Making your views known:
The importance of anonymity before and after classroom debates

Giulia Gelmini Hornsby, Shaaron Ainsworth, Marie Buda, Charles Crook, Claire O'Malley,
Learning Sciences Research Institute, University of Nottingham, Exchange Building, Jubilee Campus,
NG8 1BB, Nottingham, U.K.
Email: gg@psychology.nottingham.ac.uk, sea@psychology.nottingham.ac.uk,
com@psychology.nottingham.ac.uk, charles.crook@nottingham.ac.uk, marie.buda@nottingham.ac.uk

Abstract: The current study aimed to examine the effect of anonymity and privacy on students' voting behaviour before and after classroom debate. A positioning system with three different settings was prototyped (Private, Anonymous or Public). It was predicted that students voting publicly would be less inclined to express changes in their views, and that they would tend to conform to the class' overall position more than students voting either anonymously or privately. Three groups of students (N=55) taking A Level General Studies took part in debates and voted in one of the three conditions. Results supported both hypotheses and suggest that anonymity and privacy play a crucial role in encouraging students to express individual and authentic positions. The implications of these results for technology mediated voting systems are discussed.

Introduction

Using personal voting systems (PVSs) in higher education is not a new practice. Universities have reported the successful implementation of electronic hand-sets (akin to remote controls) in lectures that are used by students to respond to questions (Dufresne *et al.,* 1996; Draper *et al.,* 2004). Lessons implementing PVSs have typically employed a format similar to the 'Audience' function in the popular television programme 'Who Wants To Be A Millionaire*?'*. After students have selected answers they are then quickly displayed in the format of a histogram (eg. Dufresne *et al.*, 1996; Stuart, Brown & Draper 2004; Kennedy & Cutts, 2005). The methods in which PVSs have been implemented into the classroom have been highly dependent on the teachers' underlying pedagogical rationale (Kennedy & Cutts, 2005). Whilst some lecturers have weaved the PVS into the traditional lecture format by using it to document students' understandings of the educational material (Draper & Brown, 2004; Stewart *et al.,* 2004), more radical uses of the PVS have included the usage of it as a major catalyst to guide discussions (Dufresne *et al.*, 1996; Crouch & Mathur, 1997).

Research suggests that in a number of educational contexts involving Internet based a-synchronous communication anonymity plays a key role in creating a more socially neutral discussion base where individuals are less exposed to social cues such as gender and status (Christopherson, 2007). Moreover, several authors have contended that anonymity in PVSs play a notable part in their educational success. The concealment has been said to provide students with a sense of class engagement without public exposure (Dufresne, 1996; Kennedy & Cutts, 2005). However, we are not aware of any systematic studies addressing the impact of anonymity compared to, for example, public or private means of expressing stances with regards to debated issues. Moreover, most studies on PVS have explored their use in 'one-off' situations, where teachers raise an issue and students give their response. We wanted to explore whether PVS could be used both to stimulate a debate and then to record whether the debate had led students to change their views about a topic. Consequently, we were also interested in determining if students were inclined to revise their opinion when their votes were publicly available for others to see.

The current study aimed to examine the effect of anonymity and privacy on the voting behaviour of students before and after classroom debates. In order to decide how to design and implement a technology based solution we started by exploring the implications of such a system using a low fidelity prototype. Low fidelity prototypes (e.g. pen and paper, models, Wizard of Oz methods) allow designers to evaluate key design features ahead of implementation and have a number of advantages (e.g. cheap to implement, robust to bugs, don't lead users to focus on superficial aspects of systems, Retting, 1994). We therefore created a non-technological positioning system dubbed the 'PositionOmeter' from paper and board. This would be used to provide evidence for the design of collaborative discussion tool which is currently under development.

The study
Conditions of Voting

In this study, we explored three different ways that student could record their views on topics (before and after they were debated). The first way was to record their views privately where no one else could see their views and where they could not see anyone else's views. The second way was to record their views in public but

anonymously so that other people could not identify which of the votes were theirs. The third way was, again, to record views in public but this time to be visibly associated with the vote. Generally, therefore conditions differed according to: (a) whether each student's vote would be *seen* by all other students in the class and (b) whether each student's vote would be *recognized* by all other students as belonging to a specific student. The implications of these different conditions are summarised below in Table 1.

Table 1: Implications of the different voting conditions.

Private	Anonymous	Public
Don't have to reveal your position	Don't have to declare your position	Do have to reveal your position
Don't have to reveal any shift in position between votes	Don't have to reveal any shift in position between votes	Do have to reveal any shift in position between votes
Don't know how the class voted overall	Do know how the class voted overall	Do know how the class voted overall
Don't know how the specific individuals voted	Don't know how the specific individuals voted	Do know how the specific individuals voted
Don't know how your vote compares to others'	Do know how your vote compares to others'	Do know how your vote compares to others'
Don't know if others are changing their votes	Do know if others are changing their votes	Do know if others are changing their votes

Findings from the social psychological literature show that when groups debate, two types of persuasion, informative and normative influence, may be at play (Deutsch and Gerard, 1955). Informational influence occurs as a result of a subject accepting a new piece of information and trusting it more than their own. If people are persuaded by other views in learning situations we might hope that it would be on this basis (i.e. that new information is presented that you have judged to be corrected and that is the only reason you now agree with this new perspective). However, it could be the case that students may respond due to normative influence. In this case students may be persuaded by other views because they fear rejection by others and so to gain social acceptance by fulfilling the positive expectations of another. Normative social influence can produce varying effects. On one hand, if group conformity is expected, it can compel people to shift their opinions towards the consensus (Asch, 1955). On the other hand, by *not* changing one's initial opinions, and by even going against the group norm it can allow one to exert individuality and demonstrate that they are capable of forming opinions without slavish regard for popularity (Deutsch & Gerard, 1955).

When voting was private, students were unseen and unrecognised. They can compare themselves to others and, for example, find they hold a minority view. Nor if they change their minds over the course of the debate do they need to be concerned that other would notice this change of heart. The representation of their vote can neither influence nor directly influence others. This condition should be the least effected by normative influence. Moreover if students do change their votes this should be more likely to be due to convergence (a change in covert and as well as overt behaviour).

Voting publicly, on the other hand, is the opposite situation to the private voting one. Student votes are both seen and recognised. In this situation, everyone is aware of everyone else's vote, and whether there is a shift in their vote from Vote 1 to Vote 2. A vote in this situation may be much more likely to be effected by normative influence. Moreover, if students do change their votes this will be just as likely to be due to compliance (a change in overt not covert behaviour) as it would convergence.

Finally, voting anonymously represents an intermediate situation to the two described above. When voting anonymously, the students are aware that their vote will not be recognised: this corresponds to the private voting situation, where students do not have to reveal their position. However, contrary to the private voting situation, students voting anonymously know how their votes compare to others, and whether others shift their positions from Vote 1 to Vote 2. Although the votes are not traceable to specific individuals, they were displayed on boards for everyone to see. For example, the vote of particularly popular or dominant students will have no more influence that anyone else's. We therefore expect to see less normative influence in this condition and less compliance than in the public vote condition.

We therefore proposed the following hypotheses. In so doing, we expected that our participant teenaged students would be more likely to be influenced towards consensus (Adams *et al.,* 1985).

- There will be no differences between students' votes at the first vote according to condition. At this stage they will have no indication as to prevailing views in the class and so will not have been influenced by seeing others votes.

- Students' voting behaviour at the second vote will be influenced by condition. Having seen other students' votes represented (as well as listened to the debate), students in the public condition will be more likely to display compliant votes than students in the Private or Anonymous condition. For example, a student might vote very differently to others in Vote 1; the moment the votes are revealed, that student realizing how different his vote is from everyone else's might want to use Vote 2 to make it conform to everyone else's in the class.
- Further, it is suggested that students in Private and Anonymous conditions will show greater changes in their votes from time 1 to time 2. If they decide to change their vote having participated in a class debate, they will not need to fear 'losing face' by being seen to change their mind. Furthermore, we expect students in the Anonymous condition to show greater change in their votes than those in the Private condition. In the anonymous condition, the students see where the class stands overall in vote 1; this will influence their Vote 2, thus causing more vote shift than in the Private condition, where students do not see where the class stands overall.

Context

This study was conducted in classes on A Level (16 to 18 yr olds) General Studies. Prior to the intervention, extensive General Studies classroom observations in the same school revealed a strong emphasis on debating skills. A review of the National Curriculum confirmed findings from the classroom observations: within General Studies, students are encouraged to develop the ability to think critically and independently, to appreciate others' perspectives and approaches, and to communicate using a variety of formats and styles. As General Studies' curriculum is designed to foster critical thinking, lessons tended to be centred on issues which do not have a pre-determined and univocal answer. General studies therefore provided an ideal context to explore how different voting conditions would influence students' responses to debated issues.

All classes were taught by the same teacher, with whom we had worked closely in the preparatory phases of the study. In 2006, we had observed classes on the 'Nature Vs Nurture Debate'; this involved students reflecting on how a number of issues can be considered to be inherited (the 'Nature' position) or acquired through culture (the 'Nurture' position). Classes were asked to reflect on the following set of issues: physical stature, intelligence, hair colour, love of freedom, sexual desire, acquisitiveness, good manners, talent as a musician. In 2007, we revisited this teacher, now working with a new cohort and asked him to explore the use of a voting system in addition to his standard procedure (described below as the Private condition).

As Table 2 illustrates, the lesson plan started with a short introduction to the topic of 'Nature Vs Nurture' and the eight issues to be debated (Phase 1), followed by a vote, where students were called to express their opinion on the degree to which they thought the eight issues were *inherited* or *acquired* (Phase 2). The teacher then led a class discussion where each of these issues was debated at a time (Phase 3). The discussion was followed by a second vote, where the students were called to express their opinion on each issue once again (without looking at their first vote) (Phase 4). The lesson ended in a final reflection on how the discussion may have led to changes in the students' opinions (Phase 5).

Table 2: The lesson plan used in all 3 classes.

Phase n.	Activity
Phase 1	Topic introduction
Phase 2	Vote 1
Phase 3	Discussion
Phase 4	Vote 2
Phase 5	Reflection

Table 3 shows an example of the voting sheets that were used in 2006. The students were given one voting sheet at Phase 2 and a separate one at Phase 4, and they were asked to mark their vote on the sheet without conferring with other student. The teacher told the students that positions 1 to 5 reflect the opinion that the feature is *inherited*, while positions 6 to 10 reflect the opinion that the feature is *acquired*. Votes towards the middle of the 1 to 10 continuum reflect a moderate position, while votes towards either end of the continuum reflect a more extreme position. No neutral position was available.

Table 3: Personal voting sheet.

	Inherited					Acquired				
	1	2	3	4	5	6	7	8	9	10
Physical Stature										

Intelligence									
Hair Colour									
Love of Freedom									
Sexual Desires									
Acquisitiveness									
Good Manners									
Talent as a Musician									

Design

This study employed a [3 by 2] mixed design. The first factor, Condition (of voting), was between groups and had three levels; Private, Anonymous and Public. The second factor, time, was within groups and had two levels; Vote 1 and Vote 2. All classes were video-recorded for later analysis; consent was obtained from all students to be video-recorded for research purposes only.

Participants

Three classes of students were recruited for the study, each taught by the same teacher. The students were 16 to 17 years of age and Private voting class (11 F and 6 M), Anonymous voting class (9 F and 8 M) and Public voting class (15 F and 6 M) were randomly allocated to one of the three conditions.

Procedure

The classes proceeded according to the teacher's standard lesson plan (described above). At the voting phases, students in the three different classes voted as follows (Figure 1):

- Students in the Private voting class only voted on their own personal voting sheets.
- Students in the Anonymous voting class voted on their own personal sheet, and subsequently transferred their vote to a public board where it was associated with a letter which only they and the teacher could decode.
- Students in the Public class voted on their own personal sheet, and subsequently transferred their vote to a public board where it was associated with their name.

The reason students in the classes using the PositionOmeter voted on their own personal sheet, and subsequently transferred their vote to a public board was to ensure that the order in which students voted in public did not influence how they responded. Figure 1 illustrates one example response for each of the three classes.
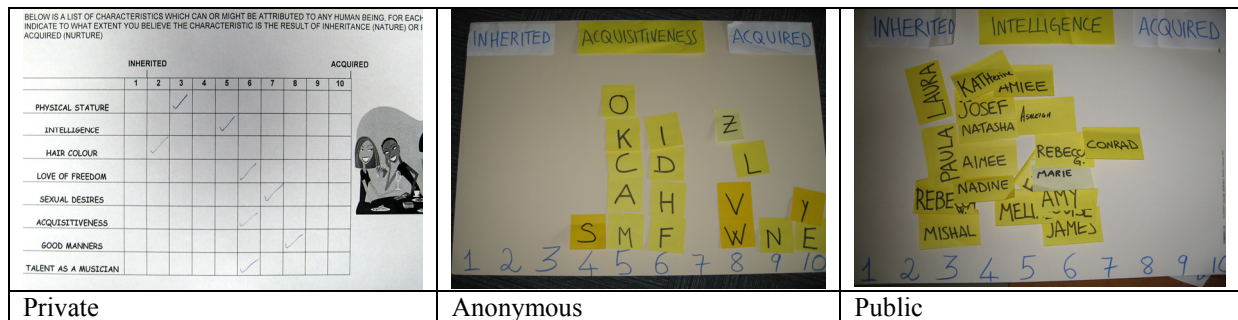

Private	Anonymous	Public

Figure 1. Voting records in the three classes.

Results

As data was on an ordinal scale (Likert scale from 1 to 10), non parametric tests were used throughout analysis. Table 4 gives an introductory overview of the students' votes independently of condition. For each individual voting item (questions 1-8), all students' answers were summed and the median computed. The same procedure was applied for Vote 1 and vote 2.

Table 4: Vote on eight issues (1(inherited) to 10 (acquired)).

No.	Question	Vote 1	Vote 2
1	Physical Stature	3	4
2	Intelligence	5	6
3	Hair Colour	2	2
4	Love of Freedom	7	7
5	Sexual Desires	8	8
6	Acquisitiveness	7	7
7	Good Manners	8	9
8	Talent as a Musician	6	5

There was a trend towards influence of condition on initial votes (K = 5.93, df = 2, $p<0.052$) though not on second votes. Students in the Private condition were more inclined to respond in favour of inherited characteristics (median 5.5) than those in the Public condition (median 6.5) (U=120, $p<0.01$).

The next two sections report on analysis of students' vote shift from Vote 1 to Vote 2, and students' divergence from the norm, respectively.

Voting conditions' influence on students' readiness to express changes in views

The difference between the students' views in Vote 1 and Vote 2 was computed by taking the absolute difference on each question. Figure 2 shows the median of the sum over all eight questions.
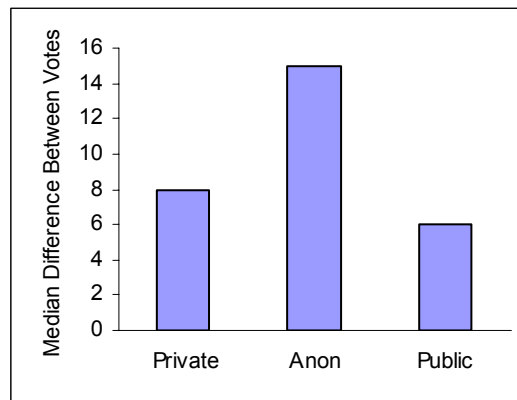

Figure 2. Difference between the students' first and second vote.

A Kruskal-Wallis test showed a significant effect of condition (H=19.9, d.f. = 2, $p<0.001$). Students in the Public condition shifted significantly less between their two votes than students in the other conditions (U = 142, $p<0.05$ Private; and U =26.5, $p<0.001$ Anon). Those in the Anon condition also differed from those in the Private condition (U = 93, $p< 0.02$).

Analysis of the individual questions showed that this difference was due to students' changing their votes on questions 1 to 4 only (Table 5).

Table 5: Kruskal Wallis statistics for all eight questions.

	Q1shift	Q2shift	Q3shift	Q4shift	Q5shift	Q6shift	Q7shift	Q8shift
K	18.85	12.64	13.42	10.76	5.22	1.07	1.31	3.87
df	2	2	2	2	2	2	2	2
Sig	0.004	0.002	0.001	0.005	0.074	0.587	0.520	0.144

Voting conditions' influence on students' divergence from the group norm

To assess whether groups were more or less divergent, the median of each group's vote was calculated (per question) and then each individual student's vote was compared to that median and the difference calculated. For example, a student who scored 3 (or 7) when the group median was 5 would therefore be given a deviation score of 2. This was then summed over all eight questions.

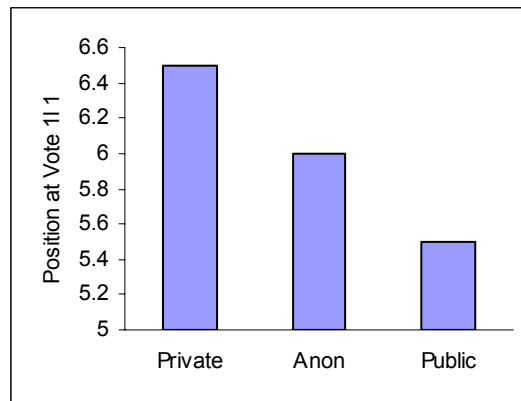Figure 3 shows the median for students' Vote 1 by condition (sum of all 8 questions).

Figure 3. Median student votes at time 1.

At the first vote, students in all conditions had no access to each others' vote (though they were aware of whether and how their vote would be revealed to each other). We therefore expected little difference in divergence from the norm between the conditions at the first vote and a Kruskal-Wallis test showed no difference by condition (H=2.3., d.f. =2).

However, at the second vote students were aware of each others' points of view. In the Private condition, this information was only available implicitly through debate but in all the other groups students had seen Vote 1 represented graphically on the boards. We therefore compared how much a student's second vote diverged from the median view expressed at Vote 1.

Figure 4 shows divergence from group norm by condition (sum of all 8 questions).
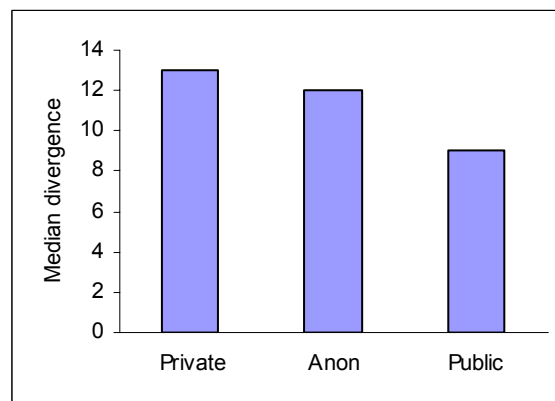

Figure 4. Degree of Divergence from Vote 1 at Vote 2 by Condition.

A Kruskal-Wallis test showed a significant effect of condition (H=10.11., df. = 2, p<0.006). In the Public condition, students' votes diverged from the norm considerably less than either of the other conditions (U = 108.5, p<0.04 Anon and U= 100.5, p<0.002 Private).

Discussion

The current study aimed to observe the effects of anonymity and privacy on student voting behaviour both before and after a classroom debate on the topic of nature-nurture.

As predicted, in Vote 1 there were no significant differences between how divergent students' votes were according to condition. At this point, students were not aware of the group norm in any of the eight questions, and consequently could not have been influenced by it. However, there was a condition difference in what they voted, with students in the Private condition most likely to believe that characteristics were inherited rather than acquired. There are two potential interpretations of this result. Firstly, that more students in this class genuinely believed that those characteristics were inherited more than students in the other class. However, it is possible that their response was already influenced by normative influence as this was the most 'neutral' position they could take on this issue given the 10 point scale.

In Vote 2, it was expected that students who voted publicly would be more inclined to conform to others' votes once. When students knew what the overall class' position was, they would use their second vote to conform to it, but only when they knew their vote would be made public. Indeed, this was the case — students voting publicly showed less of a divergence from the class' overall position than those voting anonymously. In addition, the students in the Public group diverged from the class' position less than those voting privately. This is hardly surprising, as the students voting privately had no access to others' views on Vote 1, hence, they could not decide to conform to others' vote when voting for the second time.

It was also hypothesized that voting conditions would have an impact on how much students would change their position from Vote 1 to Vote 2. More specifically, it was predicted that students would feel more at liberty to shift their voting stance when their identities were not disclosed in the Anonymous and Private conditions, in comparison to the Public condition. This hypothesis was, again, accepted. Students in the Anonymous condition shifted their opinion the most from before to after the debate, followed by the Private and then Public conditions.

This provides support to the hypothesis that students are less inclined to shift voting stances when their identity is revealed. In an intimate environment such as the classroom, students have established acquaintances and have thereby cemented an identity. As a result, students may be more concerned about preserving character; asserting and adamantly sticking to one's views with regards to debatable issues can serve this function. It is clear that the anonymity and privacy made students feel more at ease to move positions 'without losing face'.

There was also a significant difference in voting shifting between the Anonymous and Private conditions, with students in the Anonymous condition shifting more than students in the Private condition. This may be due to the one salient difference between the two conditions — the revealing of the votes and hence group norms in the Anonymous group. Although less normative influence may be at play in this condition (compared to the Public condition), this extra information about the norm (compared to the Private condition) may still be expected to influence students' votes through informational influence.

Conclusions and Future Work

In this paper, we have argued for the crucial role played by different voting conditions in classroom debate. By experimenting with a low fidelity prototype in a real context of use, we have gathered strong indications for the eventual design of the system as voting systems allow for the efficient implementation of voting and for the disclosure of different levels of information on the vote results themselves.

Firstly, personal voting systems allow for the visualisation of the class' overall position: immediately after all students have voted, a report can be produced showing where the students are positioned. This constitutes an opportunity for students to reflect on how their own positions relates to the class' one and allows for informational influence as well as the less desirable normative influence.

Secondly, personal voting systems allow for the manipulation of the level of information displayed concerning the students' identity: each vote can be displayed anonymously or publicly. As our findings indicate, students voting anonymously are (a) more willing to express a change in their position and (b) express more independent views than the students voting publicly. Hence, we see anonymity as an opportunity for students to express their opinions without being preoccupied with their identity being threatened by public exposure or face loss. If students change their votes, this may be due more to informational influence and so act via conversion rather than compliance.

Future work involves implementing the voting system in our collaborative discussion system and analysing whether the discussion is influenced by the different voting conditions discussed above.

We are interested to see whether representing the students' position publicly influences classroom discussion, i.e. whether the teacher and the students capitalise on the voting representation to collaboratively construct arguments within a debate. For example, teachers could use the information about the class overall position in order to encourage students to build arguments supporting minority views. Also, students may be more inclined to participate in the discussion when the class' position is available to them.

We are also interested to see whether representing students' votes anonymously or publicly influences the quality of the debate. For example, teachers may be able to use the information displayed by the voting system in order to orient the focus of the discussion towards specific individuals' opinions rather than others'. In turn, students may be encouraged to express their position in different ways according to the voting condition they are in.

In addition, further studies could explore whether changes in students' votes reflected an internalised opinion change (i.e., they changed their minds); for example, it would be interesting to assess whether the students' second vote in the Public condition reflected an actual conversion to the class' overall position, or a superficial compliance to the group norm due to public exposure. In order to do this, a follow-up intervention could be designed, where the same students who participated in this study vote again privately on the same issues. This would enable us to establish whether the students' position change from Vote 1 to Vote 2 in this study reflected a true opinion shift.

The results of this study have shown that simple changes to the design of PVS can have significant impact upon students' behaviour. This knowledge can inform the design of new technologies, suggest lessons plans for their use and even prompt guidelines for assessment (if you wish to assess the impact of a class debate you should do so anonymously or in private).

References

Adams, G. R., Ryan, J. H., Hoffman, J. J., Dobson, W. R., & Nielsen, E. C. (1985). Ego identity status, conformity behavior, and personality in late adolescence. *Journal of Personality and Social Psychology*, *47*(5), 1091-1104.

Asch, S. E. (1955). Opinions and social pressure. *Scientific American*, *193*, 31-35.

Boyle, J. T. & Nicol, D. J. (2003). Using classroom communication systems to support interaction and discussion in large class settings. *Association for Learning Technology Journal*, *11*(3), 43-57.

Christopherson, K.M. (2007). The positive and negative implications of anonymity in Internet social interactions: "On the Internet, nobody knows you're a dog". *Computers in Human Behavior*, 23(6), 3038-3056.

Deutsch, M. & Gerard, H. (1955). A study of normative and informational social influences upon individual judgment. *Journal of Abnormal and Social Psychology*, *51*, 629-636.

Draper, S. & Brown, M. I. (2004). Increasing interactivity in lectures using an electronic voting system. *Journal of Computer Assisted Learning*, *20*, 81-94.

Draper, S., Cargill, J., & Cutts, Q. (2002). Electronically enhanced classroom interaction. *Australian Journal of Educational Technology*, *18*(1), 13-23.

Dufresne, R. J., Gerace, W. J., Leonard, W. J., Mestre, J. P., & Wenk, L. (1996). *Classtalk:* A classroom communication system for active learning. *Journal of Computing in Higher Education*, *7*, 3-47.

Katz, D. (1960). The functional approach to the study of attitudes. *The Public Opinion Quarterly*, *24*(2), 163-204.

Kelman, H. C. (1958). Compliance, identification, and internalization: three processes of attitude change. *The Journal of Conflict Resolution*, *2*(1), 51-60.

Kennedy, G. E. & Cutts, Q. I. (2005). The association between students' use of an electronic voting system and their learning outcomes. *Journal of Computer Assisted Learning*, *21*, 260-268.

Rettig, M. (1994). Prototyping for tiny fingers. *Communications of the ACM*, Vol. 37, No. 4. 21-27.

Mazur, E. (1999). Peer instruction: A user's manual. *American Journal of Physics*, *67*(4), 359-400.

Stuart, S. A., Brown, M. I., & Draper, S. (2004). Using an electronic voting system in logic lectures: one practitioner's application. *Journal of Computer Assisted Learning*, *20*, 95-102.