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MOBILE AUDIENCE RESPONSE SYSTEM AS A SUPPORT TOOL IN EDUCATION

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Abstract - Audience response systems (ARS) allow participants at a meeting or in a classroom to respond to questions, thus increasing the attention of the attendees. These systems are suitable for events with a number of participants where decision-making or assessment must be conducted quickly. ARS can also be used in large classes to increase the level of student engagement and to provide prompt feedback.

In this context, we have decided to develop an audience response system that can be used in the educational process. The system contains two parts: server application designed for the teachers and client application designed for the students. Both, the server and the client application have been developed with Java. The first one can be installed on the teachers PC or laptop, the second one on students' mobile phones. The system support two possible answer's formats: simple text and image.

The developed system was tested at the Faculty of Law – Bitola, and the evaluation results are shown in this paper.

I. INTRODUCTION

An audience response system (ARS) is an interactive tool that enables participants and presenters to interact dynamically through question-and-answer polling in various environments. These systems are especially useful for events with a large number of attendees (meetings, seminars, conferences, classrooms, etc.), because of the immediate feedback that the presenter receives. ARS also enables the presenter to collect participant data, to display graphical polling results, or to use them in various reports and analysis.

Over the past decade, the rapid technology advances, have led to increase used of information systems in education process. Current literature overwhelmingly suggests that students have positive attitudes towards the use of modern technology during the classes. One of the representatives of this modern technology is undoubtedly an audience response system.

ARSs have been used to improve student interaction, engagement, and attention [1], increase student attendance [2], stimulate peer and class discussion [3] and provide feedback for both

students and teachers allowing deepening the discussions about specific topics that were not grasped by the majority of students.

The purpose of this study is to explore the benefits and challenges of using the Mobile Audience Response System (MARS) in higher education in Macedonia (specifically at the Faculty of Law in Bitola). For this reason, a Mobile Audience Response System was developed and tested at the Faculty of Law – Bitola. The evaluation was done from students' and from teachers' perspective.

II. RELATED WORKS

A number of literature reviews on use of audience response systems in education, have been presented over the last years. The common conclusion is that using ARS has several benefits such as increased student engagement, increased interactivity, fast feedback, etc. [5, 6]. In addition, it leads to increased awareness of both students and teachers about students' understanding of specific topics [7]. According to Caldwell [8], Kay, and LeSage [9], students have positive attitudes towards the use of response systems. Hadzidedic et al. [4] have made a review of 67 papers related with an ARSs and summarize the reported benefits of their use, that are: increased attendance, attention, anonymity, participation and engagement levels, interaction, discussion, contingent teaching, quality, feedback, formative assessment and etc. Similarly, Pradhan et al. [10] found significantly higher levels of learning with an ARS versus traditional lectures in residency education. In addition, they found that both groups who showed high achievement in previous courses and those who showed low achievement in previous courses significantly increased their test scores with the use of ARS during the educational process. Some papers also show that students preferred ARS presentations to lecture presentations [11], [12]. They are also more comfortable responding to polls using an ARS than with traditional hand rising in class [13]. ARS

utilization helped the students to focus on key points in the lecture, while the feedback helped the teacher to identify the areas for further review [14]. Sally et al. [15] also found that students were more engaged (83%), intellectually stimulated (85%), and motivated to think (89%) in lectures where an ARS was used versus lectures without an ARS.

III. SYSTEM DESCRIPTION

For this study, a Mobile Audience Response System (MARS) was developed and tested. The system contains two parts: server application and client application. Both, the server and the client application have been developed with Java.

The teachers use the server application on their laptops or PC. Using this application, they can establish new TCP/IP connection, manage questions and student answers, manage students etc. The application use mysql database for recording the data send from the client application. In other words, the students send data from their mobile phones (where a client application is installed) to the server application. The server application interface is shown on Fig.1.

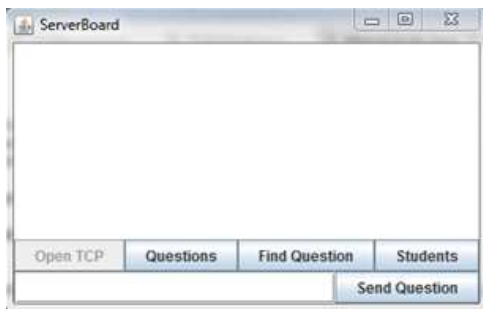


Figure 1. Server desktop application

The client application is a small application that needs to be installed on the students' mobile phones (Fig. 2). In the scope of this study, we have developed mobile application only for Android OS. After installing the application, the students need to login with their username and password and to wait for teacher questions. After the question is presented, they need to send answer to the server. There are two types of answers:

- Text: the student inserts text answer in the free text field – new record in the database will be added.
- Image: the students can browse for images, select the adequate image and send the image. Before sending, the students have preview of the image – new record in the

database will be added and the image will be uploaded on the server.

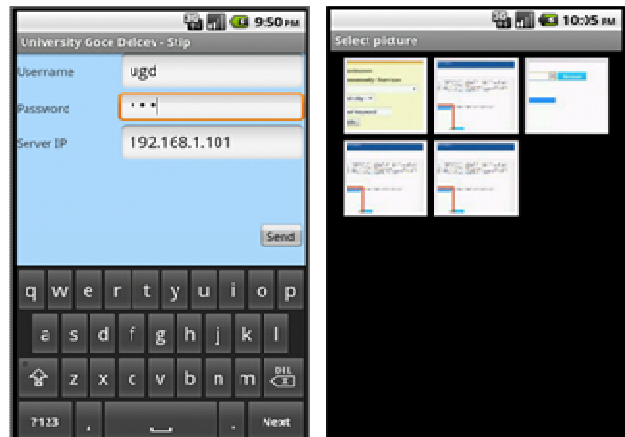


Figure 2. Client mobile application

Results are immediately transferred through a wireless connection and saved in a database. Then, the teacher can review the students' answers, present them and discuss them with the students.

Fig. 2 shows the system data flow.

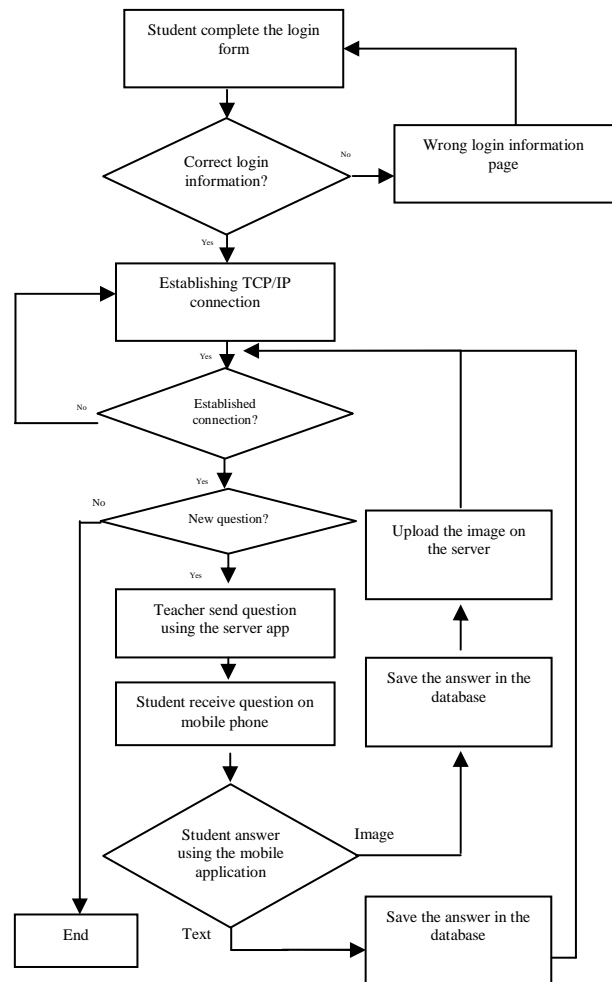


Figure 3. System data flow

IV. SYSTEM EVALUATION

The system was tested at the Faculty of Law in Bitola, as a part of the laboratory classes of two courses from undergraduate studies: Institutional Law and Introduction to computer science. The system was used from 97 students, 47 of them attended laboratory classes of Institutional Law, and the rest of them attended the laboratory classes of Introduction to computer science.

Developed system was used to gauge student comprehension, making overview at the end of each lecture, for students testing and for electronic survey. Electronic questionnaires were used to collect the data about students' and teachers' experiences from using MARS.

Table I shows the statistics from using MARS.

TABLE I. STATISTICS FROM USING THE SYSTEM

	Activity	Number	
		Institutional Law	Introduction to computer science
1.	Number of students who used the system	47	50
2.	Number of laboratory classes	10	12
3.	Total number of sent questions from the teaching assistant	110	132
4.	Number of questionnaires	2	4
5.	Number of quizzes	8	10
6.	Total number of answers from the students as text	2385	2554
7.	Total number of answers from the students as image	1542	1784
8.	Percentage of correct answers	72.5%	68.9%

In order to overview the curriculum content from the laboratory classes, at the end of each lecture the teaching assistant inserted 15 questions related with the current lecture, using the system, while the students answered these questions using the client application installed on their mobile phones. After that, the teaching assistant discussed the results of each question with the students.

The results gained with the system were used by the teaching assistant to gauge students' comprehension and to adjust the direction of the lecture accordingly.

The common opinion was that using MARS during the laboratory classes the student engagement and attention raised and was higher than in traditional laboratory classes.

Students' experience was evaluated after using the developed system. The results from this evaluation are shown in Table II.

TABLE II. QUESTIONNAIRE FOR THE STUDENTS

	Question	Answers			
		Institutional Law		Introduction to computer science	
		Yes	No	Yes	No
1.	Do you perceive any benefits to their overall learning experience as a result of MARS use in the education process	38	9	43	7
2.	Do you have positive attitudes towards the use of new technologies in classes	41	6	44	6
3.	The use of MARS stimulated me to be more active in the laboratory classes	39	8	42	8
4.	Improving communication	37	10	39	11
5.	The mobile application is user-friendly	40	7	41	9
6.	I would like to use the same system in other classes	43	4	45	5

For this study, we have also conducted questionnaires for the teaching assistants. The results from this evaluation are shown in Table III.

TABLE III. QUESTIONNAIRE FOR TEACHING ASSISTANTS USING FIVE POINT LIKERT SCALE (1: STRONGLY DISAGREE, 5: STRONGLY AGREE)

	Question	Answer	
		Institutional Law	Introduction to computer science
1.	The teachers can receive immediate feedback about whether concepts were understood in class	5	5
2.	Impact on students attendance	4	4
3.	Improving the communication	4	5
4.	The desktop application is user-friendly	5	5

According to the results from the electronic questionnaire, students indicated that the use of MARS helped them to improve attention and interaction and to learn lecture material more effectively.

In addition, the teaching assistants agree that MARS utilization increased active learning, revealed student comprehension, and lead to more effective educational process. Furthermore, they agree that the implemented system is easy to use, and it could be a very useful tool for collecting students' feedback.

The results also revealed positive attitude of the students towards the introduction of a new technologies in education.

V. CONCLUSION

The main goal of this paper is to develop and evaluate a mobile audience response system as a support tool in higher education. The system was

used in the educational process at the Faculty of Law - Bitola. The system was used for implementation of electronic surveys, making overview at the end of each lecture and introducing a new way of students' testing within the laboratory classes.

The results of evaluation show positive effects of using MARS on some important elements of the learning experience such as: student engagement, attention, interaction and motivation. Possibility of obtaining instant feedback, for both students and teachers, was also found very useful.

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