Improving the quality of student experience in large lectures using quick polls

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A quick polling initiative was tested in finance classes using multiple choice questions to determine whether it can improve student interaction and engagement in a large class. Students (n = 446) responded using either a smartphone app (53%) or by using pen and paper (47%). Immediate feedback was provided to students using charts that were generated from the responses of those who used the app. The sample included 41% males, 59% females, 76% undergraduates and 24% graduate students. Student perceptions of the usefulness of quick polling in relation to their engagement in and preparation for the classes and their understanding of the subject content were evaluated using a questionnaire. Results indicate that females perceived they were more prepared for and engaged in class than males. Graduate students felt they were more engaged in classes, prepared for classes, and that their understanding of the subject improved than undergraduate students. There were limited differences between those who used the app and those who used pen and paper.

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Introduction

Internationally, research suggests that student engagement is a critical component of success in university study (Kuh, 2003; Tinto, 2005). Student engagement in large lectures, in particular, may play a significant role in helping to achieve set learning outcomes, by providing students with an environment that fosters active learning. However, there are reports internationally that student engagement has declined in recent years (e.g. Barnett & Coate, 2005 for the UK experience). Cole (2009) observes that the underlying factors relate to increases in student numbers, student diversity, and increased financial cost of higher education in the UK. In the US, reports suggest students have decreased their study time (Babcock & Marks, 2010), particularly business students (National Survey of Student Engagement , 2011). Similar to the UK, the NSSE study in the US also notes financial cost as a factor as well as study time, learning strategy, preparedness, and the challenging nature of materials.

In Australia, according to the *Australasian Survey of Student Engagement* 2010 *Institution Report* (Australian Council for Educational Research, 2010) and *The first year experience in Australian Universities: Findings from 1994 to 2009* (James, Krause & Jennings, 2010), issues continue to persist around student engagement. Lecturers report the challenges they have in encouraging participation and engagement, particularly in large lectures, amidst a broader higher education landscape characteristic of declining rates of lecture attendance, students spending less time at university, and doing more paid work (James, Krause & Jennings, 2010).

The traditional lecturing approach has also been criticised for not providing a range of opportunities for students to become active learners (McKeachie, 2002). Simply transmitting information promotes passive learning. Thus, increasing student engagement must shift focus from what the teacher does to what the student does

(Biggs & Tang, 2007). This focus should encompass conditions and activities that contribute to student learning (Krause, Hartley, James & McInnis, 2005), such as interacting with peers and university staff inside the classroom and within the wider university context and collaborating with people from diverse backgrounds (Baker & Devlin, 2009). Particular emphasis is placed on the teaching techniques used in the lecture theatre, the organisation of teaching for the course, opportunities for learning outside the classroom and assessment (Exeter et al., 2010).

Fortunately, technology- and multi-device supported environments are available in the 21st century for universities to leverage in support of learning and teaching. Students use laptops, tablets and smartphones and are increasingly familiar with apps, SMS, and the internet. Universities enrich their learning and teaching environment by providing opportunities to use existing technologies, for example by providing wireless connection and learning management systems, and using SMS technology and other innovative ways to communicate with students. One way to bridge the student-teacher gap and address issues surrounding increasing student participation and engagement in large lectures is to conduct quick polls using a mobile application.

Thus, this study recognised that student participation and engagement in large lectures can be problematic, however, using quick polls via a smartphone app can offer a solution. Following implementation in a large finance class, students who used that app reported that their participation improved their understanding of subject content and interaction with other students than those who used pen and paper. Females also indicated a more positive experience than males in relation to preparedness and engagement.

Benefits of using quick polling

Quick polling is an interactive way to engage students in classes by asking them to respond to quick questions and provide immediate feedback. The technology that supports quick polling is not new. Clickers, or student response systems, have been popular in the US for the past decade or so, although the technology behind audience

response systems has been around since the 1960s (Keller, 2007). They are widely used, and their benefits for enriching the classroom experience have been widely reported (Caldwell, 2007; Kay & LeSage, 2009; Laxman, 2011; Lin, Liu & Chu 2011). Caldwell (2007: 11) emphasises that "many instructors have adopted clicker technology to compensate for the passive, one-way communication inherent in lecturing and the difficulty students experience in maintaining sustained concentration". Laxman (2011: 1291) also reveals that "clicker technology offers great promise in promoting more collaborative and engaging learning environments and innovating instructional delivery, provided lecturers apply sound pedagogical principles in their teaching". Simpson and Oliver (2007) also argue that both practice and research on this topic has 'matured' in recent years.

Quick polling has the ability to increase student interest and participation, and can be used as a formative feedback tool. Using quick polling, students – particularly those who are shy – will be given the opportunity to test their understanding or express their views in complete anonymity during lectures. They can instantly respond to questions, and some applications, similar to the one referred to in this article, automatically summarise and present the results. Lecturers can then gauge instantly students' views or understanding of concepts or topics, and adjust their teaching accordingly. Furthermore, use of quick polling can help with student attention shortfall during the lecture. Kay and LeSage (2009: 821) note that "one technique for addressing student attention deficits during a class is to present questions at 20 min intervals, thereby requiring students to shift their attention and actively participate in the learning process." Another benefit of quick polling is the students' ability to compare their responses to those of their peers. Quick polling may thus promote a competitive atmosphere during the lecture. On the other hand, as Kay and LeSage (2009: 823) observe, "some students may want to monitor their progress, while others may want assurance that they are not alone in their misunderstanding of key concepts."

Challenges of quick polling

Some educators, new to teaching or those established in their own traditional teaching practices, might encounter difficulties in introducing quick polling into their teaching style. A certain level of preparation is needed for educators to successfully embed it in their teaching. Furthermore, notes Penuel (2010: 135) "not all subject matters lend themselves well to the kinds of factual and conceptual questions that response systems are designed to accommodate." One might also argue that quick polling enhances social engagement more than helping with students' deeper understanding of the topic. Use of quick polling requires sound pedagogical underpinning. This means that consideration of the appropriate teaching and learning context, the interactivity that takes place, and the self-monitoring and feedback that can exist need to be taken (Biggs, 2012; Cutts & Kennedy, 2005). In doing so, instructors also need to align the learning objectives they wish to achieve, the sorts of technology-supported learning and teaching activities that take place and the kinds of assessments that are required to achieve those objectives. Adoption of this technology on its own "will not bring you enthusiastic, actively engaged learners" (Murphy & Smark 2006: 188). Instructors need to be familiar with the hardware and software and should work the interactive components into their presentations in ways that follow and add to the structure of their lectures (Preis, Kellar & Crosby, 2011).

Despite these challenges, the use of clickers in classrooms continues to benefit staff and students. However, the cost to use and upgrade them can be high. In some universities in the US, this cost has been distributed to students. Universities have also developed their own in-house quick polling tools. There are web-based applications available that use SMS technology and the internet. Then there are also free and paid smartphone apps available for both iOS and Android devices. Thus, cost to students being one of the considerations in this study, we searched for an app that is free. The following section briefly introduces the app that was used in the study.

About the app and its use in this study

We investigated the potential of Zwoor, a free app for both Android and Apple devices. Devices were tested and showed applicability in the most common smartphones and tablets used by students, including Samsung, iPhone and iPad devices. As claimed by the developers, Zwoor comes in both event and survey apps. Conferences, trade shows and business events are to the event app as mobile surveys are to the survey app, including classroom surveys used in the present study.

The following research questions were investigated in this study:

(1) How do students perceive the benefits of a quick polling activity in relation to their engagement in and preparation for the classes and their understanding of the subject content?

(2) What are the differences in the students' perception of the usefulness of participating in quick polling between those using a Zwoor app and those using pen and paper?

(3) What are the effects of gender and level of study on the perceptions of the usefulness of participating in quick polling?

Institutional background

The Zwoor app was used in two corporate finance courses. One course was at the third year undergraduate level. The other course was at the first year level of a master's degree. Each course was split into two streams. A total of four lectures were given per week. The content of the undergraduate and the master's course was comparable.

The two courses differed in terms of size and composition. The undergraduate corporate finance class consisted of a total of 560 students while the corporate finance master's course comprised approximately 160 students.

The topics covered in the first five weeks included raising equity and debt capital, capital structure and the weighted average cost of capital, payout policy, and advanced topics in capital budgeting. In the very

first lecture, the lecturer informed the students about the app, how it would be used in class, and how it would benefit the students. The students were also asked to download the app.

At the end of each class, the lecturer provided the students with one survey code for that class. Each app survey consisted of five multiple choice questions, each with five possible answers of which only one was correct (Fig. 1). The questions were also shown on a big screen so that students without mobile access could also participate.

Figure 1: *Student view of the quick poll using an iPhone*


Part of the assessment in both courses was a multiple choice mid-semester test. It was communicated to the students that making use of the app in class would not only help them to understand the material better, but it would also provide them with valuable test questions for the mid-semester test.

Students who did not have smartphones or tablets were asked to do the multiple choice questions on paper. The lecturer displayed the questions via the projection screen. After letting the students spend between one to two minutes per question, the lecturer then logged into the online portal of the app to show the results. With the app, it is possible to see what fraction of the students chose a particular answer

via a histogram (Fig. 2). The results are displayed on a website, which was projected on screen so that all students could see the results. The lecturer then went through each question and explained to the students why a particular answer was correct or incorrect.

Figure 2: *Example of a bar chart on a single quick poll question*
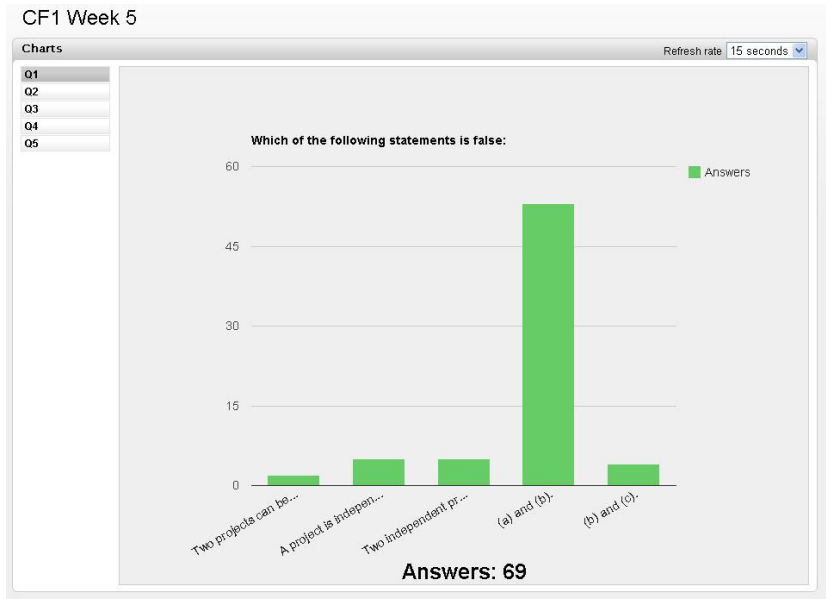
After each class, the five multiple choice app questions were made available to the students on PowerPoint slides via the class LMS system.

Method

A total of 720 students from four finance classes in a semester participated in this strategy using quick polling to assess their understanding of the content of the classes. The data was collected within the specific context of an undergraduate and postgraduate Corporate Finance subject in a large business faculty in a research-intensive university in Australia. Respondents included local and

international students, mostly from Australia, China and Southeast Asia, who were undertaking a Master of Management course. From these classes, 446 students at the end of the semester completed a questionnaire. Of those students who completed the questionnaire, 76% were undergraduate students, 24% were graduate students, 41% were males and 59% were females. Each week, five multiple choice questions were administered during the lecture. Students were able to respond using either an app on their mobile device (53%) or by using pen and paper (47%). Immediate feedback was provided to students using charts that were generated from the responses given by students who chose to use the mobile app. Students who did not use the app to respond to the questions were able to look at their own responses and see how they went on the questions. At the end of the semester a questionnaire was used to evaluate the student perceptions of the usefulness of quick polling in relation to their engagement in and preparation for the classes and their understanding of the subject content.

Instrument

The 18-item questionnaire that was developed for the purpose of this study included 13 items asking students to report on their perception of the effects of the experiences of using the quick polling as a strategy in their large classes, within broad areas of interest such as engagement in and preparation for the classes and understanding of the subject content (see Appendix 1). These items used a 5-point Likert response format (strongly agree to strongly disagree). There were two demographic items (gender and level of study), one item specifically asked about the ease of using the app for providing quick poll answers and one item to determine if students used the Zwoor app or they used a pen and paper to participate in the activity. Table 1 shows sample items categorised under area of interest.

Table 1: *Example items*

Area of interest	Number of items	Example items
Preference	4	I would prefer that my other classes also used quick polling
		I would like to have more opportunities to participate in quick polls during the lecture
Improvement	4	My participation in quick polls improved my understanding of the subject content
		My participation in quick polls improved my performance in this subject
Preparedness	2	I spend more time preparing for this class so that I can participate in quick polls
		Using quick polls improved my attendance in this subject
Engagement	2	My participation in quick polls improved my interaction with my lecturer
		My participation in quick polls improved my interaction with other students

Method of analysis

All quantitative data from the 446 participants were analysed using IBM SPPS® 20. Multiple analyses were used including chi-square tests of independence and factor analysis. The chi-square test was used to test if groups of students differed significantly, such as the experience of males and females, app users and non-users and graduate and undergraduate students. Because some questions can be related, factor analysis was used to determine whether some underlying factors can be explained by a group of related questions. An alpha level of 0.05 was used for all statistical tests.

Results

Overall, there was strong positive experience in participating in quick polls either using the app or by using pen and paper (Table 2). Students generally indicated that they enjoyed participating in quick

polls (85%) and that they would recommend using it again in the subject (86%).

Table 2:   *Overall distributions and summary statistics for participating students*

			Distribution of responses*					
			1	*2*	*3*	*4*	*5*	*NA*
Item	*N*	*M*	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Q2. It was easy to use the Zwoor app in or out of class	439	4.60	5 (1.1)	31 (7.1)	32 (7.3)	151 (34.4)	67 (15.3)	153 (34.9)
Q3. I enjoyed participating in quick polls using Zwoor app, or by writing my answers on paper	434	4.03	4 (0.9)	21 (4.8)	41 (9.4)	259 (59.7)	109 (25.1)	-
Q4. I would recommend using quick polling again in this subject	439	4.11	5 (1.1)	18 (4.1)	40 (9.1)	239 (54.4)	137 (31.2)	-
Q5. I would prefer that my other classes also use quick polling	441	3.90	7 (1.6)	25 (5.7)	82 (18.6)	217 (49.2)	110 (24.9)	-
Q6. I would like to have more opportunities to participate in quick polls during the lecture	441	3.72	12 (2.7)	37 (8.4)	95 (21.5)	216 (49.0)	81 (18.4)	-
Q7. My participation in quick polls improved my understanding of the subject content	440	3.95	7 (1.6)	12 (2.7)	85 (19.3)	230 (52.3)	106 (24.1)	-
Q8. My participation in quick polls improved my interaction with other students	440	3.16	19 (4.3)	113 (25.7)	134 (30.5)	129 (29.3)	45 (10.2)	-
Q9. My participation in quick polls improved my interaction with my lecturer	440	3.50	14 (3.2)	51 (11.6)	130 (29.5)	194 (44.1)	51 (11.6)	-
Q10. My participation in quick polls improved my performance in this subject	439	3.54	4 (0.9)	19 (4.3)	194 (44.2)	179 (40.8)	43 (9.8)	-

Q11. I anticipate that my mark in this subject will improve by participating in quick polls	437	3.50	6 (1.4)	24 (5.5)	196 (44.9)	171 (39.1)	40 (9.2)	-
Q12. Using quick polling improved my attendance in this subject	439	2.97	37 (8.4)	126 (28.7)	130 (29.6)	112 (25.5)	34 (7.7)	-
Q13. I spend more time preparing for this class so that I can participate in quick polls	439	2.76	42 (9.6)	152 (34.6)	130 (29.6)	100 (22.8)	15 (3.4)	-
Q14. Receiving feedback from the lecturer about the solutions of the quick polls helped me to better understand how to answer multiple choice questions.	436	4.27	5 (1.1)	9 (2.1)	23 (5.3)	226 (51.8)	173 (39.7)	-

* 1 = Strongly Disagree; 2 = Disagree; 3 = Unsure; 4 = Agree; 5 = Strongly Agree; NA = Not Applicable

Chi-square tests of independence

As mentioned, students had the option of participating in the quick polling activities by using the Zwoor app or using pen and paper to complete the questions. Chi-square tests were used to determine the differences in experiences for students who used the app to participate compared to those who used pen and paper (Table 3). The results indicate that students who used the Zwoor app were more likely to agree that they would like to have more opportunities to participate in quick polling during the classes. They also were more likely to agree that they felt participating in the quick polling activities improved their understanding of the subject content and the activities improved their interaction with other students. For other areas of interest such as interaction with teachers, improved attendance and being more motivated to do the preparation, there were no significant differences between those who used the app and those who used pen and paper.

Table 3: *Chi-square test of independence use app versus paper based quick polling**

Item	Chi-square test		
	x^2	df	sig
I would recommend using quick polling again in this subject	7.997	4	0.092
I would prefer that my other classes also use quick polling	13.482	4	0.090
I would like to have more opportunities to participate in quick polls during the lecture	*18.621*	*4*	*0.001*
My participation in quick polls improved my understanding of the subject content	*10.932*	*4*	*0.027*
My participation in quick polls improved my interaction with other students	4.770	4	0.312
My participation in quick polls improved my interaction with my lecturer	*11.641*	*4*	*0.020*
My participation in quick polls improved my performance in this subject	4.298	4	0.367
I anticipate that my mark in this subject will improve by participating in quick polls	5.451	4	0.244
Using quick polling improved my attendance in this subject	6.345	4	0.175
I spend more time preparing for this class so that I can participate in quick polls	5.236	4	0.264
Receiving feedback from the lecturer about the solutions of the quick polls helped me to better understand how to answer multiple choice questions.	3.841	4	0.428

* italicised indicated significant differences at the 0.05 level of significance

Factor analysis, reliability and discriminant validity

Principal components analysis with oblimin rotation was selected based on there being a hypothesised correlation between each of the dimensions of the questionnaire (preference, improvement, preparedness and engagement). Results of the factor analysis showed a clear four factor structure with no significant cross loadings (Table 4). The four-factor account for a total of 70.51% of the total variance. These four factors were assessed for internal consistency using

Cronbach α (Table 3) and the reliability estimates ranged from 0.631 to 0.848, which indicates acceptable to excellent internal reliability (George & Mallery, 2001), and an estimate of 0.60 has long been regarded as a threshold of acceptable reliability for research purposes (Nunnally, 1978).

Table 4: *Factor analysis and reliability estimates**

Factors	1	2	3	4
	0.870			
1	0.833			
Preference	0.770			
	0.717			
		0.747		
2		0.712		
Improvement		0.588		
		0.562		
3			0.826	
Preparedness			0.817	
4				0.852
Engagement				0.714
Eigenvalues	4.92	1.95	0.84	0.75
% Variance	41.01	16.21	7.04	6.25
α	0.848	0.776	0.718	0.631

* Factor loadings below 0.5 are not reported.

Item-scale correlations (being between .200 and .500) confirmed that all items have been identified in the appropriate factor and made an appreciable contribution to that factor. The mean correlation of each of the five dimensions with all other dimensions supported that all dimensions make a unique contribution (Table 5).

Table 5: *Item scale and mean correlations*

Factor	1	2	3	4
1. Preference	1.00			
2. Improvement	0.579			
3. Preparedness	0.240	0.434		
4. Engagement	0.322	0.476	0.489	1.00
Mean Correlation	0.380	0.496	0.388	0.429

Experiences of quick polling

Independent samples *t*-test were used to determine if there were differences in the way males and females and undergraduate students and graduate students perceived the experiences of quick polling in their finance classes (Table 6). Results indicate that there is a difference in the way females see the use of quick polling in class than males. Females indicate they are significantly more prepared for class ($t = 3.85$; $p = .000$) and more engaged with teachers and other students ($t = 2.66$; $p = .008$) than males feel they are. There are no significant gender differences in student preferences for using quick polling in class, nor their perception that participating in quick polling can improve their understanding of the subject content. In this sample, there are significant differences in the way postgraduate students perceive the use of quick polling in class to undergraduate students. Postgraduate students feel that participating in quick polling makes them more prepared for class ($t = 4.85$; $p = .000$), are more engaged with teachers and other students ($t = 3.24$; $p = .001$) and feel that quick polling activities do improve their understanding of the content ($t = 2.10$; $p = .036$).

Table 6: *Tests of differences between gender and level of study*

Gender	Males		Females			
	Mean	SD	Mean	SD	*t*-value	*p*-value
Preference	4.00	0.736	3.90	0.692	1.44	0.150
Improvement	3.81	0.654	3.81	0.566	0.086	0.931
Preparedness	2.66	0.981	3.00	0.867	3.85	0.000
Engagement	3.20	0.956	3.42	0.764	2.66	0.008

Level of study	UG		PG			
	Mean	SD	Mean	SD	*t*-value	*p*-value
Preference	3.94	0.727	3.92	0.667	0.335	0.738
Improvement	3.78	0.594	3.92	0.617	2.10	0.036
Preparedness	2.75	0.924	3.21	0.872	4.58	0.000
Engagement	3.26	0.873	3.56	0.751	3.24	0.001

Discussion

The results suggest that students' use of quick polling in class generally had a positive experience but that whether the students used the Zwoor app or used pen and paper to participate made little difference in this sample. However the immediate feedback is only possible if students used the app to complete the activity and whilst we have no data on this, it is possible that even for students who used pen and paper it is the immediate feedback that is most helpful for them. We do know that the majority of students (76%) who participated indicated that receiving instant feedback helped them better understand the concepts being covered in the class (Table 2). This would justify the use of the app over pen and paper for such an activity. There was no such compelling case for improving interaction with other students, with only 40% of students agreeing with this statement. This could be explained in that students generally did the polling activity on their own. If having students work together to consider the questions made a difference in this respect, then it would be recommended to have students work in pairs or small groups and agree on an answer to select. If there is disagreement in the groups, students could be asked to convince the other members that they have the correct response.

The students who participated in this study generally had positive experiences, but there were gender differences in students' perception of the usefulness of the quick polling activity with females indicating more positive experiences in relation to preparedness and engagement. There were significant differences in the experiences of graduate students and undergraduate students with graduates having more positive experiences in the areas of improvement, preparedness

and engagement. Whilst no significant difference by gender or level of study, most students felt strongly that they preferred the use of quick polling and would like to see it in other classes (Preference; M = 3.94, SD =.712). Generally, quick polling activity was perceived to have many positive benefits for the students who participated in this study. Furthermore, this is a simple and low resource activity that is easy to implement.

Limitations

We were aware of the equity issues as some students may not have smartphones or tablets or simply prefer to use pen and paper. A couple of options were given to students to address this issue. They were encouraged to use pen and paper; or to borrow devices from their peers. This worked quite well. Even those that did not have smartphones found participating in quick polling useful.

The implementation of quick polling was not without issues. Wireless internet connection was reported by students as being fairly unstable at times. Blackberry devices also were not supported by the university Wi-Fi system.

Longer questions were also truncated when viewing the questions on their devices. This was discovered early on, thus the complete questions were shown on lecture slides. A few students also thought that having the survey results shown after class would be a good idea.

Implications

Though this app was used in a corporate finance classes only, the results have implications for large classes in general. The Zwoor app offers a simple yet powerful solution to providing students with the motivation to follow subject content more attentively. It also gives students the opportunity and motivation to engage with the lecturer.

We believe that the findings have implications for a wide range of courses which attract large student enrolments (e.g., business, science, information technology, engineering) and types of higher education institutions. Given the high demand for education, it is

unavoidable that universities need to pool together students from different subjects and create large classes. This is particularly so in capstone subjects that overlap with many areas of study. It is in these large mixed classes, with students from different academic and ethnic backgrounds, that the traditional strategies used to engage students, via direct questioning or group work, becomes increasingly difficult to implement. Our results suggest that the use of innovative new technologies can help improve the learning experience of students.

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Disclaimer

The authors are not affiliated, associated, authorised, endorsed by, or in any way officially connected with Zwoor or any of its subsidiaries or its affiliates.

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Appendix 1

Corporate Finance Quick Polling Survey

Please answer all questions.

Q1. Did you use the Zwoor app for the multiple choice quick polls?
☐ Yes, I used Zwoor app
☐ No, I did not use Zwoor app but still did the quick polls

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree	NA
Q2. It was easy to use the Zwoor app in or out of class (select NA if you answered 'No' to Q1)	☐	☐	☐	☐	☐	☐
Q3. I enjoyed participating in quick polls using Zwoor app, or by writing my answers on paper	☐	☐	☐	☐	☐	
Q4. I would recommend using quick polling again in this subject	☐	☐	☐	☐	☐	
Q5. I would prefer that my other classes also use quick polling	☐	☐	☐	☐	☐	
Q6. I would like to have more opportunities to participate in quick polls during the lecture	☐	☐	☐	☐	☐	
Q7. My participation in quick polls improved my understanding of the subject content	☐	☐	☐	☐	☐	
Q8. My participation in quick polls improved my interaction with other students	☐	☐	☐	☐	☐	
Q9. My participation in quick polls improved my interaction with my lecturer	☐	☐	☐	☐	☐	

Q10. My participation in quick polls improved my performance in this subject	☐	☐	☐	☐	☐	
Q11. I anticipate that my mark in this subject will improve by participating in quick polls	☐	☐	☐	☐	☐	
Q12. Using quick polling improved my attendance in this subject	☐	☐	☐	☐	☐	
Q13. I spend more time preparing for this class so that I can participate in quick polls	☐	☐	☐	☐	☐	
Q14. Receiving feedback from the lecturer about the solutions of the quick polls helped me to better understand how to answer multiple choice questions.	☐	☐	☐	☐	☐	
Q15. I participated in quick polls (times):	☐ 1-2		☐ 3-4		☐ 5 or more	
Q16. Sex	☐ Male			☐ Female		
Q17. Level of study	☐ Undergraduate			☐ Graduate		
Q18. Overall, how would you describe your experience using quick polls in Corporate Finance?						

About the Authors

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