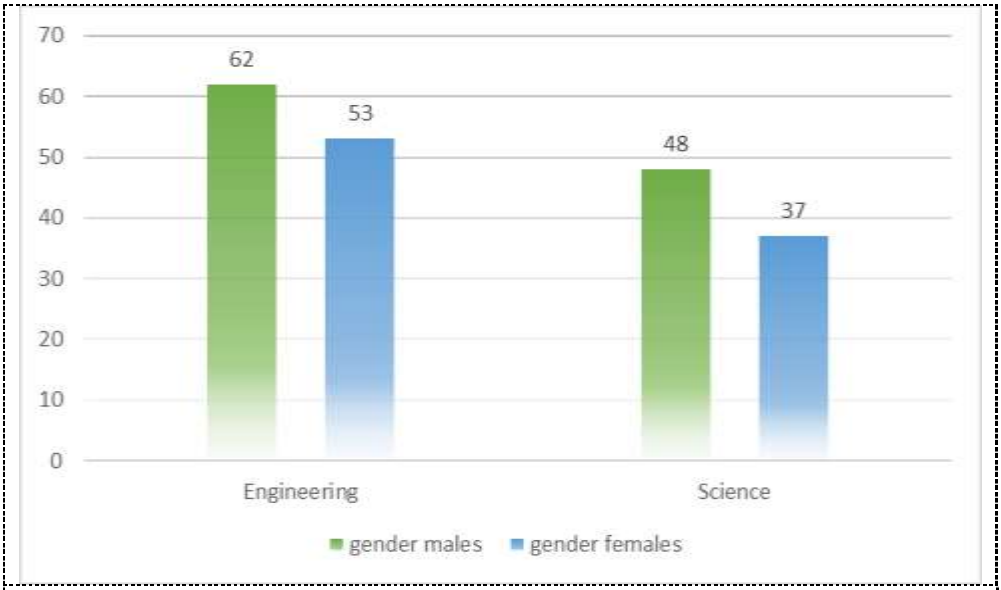

Fig. 1: Study samples.

The questionnaire consists of 8 main questions concerned with the use of smartphone applications. A Likert scale was adopted to analyze the students' answers and provide four answers: (I don't care, A little Average A lot).as in Table 2.

Table 2: Likert scale probabilities

Degree	Response
1-1.75	I don't care
1.75-2.5	A little
2.5-3.25	Average
3.25-4	A lot

4. A Likert scale

It is a scale that relies primarily on the opinions of a sample from the study environment. It is a one-dimensional scale and the scale discusses viewpoints and attempts to understand and analyze them to reach accurate results [19].
The paragraphs that we adopted as the axis of the Likert scale were realistic questions close to the student's needs and interests so that the results would be more realistic and accurate, as shown in the table (3).

Table 3: Questionnaire paragraphs

Paragraph number	Paragraph
1	I follow the directions and instructions in the educational system (Bologna Path) continuously using my smartphone.
2	I make sure to use the smartphone to complete assignments and reports related to the Bologna Path.
3	I use the smartphone to develop my scientific skills through research and updating information.
4	I use the smartphone to photograph lectures or important parts of them.
5	I constantly follow scientific websites and libraries related to my study topics.
6	I share information with my friends and communicate with them to analyze assignments.
7	I use the smartphone to study applications related to my specialty and some programming languages.
8	I would like and hope to develop smartphone applications to manage the educational process according to the Bologna process?

The questionnaire variables can be divided into two sections: The first is the independent variables, and here in our study they were represented by gender (males and females) and college (science and engineering). The second section is the non-independent variable, which is the result of the scores after using the Likert scale and analyzing the students' answers to the questions set by the study [20].

5. Results

In order to achieve the aim of the study and the success of the questionnaire and achieve the maximum benefit by knowing the students' thinking towards smartphone applications and how to use them in the educational process, the arithmetic mean of the sample answers for each paragraph was calculated, as well as the standard deviation of those answers, and the results were as in the table (4).

Table 4: Questionnaire results and standard deviation

Paragraph number	I don't care	A little	Average	A lot	Arithmetic mean	Standard deviation	ratio	Sample direction	Paragraph sequence
8	0	0	19	181	3.91	0.29	97.625	a lot	1
6	0	8	24	168	3.80	0.49	95	a lot	2
1	2	23	46	129	3.51	0.74	87.75	a lot	3
2	0	6	120	74	3.34	0.53	83.5	a lot	4
3	39	21	83	57	2.79	1.06	69.75	average	5
5	45	103	37	15	2.11	0.84	52.75	a little	6
7	63	72	55	10	2.06	0.89	51.5	average	7
4	118	24	55	3	1.72	0.92	42.875	I don’t care	8

6. Discussion

When we analyze the results of the questionnaire carefully, we find that paragraph 8, which is (I would like and hope to develop smartphone applications to manage the educational process according to the Bologna process?) has obtained the highest arithmetic average, with a percentage of more than 96%, which confirms the students’ desire to program smartphone applications specific to the Bologna process, which keeps pace with this progress and opens new horizons for the student to learn.

As for paragraph 6, which is (I share information with my friends and communicate with them to analyze assignments) getting the second place with the highest arithmetic mean, it indicates that students benefit from smartphone applications and invest them to help each other and exchange information. Paragraph 1, which is (I follow the directions and instructions in the educational system (Bologna Path) continuously using my smartphone) came in third place, which confirms that students follow up on their assignments via various smartphone applications. The same goes for paragraph 2 (I make sure to use the smartphone to complete assignments and reports related to the Bologna Path) which confirms that students benefit from smartphone applications to complete assignments.

As for paragraph 4 (I use the smartphone to photograph lectures or important parts of them) it came in last place, which explains that students do not benefit from smartphones to record lectures and photograph important parts of them, because most of the applications used in this regard are general and multi-use and can cause disruption to the lesson, which calls for creating applications for smartphones specifically for recording lectures without affecting others.

7. Conclusion

Interactive learning is considered one of the best teaching methods because of its impact on the student, and one of the most prominent methods used in interactive learning is the use of smartphone applications, which receive students' attention because they save them effort and time and provide them with a suitable environment for education, as through them they can search for information and communicate with each other and exchange information.

Programming smartphone applications specialized in educational fields and different specializations achieves great progress in the educational process and contributes to its development and facilitating the tasks of the student and teacher alike. To achieve maximum benefit from smartphone applications to serve the educational process, must designing special mobile applications (according to the needs of the department or college) and general ones (that can be used by all students) and including smartphone application programming curricula within the curriculum vocabulary for the computer subject and activating lecture management and archiving through smartphones to serve the educational process.

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