

Replacement of a clicker system by a mobile device audience response system

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Conference Key Areas: Information and communication technologies, New learning concepts for engineering education, Novel education tools for engineering programs

Keywords: student response system, audience response system, classroom response system, student activation, audience participation, mobile devices

INTRODUCTION

In higher education lectures are still a frequent used approach to transfer knowledge. Although lectures have their advantages, it is difficult to gain interactivity [1]. Numerous studies describe the benefits of active learning [2]. An audience response system (ARS) is a technology that can be used to stimulate active learning in a lecture. An ARS allows a teacher to collect, summarize and visualize the answers of all the students at once with the help of ICT. An ARS also provides direct feedback to the lecturer and the students [4]. Different kinds of ARS are available such as clickers and web based applications [4]. Research on the benefits of clickers indicates an increase of engagement, attention, participation and promotion of group learning processes [3,5,6].

An audience response system can

- refocus the students attention after a period of passive listening [7].
- encourage the active participation of students during lectures [6,7].

- create the possibility for shy and unsure students to anonymously respond to questions and to express their opinion [6,7].
- give a student feedback on his or her understanding [4,6].
- give a lecturer an immediate (answers are automatically collected) and more reliable feedback of class understanding because students are less influenced by each other when giving an answer (which can happen using more analogue response methods) [3,6,7].

Instructions supported by an audience response system make students active participants in the learning process [7,8].

In 2006-2007 clickers were introduced for the first time at Campus De Nayer (University College Lessius, Belgium). They were implemented during “Mechanics” and “Physics” classes for approximately 200 first year students in the bachelor of engineering technology. Students who used the clickers were enthusiastic about the system [8].

But we experience the following disadvantages of the clicker system:

- The handheld remote is expensive. The students must pay a warranty for the use of a clicker. Students are reluctant to pay the warranty [8].
- The clickers aren't student proof. A lot of remotes are defect.
- To interact with the clickers the lecturers must have a software application installed on their computer and a receiver plugged in the laptop. The connection between the receiver and the laptop fails now and then.
- Because of the cost of a receiver, our campus only has one receiver. When more teachers want to use the clicker system, it gets more complex to share the receiver.
- The lecturer or a third person is held responsible for the distribution and collection of clickers. This is time consuming.

So the clicker system causes frustrations because of some logistical and technology-based difficulties, which is confirmed by Kay and LeSage [7].

With mobile devices becoming more popular, several response system companies now have developed software which allows to vote from a student's own personal mobile device, e.g. a netbook, laptop, tablet or even mobile phone.

In 2013 we got the opportunity to test such an in-class software polling system. The principles of the software polling system are identical to the clicker system but there is no need for a dedicated expensive handheld remote and receiver. The software polling system combines a web-based application with mobile technology.

We have used this opportunity to examine the following topics:

- Are our students still enthusiastic about an ARS and if so why were the clickers no success in the past?
- Which medium do students prefer to interact with their lecturer?
- What are the benefits and disadvantages of both the clicker system and the software polling system?

In our study students used laptops, mobile phones and tablets to vote with the in-class software polling system. Research on the effect of laptop use in classrooms reveals that the use of a laptop in the classroom has a negative effect on the students learning [10,11]. Students admit that they use their laptops during lectures

for other things than taking notes [11]. Moreover studies show that the use of a laptop poses a distraction to fellow students [10,11]. By consequence, we wondered whether there is a possible distraction caused by the use of mobile technology.

In this article we report on our experience with both systems.

1 THE EXPERIMENT

In the first semester of 2012-2013 none of the lecturers at Campus De Nayer used the clicker system during lectures. The teachers used the classic method of hand raising to create interaction and to apply peer instructed learning [12].

In the second semester the clicker system was used during the 12 “Mechanics” lectures, whereas the software polling system, “Poll Everywhere” was used during 20 “Physics” lectures. Both systems were used for the same 160 first year students. By consequence the students were able to compare the different systems.

About 60 students were in possession of a clicker. The amount of students that used the clicker reduced in the course of the semester to about 30 students.

70 students participated with their mobile device in the “Physics” course. By the end of the semester this amount diminished to 40 students.

At two different moments during the semester, we submitted 4 questions to the students to learn about their impressions of the software polling system. At the end of the semester we queried the students again with 16 questions. 51 students answered the final poll online with the help of the software polling system. And 65 students answered the same questions on paper. This is a response rate of 72,5%.

2 THE RESULTS

2.1 Student engagement

Our study confirms the results of other studies:

- 74% of the students agreed that an ARS (clicker or mobile device) engaged them in lecture and 78% agreed that it kept them attentive.
- Some studies have proved that the ARS doesn't improve attendance expect when there is a link to the students grade [7]. Because the use of an ARS possibly makes the classroom experience more attractive [6], we examined if an ARS would encourage students to attend the lectures more often. In *Fig. 1* the answers of the students to the question "interactivity increases my attendance to lectures" are given. The result supports the statement that interactivity has no big impact on students' attendance.

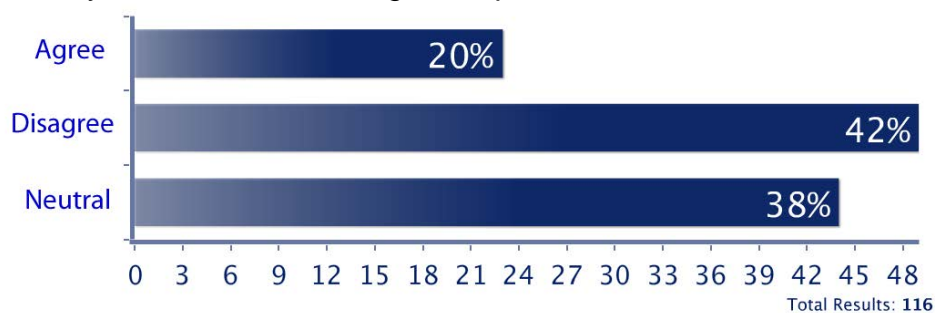


Fig. 1. Interactivity increases my attendance to lectures

The majority of the students is enthusiastic about the use of an ARS and would like to use a voting system in more lectures. 34% of the students would like to use a voting system in all lectures and 59% would like to use it in more lectures but not all.

2.2 Student learning

Students strongly agree (85%) that the use of a voting system immediately provides feedback about their understanding as also mentioned by several studies [4,7].

A lot of studies investigated the impact of ARS on the learning process. And all of them agree that the learning performance increases as a result of the use of an ARS [3,6,7]. Most of these studies focus on the learning process during the lecture or the effect on the students' grades. We asked the students about the effect of the ARS on the processing of the learning material after class. A little more than half (52 %) of the students agree that the use of a voting system in lectures helps them to study the material afterwards.

We also asked the students if they expected better exam results as a consequence of the use of interactive questions. The majority of the students don't know if there would be any effect. And because of a change in the "Physics" program, we can't compare the exam results of this year to a previous year.

2.3 Technology

We compared the use of a clicker system with the use of a software polling system and the classical raising hands. 81% of the students prefer a clicker or software polling system to raising hands (*Fig. 2*). Students prefer the use of an ARS mainly for two reasons :

- They can vote anonymously.
- They can see a histogram with the chosen answers.

With Poll Everywhere the lecturer has the option to present live charts: students see the charts growing while their fellow students are voting. Since this option definitely influences their answer, it is best to hide the chart until all students have voted.

The majority of the students who preferred the ARS, decided in favour of their own mobile device instead of a clicker.

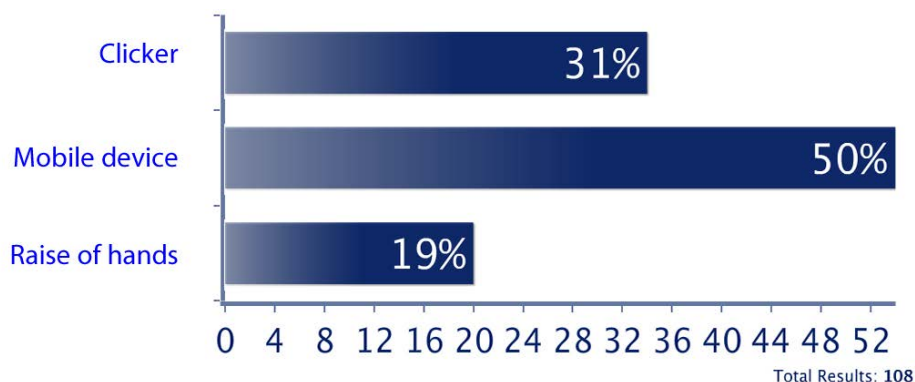


Fig. 2. Which medium do you prefer to vote?

For the use of Poll Everywhere we had to install a WiFi network in the lecture halls. Students could use this WiFi network also to surf the internet, to chat, So in the final survey and the 4 intermediate polls, we asked the students if the use of a mobile device distracted them.

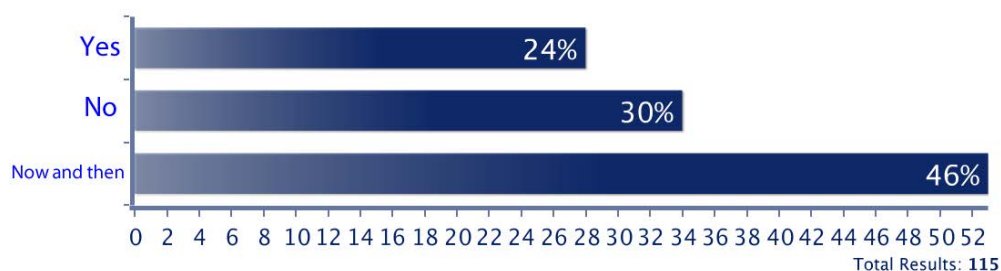


Fig. 3. Were you distracted by your mobile device? (Final survey)

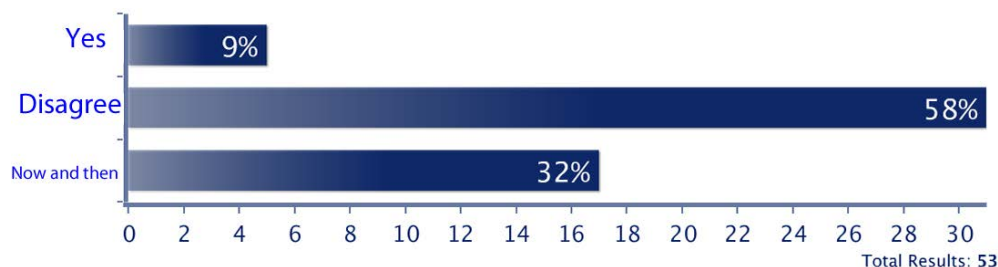


Fig. 4. Were you distracted by your mobile device? (Interim survey)

The final survey shows that 70% of the students admitted to be distracted by their mobile device (Fig. 3), whereas only 41% mentioned to be distracted when asked the same question during the intermediate surveys (Fig. 4). The latter is a consequence of the fact that students feared that we would stop the accessibility of the WiFi network when they would inform us what they were really doing.

The intermediate poll was only answered by students who had a mobile device. The final poll was answered by students with a mobile device, as well as on paper by students without a mobile device.

Table 1 and Table 2 show the link between the medium students prefer and how distracted they get by their mobile device.

Table 1. Segmentation report medium vs. distraction for the students who voted online

Which medium do you prefer?	Were you distracted by your mobile device?				
	Yes	No	Now and then	No response	Total
Clicker	2	1	6	0	9
Mobile device	3	13	21	1	38
Hands	1	1	1	0	3
No response	1	0	0	0	1
Total	7	15	28	1	51

68,6% of the students who voted online admit being distracted by their mobile device and prefer their own device to vote (Table 1).

Table 2. Segmentation report medium vs. distraction for the students who voted on paper

Which medium do you prefer?	Were you distracted by your mobile device?				
	Yes	No	Now and then	No response	Total
Clicker	9	5	11	1	26
Mobile device	3	7	5	0	15
Hands	8	5	4	0	17
No response	1	2	4	0	7
Total	21	19	24	1	65

A majority of the students who voted on paper, prefers the clicker system. And 77% of the students who preferred the clicker system, say they get distracted by a mobile device. Most of the students who prefer voting by raise of hands, say they are distracted by their mobile device. So it seems that the students who voted on paper, choose for another medium then a mobile device to avoid distraction. On the other hand, it is difficult to draw a conclusion concerning distraction, since we didn't measure the amount of distraction by mobile devices in a lecture without the use of an ARS.

Only a fraction of the students who voted on paper have participated with their mobile device during the first "Physics" lectures and stopped using it later on. So it is remarkable that the majority of the students who voted on paper didn't use their mobile device at all, but still 69% of them admit to have been distracted. Further research is necessary to determine what causes this result:

- To what extent are students distracted by their mobile device if they aren't using it for voting during a lecture in which an ARS is used?
- To what extent are students distracted by their mobile device during a lecture in which an ARS is not used?
- To what extent are the students distracted by fellow students who are using their mobile device?

After a few lectures we saw a drop of the amount of students that took along their clicker or mobile device. For both systems the most common reasons were:

- Forgotten
- Battery low

And for Poll Everywhere a part of the students had problems to get an internet connection so they stopped trying. Students who brought a laptop to the lecture, stopped to bring it along because it was too heavy and they preferred to vote together with their neighbour.

Although half of the students didn't have a clicker or a mobile device with them, the use of the ARS also kept them active and engaged because they worked together with a neighbour or just reflected on the question without voting (*Fig. 5*). This is confirmed by several studies [12,13].

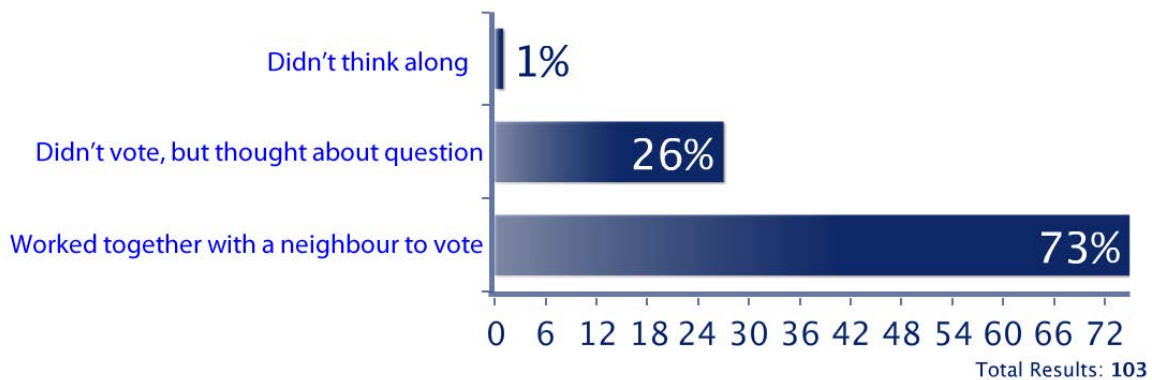


Fig. 5. What did you do when you didn't have a clicker or mobile device to vote?

3 SUMMARY

This study shows that an ARS is definitely a technology which helps to activate students during lectures. The type of technology is of minor importance. Clickers and the software polling system have both their benefits and disadvantages which should be taken in consideration when choosing an ARS.

Although the majority of the students prefer a software polling system, the disadvantages of the system should not be neglected. An ARS system activates and engages students, but raises questions about distraction and the "legal" use of mobile devices during lectures. Further research is necessary to determine the impact of this distraction, which should be considered in combination with the effect of interactivity on the learning performance of students.

An in-class software polling system has a some benefits compared to a clicker system, such as

- no software needed on the lecturers computer;
- no expensive clickers or receiver needed;
- students can vote from different locations (big advantage for video conferencing lectures).

A disadvantage of the polling software is that not all students have a mobile device or they are experiencing technical problems with their device. But even if only half of the students have a mobile device to vote, this technology still has a major impact and can stimulate collaborative learning.

4 ACKNOWLEDGMENTS

We would like to thank Joris Verheyden for his time and for his persistence despite the sometimes counteracting clicker technology.

Our thanks also go to Anneleen Cosemans from the Teaching and learning department of KULeuven for her valued feedback.

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