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Time for change: critical issues for teacher educators

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Abstract

Changes in classrooms provoked by technology do not necessarily translate into significant improvements in teaching and learning. We must ask what changes in pedagogy have occurred as a result of equipping classrooms with technology, how those changes have produced improvements in students' learning, and what conditions promote successful changes in pedagogy.

Keywords

Classroom practice, cognition, evaluation/formative, evaluation/summative, policy, problem solving

1 INTRODUCTION

In spite of technology, teaching has changed little since the days when students heard the prophets' words or roamed as scholar adventurers. Most research in technology settings, with the notable exception of studies such as the ImpacT Report (1993), has failed to determine what teaching acts actually occur with regularity in technology settings, what impact, if any, those teaching acts have on students, and how changes in teaching have been initiated and sustained. To remedy this situation, we must scrutinise our work and change our perspectives. The revolution in software evaluation (Squires and McDougall, 1994), shifting from an emphasis on mechanistic evaluation instruments to rubrics assessing what teachers and students can know and do with technology, points the way.

An examination of the sources and effects of change in teaching practices must acknowledge the impact of teachers' underlying beliefs about the teaching/learning process on their decisions (Marshall, 1993; Benzie, 1995). Questions framed in a behaviourist perspective often fail to inform us of what is actually happening in classrooms, why specific teaching acts were chosen, and what happens as a result of the choices. As long as our questions are rooted in behaviourist conceptions of

teaching and learning, we will not move forward in our understanding of the complex relation between teaching and students' understanding and action.

Progress has been made in specifying the differences between behaviourist and constructivist methods (Murphy and Moon, 1989), but the educational technology community has paid scant attention to the manifold interconnections between teaching and learning within the different frameworks.

2 THE PROBLEM OF CHANGE AND CRITICAL ISSUES

Issue 1. What, if anything, has changed in teaching since the introduction of technology into classrooms? And if there are changes, are those changes consistent with good pedagogical practice?

We must not assume that all teachers embrace the same vision of what changes in classroom practice ought to result from technology use, or that the majority of teachers will change their methods as they incorporate technology.

Consider that sales of drill and practice software constitute the largest sales of educational software in the United States. This is consistent with many American teachers' beliefs in the efficacy of behaviourist teaching methods. Can we say that teaching has changed because technology now delivers lessons where the teacher previously used cardboard flashcards or workbooks filled with drill exercises?

Consider an illustration that is only one step removed from the electronic flashcard-type of pedagogy. In many classrooms where students have access to relatively complex problem-solving software, the software is used in ways that undercut the pedagogical intent of the developers. One example is classrooms where students work with *Hot Dog Stand*, a program that can operate on at least three levels: (1) buy and sell hot dogs and see how much money you make; (2) buy and sell hot dogs based on a 'good consumer' model and see how much money you make; (3) adopt hypotheses about what types of purchases generate the highest revenue and play out a series of games testing those hypotheses. In the majority of classrooms I visit, teachers, apologetically but routinely, leave students to their own devices with the software assuming that 'something' will be learned.

Many teachers, if they monitor the students' activities at all, seem content with this use of the software. A constructivist would say that the teacher's role here is to generate some dissonance. If the students have not arrived at the stage of routinely testing hypotheses, the teacher should structure the lesson so that hypothesis testing becomes a focal point, and model, if students do not understand hypothesis-testing techniques, strategies for testing hypotheses. But many teachers are unsure of how to weave together hardware and thoughtware.

Teachers working from a behaviourist perspective tend to emphasise learning content over learning process so they use technology either to teach the same content they taught previously but at a faster pace or to teach more content in the same time period. Are we satisfied with this approach?

Constructivist teachers tend to be less concerned with students' performance on standardised tests and more concerned with students' ability to engage "fundamental ideas", so they tend to regard technology as a tool for teaching topics that might have been difficult to teach in pre-technology days. They use technology for problem solving, for working with geometric constructions at earlier grade levels than they did

before the advent of technology, and/or for providing opportunities for students to create projects based on Internet access or videodisk use.

But what of the depth of those lessons? How often have we seen superficial 'cut and paste' productions? What have students learned from collecting a series of images stored somewhere and pasted into their reports? Are the reports more insightful? Do they provide a heightened learning experience for students who might otherwise not have understood the ideas and processes supposedly provoked by the activity?

In the absence of models or criteria for conducting technology-based instruction, many teachers begin to assume that merely using technology will enhance students' learning. We must help teachers analyse their work, and help them make the connection between what they do with technology and how those actions contribute to students' performance.

Issue 2. Can we say that changes occurring since the introduction of technology have been productive for students?

Empirical data about the effects of technology use by students are sadly lacking, and most impact studies have been conducted in the behaviourist tradition. We do have anecdotal reports of benefits derived from technology use, but the criteria applied to judge the effectiveness of these lessons are sketchy at best.

Here again, the fundamental split between two opposing epistemological traditions comes into play. If you adhere to a behaviourist tradition, the fact that students' skills seem to be enhanced by the use of drill programs will lead you to say that the use of technology has been an important addition to classrooms. The constructivist would question such complacency, saying technology may not have been responsible, the skills may not be important skills, and may not be integrated into the students' repertoire of performances.

From a constructivist perspective we have reason to be pessimistic about what changes have occurred as a result of technology's role in today's classrooms. Let us consider an example.

Let us say that Hypercard is used for a project called 'Our Visit to the Zoo.' Students collect all sorts of information about animals - their eating habits, their size, their countries of origin, the gestation period, rate of growth, etc., and record the data. After the zoo visit, students collect more data, check the data, and obtain pictures of the animals. Then they manipulate the stacks to group together all the animals with similar gestation periods. From these data different types of graphs and charts can be made. The creation of those graphs and charts can lead to still more questions about the relations between variables. Students may ask if animals with long gestation periods produce animals that at adulthood are larger than animals with shorter gestation periods. Sorting and resorting allows students to work at key skills of classifying, sorting, and searching. Those are activities that can lead to cognitive reorganisation.

But we do not have many studies to check if such technology-related manipulations of data occur or produce changes in students' thinking. In fact, we have ignored or been cautious about setting specific criteria for how students' thinking should be shaped from technology use. Our failure to consider what we want students to learn from working with technology often leads us to accept activity for the sake of activity.

Issue 3. What conditions lead teachers to successfully initiate and sustain technology use, and are those changes productive for learning?

If we look back to the introduction of classroom-based technology use, I think we would be well advised to think that, like Moses leading the Israelites through the wilderness, we may have had an idea of our destination but little notion of what might happen along the way. We have been less than rigorous in our definitions or demands about what constitutes appropriate levels of change. Similarly, we have not been vigilant about charting the connection between change and the conditions that promote change.

Is it truly a change if a teacher shifts from using workbooks to using electronic flashcards? Is it truly a change if a teacher supplies problem-solving software for students, but fails to monitor students' learning in those situations? Is it truly a change if teachers fail to determine if students have opportunities to apply what they've learned in technology settings to other classroom activities? Is it truly a change if teachers fail to look at technology's ability for recursion, iteration, for random generation, and fail to model the thinking strategies needed to work with these processes? Is it a change if teachers neglect to build those capabilities into explicit lessons - both with and without the use of technology?

Do we know what changes are difficult for teachers to make but worth making in terms of productive growth for students? Here again, the difference in belief systems shows its impact. It is relatively easy for a behaviourist teacher to change from being a non technology-user to a frequent technology-user. Granted changes in scheduling must occur and maybe students must double up, but the classroom will look pretty much the same as before.

But the change for a constructivist teacher might be more difficult. Where do manipulatives fit with computer use? Do we model problem solving to the entire class or small groups? Does every student work with the same piece of software? At the same time? If not, are different skills addressed? How is the curriculum reorganised to accommodate all these solutions?

Similarly, the criteria behaviourist teachers may apply to judge the success of their work will differ from criteria judged acceptable by teachers working within a constructivist framework, so it may be simpler for a behaviourist teacher to be satisfied by technology use. But we have little data on the ways teachers conduct evaluations of students' work in technology settings, nor do we know what use is made of the evaluative data, so these questions are not easily answered.

3 CONCLUSION

Change can happen serendipitously. An unexpected insight leads to a change in behaviour. Change can happen because of a plan when we know what we want to do and act to achieve that plan. Change can happen haphazardly. Do we know anything about the course of technology-based pedagogical change? Is serendipity fruitful? Does planned change work and, if not, what do teachers do when planning fails? Do they revert to previous pedagogical practices or rework their attempts at change? Do we know anything about the stability or permanence or generalisability of technology-related change?

If we work with a set of criteria, we know what we want to do, what impact our actions should have, and what the level of acceptable attainment would be. In the absence of criteria can we say that technology-using teachers have met our expectations? Can we tell how difficult it will be to attain our goals? Can we say what strategies work in reaching those goals?

It is time to assess what types of change have occurred, what types of change have been difficult and why, and what the implications of change mean for students. Three major questions might form the basis of our work: How should technology-based teaching and learning be conceptualised? How do teachers adapt technology-based teaching practices in ways that are consistent with the specific features of technology? How do technology-based classroom activities acknowledge the ways learning occurs? These questions, posed in order to provoke a re-examination of pedagogical practices, may help us set an agenda for stable, generalisable, and attainable change.

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5 BIOGRAPHY

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