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## Case study 1.

### Immediate feedback in classes: live polling for motivation and learning

**Example MeLTS Question**

• **Question 6.3:** Write a minimal SOP expression for this Karnaugh Map

A:  $AB'C'D' + A'B'C' + BD$

B:  $B'C'D' + A'B'C' + BD$

C:  $B'C'D' + A'C'D + BD$

D: None of the above

		CD	00	01	11	10
AB	00		1	1		
	01			1	1	
	11			1	1	
	10		1			

### Summary

The use of live polls in lectures to gain immediate feedback from students on their understanding of a topic. Students participate in the polls using their personal mobile devices. A number of advantages are evident:

- Immediate feedback: lecturers are able to identify learning issues within a large class immediately and respond appropriately
- Student self-measurement: students are able to measure their own understanding in comparison to their peers
- Creating an interactive environment: live polling increased engagement of students in a lecture situation and promoted discussion of content
- Pausing the flow of lecture content, particularly 'teacher talk' to allow space for student reflection and response

### Keywords

Audience response systems; personal response system; in-class polling; in-class feedback; 'clickers'



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## What worked?

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This case profile describes two lecturers in the Law and Engineering faculties. Students use their own internet-enabled devices (such as a smart phone or laptop) to access online polls devised by the lecturer. The results of the poll are then projected onto the lecture theatre screens; this enables the lecturers to identify any areas of misunderstanding and to change the course of the lecture if necessary to ensure students have grasped the correct content.

The primary goal of the use of this technology, as noted by both lecturers, is to gain instant feedback during lectures from students on their understanding of particular topics or concepts. Both lecturers felt able to improve learning outcomes by helping students to engage and interact with the material and promote the discussion of content with other students. The immediacy of this feedback enables the lecturers to adapt their lesson 'on the fly' to better respond to their students' learning needs.

### Live polling in the Faculty of Law

Daniel is a lecturer in the Faculty of Law. He became interested in using live polling as a tool in his classes following his involvement with a university-wide trial initiative that focused on increasing lecturer/student interactions during classes. The trial included polling software, among other hardware and software. At the end of the trial Daniel remained interested in the potential of polling, particularly in increasing the level of interactivity in his lectures. Daniel is now using polling as one of several lecturing strategies to increase interactivity, change pace, break up 'teacher talk' and give students opportunities to understand the key messages. His lectures make good use of watching videos, listening to radio clips, asking questions and organising students into group discussions.

*You know, I run my classes in a very interactive kind of multimedia sense generally... I'm showing videos and doing polls and playing clips, radio clips and whatever and doing class exercises...My whole approach is designed to try and maximise student engagement. (Daniel)*

With regards to live polling activities in his classes, Daniel stated that his main goal was to gather formative feedback in order to gauge student understanding prior to beginning a topic.

Currently, Daniel uses a free version of polling software called *Poll Everywhere* that can collect responses from up to 40 students at a time. Due to a lack of funding, Daniel has been limited to applications that offer free or trial access, often with limited functionality. In this case the software is limited to 40 responses, but it otherwise suits his needs.

While Daniel primarily uses multiple choice questions in his poll/s, the software can support other forms of responses (for example, open ended answers). He feels that multiple choice questions provide an easy way to quickly gather student responses which can be easily displayed 'live' in his class as a stimulus for discussion. Prior to the start of each class Daniel trials the poll/s to ensure that the system is working correctly. During his lecture he displays

the poll questions and students use laptops or smartphones to provide their answers. The polling software collates these answers into graphs or tables, which are then displayed on the large lecture screens.

Daniel incorporates a live poll at regular intervals throughout each semester. He has found the software to be particularly beneficial when covering sensitive topics in class since it can allow students to be able to contribute their opinions anonymously. Daniel explained that the ability to contribute anonymously has been particularly important for his ethics unit, where exploring opinions is important. The freedom of anonymity in the students' responses provides them with the potential to share and change their opinions however controversial they may be.

Daniel reported that the use of live polling has been received positively by students in his classes; he has received many positive comments from students on class evaluations to say they enjoy it.

*The students love it and every time I...go to my search or evaluations, multiple students comment on it and say they really enjoy it. So it works well. (Daniel)*

In the future Daniel plans to continue using live polling in his lectures. He wants to include polling in classes greater than 40 students (a limitation of the free version of the polling service he is currently using) but will need to either secure funding, or find a suitable alternative system.

### **Live polling in the Faculty of Engineering**

Geoff is a lecturer in the Faculty of Engineering who set about creating his own live polling program when he found commercial solutions were insufficient to meet his requirements. Specifically, Geoff wanted a program that did not require extra equipment (such as 'clickers'), came at no extra cost (such as subscription fees), and was interoperable with student owned devices. He also needed the system to work well within the university's infrastructure and learning management system, and to act as a data collection mechanism for the lecturing team.

In collaboration with a colleague and several students, Geoff designed a live polling program called MeLTS: Monash eLearning Tools System. Geoff and his team took a year to develop MeLTS in between other projects and have had a prototype running in first year Electrical Engineering classes for over a year. During this period, Geoff and his colleagues experimented by adding and removing features based on their experience of what has or has not worked. As a result of this refinement process, the polls can now be accessed across the majority of mobile devices, and are able to be embedded within the learning management system.

During their lectures, Geoff and his colleagues introduce concepts and then poll the students immediately to gauge student understanding through comprehension questions. This allows the lecturer to quickly identify which aspects of the concepts students have misunderstood, and therefore what needs to be explained further in class. In particular,

Geoff noted the need to pay attention to constructing questions and multiple choice answers that “fall into common misconception areas...” Geoff’s students valued the ability to communicate their level of understanding to the lecturer and the opportunity to get immediate clarification. As one student put it:

*The use of MeLTS was good in that it provided us immediate feedback with our understanding of the topic currently being studied and we could either tick the understanding or not button which the lecturers would then note and explain again if clarification was required. (Student)*

Geoff initially trialled the program in lectures without providing marks for participation. During this time he estimates that 15 percent of students across the semester used the polls. Following this, Geoff introduced marks for participation; students would receive a mark for submitting a response to the poll which represented 2.5 percent of their overall mark. He argues that as a result, the response rate to the live polls during this semester increased to around 50 percent of the class.

In designing their system, Geoff and his team built on the idea of live polling allowing students to see how they compare to their peers. In particular, the team drew on the idea of gamification, incorporating a leader board into their live polls which they see as encouraging a greater level of positive competition in class among students. As one student confirmed:

*MeLTS provides fantastic engagement as you have to pay attention, we all want to participate to beat our friends on the leader board. It's simple but very effective. (Student)*

Geoff noted that the use of polls in lectures is therefore proving beneficial in terms of providing information about where students have progressed with their learning, and the terms and aspects of the course that may be misunderstood. The lecturing team is particularly interested in storing the polled data collected from students which would enable the lecturers to look at long-term trends regarding student progress and understanding.

All told, a number of outcomes could be seen to be arising from the system’s use with first year classes:

- Increased student engagement and motivation with content, including increased in-class discussion of content
- Ability of lecturers to re-pitch and re-design their lessons ‘on the fly’
- Pausing the flow of content to provide an opportunity for students to evaluate their understanding
- A notable correlation between use of polling and high student achievement (however it was suspected that those students who engaged in the polling tended to be more confident and/or high performing students)

Geoff and his team are hoping to further develop their program into a free product for other education providers. In addition to simplifying the system, Geoff and his team intend to add features such as simple analytics (analysis of data or statistics about students and their responses) and more competitive elements.

## Why it worked

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### Enablers

There are a variety of enabling factors that have led to or established the conditions within which live polling has been successfully used. This section highlights specific enabling factors that were evident in these specific case studies. These include:

**‘Failed’ institutional TEL initiatives can seed future innovation. Innovation does not occur in a vacuum nor is it an overnight success:** Both these cases of successful live polling did not occur spontaneously. Both sets of lecturers had been previously introduced, through a university-wide pilot initiative, to an early version of polling technology. While the pilot was not necessarily successful in establishing an institution-wide change in practice, it had introduced the idea that live polling in university lectures could be used to increase student engagement with lectures and with some course content. The university initiative was successful in ‘seeding’ the idea of live polling amongst students and staff and has served to underpin current live polling practices.

**Accessible for university and student devices:** The success of live polling is dependent on the software being easily accessible by student and lecturer devices, including tablets and phones.

**Applicable across a range of contexts and purposes:** The success of live polling in both cases was clearly linked to its versatility to be used in a variety of contexts including small and large classes as well as for a range of purposes including testing for understanding, satisfaction, problem solving, and for stimulating discussion.

**Robust wireless infrastructure:** The wireless infrastructure was robust enough to handle large numbers of students simultaneously using their devices to access the poll. Moreover, the students need to be able to access the wireless network, and the internet without a series of password prompts which would otherwise dramatically hinder access to the poll, and thereby the flow of the lecture.

**Alignment with lecturers’ educational philosophy:** Both lecturers persisted in seeking/programming and using the technology because it fitted with their own perspectives on how lectures should be conducted (for example, reduced didacticism, increased interaction between lecturer and students) and what facilitates learning (for example, lecturer reflexivity to student understanding and competition). From the perspective of enabling conditions, there is an obvious, but

valuable comment to be made about the necessity for an alignment or marrying of technology, activity and educational beliefs.

## Challenges

There are several challenges that can be noted in these cases of live polling. These include:

**Incompatibility of student devices with some polling software:** There are obvious benefits of using students' own personal devices rather than specialised polling devices such as hand-held 'clickers' and keypads. However, both lecturers quickly found that not all personal devices are compatible with the various live polling applications and websites that are on offer to them. This is a particular concern if students receive marks for participation. One 'work around' to this has been to enable students to be eligible for marks by participating via in-class answers or in the tutorials.

**External polling services not 'fitting' with the Learning Management System (LMS):** One lecturer noted that external polling systems could not be easily integrated with the university LMS. This poses two main challenges: firstly, lecturers are required to create separate accounts and input student information into the polling system. Secondly, external polling systems often involve students having to register with personal details - introducing additional issues of data privacy and third party access.

**Orchestrating teaching at same time as troubleshooting technology issues:** Both lecturers noted that several of their less 'tech-savvy' colleagues had not been comfortable in their ability to troubleshoot minor technical problems with the live polling technology during class such as dealing with students with incompatible devices or the poll failing to load. The lecturers commented that their colleagues may have been more comfortable with the technology if support was available from the IT department. However, using 'unsupported' applications did not allow for this.

## What the research literature says

Live polling is not a new phenomenon. It has, in a variety of digital and non-digital forms, been used for decades. An advantage of digital polling, over paper based forms, is the speed at which students can provide their answers, and have them collated and represented. Digital polling also has an advantage over asking students to raise hands or using similar signs, namely, that the students can be anonymous, increasing the potential for participation by less confident students or in cases of high risk, as well as providing an arguably faster and more accurate collation and representation of the answers. A further advantage of digital systems is the potential for easier collation and analysis of data over time. In contrast, arguments could be made in support of non-digital media, including a strong argument for simplicity, or lack of first order barriers (for example, technology access, technical skills).

Beyond the choice of media, there is a more fundamental set of questions that need to be asked: why and how should student polling be used during classes?

The engagement of students in active learning is considered a primary goal in the use of live polling (Wieman, C., et al., 2009). In a review of 67 peer-reviewed articles and chapters, Kay and LeSage (2009) provide a more detailed summary of key reasons for why live polling should be used, namely “improvements to the classroom environment (increases in attendance, attention levels, participation and engagement), learning (interaction, discussion, contingent teaching, quality of learning, learning performance), and assessment (feedback, formative, normative)” (p. 819). Their review elaborates on each of these reported advantages; however, they also go on to point out that there are several challenges for both the educators and students in the use of in-class polling. Teachers need time to learn the polling system, how to construct effective questions, and how to devise strategies to respond meaningfully to the feedback. In contrast, students need to also adjust to a new system in which their participation is more closely monitored, with fewer opportunities to remain passive listeners.

Although Kay and LeSage (2009) noted that a number of studies reported an increased level of student engagement in response to the use of live polling, they also stated that there is a need for further, systematic research to explore the variables at play. One such factor, as observed by the above Engineering case study, was the increased participation due to grading of responses. Indeed, Bernstein and Lederman (2001) found that improved attendance resulted in an increase of students’ grades by upwards of five percent. Another variable was the degree of risk taking involved, as noted by the above Law case study. Boud and Molloy (2013) found that the anonymous nature of the technology can facilitate increased participation since it allows students to share their opinion in a non-threatening environment.

Bergtrom (2006) argues that students’ attention on the lecture typically diminishes after 20 minutes and accordingly live polling can be used to reengage their focus. However, Wieman, et al. (2009) report that students become annoyed if they perceive the main role of the polling is simply to “keep them awake” (p. 10). Wieman et al. (2009) argue that this perception is reinforced if the questions are too easy.

Therefore it is important to consider the purpose in constructing the questions. Arguably, while the poll could be used to simply quiz or test knowledge such as that drawn from a reading, the value of the live polling is in leveraging the interactional affordances of the class context. As a result, there appears to be two main categories of valuable use in class:

- *Responding to students*, also described by Kay and LeSage (2009) as contingent teaching. In this broad approach, lecturers use polls to come to better understand their students’ backgrounds, opinions, pre-existing knowledge, or goals to better align the content, delivery and activities. As described in the Engineering case study, this category also includes the task of gauging conceptual understanding of ideas or skills just covered so that remedial actions can be taken if necessary. Importantly, not only do the questions need to be carefully constructed so that they are clear and



result in meaningful responses, but also they need to be actionable. In other words, the student responses should be consequential, that is, resulting in some action or acknowledgement by the lecturer. A common failing in the use of polls to elicit conceptual understanding is to simply repeat the slides, or commentary, not adapting or finding alternative ways to explain the concept.

- *Encouraging students to test or discuss their ideas.* This notably includes two forms: (a) predicting results of a lecture demonstration, simulation, experiment; and (b) stimulating students in discussing their ideas with each other and testing those ideas within the polling system. This was seen in the Law case study in which students' beliefs around ethics were elicited and then used to prompt class discussion. Significant work has been done in the area of using live polling to stimulate peer discussion (also described as peer instruction). Researchers suggest that use of the following format during live polling promotes peer-to-peer learning (Crouch, Watkins, Fagen & Mazur, 2009) for example, 'Posing the question;' 'Giving students time to think about the question and discuss it amongst themselves;' 'Asking students to submit an answer to the poll;' 'Discussing the outcome as a class.'

A selection of case studies, guidelines, and key readings are provided at the end of this case for anyone who wishes to further explore the topic.

## Moving forwards

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### Participant advice

The respondents articulated several key 'methods for success,' that they noted as being simple and effective practices that were related to the success of live polling in enhancing learning amongst their students.

**Consider your content** - you need to consider how you construct your questions and multiple choice answers for the live polls, if done carefully the poll results can reveal areas in which students are misunderstanding the content.

**Be consistent** - you need to set the expectation at the beginning of the semester on how frequently you plan to use live polling and ideally you would use it more than once during a lecture.

**Encourage participation** - explain the benefits of participation for the students. If possible, consider offering marks for participation.

**Prepare students** - let students know that you are going to conduct live polling during the lecture so that they can (a) bring their devices, and (b) have their devices readily to hand.



**Practice** - make sure the poll is working before you begin the class. It's a good idea to actually try and complete the poll that you have set up to make sure that it's accessible.

### Institutions moving forward

- The role of student feedback during classes needs to be explored by institutions and celebrated with lecturers. Without an underlying understanding and valuing of student feedback in the structure and goal of lectures, the lecturers are unlikely to explore polling, or persist over time as technologies and options change. This should also include guidelines on effective question construction, as well as activity (for example, peer instruction) management.
- Access to polling systems need to be enabled. These need to be suitable for large classes and supported by a (wireless) network infrastructure that can handle a large number of students in the same class, using different devices, accessing the same service (for example, the website). In addition to software access and wireless infrastructure, institutions need to communicate these to staff, particularly those who are used to limited or patchy network coverage in their teaching spaces. Teaching spaces need to be advertised by wireless network capacity in addition to seat capacity.
- Data collected through polling systems can be used for more than in-class activity. Polling systems are able to offer more detailed analytics, articulate into learning management systems, and provide teaching staff, students and wider institutions with re-usable data for learning, assessment and course management. For instance, use of the poll analytics could enable a more fine-tuned lecturer response, as well as provide opportunities to represent student feedback, and potentially learning, in the course structure.

### Resources for exploring

Outlined below are a range of available online polling technologies. The list is not comprehensive; each system has been included because it has featured in the project data collection or in related literature or cases. In addition, the list does not mean to suggest endorsement. Each of the systems need to be individually evaluated for the particular needs of the lecturers since they have different sign-up features, subscription rates, variable access to student data, and no integration with university systems.

#### **Poll Everywhere**

A poll is constructed through the *Poll Everywhere* website or app. Students answer in real time using their mobile phones or other devices via their web browser, SMS, *Twitter*. The results are then displayed live on the presenter's web browser or even within their PowerPoint.

URL: <http://www.polleverywhere.com>

<b>Socrative</b>	<p>A poll is constructed through the <i>Socrative</i> app or website. Students participate by using their personal devices to input their answer into the poll. The results are assembled through the <i>Socrative</i> program and personalised reports are created of the students' results.</p> <p>URL: <a href="http://www.socrative.com">http://www.socrative.com</a></p>
<b>Promethean</b>	<p><i>Promethean</i> offers several different live polling systems. Two of them involve students using a hand held 'clicker' to participate in the poll. The other involves students accessing the live poll through their mobile devices. Results can be displayed in different formats including via web browser or a <i>Promethean</i> interactive whiteboard.</p> <p>URL: <a href="https://www.prometheanworld.com">https://www.prometheanworld.com</a></p>
<b>GoSoapBox</b>	<p>A poll is constructed through the <i>GoSoapBox</i> app or website. Students participate in the poll via their personal devices. <i>GoSoapBox</i> also includes a 'social question and answer' feature in which the audience asks questions via the app from their personal device, the audience then votes via the app for the questions they most want answered.</p> <p>URL: <a href="http://gosoapbox.com">http://gosoapbox.com</a></p>
<b>Audience opinion</b>	<p>A poll is constructed through the <i>Audience Opinion</i> app or website. Students participate in the poll via the audience opinion app which they access on their personal mobile device. The results are then displayed in a variety of formats including graphs and charts.</p> <p>URL: <a href="http://www.audienceopinion.com">http://www.audienceopinion.com</a></p>

## Guides, Cases and Readings

- The University of British Columbia hosts a large collection of useful resources including an Instructor's guide to the effective use of personal response systems ('clickers'). This guide includes descriptions of how you can organise your classroom, the kind of questions that may elicit different kinds of activity, and common challenges. Other resources include a list of videos demonstrating their use as well as research articles.  
URL: <http://www.cwsei.ubc.ca/resources/clickers.htm>
- Macquarie University provides a short description of an academic using in-class live polling.  
Part 1: <http://bit.ly/1HsbuIG> and Part 2: <http://bit.ly/1ug7FWr>
- Kay and LeSage (2009) have produced a useful review of the literature, albeit published in 2009, which offers a range of justifications for the use of audience response systems, its challenges, and a variety of ways they can be used.

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