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TEACHING AND LEARNING

Using audience response systems to amplify student learning in political science: a case study of electoral systems teaching

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Abstract Audience response systems (ARS) are now a very widespread technological teaching tool within political science, being used as either an opinion polling or an assessment tool in the classroom. This article presents a case study of an in-class demonstration using an ARS within an electoral systems and voting behaviour module to illustrate how these systems can be used in more innovative pedagogical ways to produce 'teachable moments' which facilitate high-level learning outcomes. It argues that political scientists should further emphasise the integration of pedagogical knowledge with technology and content knowledge to embed ARS technology within a more transformative learning process in order to amplify students' understanding of political science concepts and aid the progression of learning.

Keywords Clickers · Audience response systems · Polling software · Technology

Introduction

An audience response system (ARS) is a piece of software through which students can submit individual, anonymous responses to questions, statements or puzzles posed to them by lecturers in 'real time', with the results being displayed onscreen for the whole class to observe. They are a very well used and increasingly popular piece of technology in the twenty-first century classroom across all disciplines in higher education (e.g. DeBourgh 2008: 76; Dangel and Wang 2008: 93; Lasry 2008:

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242; Sobel and Grotti 2012: 260), including political science (see Loep 2018; Ulbig 2016; Evans 2012; Gormley-Heenan and McCartan 2009: 281). When used effectively, the integration of this type of technology has been shown to enhance teaching, particularly within large groups and in research methods modules (e.g. Velasco and Cavdar 2013). Central to this is the TPACK framework developed by Koehler and Mishra (2009) which highlights how lecturers can integrate existing content and pedagogical knowledge with technology knowledge to encourage a 'transformation' of both the subject matter and the classroom (Koehler et al. 2013, p. 15). This article firstly analyses the traditional uses of ARS systems within political science, finding that they fall into two categories (opinion polling and assessment tracking) and that, in terms of pedagogy and learning outcomes, they promote only low-level transformations of the subject matter in teaching. A case study of a more innovative use of ARS within an electoral systems and voting behaviour module is then presented. It is argued that this case study points to a third and more highly transformative use of this type of technology; one which continues to emphasise technological and content knowledge, but which has a much stronger pedagogical component, amplifying student learning and targeting learning outcomes of analysis and evaluation. As such, the article encourages more innovative uses of this technology within the political science classroom.

Why and how do we use audience response systems in the classroom?

The use of ARS within political science often hinges on two core assumptions. The first relates to the arena in which this technology is used, with an overwhelming consensus that ARS systems are for large group teaching (e.g. Velasco and Cavdar 2013; Ulbig 2016: 44), defined variously as being classes of over fifty (Holland et al. 2013: 275) to over 100 students (Velasco and Cavdar 2013: 823; Evans 2012: 86; Damron and Mott 2005: 373). The second assumption relates to the manner in which the technology is used, with a binary division of usage as either an opinion polling tool or an assessment tool. Holland et al. (2013) propose ARS technology to be used in a classic opinion polling style, whereby the lecturer asks students to express their views on what may be controversial or divisive political issues (p. 278). Assessment use is put forward by Evans (2012) for example, who describes clicker questions which form part of an assessed component of an American Government and Politics module. Damron and Mott (2005) suggest a similar approach, but one which provides the lecturer with an immediate assessment of the number of students who have grasped a key concept within a comparative politics lecture. Here ARS can act as a 'temperature gauge' for the class (Ulbig 2016: 49), demonstrating students' understanding and retention of key concepts in real time.

This use of ARS is by no means unique to political science. Rather, it is the norm outside the discipline too. ARS systems are purported to be effective tools for opinion or content polling of large groups in mathematics (Simelane and Skhosana 2012), informatics (Collins 2007: 82), nursing (DeBourgh 2008), psychology (Anderson et al. 2013) and the sciences (Crouch et al. 2004; Beatty et al. 2006; Lasry 2008; Beatty and Gerace 2009) to cite just a few. The overwhelming majority

of uses also fall into the assessment or 'recall' category, enabling the lecturer to assess student understanding in real time (Dangel and Wang 2008: 99). Here, clicker use remains fairly constant between the disciplines. There is thus much continuity of ARS use across the higher education sector as a whole.

Research has shown that both opinion polling and assessment usage of ARS can bring benefits to the student learning experience. Most noteworthy here is the empowerment of students, particularly those who may otherwise be reluctant to participate (Holland et al. 2013: 275, 280). Ulbig (2016: 43) cites a broader group of beneficiaries including tactile learners. However, the strongest empowerment argument is made by Velasco and Cavdar (2013: 824) who highlight the role of ARS systems in moving all students from a passive to a more active role in lectures (see also Collins 2007: 81).

Conversely, however, although ARS systems are a tool for encouraging student interaction, the literature on both assessment and opinion polling reinforces the view of the lecturer-centred classroom. Dangel and Wang (2008) argue that ARS facilitate 'a pedagogical orientation of the instructor directing and the student reacting' (p. 94). There is a significant body of work which also recognises this, and which focuses on the need for lecturers to use assessment polling as a more pedagogical tool to modify the content of their class and thus adapt to student needs (Collins 2007, 83; Gormley-Heenan and McCartan 2009: 382; Simelane and Skhosana 2012: 282; Holland et al. 2013: 287; Velasco and Cavdar 2013: 824; Ulbig 2016: 42). The impact of ARS technology in these situations is highly contingent on the lecturer's individual approach. This brought Lasry (2008) to conclude that the real benefit of ARS was 'more on the teaching side, than on the learning side' (p. 243), making lectures more efficient, something which is echoed elsewhere (Anderson et al. 2013: 222). This emphasis on teacher-centred benefits suggests that there is a lack of ARS use which more obviously stimulates students' learning. Dangel and Wang agree here, stating that assessment polling with ARS is 'least likely to produce the kind of transformational learning called for twenty-first century students' (2008: 96). In terms of students' cognitive learning outcomes, it may work to enhance student understanding, but it does little to encourage students' skills of evaluation or critical thinking (Dangel and Wang 2008: 99).

Integrating audience response systems into the TPACK framework

The TPACK framework is useful in helping to understand the use of ARS technology in the classroom and is often cited by those exploring the implementation of ARS in higher education settings (see for instance Sobel and Grotti 2012: 260; Archambault and Barnett 2010). Put forward by Koehler and Mishra (2009), this framework builds on Shulman's (1986) work which demonstrated how the integration of pedagogical knowledge with content knowledge was fundamental to good teaching and effective student learning. Koehler and Mishra sought to understand how technology could be utilised to further enhance teaching. They therefore outline the interaction between three key types of lecturer knowledge (content, pedagogy and technology). When fully combined, these streams of knowledge form

technological, pedagogical and content knowledge (TPACK). Central to this concept is the 'transformation of the subject matter for teaching' (Koehler et al. 2013, 15) through the integration of the lecturer's pedagogical content knowledge with their knowledge of technology. This means selecting and utilising appropriate technology in order to challenge 'common misconceptions …. [forge] connections among different content based ideas …[or] … alternative ways of looking at the same idea or problem' (Ibid, 15). Researchers have demonstrated that we can measure the extent to which different elements of the TPACK framework are being used in the classroom (Hoseeini 2014; Archambault and Barnett 2010: 1656). As such, the TPACK framework is considered useful when seeking to understand how technology can be utilised to improve teaching and learning.

By examining existing use of ARS, we can see how these three streams can begin to come together within a lecturer's teaching (Koehler and Mishra 2009: 65). We can also see how the documented uses of ARS within political science and across the higher education sector more broadly, bring together the content knowledge and the technology knowledge very visibly, but that the pedagogical knowledge stream is weaker. For instance, let us imagine that a political science lecturer is teaching a class about voting behaviour. They will bring to their own content knowledge about explanatory theories of voting behaviour to the class. They will also bring some pedagogical knowledge. By this we mean the 'network of understanding that underpins [teaching] practice' (Kinchin 2012: 46). Such knowledge may be drawn from academic literature, institutional training courses or simply from classroom experience. It will inform how they present this knowledge to the class and engage students with the material. The lecturer may decide to use ARS software to test students' understanding or retention of key voting behaviour theories in the middle of the class. Here, they are using not just content, but also a form of technological knowledge. The ARS technology is being used as a tool to help the lecturer gauge the extent to which the transmission of content knowledge to students has been successful. As such, we can see quite clearly that technological content knowledge (TCK) is fostered by the integration of this technology (see Fig. 1). If the ARS polling shows that students are struggling to grasp a concept, the lecturer may present the material in a different manner, or seek to explain it in a different way. There is therefore also some pedagogical knowledge coming into play here, but this would be what Dangel and Wang (2008: 96) would consider to be at a fairly low level in terms of the learning outcomes it facilitates. It would be very much geared around the understanding or application of theories or concepts. If the ARS showed that the students did not understand a key element of a lecture, the teacher may decide to repeat or adapt their explanation of it. The pedagogical stream is present, but it is not stimulating high-level pedagogical outcomes for the students.

This fits with existing research on both pedagogy and technology in higher education. Kinchin (2012) for instance finds that while content and technology are often seen as core components of the modern university teaching environment, pedagogy itself is 'often tacitly presumed to somehow "be there"' (p. 44). As a result, technology use does not enhance the learning process, but rather facilitates the continuation of it through a different medium, something Kinchin (2012: 44) would call the 'default book structure' of the teacher-centred classroom or a form of 'technology

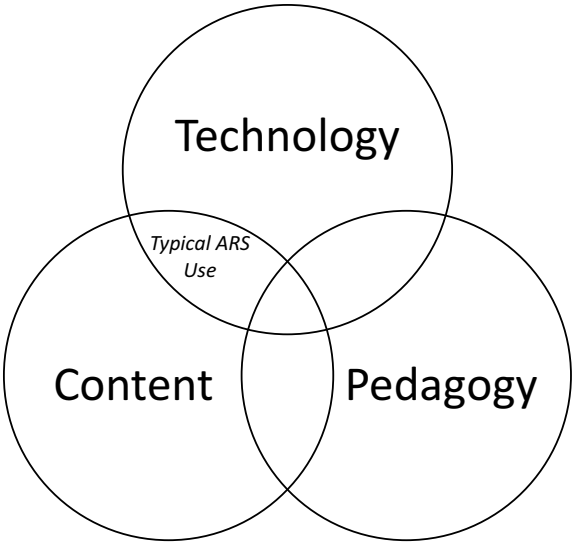

Fig. 1 ARS use within the technological content knowledge sectors. *Source*: Adapted from Koehler and Mishra (2009 p. 63)

enhanced non-learning'. Hosseini's work complements this, finding in particular that the integration of technology knowledge with pedagogical knowledge (TPK) is often missing or is less visible in the classroom (2014: 98).

This is also demonstrated by the emphasis which best practice examples of ARS use place on the wording and format of the questions being asked through the systems, rather than on the learning environment which they facilitate. Collins, for instance, believes that effective questions lie 'at the heart' of successful ARS use (2007: 85), while Beatty et al. find that the efficacy of polling software 'depends strongly on the quality of the questions' (2006: 31). Although the framing of the questions asked can move students towards a form of 'deep learning' (Beatty 2004: 6) as opposed to surface learning, the focus is very much on lecturer-driven content and discussion in order to meet lower-level learning outcomes of understanding or applying material. In fact, the name ARS itself suggests that 'the action is in the front—on the stage', with the students being the more passive 'audience', the consumers who are there to respond to what is displayed at the front of the class (Dangel and Wang 2008: 94). Interestingly, research by Dangel and Wang found that only a handful of authors referred to the technology as a 'participation system' (ibid), with most emphasising either the importance of the teacher in taking control of the session. It is clear then that the current usage of ARS in the classroom within political science and elsewhere is one which Mostert and Quinn (2009) would describe as being 'pedagogically poor' (p. 73). Pedagogy may be present, but it enhances only the lower-level cognitive outcomes for the students.

Reasserting the pedagogy of ARS in the political science classroom

These concerns over the pedagogical benefits of typical ARS use suggest that we should look beyond the more static assessment and opinion polling uses of clicker

technology which dominate the classroom environment. Indeed, Gormley-Heenan and McCartan (2009: 279) have hinted at a very different approach to clicker use, describing ARS systems as 'natural bedfellows' for those teaching in political science courses. Although the authors still largely subscribe to the dominant view of assessment or opinion-based clicker use, they appreciate how this type of system, by its very nature as a voting tool, appears to fit more naturally with political science topics, highlighting in particular its potential use for teaching voting behaviour. Damron and Mott (2005) would agree with this, proposing the use of ARS to help students simulate a constitutional convention (p. 374) in which they can propose and vote on amendments.

The use of ARS as part of an electoral systems and voting behaviour module taught at the University of [NAME] falls very much outside the traditional use of ARS and sits more clearly within Gormley-Heenan and McCartan's suggestion that classroom voting technology could enhance teaching on voting systems themselves. It offers a third type of use for ARS systems; one of the progression or transformation of student learning. Here, ARS use is pivotal to the development of students' learning or understanding, rather than being merely a reporting or assessment of it, and pushes students towards higher-level cognitive learning outcomes, as they analyse and evaluate material. The remainder of this article outlines the means by which polling software was used to teach a small class of sixteen second-year politics students. Electoral systems can be a challenging topic for undergraduate students. Farrell (2011: 1) writes that it can be difficult 'to enthuse [them] about the details of how one electoral system varies from another'. As a result, it was crucial to establish the idea of the importance of electoral systems and their ability to shape electoral preferences at the very beginning of the module.

The class ran as a demonstration in which the students were asked to participate in a mock voting exercise, facilitated by an ARS. Poll Everywhere software was selected for this class as it is quicker and more efficient to implement than handheld clickers. It can be set up online in advance of the class and requires no handsets to be purchased, alleviating any concerns about the cost of purchasing relevant software which has been highlighted by previous studies (e.g. Evans 2012: 88). Students must only bring either a mobile phone or a laptop to class with them, where they are provided with a web address or text number in order to participate in the lecturer's polling session. The demonstration of electoral systems required this class to have a vote on something. While traditional literature emphasises the need to take great care in constructing polling questions which will require students to think critically (e.g. Evans 2012: 89), literature on demonstrations tells us that while online polling can be particularly memorable (Crouch et al.: 835), simplicity in the demonstration is key (Gross 2002: 5). The question here was therefore of much less importance. The students were asked to decide a somewhat less than important question than most elections; voting simply for their favourite biscuit. With a selection of four biscuits on display, the class were asked to sample each of them and to discuss the ways in which they could decide between them which was their preferred biscuit. This initially led to discussions of voting with a simple show of hands, possible constructions of ballot papers and whether a preferential vote would be the fairest method to use. The lecturer then asked students to use their laptops or mobile phones to take

part in a series of three votes using the different types of electoral systems which they had suggested.

Firstly, the polling software was used to demonstrate a first-past-the-post (FPTP)-style system. Here, students cast only one vote and, as the results displayed on the screen showed, the winning biscuit was the one with the plurality of votes. This was a simple demonstration of what most students had considered to be the most obvious way of electing a winner. It fits with their notion of a simple show-of-hands vote and the results showed a clear winner (see Fig. 2). No students disputed the outcome of the vote. The voting was then repeated using a different style of electoral system. All but the top two choices from the first vote were eliminated and the class were asked to vote once again, this time choosing between the two highest scoring biscuits from the first round. This was a replication of a two-round or run-off electoral system in which candidates are eliminated and voters must go back to the polls on a second occasion. The elimination here ensured that the winner received an absolute majority rather than a simple plurality of votes. As a result, the winning biscuit in the first vote (the plurality FPTP system) was not the same under the second vote (two-ballot system). Finally, the students were asked to rank their choice of biscuit, in a preferential style system, something which is again quite simple to design and implement using polling software. All of the results were saved within the poll everywhere facility for students to view, but the results were also noted on a whiteboard at the front of the class.

The exercise thus demonstrated at first-hand the systemic effects of electoral systems. It provided a vivid demonstration of how electoral system design can affect an electoral outcome. The students were voting on the same set of biscuits throughout and at no point did any student change their mind about their preferred choice of biscuit, yet the results were clearly very different. Most immediate to the students was the difference between the FPTP and the two-round systems. The fact that the

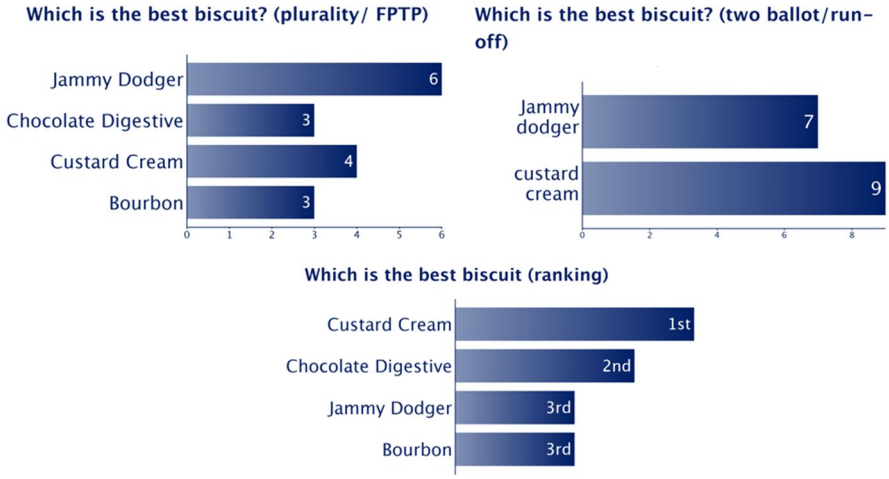

Fig. 2 Voting with plurality- and majority-style electoral systems

winning biscuit in the former was not the one produced by the latter emphasised what Farrell (2011: 44) describes as the 'critical new ingredient' of the two-round system—the need for an overall majority rather than a simple plurality. This in itself facilitated discussions between the students about elections in the UK and how (or not) it was that elected representatives receive a majority of the vote. It also enabled discussion of the impact of two-round systems on smaller parties (see for instance Elgie 1997: 91) and why outsider candidates can have a stronger chance of success (Birch 2003: 325).

This simulation was also a useful means of highlighting the strategic effects of electoral systems, particularly the notion of voter choice and the difference between categorical and ordinal ballot papers. In the FPTP and two-round systems, the students had only been able to cast a vote for one biscuit, whereas where rankings had been used they had been able to select a second, third and fourth choice. The students also discussed the way in which the two-round system had forced a small group of them to reconsider their choices; finding that their preferred biscuit had been eliminated, some of the class had selected for the 'least worst' biscuit rather than their most favourite. Crucially, this discussion happened without the need for any prompting from the lecturer. Students had begun to analyse and evaluate systems and their importance without realising it. The lecturer was then able to summarise and to encourage the class to think about the different choices which need to be made when choosing electoral systems and the competing values inherent in electoral system design (Lijphart and Grofman 1984: 4).

Completing this demonstration through an ARS system brought an immediacy to the results—and to the realisation of what was happening. It also emphasised the 'mechanical' aspect of electoral systems. The students assumed that the technology would ensure a fair and accurate result. If the votes had been completed using paper ballots, the lecturer would count them and reveal the results. Here, the election would have had a more personal or human element in which the supposed neutrality of a system may not have been so apparent. The class may have been suspicious that the lecturer was amending the vote themselves in order to change the result. The ARS therefore helped students to examine the notion that the systems themselves are not neutral, in a much starker way than would be possible without using the technology.

Following the exercise, the class were asked to provide some qualitative written feedback on the use of the polling software. The literature on demonstrations in the classroom tells us that student learning will be much greater where a demonstration has 'actively engaged them' (Crouch et al.: 834) and that it can 'pique the students' interest in a new phenomenon' (Gross 2002: 3). The comments provided by the students concurred with this. They included praise for the demonstration as 'a brilliant way of visualising the differences between systems without using complex hypothetical examples'; 'you can instantly see the dramatic effects of using different electoral systems' and 'you could see how it all changed in real time'. The clickers had provided a moment of excitement and interest, but they had also gone further than this. They had, in the space of just 5 or so minutes, challenged students' traditional assumptions about what electoral systems do. The understanding learning outcomes were met almost instantly. The remainder of the class could therefore focus

on higher-level analysis and evaluations of the systems themselves, why the results were so different and why this actually mattered. Thus, the integration ARS in this way enables technology and content knowledge to combine with a higher level of pedagogical knowledge than occurs with more common uses of this technology.

Embedding ARS technology to create a 'teachable moment'

This type of ARS use as a teaching tool within political science fits more clearly within the TPACK model. Rather than being used as an 'add on' to traditional modes of teaching (Koehler and Mishra 2009: 67), the polling technology is thoroughly embedded within the learning process. The lecturer's technological knowledge (of polling software) and content knowledge (of the types and effects of electoral systems) are being comprehensively integrated with pedagogical knowledge and the desire to push students to reach higher learning outcomes. The technology itself is a fundamental part of the learning process, demonstrating how differently structured electoral systems will facilitate different outcomes. As such, although it does enable the transferring of content knowledge (through a basic understanding of how different electoral systems function), it is more obviously a tool to transform their understanding of the impact of electoral systems. It facilitates an understanding that electoral systems do matter; that they are not neutral devices and that the very design or 'input' of an electoral system can transform the results or 'output'. It can create a 'eureka' moment for students in which the topic suddenly becomes less boring and impenetrable and favours a more active, student-centred model of learning. To go back to Dengel and Wang's pedagogical criticisms of ARS use, this demonstration is about more than presenting 'remembering-level' questions to students.

This also aligns well with more recent political science literature describing the use of ARS as a method to create 'teachable moments' (Holland et al.: 276), where students are deliberately brought to 'the realisation that … their beliefs, perceptions, ideas or models conflict' (Beatty and Gerace 2009: 158) and upon which an entire class hinges upon. This particular example, however, goes much further. For in this case, it is not just the entire class which hinges on this particular ARS session, it is the whole of the electoral systems and voting behaviour module. The polling simulation acts as a reference point throughout the following teaching sessions, as the class compare and evaluate different types of electoral system and discuss issues of representation, fairness and voter choice.

Other uses of ARS could be considered to facilitate teaching within classes on the theme of electoral systems and voting behaviour. Students in larger classes could, for example, use ARS as a tool to illustrate and discuss the difference which district magnitude makes to an election result in a proportional system—with the class divided into different constituencies. ARS could be used to further examinations of the way in which electoral formulae may privilege political parties of a certain size (Lijphart 1990), with students representing smaller political parties struggling to achieve representation in an election with their classmates. It could also be used to demonstrate how thresholds can affect the representation of political parties, or the proportion of votes cast which are wasted, either as a result of thresholds for

parliamentary representation or the mechanics of the voting system itself. It would facilitate fast, accurate representations of the number of students in a classroom whose votes did or did not actually 'count', providing very visual indications of how electoral systems can influence this. In much larger classes, these could be combined to a much more comprehensive use of ARS to consider the various determinants of disproportionality and wasted votes, drawing on work such as that by Anckar (1997) to show how different thresholds, district magnitudes and formulae can affect the proportionality of a result and the number of wasted votes. The speed by which preferences can be counted using ARS and the immediacy of the results means that several different scenarios can be explored within a short teaching session.

Conclusion

Exploring the use of ARS within political science and within higher education more broadly demonstrates something of a 'historic constancy' (Daniel 1996: 137, as quoted in Mostert and Quinn 2009: 75) in its manner of use. Content assessment and opinion polling are the only widely applied functions of this technology, promoting a style of technology integration which seems to prioritise technological knowledge and content knowledge above that of pedagogy. In particular, it fails to encourage students to move to higher-level cognitive learning outcomes such as critical thinking and evaluation. The prevalence of these forms of ARS use can make it difficult for lecturers to 'imagine strategies that take them outside' this assumption about the use of these clicker systems (ibid).

Writing in 2008, Dangel and Wang suggested that 'the glass is only half full' and that new applications for ARS, based on 'sound pedagogical practices' would come to light (p. 102). The application of an ARS system outlined here within a political science module is a step towards filling this glass. It suggests that there is a third type of application of ARS systems, one which fits more closely with the TPACK framework, incorporating a student-centred pedgagogy more visibly alongside that of technological and content knowledge. As such, it perhaps creates what Watling would describe as the bridge between the technology and the pedagogy (2009: 96) within ARS software. It also begins to answer Mishra et al.'s (2011) call for new ways of thinking about teaching within the TPACK framework, particularly the notion of embodied thinking, in which the learning experience is less static and much more tactile (ibid: 14). Thus, while ARS technology in itself 'does not embody a student-centred instructional paradigm' (Niederhauser and Stoddart 2001: 16), this case study illustrates that it can promote a more active and constructivist form of student learning within political science. It is what Shelton (2016: 304) would consider a 'small-scale' example of effective practice and could be embedded within any political science teaching in the areas of electoral system design or representation, as well as particular elections and electoral circumstances.

References

Anckar, C. 1997. Determinants of Disproportionality and Wasted Votes. *Electoral Studies* 16(4): 501–515.

Anderson, L.S., A.F. Healy, J.A. Kole, and L.E. Bourne. 2013. The Clicker Technique: Cultivating Efficient Teaching and Successful Learning. *Applied Cognitive Psychology* 27(2): 222–234.

Archambault, L.M., and J.H. Barnett. 2010. Revisiting Technological Pedagogical Content Knowledge: Exploring the TPACK Framework. *Computers & Education* 55: 1656–1662.

Beatty, I. 2004. Transforming Student Learning with Classroom Communication System. *Educause Center for applied research: Research Bulletin* 2004(3). Retrieved from https://arxiv.org/ftp/physics/papers/0508/0508129.pdf. Accessed 30 January 2017.

Beatty, I.D., and W.J. Gerace. 2009. Technology Enhanced Formative Assessment: A Research Based Pedagogy for Teaching Science with Classroom Response Technology. *Journal of Science Education Technology* 18: 146–162.

Beatty, I.D., W.J. Gerace, W.J. Leonard, and R.J. Dufresne. 2006. Designing Effective Questions for Classroom Response System Teaching. *American Journal of Physics* 74(31): 31–39.

Birch, S. 2003. Two Round Electoral Systems and Democracy. *Comparative Political Studies* 36(3): 319–344.

Collins, L. 2007. Livening up the Classroom: Using Audience Response Systems to Promote Active Learning. *Informatics Education* 26(1): 81–88.

Crouch, C., A.P. Fagan, J.P. Callan, and E. Mazur. 2004. Classroom Demonstrations: Learning Tools or Entertainment? *American Journal of Physics* 72: 835–838.

Damron, D., and J. Mott. 2005. Creating an Interactive Classroom: Enhancing Student Engagement and Learning in Political Science Courses. *Journal of Political Science Education* 1: 367–383.

Dangel, H.L., and C.X. Wang. 2008. Student Response Systems in Higher Education: Moving Beyond Linear Teaching and Surface Learning. *Journal of Educational Technology Development and Exchange* 1(1): 93–104.

Daniel, J.S. 1996. *Mega-Universities and Knowledge Media: Technology Solutions for Higher Education*. London: Kogan Page.

DeBourgh, G.A. 2008. Use of Classroom 'clickers' to Promote Acquisition of Advanced Reasoning Skills. *Nurse Education in Practice* 8(2): 76–87.

Elgie, R. 1997. Two Ballot Majority Electoral Systems. *Representation* 34(2): 89–94.

Evans, H.K. 2012. Making Politics "Click": The Costs and Benefits of Using Clickers in an Introductory Political Science Course. *Journal of Political Science Education* 8: 85–93.

Farrell, D.M. 2011. *Electoral Systems: A Comparative Introduction*. 2nd ed. Basingstoke: Palgrave Macmillan.

Gormley-Heenan, C., and K. McCartan. 2009. Making it Matter: Teaching and Learning in Political Science using an Audience Response System. *European Political Science* 8: 379–391.

Gross, J.L. 2002. Seeing is Believing: Classroom Demonstrations as Scientific Inquiry. *Journal of Physics Teacher Education Online* 1: 3–6.

Holland, L., P. Schwartz-Shea, and J.M.J. Yim. 2013. Adapting Clicker Technology to Diversity Courses: New Research Insights. *Journal of Political Science Education* 9: 273–291.

Hosseini, Z. 2014. Development of Technological Pedagogical Content Knowledge through Constructionist Activities. *Procedia - Social and Behavioral Sciences* 182: 98–103.

Kinchin, I. 2012. Avoiding Technology-Enhanced Non-learning. *British Journal of Educational Technology* 43(2): 43–48.

Koehler, M.J., and P. Mishra. 2009. What is Technological Pedagogical Content Knowledge? *Contemporary Issues in Technology and Teacher Education* 9(1): 60–70.

Koehler, M.J., P. Mishra, and W. Cain. 2013. What is Technological Pedagogical Content Knowledge (TPACK)? *Journal of Education* 193(3): 13–19.

Lasry, N. 2008. ARSs or Flashcards: Is There Really a Difference? *The Physics Teacher* 46: 242–244.

Lijphart, A. 1990. The Political Consequences of Electoral Laws. *American Political Science Review* 84(2): 481–496.

Lijphart, A., and B. Grofman. 1984. Choosing an Electoral System. In *Choosing an Electoral System: Issues and Alternatives*, ed. A. Lijphart and B. Grofman, 3–14. New York: Praeger.

Loep, E.D. 2018. Beyond Polls: Using Science and Student Data to Stimulate Learning. *Journal of Political Science Education* 14(1): 17–41.

Mostert, M., and L. Quinn. 2009. Using ICTs in Teaching and Learning; Reflections on Professional Development of Academic Staff. *International Journal of Education and Development using ICT* 5(5): 72–84.

Niederhauser, D.S., and T. Stoddart. 2001. Teachers' Instructional Perspectives and Use of Education Software. *Teaching and Teacher Education* 17(1): 15–31.

Shelton, C. 2016. Giving up Technology and Social Media: Why Lecturers Stop Using Technology in Teaching. *Technology, Pedagogy & Education* 26(3): 303–321.

Shulman, L.S. 1986. Those Who Understand: Knowledge Growth in Teaching. *Educational Researcher* 15(2): 4–14.

Simelane, S., and P.M. Skhosana. 2012. Impact of Clicker Technology in a Mathematics Course. *Knowledge Management & E-Learning: An International Journal* 4(3): 279–292.

Sobel, K., and M.G. Grotti. 2012. Using the TPACK Framework to Facilitate Decision Making on Instructional Technologies. *Journal of Electronic Resources Librarianship* 24(4): 255–262.

Ulbig, S.G. 2016. I Like the Way this Feels: Using Classroom Response System Technology to Enhance Tactile Learners. *Introductory American Government Experience', Journal of Political Science Education* 12(1): 41–57.

Velasco, M., and G. Cavdar. 2013. Teaching Large Classes with Clickers: Results from a Teaching Experiment in Comparative Politics. *Political Science and Politics* 46(4): 823–829.

Watling, S. 2009. Technology enhanced learning: a new digital divide? In *The Future of Higher Education: Policy, Pedagogy and the Student Experience*, ed. L. Bell, H. Stevenson, and M. Neary, 83–96. London: Continuum.

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