Student perceptions of engagement using mobile-based polling as an audience response system: Implications for leadership studies

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Abstract

The increase in ownership and use of mobile-based devices among college students creates unique opportunities for faculty to develop highly engaging learning environments. With many educational institutions offering campus-wide Wi-Fi, students have the ability to use their mobile devices, including cell phones, tablets, and laptops for engaging with curriculum, specifically with leadership concepts. One method of engaging students is through the use of mobile-based polling, as an audience response system (ARS). Although most studies on the use of ARS in educational settings include traditional response system methods (e.g., clickers), emerging technologies have fueled interest in mobile-based polling. The purpose of this study was to examine the effects that mobile-based polling has among students of leadership when used as an audience response system. A survey regarding perceptions of mobile-based polling was administered to students enrolled in undergraduate leadership courses with the purpose of understanding its importance on various aspects of student engagement. Results regarding their polling experiences indicated that students became highly engaged on three levels—behaviorally, emotionally, and cognitively. Additionally, survey responses suggested that students viewed mobile-based polling as viable for purposes outside of the classroom. Suggestions for using mobile-based polling for learning leadership concepts are also presented. The authors of this study not only present mobile-based polling as an emerging technology with advantages over traditional clickers, but as a pedagogical approach for increasing student engagement and as a tool for enhancing leadership skills.

Introduction

Audience Response Systems. During the previous two decades, research regarding the use of audience response systems (ARS) has received increased attention. Studies on the use of

ARS have been identified in the literature under various names including classroom communication systems (Dufrense, Wenk, Mestre, Gerace, & Leonard, 1996), electronic response systems (Hall, Waitz, Brodeur, Soderholm, & Nasr, 2002; Judson & Sawada, 2002), electronic voting systems (King & Robinson, 2009), voting machines (Reay, Bao, Pengfei, Warnakulasooriya, & Baugh, 2005), classroom response systems (Fies & Marshall, 2006), and, the more recognizable term, *clickers* (Caldwell, 2007).

Recent studies have focused on the use of mobile-based polling as an alternative to traditional ARS, highlighting its cost-effectiveness (Richards, 2009) and its independence from additional hardware or software most often associated with traditional clickers (Shon & Smith, 2011). Mobile-based polling relies on the transmission of short message service (SMS) signals from cell phones, and Wi-Fi signals for laptops and tablets. When compared to clickers, mobile-based polling offers flexibility by allowing participants to use personal electronic devices such as cell phones (Shon & Smith, 2011; Burkhardt & Cohen, 2012) tablets, laptops, and browser-based mobile devices (Bhargava, et al., 2013).

Mobile-based Polling. There has been a rise in the amount of literature devoted to the use of mobile-based polling and the advantages of its use in educational settings. Studies have noted the advantages associated with mobile-based polling (Andergassen, Guerra, Ledermueller, & Neumann, 2013; Richards, 2009; Shon & Smith, 2011). Richards (2009) noted how mobile-based polling—when compared to traditional ARS---avoids the burden of costs associated with additional hardware or software often shared by students, faculty, or institutions. Mobile-based polling can also be used at a moment's notice without plugging in hardware (clicker receivers), allotting time for downloading software, or having to maintain the computer memory space used by the software (Shon & Smith, 2011).

Prior to a presentation or lecture, facilitators of mobile-based polls create custom questions (multiple-choice, true or false, or open-ended) through a host web-site. Questions are displayed to an audience through a computer or video projection technology, with instructions for responding using mobile devices. Instead of clickers, which use RFID signals, responses are sent through mobile-based (Wi-Fi) or text-based (SMS) signals. These signals are received and aggregated results are displayed at the host web site. Although the time between the posting of a poll question and the displaying of audience responses might be considered real-time, delays may occur due to Wi-Fi and SMS signal strength.

Poll Everywhere. The authors of this study used the hosting service Poll Everywhere, and have agreed to use the term *mobile-based polling* for creating interactive polls with the participating sample. Poll Everywhere is one of several internet-based sites which allows facilitators to create and manage polling questions, and display them to audiences through computer and/or video projection. Participants respond to displayed polling questions using their mobile devices (e.g., laptops, cell phones, tablets). Although an internet site is needed to create questions, aggregate and display participant responses, signals are received from both cell phone text messaging and browser-based devices such as laptops or tablets. Because Poll Everywhere offers flexibility using both Wi-Fi and text-messaging technology, the terms used in the literature to explain its platform are varied. For example, the Poll Everywhere web site describes its service as using a "standard web technology" (Poll Everywhere.com). Reviewers of Poll

Everywhere support this idea by describing it as a *web-based response system* (Graham, 2010), by "simply using an internet connection" (Sellar, 2011, p.57). However, others have highlighted Poll Everywhere's ability to rely on text-messaging by introducing such terms as, *text-based* technology (Shon & Smith, 2011), *text messaging polling service* (Tremblay, 2010), and *mobile phone polling* (Burkhardt & Cohen, 2012). Because Poll Everywhere relies on an internet-based platform, yet receives both Wi-Fi and text-messaging signals, it appears that a more encompassing term is warranted. Therefore, the term *mobile-based polling* is used in this study to emphasize the importance on the type of devices being used as well as include the kinds of signals involved for receiving participant responses.

Mobile Device Users and Learning. An important aspect for using mobile-based polling regards the type of student using the technology and the context in which the learning occurs. Studies from the Pew Research Center found that 91% of adults own a cell phone (Brenner, 2013) with 96% of college undergraduates at four-year institutions owning cell phones (Smith, Rainie, & Zichuhr, 2011). These statistics are not far from Hanley's (2011) finding that 99% of college students use cell phones and 97% use text messaging as their primary means of communication. College students born between 1980 and 1991 (ages 18-29), often referred to as the *Millennial* generation (Taylor &Keeter, 2010), or as Prensky (2001) refers to as *digital natives*, are more likely than older Americans to treat their cell phones as a necessary and important appendage and believe the adoption and understanding of technology in everyday life is what makes them distinctive from other generations (Taylor & Keeter, 2010). Tremblay (2010) suggested that because of their heavy usage of mobile phones, younger students (mean age of 22.5) might in fact discourage faculty and institutions from requiring 'stand-alone' technologies like clickers. Wisneiwski's (2010) year-long study on Millennials, suggested that leadership studies programs offer innovative and creative approaches for using technology toward effective teaching and learning processes. According to a 2012 report by EDUCAUSE, college students have an expectation that professors will use technology to engage them personally and academically (Dahlstrom, 2012). For example, during an interview with *NEA Today* magazine, a seventeen-year old high school student was quoted regarding his opinion on what educators need to know about technology. He explained, "don't just use technology for the sake of technology—find a way for it to deepen our understanding of a subject" (Long, 2014, para. 24). It would seem advantageous for faculty of leadership studies programs to explore the use of new technologies for its flexibility and cost-effectiveness. Faculty using new technologies for teaching might also discover its relevance and acceptance as a pedagogical method among younger generations.

Student Engagement – Three Levels. Research on student engagement began to emerge in the 1970's and 1980's with early studies focused on student levels of participation and time-related tasks (Harris, 2008). Astin (1984) introduced the term *engagement* referring to, "the amount of physical and psychological energy that the student devotes to the academic experience" (p. 297). As research continued to develop on student engagement, researchers were challenged to create a general and acceptable definition. Other researchers classified various definitions of student engagement to include such terms as academic-cognitive (Dunleavy, 2008), intellectual engagement (Dunleavy & Milton, 2009), and aspects of student engagement based on Flow Theory, or the optimal learning situations that produce positive emotions and tend to increase motivation (Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003).

Fredricks, Blumenfeld, and Paris (2004), investigated 44 studies on student engagement and developed a classification arranged into three conceptual areas; behavioral (actions), emotional (feelings), and cognitive (thoughts). The behavioral approach focuses on the level of physical participation students give toward academic-related activities. This might involve preferences toward following rules or raising a hand in class. The emotional category regards the attitudes and feelings students have toward learning, school, faculty, and class peers. Cognitive engagement refers to the level of investment students give toward learning and mastering the course material. Their comprehensive review of the literature outlined the various definitions of student engagement and viewed it as a multidisciplinary concept. They explained the limitations of presenting engagement as a multifaceted concept by stating it as "theoretically messy" in that it "overlaps with other constructs" (p. 84). In addition, the authors suggested that future studies of engagement differentiate between the three conceptual types.

The three levels of engagement offered by Fredricks, Blumenfeld, and Paris (2004) appear to align with the three learning domains of Bloom's Taxonomy (1956)—cognitive, affective, and psychomotor. Bloom's cognitive domain refers to "the recognition of knowledge and the development of intellectual abilities" (p. 7); similar to the cognitive level of engagement presented by Fredricks, Blumenfeld, and Paris. Bloom's definition of the affective domain is marked by "changes in interest, attitudes" (p. 7); again similar to the construct of emotional engagement as outlined by Fredricks, Blumenfield, and Paris. At the time of the original publication, Bloom's plan to develop and publish work regarding the psychomotor domain was suggested but never accomplished. Others have attempted to define the psychomotor domain, to include the use of the five senses, changes in bodily movements, and increased attainment of motor skills during learning activity (Simpson, 1966). As technology develops, educators will need to continue exploration on the impact various technologies have toward student engagement. Odom, Jarvis, Sandlin, and Peek (2013), asserted that using technology like social media in leadership classrooms encourages student engagement on the three domains associated with Bloom's Taxonomy. Stressing a self-directed approach to learning, they suggested that certain technologies must stimulate learners cognitively, affectively, and physically.

Mobile-based Polling and Leadership Studies. Polling as a pedagogical approach, may contribute to student engagement; but it may also add to the understanding, practice, and assessment of leadership as an academic discipline. Although a majority of the research on the use of ARS for polling has occurred in educational settings, there are several reasons to promote its use specifically among students of leadership studies.

First, there are no studies to date that examine the use of ARS (traditional or mobile-based) with students in leadership studies programs. Mazur (1997) and others have suggested using audience response systems for peer-instructed pedagogical approaches among various disciplines in higher education settings. A review of 52 studies on the use of ARS in educational settings focused on the academic fields of science, medicine, mathematics, engineering, and business (Kay & LeSage, 2009). Other studies have included the use of ARS in safety training (LaRose, 2009), continuing education (Miller, Ashar, & Getz, 2003), information literacy (Burkhardt & Cohen, 2012), fund-raising pledges in non-profit organizations, and during religious services among church congregations (Mollman, 2008). Adding to the current body of literature—particularly, research on the effects of mobile-based polling—provides insight for

how students of leadership might engage with understanding and practicing leadership concepts. Focusing on the behavioral, emotional, and cognitive aspects related to polling contributes to gaining insight for how polling is used to elicit certain actions, feelings, and understanding of leadership concepts.

Second, leadership is a relatively new field of study, and methods to enhance pedagogical approaches are critical to the development of leadership as an academic discipline. Undergraduate and graduate programs of leadership began to emerge in the 1980's, after the call from James McGregor Burns (1978) to formalize leadership studies among educational institutions. Because the concept of leadership is multi-disciplinary, it is often threaded into course delivery in traditional academic programs. Debate exists however, as to whether leadership studies can be viewed as a stand-alone discipline, and if it has been exposed to the same rigorous scrutiny of fields such as engineering, mathematics, or the sciences. Proponents who support the formalization of leadership studies argue for it to be viewed as an academic discipline (Sowcik, 2013), and suggest that universities not having departments devoted to studying leadership would become the minority within a generation (Riggio, 2011). In his research regarding a leadership model of learning for Millennials. Wisniewski (2010), suggested a constructivist or active learning approach which embraces the use of technology to connect new information with past experiences. He asserted that such an approach to leadership studies has the potential to "enhance leadership effectiveness" (p. 64). As leadership programs continue to emerge among educational institutions, it is important to regard patterns of learning particular to generations of the twenty-first century.

Last, the mastery and demonstration of certain leadership skills through the practice of polling could contribute in some way toward the development of 'best-practices'. Sowcik (2013) suggested a continued advancement of accepted standards and 'best-practices' at institutions offering programs in leadership studies. But how might mobile-based polling contribute to this mission? At its basic level, leadership students are *participants* when using their devices. They observe how faculty members use polling as the method to engage those in the classroom--- behaviorally, emotionally, and cognitively. But students may also serve as *facilitators* by learning how to design a mobile-based poll and present leadership concepts themselves to engage an audience. Since mobile-based polling requires no hardware or software purchase and can be used with little to no technology training, it provides an opportunity for students to practice several skills often found in leadership programs. For example, leadership students could be taught to enhance their communication and presentation skills by facilitating a polling session. Designing a poll may help them gain understanding of how the process contributes to the levels of motivation and participation among followers. Students could be encouraged to use polling in the context of a peer-instructed model, developed by Mazur (1997), promoting intellectually stimulating discussions, team decision-making skills, and problem-solving. Allowing students the opportunity to facilitate mobile-based polling empowers them to learn skills necessary for leadership.

The literature on the use of ARS in educational settings seems plentiful; however none exists pertaining to implications of its use for leadership studies. A particular focus to be considered is how mobile-based polling increases student engagement as defined by behaviors, emotions, and cognitive activity. It also provides implications for using polling as a pedagogical

approach within the study of leadership to support polling as an effective tool for students—both as participants and facilitators. It is the intent of the authors to provide meaningful insights for those who are interested in integrating innovative technologies for teaching leadership.

Methodology

Design. During a fourteen-week semester, students enrolled in five organizational leadership courses were invited by their faculty members on two occasions to use personal electronic devices in response to mobile-based polling questions. The polling questions were integrated into course delivery as part of class discussions on various leadership topics. Poll Everywhere, was chosen by the participating faculty and used for this study. Students were presented with information about the nature of the study and were offered the opportunity to volunteer their responses to a survey.

Survey Instrument. A 50-item survey instrument regarding the use of mobile-based polling was developed and administered in hard-copy form to 95 undergraduate students enrolled in traditional (face-to-face) organizational leadership courses at a university located in the mid-western region of the United States. The purpose of the instrument was to collect student opinions regarding the use of their personal electronic devices for mobile-based polling activity during class. The survey items were categorized into several sections—use (11 items), participation (8 items), engagement (11 items), and transfer of learning (7 items)—with 13 items designated for the collection of demographic information. Students were notified in advance (via class announcements or email) and given the choice to participate. The Institutional Review Board granted permission to the authors to conduct research on human subjects.

Sample. The sample (*N=95)* consisted of 52 males and 43 females with 79% born between the years of 1980 and 1992 (ages 18-30), a close representation of the age category for Millennials as reflected by the Pew Research Center (Taylor & Keeter, 2010) . With the exception of two participants, those in the sample classified themselves as having third-year (junior) or fourth-year (senior) undergraduate status, since entrance into this particular degree program is designed for students who have already earned at least half of their total credits needed for graduation. All participants indicated they owned a personal electronic device compatible for use with mobile-based polling activity. Table 1 represents a summary of their preferred polling devices:

Table 1
Preferences of Personal Electronic Device Usage

Type of Device	N=95
Smartphone	76
Feature Phone (not smart phone)	11
Tablet (e.g. iPad, Kindle)	5
Laptop	3

Faculty who were not the primary instructors for the courses involved in this study volunteered their time to administer hard-copy surveys. The survey did not contain any personally identifying information. These measures were taken to avoid student perceptions of grades being associated with participation in this study.

Findings

Introduction. Specific survey items were identified and grouped according to three conceptual areas of student engagement—behavioral, emotional, and cognitive—similar to the learning domains of Bloom's Taxonomy (1956) and the concepts of engagement outlined by Fredricks, Blumenfeld, and Paris (2004). Although the concept of student engagement is complex, the survey items chosen for this study were agreed upon by the authors and used to understand the effects of mobile-based polling. Items pertaining to physical reactions of student polling were grouped as *behavioral*, while items targeting a particular emotional feeling were labeled as *emotional*. The *cognitive* grouping of items pertained to ones referring to the process or quality of learning while polling. Survey items which did not align with any of the three engagement categories were removed from the data set and are not reported as a part of this study. While the items chosen were not subject to any measures of validity or reliability, descriptive results from each grouping are presented and compared to previous research regarding the use of ARS among college students.

Behavior-Related Engagement. For the *behavioral* aspect of engagement, in general students reported having positive attitudes between the use of mobile-based polling and certain classroom behaviors as shown in Table 2.

Table 2
Descriptive Results of Survey Items Pertaining to Behavior-Related Engagement

Behavior-Related Survey Items	*N*	*M*	*StDev*
In class, I feel comfortable speaking up during discussions.	95	1.87	.64
I prefer to respond through real-time polling rather than speaking aloud in class.	95	2.11	.84
I prefer using real-time polling when responding to controversial questions so that others do not see my responses.	95	1.83	.74
I like using a personal mobile device to engage in real time polling during class.	95	1.36	.52
I like that my polling responses are anonymous.	95	1.48	.56
I feel that respondents should be identified while answering questions using real-time polling so that each person is accountable.	95	3.07	.82
I become attentive when my instructor directs us to respond using real-time polling.	95	1.67	.63

Note. Scale: 1 = strongly agree, 2 = agree, 3 = disagree, 4 = strongly disagree

Although a majority of students stated feeling comfortable speaking up in class (*M*=1.87, *SD*=.*64*), only 60% preferred the use of polling over speaking aloud during class discussion (*M*=2.11, *SD*=.*84*). The remaining items selected for the *behavior-related* category received, on average, favorable responses of strongly agree or agree. The survey item regarding student anonymity during polling was favorable (*M*=1.48, *SD*=.*56*) as well as the item referring to remaining anonymous during controversial questions (*M*=1.83, *SD*=.74). Conversely, the item suggesting that students be identified during polling for reasons of accountability received a negative response (*M*=3.07, *SD*=.82).

Emotion-Related Engagement. Four items from the survey related to *emotional* responses of students participating with mobile-based polling. These included the feelings of having a voice during class discussion, level of fun (enjoyment), and a sense of connectedness to the class (Table 3). As a precautionary measure to identify possible hurried or randomized student responses, a reversed item stating polling as a 'waste of time' was also added.

Table 3
Descriptive Results of Survey Items Pertaining to Emotion-Related Engagement

Emotion-Related Survey Items	*N*	*M*	*StDev*
Using real-time polling in class makes me feel as if I have a voice to contribute during class discussions.	95	1.71	.65
Using mobile devices for real-time polling during class is fun.	95	1.40	.55
Conducting real-time polling during class is a waste of class time.	95	3.44	.71
I feel more connected to the class when participating with real-time polling.	95	1.65	.68

Note. Scale: 1 = strongly agree, 2 = agree, 3 = disagree, 4 = strongly disagree

Generally, results for the emotion-related items were positive. Students gave high ratings for several emotion-related survey items including the feeling of 'having a voice' during class discussions (*M*=1.71, *SD*=.65), perceiving the activity of polling as being 'fun' (*M*=1.40, *SD*=.55), and having a sense of emotional 'connectedness' to the class during polling (*M*=1.65, *SD*=.68). The reversed item results pertaining to polling as a 'waste of time' were consistent with the remaining emotion-related data (*M*=3.44, *SD*=.71) indicating a favorable view of the polling experience.

Overall, students in this sample expressed having positive emotions related to using personal devices for mobile-based polling. These results support the work of Fredricks, Blumenfeld, and Paris (2004) suggesting the concept of student engagement includes positive emotions of students regarding their learning, school, faculty, or peers.

Cognitive-Related Engagement. The next section of the survey, *Learning Transfer,* included items designed to gain understanding of the *cognitive* efforts students may exert from their polling experiences. Specifically, this section of the survey focused on understanding the level to which students understood the benefits of mobile-based polling toward learning the course material, and whether or not they intended to facilitate (lead) polling in other contexts outside of the classroom. These occasions might include other courses students take or professional work-related experiences outside of the classroom which provide opportunities for students (or graduates) to lead the polling process. It was assumed that the level of cognitive investment made by students for this study aligns with Bloom's cognitive learning domains (1956) and contributes to the concept of cognitive engagement as categorized by Fredricks, Blumenfeld and Paris (2004). Results of the cognitive-related items from the survey are given in Table 4.

Table 4
Descriptive Results of Survey Items Pertaining to Cognitive-Related Engagement

Cognitive-Related Survey Items	*N*	*M*	*StDev*
I feel that using real-time polling during class enhances the quality of discussions.	95	1.46	.50
The use of real-time polling in class enhances controversial discussions.	95	1.51	.58
Using real-time polling during class helps me to better understand the class material.	95	1.84	.57
I see the benefits to using real-time polling after graduation in my professional life. (Example: meetings, or training sessions).	95	1.80	.60
I would like to learn how to run real-time polling sessions in order to use it outside the classroom.	95	1.89	.63
Being able to administer real-time polling sessions would be an excellent marketable skill for me to demonstrate in the workforce.	95	1.78	.59
I would feel comfortable administering a real-time polling session in another environment outside this class.	95	1.84	.66
I would use a real-time poll for a presentation in another class.	95	1.70	.59

Note. Scale: 1 = strongly agree, 2 = agree, 3 = disagree, 4 = strongly disagree

Overall, students provided positive views regarding their level of cognitive effort toward mobile-based polling. Participants reported a perception of mobile-based polling as an enhancement to both the quality of class discussions (*M*=1.46, *SD*=.50) and controversial discussions (*M*=1.51, *SD*=.58). Students also believed that mobile-based polling helped them better understand course material (*M*=1.84, *SD*=.57).

Students reported anticipating leading a mobile-based polling activity themselves in either professional or school-related contexts outside of class. Their responses indicated a desire for learning how to facilitate polling sessions (*M*=1.89, *SD*=.63), and feelings of

comfortableness for administering polling sessions (*M=1.84, SD=.66*) in contexts outside of the classroom. A majority believed that administering mobile-based polling would be an excellent marketable skill for entering the workforce (*M=1.78, SD=.59*) and that there are benefits to knowing how to administer mobile-based polling in a professional context after graduation (*M=1.80, SD=.60*).

Implications for Leadership Studies

Behavioral Engagement and Empowerment. For this study, the results pertaining to student perceptions of behavioral engagement present some interesting points regarding anonymity. Generally, the results from the behavior-related items presented a consensus among students who prefered their identities to be hidden during polling experiences. But why is the behavior to remain anonymous in the classroom important to pedagogy? These results seem to support what Graham, Tripp, Seawright, and Joeckel (2007) refer to as 'reluctant participants'. The three aspects they use to define this group include: "1. Students who want to know their peers' opinions but are reluctant to share their own; 2. students who are hesitant to ask questions in class when they do not understand the material; and 3. students who prefer classes without student participation" (Graham et al., 2007, p. 242).

Graham et al., suggested the use of ARS as a teaching strategy for empowering rather than compelling student participation. Through this strategy, polling is viewed as an act of empowerment for students who wish to give their opinions but in an anonymous fashion. Leadership students might gain understanding of empowerment by participating in or facilitating a mobile-based polling session. Although anonymity during polling may encourage a sense of empowerment in some students, the polling experience may also promote group interdependence and decision-making. In particular, leadership concepts, such as strategies to avoid Groupthink (Janis, 1972), could be introduced and practiced by placing students into small groups to explore solutions to case studies or leadership-based questions. Leadership students could be encouraged to explore alternatives and freely express objecting opinions in dyads, triads, or small groups—as supported by Janis. The use of polling to collect responses seems to provide a sense of empowerment to those who wish to have a voice but who prefer to remain anonymous. Leadership students may gain empowerment through participation in the anonymous act of polling. When learning how to facilitate a poll, students may also learn the importance of accepting and validating the input of responses from those who participate with polling, by leading class discussions and giving recognition to anonymous answers.

Emotional Engagement and Followership. The results from the emotion-related aspect of this study may also be useful for understanding how leaders use the emotional responses of followers to increase engagement. Goffee and Jones (2001) focused on the dual relationship between leaders and followers and the three emotional responses followers wish to experience with effective leadership—significance, community, and excitement. According to their view, feelings of significance occurs when followers engage in activity in which their input is valued or given a level of importance from the leader—similar to the earlier discussion on empowerment. When their input matters, followers feel a sense of significance. A feeling of community occurs when followers have a sense of unity around an activity and a sense of belonging to each other during the process. Excitement, or what Goffee and Jones term as a

'buzzing' feeling, occurs when followers are near a leader who challenges them or elicits feelings of engagement with the world. Our findings suggested that these emotions emerged among participants during polling experiences. A majority of students who participated in this research expressed a feeling of having a voice, a sense of connectedness to the class, and described their polling experience as being fun. Leadership students can be taught to increase their awareness of such emotions—in themselves and others--and how these emotions may contribute to stronger levels of commitment from followers.

Cognitive Engagement and Intellectual Stimulation. The ability to motivate others through cognitive activity of learning and applying new information is critical to leadership studies. Mobile-based polling provides opportunities for students to learn leadership lessons in an experiential environment—or learning by doing. The survey results of the cognitive-related items suggested that students perceived polling as a means to enhance the quality of learning, understand content, and engage with discussion concerning controversial issues. Further, the results from student responses indicated a strong preference for learning how to facilitate a polling session for use outside the classroom with an equal number of students feeling confident enough to lead a polling session. This learning transfer is important for leadership students who use polling for academic-related projects in other courses or professional work-related presentations. To illustrate, students could be required to create polling sessions with peers who may perceive the experience as intellectually stimulating—a cornerstone aspect of Bass and Avolio's (1994) Transformational Leadership Theory. Bass (1990) described intellectual stimulation as contributing to the "independence and autonomy of subordinates" (p. 216), while Northouse (2010) asserted that intellectual stimulation "encourages followers to think things out on their own and engage in careful problem solving" (p. 179). The findings of our study suggested that mobile-based polling has the potential to promote independent thought and innovative problem solving. If those who lead a polling session can purposefully stimulate followers on an intellectual level, a certain degree of motivation to learn may also emerge. In this way, leadership students could learn to apply the technology of polling to increase their understanding of concepts associated with Transformational Leadership, such as intellectual stimulation.

Limitations, Suggestions for Research, and Conclusion

Limitations. Limitations of this study should be noted. The survey items were chosen to measure levels of behavioral, emotional, and cognitive-related engagement similar to concepts suggested by Fredricks, Blumenfeld, and Paris (2004). However, the items were not subject to any validation process but were identified and chosen with consensus of the authors and as a result of the familiarity with the literature. The absence of validating the survey items may in fact contribute to what Fredricks, Blumenfield, and Paris referred to as a "theoretically messy" (p. 84) construct of engagement. For example, Tremblay's (2010) findings suggested a correlation between college students who used Poll Everywhere for classroom purposes and emotional engagement; however, emotional engagement did not seem to be clearly defined as in our study. Therefore, careful attention was given to align specific survey items that were thought to correspond with particular levels of engagement. Future studies on using ARS for audience engagement would benefit to include validated instruments as well as measuring learning

outcomes.

Additionally, there are technological limitations for students using their personal devices when compared to traditional ARS which rely on hardware, software, and RFID signals. The authors of this study, as well as others who have examined similar ARS, have found the mobile-based options, specifically Poll Everywhere, to have longer delay times, and do not respond well with some devices (such as certain phone plans). They also have found decreased performance of mobile-based polling under certain circumstances such as location of Wi-Fi and strength of signal.

Suggestions for Future Research. Further research might focus on the degree to which mobile-based polling helps students learn new material. It could be assumed that the learning processes which occurs for students using mobile-based polling would be identical with the processes for traditional ARS (e.g., clickers). Studies on traditional ARS suggested that learning among students occurs, if instructors integrate intentional pedagogical approaches into their polling activity (Caldwell, 2007; Kay & LeSage, 2009). However, for mobile-based polling, studies are scarce when addressing measures of student learning.

Additionally, the difference between using personal devices for polling versus traditional clickers may stem from student attitudes regarding the device itself. Often, clickers must be purchased by the institution or the student, much like a text book or lab fee. In this sense, clickers may not be perceived as a personal item and are restricted in their use to respond only to RFID signals of a receiver. However, the use of personal electronic devices (e.g., smartphones, laptops, tablets) invites students to respond through what they might perceive as a unique and intimate source. Personal devices are used for far more reasons than responding to classroom polls; therefore, students may view them as extensions of their everyday lives. Using their own devices, it is possible for students to feel higher levels of personal investment toward their learning when compared to using clickers.

Finally, leadership studies may benefit from further research on the effects mobile-based polling may have toward learning leadership concepts. Assessment of specific leadership skills demonstrated by students who facilitate (design and lead) polling sessions could add to the understanding between leadership and technology. Research could be conducted to focus on academic benchmarks attained by students who facilitate polls and the levels to which they influence others through its use.

Conclusion. The use of personal devices as an ARS among college students seems promising; particularly at a time when most students possess the personal technology to willingly link their devices for purposes of learning. Because an overwhelming majority of college students own such devices and attend institutions with campus-wide Wi-Fi, the integration of mobile-based technology with pedagogy may become more commonplace. Faculty interested in broadening their delivery methods would find numerous benefits for using mobile-based polling in the classroom. Institutions and faculty considering the adoption of ARS should become aware of the costs, benefits, limitations, and impact toward on student learning.

Overall, the students involved in this study provided positive feedback regarding their experiences using personal devices during mobile-based polling activity. When compared to previous literature, the results of this study seem to follow similar trends of positive perceptions of polling among students. For these participants mobile-based polling appears to have increased engagement on three levels: behaviorally, emotionally, and cognitively. Though literature on student engagement is exhaustive, understanding it through these three aspects may contribute to a greater awareness of mobile-based polling as a learning tool. Inviting students to use their personal devices to share opinions and compare results seems to produce positive actions, feelings, and desire to learn.

Those who are involved with the formal study of leadership may find significant uses for mobile-based polling. Leadership concepts like teamwork, problem-solving, motivation, conflict resolution, goal-setting, and others could be implemented through polling activity. More importantly, students could be taught to facilitate and create polling experiences that motivate, inspire, and intellectually challenge those who participate. Aspects of leadership theories can be presented and discussed through polling activity. In addition, it is plausible for students to be taught how to facilitate polling sessions and increase their level of confidence in using such technology. It could allow students to see beyond understanding the *content* of their presentation skills to becoming aware of the *process of influencing others*, a concept that is foundational to the study of leadership. These kinds of skills occur in an experiential learning environment, and can be marketable in a competitive and rapidly changing world. The study of leadership will not exist apart from new and innovative technology. Effective leaders will continue to find ways to influence others through creative, yet personal means.

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