Edge Hill University

AN INTRODUCTION TO CLICKER SYSTEMS

FOR PEER INSTRUCTION AND INTERACTION

Introduction

This document has been created to introduce you to:

- the range of potential uses for Clickers in Higher Education

- the range of names used to refer to Clickers

- how Clickers could be used well for certain purposes

- how to get started using Clickers in the context of Edge Hill University

- the scholarly literature related to using Clickers and similar tools

What are Clickers?

Clickers is one of the generic names that we give to a range of tools that have been developed to aid some interactive activities in large lecture settings.

They have many other names such as Audience Response Systems, or Classroom Communication Systems. Kay (2008) reports that the most common names in the literature are:

- Audience Response Systems
- Personal Response Systems
- Electronic Voting Systems
- Student Response Systems
- Classroom Communication Systems
- Classroom Response Systems
- Electronic Response Systems

- Clickers

We are using the word 'Clickers' as it's a neutral title that doesn't imply anything about how they are being used.

Examples of Use

To introduce you to their use, here are two examples of how the systems are used in Higher Education.

- 1. 'Peer Instruction'.
  - Eric Mazur teaches Physics and started designing the 'Peer Instruction' method over 20 years ago. This method would generally involve:
    - teacher presents a question on screen
    - students respond using the Clickers
    - teacher presents responses from the class, but does not provide the correct answer.
    - the class is told to discuss possible solutions in pairs
    - students are provided with the opportunity to vote a second time.
    - After the second vote, the issues are resolved through class discussion and clarifications from the instructor.
  - An early version of his technique is covered briefly in the video 'From Questions to Concepts: Interactive Teaching in Physics'

- o He developed this method when he realised that his students "were just memorizing information rather than learning to understand the material". He talks about the development of the ideas in detail in 'Confessions of a Converted Lecturer: Eric Mazur'.
- 2. Using Clickers to sustain attention in lectures.
  - o This can be a very simple technique of asking a question every 20 minutes to address student attention deficits (Kay and LeSage, 2009). This is sometimes used in Edge Hill's staff inductions.
  - o A range of researchers have looked at this aspect of using Clickers. For example Latessa and Mouw (2005) in Innovations in Family Medicine Education report that "The learners reported that the ARS made the presentation more fun... helped them be more attentive...".

Benefits reported

Kay and LeSage (2009) reviewed the literature around Clickers finding 67 peer reviewed Journal articles published between 2000 and 2007. They discovered a range of reported benefits and challenges, and this session looks in depth at those as a way of guiding our understanding of how these systems can be used well.

Benefits to the classroom environment included:

- **Attendance**: Students go to class more - "Multiple studies have found that attendance does improve when an ARS is used, provided it is linked to a portion of a student's final mark... Greer and Heaney (2004) observed that students were displeased about being forced to attend class in order to gain academic credit for ARS participation."
- **Attention**: Students are more focused in class - "One technique for addressing student attention deficits during a class is to present ARS questions at 20 min intervals, thereby requiring students to shift their attention and actively participate in the learning process. The success of this approach has been confirmed by numerous studies"
- **Anonymity and participation**: Responses can be anonymous - "substantial evidence indicates that using an ARS increases student participation when compared to classrooms where an ARS was not used"

Benefits to learning included

- **Interaction**: Students interact more with peers to discuss ideas - " researchers have reported greater articulation of student thinking... more

probing questions, an increased focus on student needs... effective peer-to-peer discussions, and active learning"

- **Discussion (Peer Instruction)**: Students actively discuss misconceptions to build knowledge - Using the Peer Instruction Method. "The research indicates that students feel they are better able to discuss and calibrate their understanding of specific concepts when peer instruction is employed"

- **Contingent teaching**: Instruction can be modified based on feedback from students.

- **Learning Performance**: Learning performance increases as a results of using ARS "many experimental studies report that classes using ARSs significantly outperform those using traditional lecture formats"

- **Quality of Learning**: Qualitative difference when learning with ARS (e.g., better explanations, thinking about important concepts, resolving misconceptions) - "In summary, using an ARS appears to emphasize the depth of student understanding, not the amount of material "covered"."

Benefits to assessment included

- **Feedback**: Students and teacher like getting regular feedback on understanding - "Using an ARS helps improve the feedback process by guaranteeing anonymity, quickly and efficiently collecting and summarizing student responses, and preventing students from copying the answers from their peers."

- **Formative Assessment**: Assessment is done that improves student understanding and quality of teaching - "Regular use of an ARS can offer

real-time feedback to both instructors and students as to how well concepts are being understood."

- **Compare responses with other students**: Students compare their ARS responses to class responses - "There is some evidence to suggest that students like to see how well they are doing relative to their peers"

Overall from this research I would note that using these systems can enhance strategies aiming to:

- Increase student attention in class
- Improve depth of understanding and performance
- Supplying students with formative feedback
- Provide anonymity to students
- Use Peer Instruction or contingent teaching

Reported Challenges

Technology-based:

- **Bringing remotes**: Students forgot or lost remotes and could not participate in class
- **ARS did not work**: Remote devices did not function properly

Teacher-based:

- **Responding to student feedback**: Less experienced teachers cannot adjust to student feedback

- **Coverage**: Cover less course content if ARS is used - "Considerable research indicates that teachers, and sometimes students, believe that less content is addressed when using an ARS... the time required to set up the ARS, hand out the remote controls at the beginning of the class, and collect remote controls at the end of the class can be significant"
- **Developing questions**: Time consuming to create ARS questions - "Researchers agree that the most effective questions have the following characteristics: they address a specific learning goal, make students aware of opinions other than their own, uncover misconceptions and confusions, explore ideas in a new context, and elicit a wide range of responses"

Student-based

- **New method**: Students find it difficult to shift to a new way of learning - While resistance to using ARSs is relatively uncommon issues recorded are "A switch of teaching methods from lecturing to ARS questioning can lead to stress, frustration, and resistance in the beginning... some students are distracted by the use of an ARS... others question their ability to direct their own learning with this tool... some students indicate that less content is covered"
- **Discussion**: Discussion leads to confusion or wasting time - "Even though these problems have not been widely reported, more information is needed about creating effective discussion that is focussed, non-threatening, and efficient."
- **Summative assessment**: Using ARS for tests may not be popular with students

Overall we can note that:

- There can be technical issues with sets, perhaps meaning that you should have a plan B.
- If you are wanting to change your lectures in response to student needs, be aware of the challenges involved
- Clickers are generally used as part of a strategy to deepen what is being learned, meaning the class might get through less content.
- Creating good questions, certainly for Peer Instruction and testing understanding of concepts, is difficult and time consuming. Good questions:
    - address a specific learning goal
    - make students aware of opinions other than their own
    - uncover misconceptions and confusions
    - explore ideas in a new context
    - elicit a wide range of responses
- While students generally accept the use of Clickers, they don't seem to like certain uses like summative assessment or anything related to final grades, and some may struggle with a change to the learning environment.
- Where discussion periods are involved in any class there are potential issues that lecturers should be aware of that could reduce the success of the activity.

Systems available

- Online systems such as Kahoot and Socrative. Contact [Learning Technology Development](#) for advice on getting started with these.
- Plickers cards which only require the lecturer to use their mobile device. Contact [Learning Technology Development](#) for advice on getting started with these.

A selection of related publications

- [Implementing clickers to assist learning in science lectures: The Clicker-Assisted Conceptual Change model](#) by Lin et al (Australasian Journal of Educational Technology, 2011) looks at a new clicker-based instruction model called 'Clicker-Assisted Conceptual Change' and examines the effects of it on scientific learning.

- [Context matters: Increasing understanding with interactive Clicker Case studies](#) by Lundeberg et al (Education Technology Research and Development, 2011) looks at the effect of Clicker Case stories on student performance. Their effect was positive however the effect varied between institutions and topics.

- ['Examining the benefits and challenges of using audience response systems: A review of the literature](#)' by Kay and LeSage (Computers and Education, 2009) is a major review of the literature in this area and is a 'must read' article. It looks at the history of the technology and terms used to describe it, followed by an in-depth review of 67 peer-reviewed papers published from 2000 to 2007.

- '[Characterizing the Effect of Seating Arrangement on Classroom Learning Using Neural Networks](#)' by Monterola, Roxas and Carreon-Monterola (Complexity, 14.4, 2009) found that when using a type of Peer Instruction there were benefits to seating high aptitude students at the corners of the classroom rather than in any other planned or random seating arrangement.

- '[A New Peer Instruction Method for Teaching Practical Skills in the Health Sciences: an Evaluation of the 'Learning Trail']' by Dollman (Advances in Health Sciences Education, 2005) looks at "an innovative application of peer-mediated instruction designed to enhance student learning in large practical classes."

- '[An investigation of the effectiveness of electronic classroom communication systems in large lecture classes]' by Sharma, Khachan, Chan and O'Byrne (Australasian Journal of Education Technology, 2005). This describes their use of Clickers where "Students used the keypads to answer two step multiple choice problems after a discussion within their group. The questions were generated using students' answers from previous exams".

- '[Peer instruction: a case study for an introductory magnetism course]' by Lenaerts, Wieme and Van Zele (European Journal of Physics, 2003) notes "the positive impact of PI has been demonstrated... Special attention has been paid to the enhancement of the traditional lecture demonstrations by PI... The framework of Vygotsky's zone of proximal development is offered as a pedagogical explanation for the effectiveness of PI."

- '[Peer Instruction versus Class-wide Discussion in Large Classes: a comparison of two interaction methods in the wired classroom]' by Nicol and Boyle (Studies in Higher Education, 2003) reports on research where Clickers were used to make it easier to give immediate feedback to students and to help manage Peer Instruction. The study discovered that the type of dialogue and discussion sequence have important effects on learning.

- '[Peer instruction: Results from a range of classrooms](#)' by Fagen, Crouch and Mazur (The Physics Teacher, 2002) notes users reported that writing good questions can be a major obstacle. When no suitable questions had been written students were asked to read before the lecture to cover breadth and then in-depth study occurred in the lecture.

- '[Peer Instruction: Ten years of experience and results](#)' by Crouch and Mazur (American Journal of Physics, 2001) reports data from ten years of teaching with Peer Instruction (PI). They also look at how they have improved their use of PI, for example they have "replaced in-class reading quizzes with pre-class written responses to the reading, introduced a research-based mechanics textbook for portions of the course, and incorporated cooperative learning into the discussion sections as well as the lectures."