

## Commentary: Changing Instruction with Technology and Action Science

In this commentary I will highlight my interests related to points raised by Glassman, Bartholomew, and Hur (2013). I will analyze those ideas that I found to be most interesting with respect to my current work in creativity, learning, and instruction and with respect to my own experiences in education. Finally, I hope that through my analysis I can elaborate and extend the topics taken up in this article to spur ideas further and offer potential research ideas that align with my interests.

Glassman and colleagues present a case study that follows their attempts to integrate a new technology (blogging) into a general education course in Child Development. Analysis of their intervention is carried out through an action science approach, specifically through Argyris and Schon's (1974) single loop and double loop learning processes. While this is not the first study to focus on technology implementation in a specific field of practice, nor even the first look at technology integration in instruction it is the first that I have found that has attempted to analyze and evaluate technology implementation primarily through an action science lens. Other studies outside of education that have attempted a similar analysis have had interesting results. Reyshav, Kumi, Sabherwal, and Azuri (2016) evaluated the use of mobile tablets in clinics using single and double loop learning and found that only during the medical encounter (direct physician to patient interaction) the mobile tablets exhibited those qualities which characterize double loop learning. When tablets were used in the waiting room (patient only) learning was still characterized as single loop. This first point raises an interesting discussion on whether the technology must be used as a tool to facilitate interaction amongst individuals to have the desired effect.

I have found in my own experience that when technology is used as a tool which facilitates communication between individuals or groups then learning will most likely occur in forms that resemble most Piaget's (1972) individual constructivism and Vygotsky's (1980) social constructivism. This is due largely to my belief that technology is an excellent tool for facilitating inter- and intra- psychological interactions through multiple means and also a tool that can take on additional functions beyond what was may have been originally designed for. The uses and means for which a technology serves are constantly changing based the types of users and types of interactions taking place. This characteristic of technology can help facilitate changes taking place in diverse environments and diverse individuals. While they do not use these terms explicitly in their article Glassman and colleagues (2013) make much the same point when stating their initial reason for integrating blogging into their classroom, "the web can be understood in many ways, but in this paper it is conceptualized primarily as a tool/intervention capable of changing the trajectory of curriculum, teaching approaches, and student activities in what are mostly still undetermined and possibly uncomfortable ways" (p. 339). Their use of the terms undetermined and uncomfortable are particular relevant with respect to the ideas of

disequilibrium and accommodation, key processes in individual constructivism. While perhaps not the main goal of the article, I believe that Glassman and colleagues make a strong case for how technology can be used to help facilitate learning through constructivist learning theories and how these may be applicable to achieving double loop learning in instruction. Looking further into the future I think it will be an important task of instructors to recognize and choose technology not only based on immediate need but also based on how adaptable the technology is. Additional research is also needed to identify these factors explicitly and help integrate them into new technology design practices.

Moving beyond the focus of technology I believe that the article makes a strong case for how action science can be operationalized in an actual classroom. While the authors do not make this claim and do not provide an analysis of steps, their very meticulous description and level of reflection would allow for such an analysis to be made. I think it would be advantageous to repeat their study or at least conduct further studies following their procedure to develop a protocol that future instructors can follow.

Another important issue that the authors did not raise but which they touched on throughout are the observed behavioral changes of students. This article focused almost exclusively on the instructor's perspective of student learning—whether students achieved the goals of the course when blogging is used as an instructional tool—but it may be interesting to examine changes occurring from the students perspective which are occurring simultaneously. A commonly held belief related to technology is that with the assistance of technology students should have higher achievement when measured through common means; however, several studies that have looked at the use of clickers or audience response systems (ARS) in university classes have found that the technology can have more of an effect on the teacher's pedagogical beliefs and practice than on student grades (Caldwell, 2007; Premuroso, Tong, & Beed, 2011; Roschelle, Penuel, & Abrahamson, 2004).

Glassman and colleagues article do a good job of describing how instructors reflect and change when using action science. I believe the next step is to evaluate what things are changing in students beyond simple grades and test scores. Is there indeed a change in understanding beyond what could be achieved in a traditional classroom? This is a perfect place for my interests in creativity and social learning via Bandura's (1977) theories of self-beliefs and self-efficacy. Technology and learning implemented in the way Glassman and colleagues describe can create a space where creative thinking may be more highly valued as a means of formative assessment, "the next day the blog 'exploded' with long posts responding to the presentation and actually moving far beyond to related issues. Almost all the original posts contained relevant, original links that readers could follow" (Glassman et al., p. 347-348). Furthermore, by increasing emphasis on creativity and demonstrating understanding explicitly there is an increased chance of changing student perceptions of what learning in school can be. Glassman et al., provide powerful evidence for in their analysis, "challenged closely held norms and how a classroom should be structured" (p. 349). With this evidence in hand I think it is imperative to keep examining this line of inquiry. How can we further challenge these norms? How can action science in particular create educational environments that will lead to creative outcomes and a change in student self-beliefs?

While by and large I enjoyed the article there were some points where I felt the authors were limited in their implementation of certain aspects of action science. First, although the authors do a great job using action science as the lens of analysis I believe that they may have overly constrained themselves by speaking strictly in terms of single loop and double loop learning. While these are certainly important it seems to me that the use of a systems analysis or system view would have better characterized the educational environment they were hoping to achieve. Thus, I believe it would be much more helpful for future researchers look at how the authors' operationalized action science in terms of model I and model II learning systems as defined by Argyris, Putnam, and Smith (1985). Given the definitions and characteristics of model I and model II it is easy to re-conceptualize the two interventions, intervention 1 as model I and intervention 2 as model II. By framing the system analysis only in terms of single loop and double loop learning the analysis is limited to learning in terms of detection and correction of error. In contrast by framing the analysis in terms of model I versus model II we can look at single-loop and double-loop learning—changes in governing variables—as well as learner and public testing of understanding, public examination of conflicting views, freedom of choice, and shared participation in curriculum design. All of these are described in the article and have added benefits for students and teachers beyond fixing a detected error. In this re-conceptualization technology is the tool to create change, single-loop to double-loop learning becomes the process of change, and model I and model II become the unit of analysis of the learning environment. Technology is more than just a means of moving from single to double loop learning, it is an effective means of facilitating curriculum change from model I to model II. Thus, this article can serve as a template for my own further explorations in using technology to develop educational environments that embrace characteristics of a model II learning system and encourage double loop learning.

## CONCLUSION

The work done in this article is a good start, but there is still much, much more that can be done. As technology improves, becomes cheaper, and creates additional affordances for learning it will only become more pervasive in education and instruction. Developing a clear understanding of how technology can help improve education will surely be an important goal of many researchers and educators in the near future. It is my sincere hope that the current research in action science and technology will be useful to current educators and that these topics receive the attention they so dearly deserve.

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