Stories of Change:
How Educators Change Their Practice

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Abstract - **Innovative tools and teaching practices often fail to be adopted by educators in the field, despite evidence of their effectiveness. Naïve models of educational change assume this lack of adoption arises from failure to properly disseminate promising work, but evidence suggests that dissemination via publication is simply not effective. Instead of studying the adoption or rejection of a particular intervention, this paper turns the problem around. We asked educators to describe changes they had made to their teaching practice and analyzed the resulting stories to learn more about: the kinds of changes being made, their motivations for changing their practice, and the means by which they learned of pedagogical innovations. Of the 99 change stories analyzed, only three demonstrate an active search for new practices or materials on the part of teachers, and published materials were consulted in just eight of the stories. Most of the changes occurred locally, without input from outside sources, or involved only personal interaction with other educators. These results have important implications for educational developers, or researchers wishing to propagate information about new teaching materials or techniques.**

Index Terms – Change of practice, Change stories, Sharing practice, Education research

INTRODUCTION

The computing community continually creates and evaluates teaching tools and techniques, but these efforts are of reduced value unless promising practices are actually *adopted* by educators in the field. In recent years there has been a growing emphasis on dissemination efforts to help bridge this gap. The solicitation for the National Science Foundation's TUES program, for example, states that "transferability and dissemination are critical aspects for projects developing instructional materials and methods and should be considered throughout the project's lifetime. More advanced projects should involve efforts to facilitate adaptation at other sites."

Unfortunately, there is little evidence that enhanced efforts at dissemination are working. A report to the National Research Council in 2008 found that "NSF- and association-funded reforms at the classroom level, however well intentioned, have not led to the hoped for magnitude of change in student learning, retention in the major, and the

like in spite of empirical evidence of effectiveness" [1]. Failure to adopt effective practices is not limited to computing or education. A meta-analysis of 743 reports, books, and articles in 2005 found that dissemination alone was not an effective implementation method in human services, education, health, business, or manufacturing. [2]

But if dissemination is ineffective, how should the computing community maximize the impact of effective tools and practices? Previous work in computing education has studied how specific tools and approaches have been adopted (or ignored) [3]-[6], and the incorporation of teaching materials from repositories [7]-[8], but much remains to be learned about how instructors decide to change their practice and how those changes are informed, implemented, and evaluated.

This paper studies the problem from the other end of the adoption process: We asked educators to describe changes they had already made to their teaching practices, in an effort to shed light on mechanisms and approaches that led instructors to those changes. We then analyzed the resulting stories to learn more about the kinds of changes being made, instructors' motivations for changing their practice, and the means by which they learned of pedagogical innovations.

CHANGE STORIES

Stories of teachers changing practice were gathered in the context of the Sharing Practice[1] project. Stories were solicited in response to the prompt:

> *Can you think of a time when something—an event, an article, a conversation, a reflection, an idea, a meeting, a plan—caused you to make a change in your teaching? What was it? What happened?*

102 stories were collected over four weeks in February and March 2011, of which 99 were usable. Stories were gathered via a webpage, and subsequently face-to-face, both individually and via a "story-circle" held at the ACM Special Interest Group on Computer Science Education (SIGCSE) Symposium in March 2011. Each contributor provided a story of their change, gave it a title, and attached keywords. Some contributors added several stories. Additionally, some demographic information was collected

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[1] http://www.sharingpractice.ac.uk

for each contributor, including, age, gender, length of career, and length of time in current institution.

For each story, contributors were asked to indicate how they felt about the change in the story in respect to several questions that elicited meaningful metadata about the experience. These questions were presented as *polarities*, using the concept of *opposing negatives* where "a desired or anticipated quality of the field is identified and the two end labels are provided as the thing not present and alternatively the thing taken to excess" [9]. To give an example from this study: "The change this story describes is limited to individual practice" at one end to "The change this story describes involved programmatic change (QA)" at the other.

Contributors were asked to make a mark on the scale that "best described" change in their story; polarities did not have scales marked on them, so contributors were not selecting from fixed values. Contributors were also asked to select from lists of mutually exclusive options asking them: how they felt about the story, whom they thought should pay attention to it, and how long they would remember it.

CHARACTERISTICS AND LIMITATIONS OF THE SAMPLE

Because of the situation of the project, there is inbuilt bias in the sample. Most contributors were personally solicited, either by a member of the Sharing Practice project team, or from related projects – these related projects are mentioned in several stories. The majority of the contributors (56) taught Computer Science or a closely related subject (e.g. "information systems" or "databases") and the majority of stories (82) were contributed by someone with more than 10 years teaching experience. The great majority of contributors (80) were over 40; the largest representation is in the 40-49 age group (36). 64 contributors had taught at their current institution for more than 5 years, 34 of those for more than 10.

The type of change described was also heavily skewed to the positive. There were only thirteen stories which contributors did not feel "glad" or "enthused" about, and only one which was unequivocally negative (and about which the contributor felt "angry"). This contrasted with our (anecdotal) experience where colleagues often talk of forced or imposed change, whether instituted because of resource constraints, management dictat or departmental fashion-following. At a Share project workshop, for example, a contributor told of their forced changes "Revamp the whole thing in two weeks!. There's not even time for people to think about how they could adopt a different approach …or make connections from different models" [3]. And, over the years, we have heard several versions of "we are all doing problem-based learning now" or "everything's agile these days". We brought these impressions to the data, and expected to find such stories reported there.

The story corpus was relatively evenly balanced in terms of gender with 54 male and 44 female contributors,

and also for institution-type with 28 research-intensive, 36 teaching-intensive and 31 mixed teaching-and-research institutions represented.

ANALYSIS OF POLARITIES

Analysis of the polarities revealed some interesting patterns. For example, when asked who was affected by the change in their story, there were notable differences in response dependent on how long the contributor had been teaching, and on the time a contributor had been at their current institution. In both cases the longer the time, the more the response moved from the change affecting individual practice only towards affecting other colleagues and then programmatic change. (See [10] for more details on the methodology used, and additional results.)

Work from the Effective Projectwork in Computer Science (EPCoS) project suggested that educators most easily adopt small pieces of practice — things that they can implement "under the radar", without asking others' permission, or involving QA procedures [11]. Evidence from this study, however, suggests that the observation from the EPCoS project may be more relevant for early-career, or less experienced, teachers. As teachers become established within a department it may be that they become increasingly involved in programmatic activities, or that they are more prepared to claim programmatic influence.

We also asked how teachers themselves felt about the change described in the stories, whether they considered it *addictive*, whether they *adapted to it* or whether they *distrusted* it. There was only one story that showed strong affinity with change being addictive. Those stories most strongly associated with "distrustful" were from teaching-intensive or mixed teaching-and-research institutions. At the same time, when we asked what the source of change was — individual agency, local culture or external driver — then those who said that the source was "individual agency" were mostly from research-intensive institutions. Teachers from research-intensive institutions were also most likely to claim a limited audience for their change — "no one special", or sometimes "the department". This may suggest that change is more likely to be imposed on staff at teaching-intensive institutions, and that staff in research-intensive institutions are more likely to "try things out" on their own cognizance.

When we questioned the nature of the change – whether it was new to the department, new to the discipline or totally new – there was a small, continuous, effect that the older the contributor and/or the longer they had been in their career (that is, the more years of experience they had) the more likely they were to say that the change their story described was "totally new".

ANALYSIS OF STORY TEXT

We found that we had questions of the stories that the analysis of polarities could not address. We wanted to ask what had *triggered* the change that the stories reported, we were interested in what *sort of changes* they described, we wondered how instructors determined the *details* of their

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change. To look at these questions we undertook a more traditional qualitative analysis, taking the story texts as our data. Four researchers independently coded the stories, each noting aspects of interest. Three explicitly sought the catalyst for the change. A fourth researcher noted the source used to inform change and how that source was discovered. Below we report our observations based on the content of the stories. Quotations from change stories are labeled with the corresponding story number (*e.g.* CS86 refers to change story 86).

Seeking solutions

The first, most notable, observation was one of absence. Across all the stories, there were only three that displayed a conscious "seeking for a solution" behaviour, two of which described finding information in published materials while the third found guidance from a presentation:

> *I was faced with designing a new grad AI course, but I did not look forward to straightforward lecturing from the book, so I looked for alternatives. I came across an article by L. Dee Fink, "A Self-Directed Guide to Designing Courses for Significant Learning", and I also read the book "Drive" by Pink, on self-determination theory. I followed Fink's design exercise while applying SDT principles. [CS86]*

> *My response was to study the various disciplines that encompass learning science. Much is known about learning, and how we can support learning. I discovered that I had not been doing a good job in the classroom. I also found that the standard textbooks for my field don't support learning well. [CS38]*

> *I decided to change what I was doing, and looked around for what might work. I happened to go to a session on teaching using case study and so decided to try a case. I searched for some, but in the end wrote my own, brainstorming the ideas with my colleagues. [CS9]*

The absence of conscious solution-seeking may be explained by the nature of our prompting question, in that the prompt does not emphasise an existing situation, but a process of change. However, the "seeking solution" behaviour is one commonly attributed to educators. Guzdial and Fossati "…propose to think about an ideal decision-making design process of instructors as composed of three parts: 1. Making a determination that a change is needed. 2. Either finding existing solutions or creating new interventions to address the desired change. 3. Evaluating the effectiveness of the solution and deciding whether to retain it or not." [12].

It may be that decision-making in teaching, as in other professions, does not involve a problem-solving approach of incremental consideration of each step. It may more closely represent naturalistic decision-making, where professionals make non-analytic choices in situations marked by time pressure, high stakes outcomes, inadequate (or missing, or unreliable or ambiguous) information, team and organizational constraints, changing conditions, and varying amounts of experience [13]. Whichever construction is a more accurate representation, "seeking solutions" was an extremely uncommon change-behaviour in our data.

Revelation

Because our request was not bounded in scale or time, contributors submitted stories that described change from a single piece of work in a single course to reflections that spanned decades of an entire career. Perhaps because of this open-endedness, the catalyst for change in several stories was a clearly-recalled moment of insight or revelation, often quite a time in the past.

> *Coup de foudre: a thunderbolt, a streak of lightning that lit up my skies and changed forever, not only me and my teaching, but also the way in which my students learned [CS27]*

In some cases, the insight was the point of a story. The title of CS85 is "An Epiphany" and contains the revelatory moment:

> *I remember quite clearly about two years after I started teaching; I was in London for a meeting with my old PhD supervisor. We were talking about our classes and she said "I never do lectures". "Never?" I said. "Really, never? So what do you do?"[CS85]*

Such moments were often set in relation to a status quo, a set of assumptions, or state of mind:

> *When I began teaching in universities a quarter of a century ago I set students essay titles, because that's what happened when I was a student. [CS15]*

> *… it's just I had never seen a class taught this way when I was an undergrad. I didn't know people could do that :-) [CS85]*

There were also stories that expected, even anticipated, this sort of change where it was not forthcoming:

> *I started sitting in on colleagues' classes, but that didn't help much. I didn't see anything they were doing that was all that different from what I was doing. But I persevered. I wish I could tell you of some epiphany that helped, but I don't think there was one. [CS21]*

Daily Bread

The most populated catalyst category was of educators initiating change in response to students: in response to something they did, or something they said, or to a close observation of their attitudes and achievements.

> *I found that almost all the students who had gotten the "differentiate using the chain rule" question wrong had done terribly on the exam, and almost all the ones who had gotten it right had done quite well. After that, I doubled the amount of time spent teaching the chain rule. [CS5]*

On a data structure and algorithms exam, I frequently gave students recursive code to do something in a binary tree and asked them to give me the output (there was typically some numeric calculation). I would get 80% incorrect answers. I observed that students would show very little work. I changed the instructions to the problem to include showing the execution tree. Making students show their work flip-flopped the percentages. Typically 80% get correct answers now. [CS18]

What made me change my practice is a student reminding me - "I have never done this before, I don't know what you want". [CS13]

The most recent experience I have of changing my practice comes from student feedback - some formal and some informal [CS26] (The title of this story is "Module Evaluations Work!")

Although sometimes the student-focused catalyst was negative:

But when I looked into their eyes halfway through the introduction I could see that a 15 month old example was no longer topical - indeed most had never heard of something that had been a lead news item a short while ago. I rescued the class by managing to work in a more recent example. But the experience was a bit of a shock. [CS20]

I had a student come to my office during my first term teaching. She was having a hard time in her 2nd year of University, was shifting from Science to Social Sciences, and was struggling. She was in an introductory Human Geography class, and she felt lost, not connecting to the material. We were touching on international issues, and she admitted to me that she JUST DIDN'T CARE. I was stunned that she was so honest, and could not respond to her honesty with anything but compassion, even though I was at a loss to imagine how an intelligent person could be so disconnected from social and environmental injustices and suffering that were our topics.[CS31]

Other Catalysts of Change

Many stories (13) report the influence of a named individual as causing them to change their teaching. For as many (18), participation in an event, or external training, or "getting out of the classroom" made the difference although often these are not reported as intentional acts: "I attended a keynote lecture about learning preferences" [CS25] , "I was reading a book and stumbled upon a quote that was written in one of the margins" [CS40], "In the toy store, wandering about, I saw some baby toys called 'bear links.' That reminded me of the linked lists I was supposed to be worrying about for class ... so I decided to get them and use them in class." [CS53]. Finally, a least populated category was "external imposition" represented by only one story, entitled "Forced to conform" [CS11].

Sources of Change Details

In all but one of the stories (the "external imposition" story above), educators were in a position to control at least some of the details of the change they described. Our earlier analysis revealed that few stories reported the sort of deliberate search for solutions that had previously been hypothesized, so how *were* educators informing decisions about pedagogical change? In just over half of the stories (50), the instructor apparently formulated the details of their pedagogical change on their own, without consulting peers or other resources.

This abundance of "local change" stories is perhaps not surprising given that "change in response to students" was found to be the most common catalyst category. One might expect these sorts of changes to occur frequently, and be relatively small in scale, making it less likely that the teacher involved would seek outside counsel. Additionally, changes made in response to student feedback are often tightly tailored to local circumstances—the constraints of a classroom or the structure of a curriculum, for example—making it less likely that a literature search would discover appropriate interventions. Published work is necessarily abstracted away from its original context in an effort to generalize a result and enhance its transferability, but the further removed the practice described is from the particulars of local circumstance, the less obviously it is relevant and the more work must be done to adapt the practice to a new environment.

All of the change stories quoted in the *Daily Bread* section fall into the "local change" category. Not all locally formulated changes were the result of student feedback, however. Eight were the result of reflection on the part of the instructor:

The original format was that the assessor would fire questions at team members about the work. I thought this approach would disadvantage anyone with limited understanding of English so I changed the format. I put more time into setting up the assessment, giving information about the areas to be assessed and asked the students to take responsibility for the walkthrough and who would be explaining sections of the documentation. [CS63]

When the instructor who normally taught the class left, we were left with no one to teach it. I was one of two professors who decided to try teaching the course. Having been trained technically as a computer scientist, I was familiar with how to teach programming, data structures, etc., but it became clear to me that teaching students about ethics and the societal impact of computing would require a completely different style of teaching. I determined that it would have to be more discussion-based, readings-based, and writing-based. [CS57]

Other changes were driven by external circumstances.

Several years ago, I taught in a classroom with no white or chalkboards. So that I could write examples for the students, I started using a tablet PC and Classroom Presenter from the U. of Washington. This has evolved into a set of "guided slides" that are partially completed that I finish in lecture, and posted soon thereafter. [CS50]

In the remaining stories, authors reported obtaining change details via interactions with other educators (39 stories) or from published materials (8 stories). The mechanisms through which these sources were located are explored in more detail below.

Transmission

As was reported above, instructors rarely searched for information when considering change. At the other extreme, 12 stories described changes resulting from chance encounters with educators who shared or demonstrated details of their teaching practice. The authors of these stories had not intended to change their practice until they were exposed to a new approach.

I never would have made this change if it weren't for a trusted friend who told me to do this and I was sort of convinced. The change was to go from more or less traditional lecture with a handful of active learning activities punctuating it, to a completely or almost-completely question-driven style with peer-instruction. [CS70]

When I started university teaching I was very 'controlled' - all "chalk & talk". It took my colleague to loosen me up! We did team teaching together and he regularly inserted activities, interactive tasks, buzz groups, video snatches for students to comment on, role play, group work etc. Basically, the 'scales dropped from my eyes' and I saw how valuable these more discursive, open-ended, student-centred approaches were; and how memorable they were to us & to the students alike. [CS99]

The change in the examples above resulted from unplanned interactions between instructors. A larger group of change stories (31) involved *primed serendipity*, where the author encountered unanticipated information but while putting themselves in situations where they could reasonably expect to learn *something* about teaching practices (e.*g*. attending a conference or workshop, or browsing a journal issue). In five of these stories the author drew on published materials to inform their change in practice. The remaining 26 narratives in this category involved personal exchanges with groups or individuals.

Several years ago I read a book titled "Beyond Bullet Points" by Cliff Atkinson that kept mentioning Richard Meyer's work on multimedia learning theory. I read several of his papers and his book as well. Over a summer I revised all of my CS1 slides to incorporate his multimedia learning principles. [CS56]

I participated in a course on Teaching with Technology. Although I had always used technology where I could, this course exposed me to dozens of different tools and uses for these tools in the classroom. I now incorporate many of these tools in my teaching. [CS12]

I was travelling on holiday to Italy. I had taken Jenny Moon's book on reflective practice, just to re-read .... I chanced on mention of a teacher who had shared his own learning journal with his students. I knew that my Soc Sci students initially had problems with reflective journalling. I thought "Why don't I share mine with them?" [CS68]

I'm a member of a science education reading group on campus. One of the papers recently was on how to evaluate your assessments (specifically tests/exams). One person in our reading group was a psychologist who researches "psychometrics" and does extensive quantitative test analysis for her courses. Based on her experiences and advice, I was inspired to go over a test I was in the process of writing for my CS0 course the following week. [CS95]

DISCUSSION

The change stories provide a valuable window into the behaviour of educators as they change their practice. Our study is novel in that it collects stories from teachers in their own words, and makes no attempt to limit the scope of the project to the adoption of any particular intervention. Stories are a relatively unusual form of data for this sort of investigation. They are not responses to direct questions (as in interviews, surveys or questionnaires), they do not represent opinions on issues, nor statements of fact. They are, however, authentic communications which illuminate complex topics, and which can provide insight into complex spaces. There is always a point to telling a story, a reason for their emergence, something the teller wants to communicate.

Stories also have an effect on the audience: "The act of listening to a story told by another person creates a … displacement of perspective that helps people see through new eyes into a different world of truth" [14]. The power of this collection of stories is demonstrated in their content, in the things the storytellers wanted us to know. And what they contributed were stories of success, of change making an improvement, most often an improvement to student learning. They also conveyed an abiding sense of personal satisfaction, of professional pride, of overcoming challenge and disappointment, in doing a good job. And in this, the contributed stories were entirely comparable even though they were from different countries, institutional contexts and academic disciplines.

Lessons for Education Developers and Researchers

In the change stories we analyzed, instructors very rarely performed the kind of deliberate, methodical search for

educational interventions that a naïve "changing practice" model implies. This has implications for educational developers and researchers wishing to propagate information about new teaching materials or techniques.

A review of the analysis above reveals that books or articles informed change in only *eight* of the 99 stories, despite the fact that part of the solicitation was via education research mailing lists, and a number of the stories were collected at an education-related conference: In other words, the participants are exactly the kinds of instructors one would *expect* to be reading the scholarly literature. Even within the group of eight, the majority found their source through primed serendipity instead of deliberate search. That is, they encountered the information while looking for something else, or while perusing a journal or proceedings.

Over 90% of the stories described changes that were either created without drawing on outside sources, or were informed by personal interactions with other educators. The relative prevalence of personal interactions as a vector for information on teaching practices is noteworthy: Instructors reported changing their practice as the result of personal interaction with a peer far more often than after reading an article or book. Peer interactions were so powerful, in fact, that in a dozen of the stories they caused instructors to make *unplanned* changes to their practice.

Research on diffusion of innovations has found that communication is more effective between similar individuals [15]. It is possible that instructors who know one another well enough to exchange information about teaching practices are similar in key respects, which could help explain the impact of the personal interactions we see in the change stories. Peers are perhaps also more likely to have similar teaching contexts — to come from similar institutions, teach the same sorts of courses, or have similar students, for example. Information coming from someone with a similar context can more immediately be recognized as relevant, and can be implemented more easily since little or no adaptation is required to employ the practice in a new setting.

Additional research will be required to illuminate the nature of the interactions between educators, but the role of personal interactions in the stories suggests that education developers would be wise to pay closer attention to the exchange of information within personal and professional networks. As Stephen Corey said in keynote talk to the National Society for the Study of Education in 1951 "I hesitate to say so, but I believe that we pedagogues tend to exaggerate greatly the amount of change in educational practice that results from reading what other people say should be done..."

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