ETEC 533: Assignment 3:

Reflections on the New Science of Learning and Teaching

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Introduction

We live in interesting times for teachers and educational researchers. There are tools at our disposal that could barely be imagined in bygone generations. The mind itself is open to the scrutiny of our investigations. Modern inventions have allowed us to look inside the brain and have given scientists and educators new insight on this important organ and the impact it has upon teaching and learning. At the same time, tried and true research methods have continued to provide data and add fidelity to prior findings. The results of this new research are helping teachers to understand how their practices impact students at a level beyond the purely behavioural. This paper will discuss recent developments in the area of education research and what this new science of learning brings to pedagogy. I will assume that the reader knows the details of the concepts discussed and will therefore be focusing on my own interpretations of their relevance.

The literature for Module A and the resulting assignments that the class produced revealed a number of common themes that I will analyze individually. The first is the development of educational research through new tools and methods. The second is how these changes are impacting educational practice, either by validating existing practices or encouraging new ones. Throughout, I will reflect on the influence that these changes have on my own research and practice.

Background

Education has been a subject of interest since as early as the invention of writing. Toga-clad Greeks sat around the agora and discussed all manner of things. The Socratic Method is perhaps the earliest documented example of peer instruction. But the systematic study of education did not begin until the turn of the 19th century. Today, the theories of Dewey, Piaget, and Vygotsky endure, particularly in teacher education programs, but new tools and methods of research in education have shed fresh light on a relatively young field. Theories persist when they have some inherent usefulness, but we are increasingly finding quantitative evidence to back them up. This is an important new facet of educational research because it adds weight to arguments for change and justifies policies and curricula.

New Tools

Many fields are converging upon educational research. New findings in cognitive psychology, developmental psychology, social psychology, and anthropology are giving educational researchers plenty of new data to analyze and develop new theories from. Educational research does not exist in a vacuum. Its subject, humans, is a species that is diverse and complex. In addition, the subject and the researcher are often the same and therefore susceptible to bias and error. The more sources of information and research

that converge on a topic make us better able to act on conclusions that we draw from it. Neuroscience in particular has revealed interesting and relevant results in recent years. Our ability to monitor the brain through a variety of scans is unprecedented. This means that we are able to interpret certain learning theories in relation to the physical features of the human body. Therefore, we need not rely solely on reaction to stimuli or self reports in order to study learning and teaching. We can look more deeply at the physical mechanisms that underlie the processes. These advances and others have allowed us to develop practices that teachers can employ in their classrooms.

Practices

Pre-Existing Knowledge

Children aren't blank slates, nor do they develop in identical environments before reaching school age. Bransford, Brown, and Cocking (2002) state that "teachers need to pay attention to the incomplete understandings, the false beliefs, and the naive renditions of concepts that learners bring with them to a given subject." We must inspect the foundation before we build a house. Learning what a student already knows will allow teachers to tailor concepts to more closely fit within a student's zone of proximal development. Sound knowledge can be extended by enriching the content that is already understood. At the same time, misconceptions can be

identified and addressed. Deconstructing fallacies is vital if new information is to be correctly and efficiently assimilated[1].

Active Learning

It is no longer enough for students to simply ingest and memorize information. My teacher training stressed the importance of constructivism and metacognition. As a teacher, this means reflection and self-assessment. This can be done after every lesson and at various points throughout the year. My organizational skills leave something to be desired, but cloud-based technology such as Google Drive and Evernote have helped me to take notes wherever and whenever ideas and observations occur to me. As a student, active learning could be acknowledging what one knows, wants to know, and what one needs to do to bridge that gap. A KWL (**K**now, **W**ant to know, and **L**earned) chart is a great example of a graphical tool that gets students thinking about their own grasp of a topic. As group two points out, active learning promotes higher order skills like analysis, evaluation, and synthesis, which are important to science teaching and learning (Beeley & Edwards, 2016). These 'higher order' skills are desirable in the other subjects as well. Group three notes that active learning can help students to carry out deliberate practice (Quarrie, Ray, & Telford,

[1] The groups gave some examples, such as misunderstanding fractions because bigger numbers mean smaller pieces. I am reminded of an anecdote, perhaps apocryphal, concerning famed logician, Ludwig Wittgenstein, and his editor, Elizabeth Anscombe. She remarked that one could understand why people thought the Sun revolved around the Earth. Wittgenstein asked her why and she replied, "Because that's what it looks like." To this Wittgenstein replied, "So what would it look like is the Earth rotated around the Sun?" This anecdote is illustrative because history shows us that erroneous conceptions can be widespread and difficult to correct, particularly if left unquestioned.

2016). An active learner can be seen as a partner in their learning process rather than a passive consumer of information.

Learning with Understanding

I have always felt that topics in school are taught too superficially. Eric Mazur's work has shown the dangers of not teaching for deep understanding (Serious Science, 2014). A shallow understanding of concepts, memorization of facts, and a strictly formulaic approach to problem solving does not produce the type of critical thinker that will thrive in the rapidly evolving society we find ourselves in. Group three's discussion of transfer highlights how deep understanding can help people use their knowledge and experience from specific examples to precise contexts or more generally (Quarrie, Ray, & Telford, 2016).

One problem I see with a dedication to deep learning is that students are not exposed to the breadth of topics or concepts that schooling traditionally aims for. A solution to this problem could be a 'genius hour' type activity like the ones mentioned by more than one group. It seems to be an effective way to differentiate the classroom while allowing individuals to engage deeply in topics that interest them. Furthermore, they can then present the results of their work to their peers, thereby adding to the breadth of material that the class is exposed to.

Motivation

Motivation is vital to education because a person must have a reason in order to learn. I was drawn to the research of John Paul Gee who looked at video games (Gee, 2008). I was also intrigued by the huge amounts of time and energy that people put into DIY instructional videos and collaborative communities. Both of these examples show that people that who are self-motivated can invest large amounts of time and effort into becoming competent or expert at certain tasks. I have heard other teachers say (and have been guilty of saying) to students to listen closely because this or that topic is important. However, upon reflection I realize that it is not enough to tell someone, especially a young child, that something is important, nor is the level of importance of any topic the same to different children. As educators, we must find ways to harness a student's intrinsic motivation.

Assessment

Assessment is vital to education but it is also the area I struggle with the most. In order to be reflective, we must know if we have been effective. Did our methods achieve our goals? Did the students learn what we or they intended? Assessment attempts to answer these questions. However, as group seven points out, assessment should also give weight to the "road along the way, and not just the destination (Hsueh, Ouellette, & Rasmussen, 2016)." I would like to cultivate the sense that sometimes we can learn something even though we

arrive at the wrong answer[2]. Of course, formative and summative assessment are both essential, but perhaps if we recognize the importance of creating lifelong learners that are reflective and adaptive, all assessments are formative because we are never 'finished' with a learning experience.

My Practice

In my own practice I will seek to use the above ideas in concert with each other. None of these practices exist in isolation. Rather, they are intertwined and reinforce one another. Pre-existing knowledge has an effect upon any attempt to teach or learn. The results of genuine assessment reveal this prior knowledge as well as newly acquired proficiencies. It also directs further learning. An active learner engaged in metacognitive activities will benefit from frequent assessment. Motivation will drive the student to seek out deeper understanding of certain topics and to continue to learn throughout their life. A flexible combination of the various practical strategies discussed above will help to strengthen and reinforce my teaching practice.

[2] I was helping a grade nine student with a science project. He had built a trebuchet. In his hypothesis he had predicted the distance certain objects would travel based upon established formulas of trajectory. He was concerned when he didn't get the 'right' answer. I reminded him of the friction in the trebuchet joints and air resistance that were unaccounted for in his calculations. He was then despondent because he hadn't learned how to calculate those forces. I suggested that simply realizing the real world effects that influenced his results was enough for the purpose of the science experiment. He was not satisfied because a "right answer" mentality had been so ingrained in him.

Conclusion

Perhaps in earlier times it was enough for students (who would become future employees and leaders of industry) to memorize facts. Things taught in school were still true and relevant years after graduation. But today there is simply too much information to digest. Furthermore, the information will change too rapidly to warrant simple memorization as a viable educational mandate. Therefore, it has become a necessity to teach students how to learn. It is also necessary to instill in them a love of learning. Teachers must be lifelong learners, but this necessity of lifelong learning seems to be a vital part of every profession today in the face of a constantly changing technological and data driven information based society. Developing a practice which encourages active, reflective learning and students motivated toward deep understanding will help ensure that our future is filled with this type of learner.

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