The Effects Of Audience Response Systems On Student Achievement: Erzurum Police College Sample

Dinleyici Yanıt Sisteminin Öğrenci Gelişimine Etkileri: Erzurum Polis Okulu Örneği

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Abstract

This study aims to reveal the effects of using the Audience Response System on academic success and student perceptions of the audience response system. The sample of this study consists of 139 Erzurum Police College students in Turkey. Two control and two treatment groups were assigned randomly. The course was designed to be the same for both treatment and control group with lectures, in-class questions, practices and exams. The instructor prepared multiple-choice questions before the lecture to ask in the classroom. While students in the control group responded the question verbally, the treatment group used ARS. One paper-based exam was used for the dependent measure of learning of concepts and skills taught in the lessons. Perceptions of students on ARS were collected via a questionnaire. Results showed that ARS usage does not have a significant effect on learner achievement after an 8-week period.

Keywords: *ARS, audience response system, police training, clicker, ınteractive learning environment*

Özet

Bu çalışma Dinleyici Yanıt Sistemine yönelik öğrenci görüşlerini ve bu sistemin öğrenci başarısına etkilerini ortaya çıkarmayı amaçlamaktadır. Bu çalışmanın örneklemini Erzurum Polis Okulundaki 139 öğrenci oluşturmaktadır. Çalışmadaki iki deney ve iki kontrol grubu rastgele seçim yöntemi kullanılarak belirlenmiştir. Deney ve kontrol grubunda yürütülen derslerdeki sınıf içi sorular, uygulamalar ve değerlendirme uygulamaları aynıdır. Dersler aynı öğretim elemanı tarafından yürütülmüştür. Dersin öğretim elemanı dersten önce eğitimde kullanılacak soruları hazırlamıştır. Kontrol grubunda ders içi sorular sözel olarak yanıtlanırken

deney gurubunda dinleyici yanıt sistemi kullanılmıştır. Öğrencilerin dersteki başarılarını ve gelişimlerini ölçmek için bir yazılı sınav yapılmıştır. Dinleyici yanıt sistemine yönelik öğrenci görüşleri anket yardımıyla toplanmıştır. Sonuçlar 8 haftalık uygulamanın ardından dinleyici yanıt sisteminin kullanımının öğrenci gelişimi üzerinde anlamlı bir etkisinin olmadığını göstermiştir.

Anahtar Kelimeler: *DYS, dinleyici yanıt sistemi, polis eğitimi, etkileşimli öğrenme ortamı*

1. Introduction

One of the tools that is used to create interactive and effective instructions in classroom is the Audience Response System (ARS) (Caldwell, 2007). ARS allows students to respond a question by clicking a button on individual response keypad (clicker). Then, answers are transmitted, usually via wireless technology, to the instructor's computer and saved as logs for future use. Students' responses can then be immediately graphically displayed in a presentation.

ARS devices have been used in the classrooms for about 40 years. Early systems were wired and required more complicated installations. With the advance of new technologies, wireless devices were used by receivers but the idea basically remained the same (Hall, Collier, Thomas & Hilgers, 2005). By the help of new software tools, it has become easy to integrate ARS on web based applications and/or presentation software. Nowadays, ARS is very popular around the K12 and universities.

Students are more comfortable while using ARS than making verbal contributions in large groups because of condition of anonymity (Banks & Monday, 2006). As ARS allows student to participate easily, it is mostly used to engage learners (Kay & Knaack, 2009; Gauci, Dantas, Williams & Kemm, 2009) during lectures. In addition, ARS is used for other purposes in classrooms such as (a) real time feedback (Jeff & Evan, 2008), (b) pre-testing for forthcoming lecture, (c) formative and summative assessment (Ghost & Renna, 2006), (d) simple opinion surveys (Solecki, Cornelius, Draper & Fisher, 2010), (e) peer assessment (Wait, Could, Forster, Jones, Nokleby, Wolfe & Youdas, 2009; Caldwell, 2007), and (f) increasing the students' motivation (Doucet, Vrins & Harvey, 2009). The main intention underlying the usage of ARS is to make the classroom environment more student-centered, knowledge-centered, assessment-centered and community centered (Roschelle, Penuel & Abrahamson, 2004).

With regard to communication, ARS has a structure that helps to design and conduct an interactive environmnt (Horawitz, 2007) in the classroom by providing extra communication channels (Groves, Gear, Jones, Connolty & Read, 2006). Thus, it encourages students to answer question and participate in in-class discussions (Latessa & Mouw, 2007). It also helps students to focus on tasks (Hinde & Hunt, 2006) and generate more questions (Horowitz, 2007). Moreover, Guthrine and Carlin (2007) stated that ARS increases the in-class contribution of students at a hundred percent rate. It allows students to learn from classmates (Webking & Valenzuela, 2006) and

facilitates collaborative activities (Ghost & Renna, 2006). With all these potential applications, ARS may have several positive contributions to make to the development of communication skills in the classroom (Burton, 2006).

ARS has several advantages in the classroom environment. In general, the increasing of students' attendance; the development of permanent learning and enhancement of interaction in class are seen as positive aspects of ARS (Horawitz, 2007). Moreover, it encourages students to answer questions and participate in in-class discussion (Latessa & Mouw, 2007). According to a study of Hinde and Hunt (2006), ARS allows students to dictate learning speed and content. It also helps students to focus on learning activities and improves students' problem solving and critical thinking abilities. Another important feature of ARS is providing on-time feedback to students. In addition, it encourages the instructor to explain how and why these applications enable students to interact socially in the classroom (Banks, 2006).

Wait et. al. (2009) found that almost all students have positive perceptions of lessons in which ARS was employed. Students reported that they thought ARS makes the classroom environment more enjoyable and user friendly (Abrahamson, 2006; Beatty, Leonard, Grace & Dufresne, 2006). They also reported that they feel more relaxed while learning (Horawitz, 2007). In terms of learning, students think that ARS increases their motivation to attend their classes and to answer questions (Ghost & Renna, 2006).

ARS is an effective tool in terms of evaluation and feedback processes (Burnstein & Lederman, 2006, Beatty at. al., 2006, Burton 2006). ARS users also agree on that ARS provide immediate, natural and adequate feedback (Burton 2006, Dominick & Bishop, 2006). In general, it has been shown that students display increased motivation when they receive feedback from instructors, classmates or the system (Cutss, 2006). Continuous feedback also brings forth more satisfaction (Hinde & Hunt, 2006). In class quizzes, practices and exams can be conducted via ARS and the system can generate a real-time feedback that functions as a kind of support for the instructor. The instructor can provide additional explanation related to responses (Dominick & Bishop, 2006). Hinde and Hunt (2006) stated that ARS helps instructors to control the lecture speed and arrange content. Preparation of both questions and exhaustive feedback options before lectures may be considered as a self-development activity for instructors (Abrahamson, 2006).

ARS features can generally be used for different types of courses and topics. Nevertheless, activities should be designed on the basis of student characteristics and the learning environment. For example, making choices may require more time when multiple-choice questions include more than four items (Horawitz, 2007). Besides its many advantages, ARS use may have a couple of limitations, namely, high installation cost and technology adaption. The cost of ARS is considered as a limitation by most of its users. Moreover, drawback of the system that instructors may experience is the problem of adapting ARS (Burnstein & Lederman, 2006) in terms of student attitude and their technological skills. In addition, setting up devices or software might take

up a lot of instructors' time (Cutts, 2006).

There are many studies on the effects of ARS on students' success in different courses. While some studies (Guthrine & Carlin, 2007; Flora, Jacob, & Nancy, 2010) have stated that there is no difference between ARS users and non-ARS users in terms of learning, others indicate that ARS provides greater learning opportunities compared to traditional approaches and makes the learning environment more enjoyable (Caldwell, 2007; Latessa & Mouw, 2007; Horawitz, 2007). In terms of perceptions, students think that ARS helps them to understand educational materials and they find it useful as it provides them with the opportunity to compare their answers with other students (Burton, 2006; Abrahamson, 2006).

ARS has been examined in many studies. However it is important that it is investigated in different contexts and cultures. This study focused on the use of ARS in a police college. Another unique feature of this study is that it is one of the first experimental studies on this topic in Turkey. The perceptions of students who used ARS in the classroom were also investigated. The findings of this study have contributed to the existing body of literature on the effects of ARS in the classroom. It also may help instructors using ARS to provide effective instruction.

2. Method

2.1. Research questions

This study aims to reveal the effects of ARS on academic success and student perceptions of ARS. The research questions that guided this study are displayed below:

1- What is the effect of ARS supported lectures on academic success?

2- What are the students' perceptions of the use of ARS in classroom?

3- How does computer ownership affect students' perceptions of ARS?

2.2. Participants

Subjects were 139 EPC students enrolled in a 'Duties and Jurisdictions of Police' course in a police college in Turkey. All participants were male. The students were randomly assigned to control and treatment groups. The control group's students were 68 persons from two different classrooms. The treatment group's students were 71 persons from two different classrooms. Groups were taught in separate sessions during the experiment. The subject's level of performance counted in the determination of course grades. All students completed the course in success.

2.3. Course content

The course 'Duties and Jurisdictions of Police' includes topics, such as policing in democratic societies, combating crime, ensuring public order and the rule of law, fun-

damental rights and freedoms of citizens, the political factors of policing, explaining the relationship between political regimes and reactive and proactive policing. The course has eight units conducted over eight weeks including one exam for assessment.

2.4. Materials

The course was designed to be the same for both treatment and control groups with lectures, in-class questions, practices and exams. Standard lectures and classroom discussions are the most common methods of instruction in many disciplines (Watts & Becker, 2008; Macdonald, Manduca, Mogk & Tewksbury, 2005; Saunders, 2001). That is why lecture and discussions were used as primary teaching method in this experiment. While students in the control group responded to question verbally, students in the treatment group used ARS. Instructor prepared multiple-choice questions before the lecture to administer during the class. The questions were shown to both groups during lectures. It took place over eight weeks with two hours of lecture periods per week.

2.5. Dependent and independent variables and data collection

The independent (active) variable used for this study is ARS usage in classroom activities. This has two levels, ARS and non-ARS. Classes were lecture-based, supported by discussion, brainstorming and questions. Before the lecture, the instructor prepared many multiple-choice questions for each class. Five to seven multiple-choice questions were used in each two-hour lecture. Instructors showed the students the questions on slides during lectures.

In classes where ARS was employed, each student was provided with a wireless keypad that was connected to the instructor's computer. The students responded to the questions individually by pressing the buttons on keypads. The frequencies of answers provided were presented to the class via projector. The instructor moderated in-class discussions on histograms and, within an allocated time, gave additional explanations if required.

In non-ARS group, students were provided with the same questions at almost the same points of the lectures. After instructor had asked some students to state their answers, he facilitated a discussion and provided further explanation in the same manner as with the ARS group. The only difference between the control and treatment groups was the use of keypads by students to respond to questions.

The dependent variables of this study were the achievements and perceptions of students. The Perceptions of students regarding ARS were also collected in order to evaluate the students' level of satisfaction with ARS. One paper-based exam was used for the dependent measure of the learning of concepts and skills taught in the lessons. This exam has twelve multiple-choice and one open-ended questions. The exam included eight units. Two experts who had presented similar courses reviewed the exams to ensure their validity. The course objectives and multiple- choice questions were also provided to the experts. The experts were asked to check did the questions match

with the given objectives and were they easily comprehensible. Questions were revised according to the experts' recommendations.

The Kuder Richardson Coefficient of reliability was employed to test the reliability of the measures. The Kuder Richardson split half test is used when the responses are categorical (Creswell, 2002). The Kuder-Richardson formula 20 (KR20) is 0.61 for exams in which reliability is moderate (Slavucci, Walter, Conley, Fink &Saba, 1997).

Students' perceptions of ARS were collected by a survey that included 14 five point likert type items. It was designed based on course perception literature. Items focused on perceptions of class components, which can potentially be affected by ARS usage. This was why it did not cover all aspects of student's perceptions. Perceptions in this study mostly referred to the interactive environment, feedback and student's reflections. The questionnaire's Cronbach's Alpha score was .917.

2.6. Procedures

The subjects were assigned randomly to the control and treatment groups. They were taught the subject of 'Tasks and Authority of Police' in one two-hour lecture per week in both groups. Lectures were supported by in-class discussions and 'question-and -answer' activities. In order to conduct these activities, five-seven questions were prepared before the lesson for each week. Class time was divided between lectures and questions.

After questions were shown via projector in 10-20 minutes lecture periods, the students are given a period of time to express their ideas. Then, the instructor moderated the discussion and ended the debates with explanations. In the treatment group, student responses were collected via ARS and histograms of responses were provided immediately after responses. The exam was carried out in the eighth week of class.

3. Results

3.1. Learning level

Achievement was measured by a paper exam. The exam was prepared taking into consideration all of the objectives in the lectures that took place during the experiment and revised by two subject matter experts. Table I presents the mean and standard deviation scores for both the control and experiment groups.

Table I. Achievement of Control and Experiment Groups

	Groups	N	$\overline{X}$	Std. Dev
Exam	Treatment	71	85,05	9,718
	Control	68	85,62	8,629

Table I shows the mean and standard deviation scores of the achievement tests for

the ARS and non-ARS groups. In order to compare the group's mean scores, an independent sample t-test was conducted using SPSS 18. The results of the t-test revealed that there was no significant difference in exam scores between the treatment and control groups t(137) = -.364 p>.05.

3.2. Computer ownership effects on ARS

Table II presents the mean and standard deviation for treatment group with regards to computer ownership effect.

Table II. Computer Ownership's Statistics

Computer Ownership	Groups	N	$\overline{X}$	Std. Dev
	No	32	60,91	8,641
	Yes	39	59,28	10,311

Table II shows the mean and standard deviation scores of the treatments group. In order to compare groups mean scores, an independent sample t-test was used. The results of the t-test showed no significant effect of computer ownership on course satisfaction (t(69)= -.710, p>.05).

3.3. Students' perceptions on ARS

Students' perceptions data of ARS were collected via a student perception survey. The data from the surveys were analyzed statistically and descriptively. Table III presents the mean and standard deviation scores for both the control and experiment groups.

Table III. Course Satisfaction Level of Control and Treatment Groups

Satisfaction	Groups	N	$\overline{X}$	Std. Dev
	Treatment	71	60,01	9,563
	Control	68	62,87	7,912

Table III shows the mean and standard deviation scores of the achievement tests for the ARS and non-ARS groups. The results of the t-test revealed that the non-ARS group scored higher than the ARS supported group in terms of satisfaction. On the other hand, the t-test results showed no significant effect of ARS supported lectures on satisfaction levels (t(137) = -1.912, p>.05). The frequencies of items in the survey are presented in Table IV.

Table IV. Treatment and Control Groups Students' Perceptions on ARS

Question Number	Item	$\overline{X}$ Treatment	$\overline{X}$ Control
Q3	I attended the class with more attention.	4,55	4,55
Q13	I could get answers to my questions in the course.	4,48	4,69
Q1	This course is more enjoyable and friendly than other courses.	4,46	4,75
Q14	My motivation has gradually increased during the course.	4,45	4,45
Q2	I participated in the class with more actively.	4,42	4,54
Q16	I got satisfying feedbacks for my in-class questions	4,38	4,54
Q12	Lecture speed was appropriate to student's level.	4,35	4,57
Q19	I think that my ideas received more attention in this course.	4,3	4,39
Q17	I interacted with the ideas of my classmates in this course.	4,28	4,43
Q10	I followed this course with gradually increasing attention.	4,21	4,43
Q7	Discussing my answers increased my motivation concerning this course.	4,2	4,37
Q15	The in-class discussions helped me with points I didn't understand in the course content.	4,15	4,36
Q6	I communicated more with my faculty and classmates in this course.	4,03	4,34
Q11	I have experienced more desire to more verbally participate desire in this course than other courses.	3,75	4,46

According to Table IV, the control and treatment groups have almost the same scores. All items scores were compared via an independent sample t-test. The results show that the only significant difference between ARS and Non-ARS groups were seen in items 11 (I have more desire to verbally participate in this course than other courses) (t(137)=-3.942, p<.05).

4. Conclusions and Discussion

This study was conducted to identify the effects of ARS on academic success and student perceptions. The results showed that ARS usage does not have a significant effect on learning achievement. Also there is no significant difference between ARS and non-ARS group in terms of course perceptions.

The results concerning the students' learning level showed that both treatment and control group had high-level success. However there is no significant difference between the groups in parallel with the some of studies (Guthrine & Carlin, 2007; Flora, Jacob, & Nancy, 2010). On the other hand, Rubio, Bassignani, White and Brant (2008) have stated that ARS usage has positive effects on learning.

The same level of success in this study can be interpreted in two ways. Firstly,

both groups had the same instructional activities such as discussion and question-answer sessions. Since only an appropriate instructional method can influence learning (Clark, 1994), the groups had the same achievements. Secondly, the high success levels of both groups could hinder the effect of ARS on learning.

According to perception survey results, both treatment and control groups found courses to be very enjoyable. But control and treatment groups had almost the same perception level in contrast to many other research studies (Latessa & Mouw, 2007; Alexander, Crescini, Juskewitch, Lachman & Pawlina, 2009). These studies showed that the students who attended ARS classes found courses to be more enjoyable and useful. This result may be related to the possibility that students may have avoided stating their actual opinions on the survey because the instructor was the also the students' commander in the police college.

The results also showed that students in treatment groups had less desire to participate to class verbally. It may be related to the fact that students already had chance to convey their personal opinions via ARS. So they may not have felt the need to express any additional ideas. It should also be considered that they felt that they had participated in the course at the same level. It means that the format of class activities may play a more important role than ARS in terms of student's level of participation.

Another result of the study is that neither experience with technology nor computer ownership affected perceptions in the ARS user group. It can be inferred that the simplicity of ARS usage may explain why groups possessing experience with technology reported the same perception level.

The use of ARS can be seen as a feature that enriches the class experience. However, ARS may become a regular part of class activities and become commonly used in the long-term. It ensures that the instructional method employed is more to the point. If needed, ARS should be used with appropriate instructional methods to promote more effective teaching and learning (Beatty et. al, 2006).

The strength of this study arises from the large sample size and the duration of ARS usage. The main weakness is that both the classroom and school atmosphere was relatively strict. It is recommended that the same study should be conducted with different courses and in different contexts.

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