Work Smarter: How an Experimental Learning Management System (LMS) Supports Better Teaching

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Abstract: We developed an experimental learning management system (LMS), called Kat. We use Kat to support student-centered strategies in our course for pre-service teachers. Our strategies include practice teaching. We believe Kat and our strategies increase authenticity, engagement, critical thinking, and retention. We believe Kat illustrates principles that all teachers should reflect on, and potential directions for the design and use of LMSs. Kat increases our efficiency: we work smarter. We're starting formal research on Kat.

Introduction

Kat is an experimental learning management system (LMS). The first author built Kat to support his university courses in education, including educational psychology for pre-service teachers. (The second author is his graduate assistant.) Kat duplicates some features of contemporary LMSs like Blackboard, Angel, and Desire to Learn. Kat includes some innovative features. Few teachers have the motivation, skills, and time to build their own LMSs. However, how we teach with Kat illustrates principles that all teachers should reflect on, especially the value of student-centered strategies. Kat also illustrates potential directions for the design and use of LMSs.

In this paper, we'll unpack five topics about Kat. First, we'll describe the origin and structure of Kat. Second, we'll explore the challenge of increasing authenticity in a course for pre-service teachers. Third, we'll describe how some of Kat's unique features increase our efficiency as teachers. Fourth, we'll consider how Kat supports learning outcomes for our students. Finally, we'll describe the research we've started.

1. Origin & Structure

An LMS can meet many possible needs and goals. A LMS is more than a course website, although it usually includes the basic features of one. Features may include a syllabus, a calendar, and directions for assignments. An LMS can provide a more personalized and confidential experience by allowing a student to log in. When the LMS knows the user's identity, it can provide customized information. For example, a course website can show a generic list of assignments for all students, while an LMS can also show a student's specific scores on those assignments.

Early in the first author's career as a professor, he had access to some contemporary LMSs, including Angel and Desire to Learn. The first author was dissatisfied with the limited features, especially the gradebook. Like many teachers, he has particular policies for excusing assignments and accepting late assignments. Unlike many teachers, he has the skills and motivation to build his own LMS to perfectly match his policies. His initial motivation was building a more personalized tool, as well as the challenge and novelty of the project. However, over time, building an LMS has inspired new teaching strategies.

Building an LMS has been a symbiotic and recursive process. As the first author develops a better understanding of LMS technology, he realizes it can support new strategies. When he wants to try a new strategy, he teaches himself the necessary technology. This process illustrates what Mishra and Koehler (2006) call Technological Pedagogical Content Knowledge. The first author identifies problems unique to our course and our students, and builds specialized tools to solve those problems.
The first author named our LMS "Kat." Kat is essentially a folder on a server, and he had to call the folder something. He also realized that we'd be referring to Kat often (e.g., "You can choose your partner in Kat"). Most of our students are undergraduate Education majors, so most are young women. In the movie 10 Things I Hate About You, Julia Stiles plays a smart, strong woman named Kat. Kat is a good role model.

The first author created Kat using free, open source tools. Kat is a series of XHTML webpages using CSS formatting and PHP scripting. Kat is built on a MySQL database, managed with phpMyAdmin, and running in Apache on a Linux virtual server. Since those details may be opaque to some readers, this is what matters: all the software for Kat is free to download and use. The only costs for creating and maintaining Kat have been the hardware and network infrastructure (which the university already owned), and the first author's time and energy. To create and edit the webpages, the first author uses Adobe Dreamweaver. Dreamweaver isn't free or open source. He could use any one of several web editors, but the first author was already familiar with Dreamweaver.

The first author isn't a professional programmer. Kat is a prototype: it works, but it's not always pretty or elegant. In some ways, Kat is the digital equivalent of cardboard and duct tape. We make this clear to students, and ask their patience when something in Kat is clunky. However, each semester, based on student feedback, the first author improves Kat in some ways, so it becomes progressively more sophisticated and user-friendly.

2. Authenticity

We teach educational psychology for pre-service teachers. We use a variety of traditional activities and assignments, including readings, written assignments about the readings, lectures, class discussions, essays, and a final exam. However, none of these experiences are as authentic as actually teaching. When teaching about teaching, we emphasize the value of student-centered strategies. We teach our students concepts like discovery learning and constructivism. We teach them that teachers should immerse their students in problem spaces, balancing some support with some freedom to explore and experiment. We tout Piaget's argument that "each time one prematurely teaches a child something he could have discovered for himself, that child is kept from inventing it and consequently from understanding it completely" (in Miller, 1993, p. 90). We also tout a "Trying Trio" of behaviors: admitting ignorance, taking risks, and making mistakes. We require our students to practice teaching, and we explicitly highlight practice teaching as a student-centered strategy. We encourage our students to engage in Trying Trio behaviors as they teach (e.g., taking a risk by facilitating a creative activity).

Pre-service teachers need to directly experience innovative teaching strategies, like student-centered strategies. Just hearing or reading about such strategies is inadequate. Ertmer and Ottenbreit-Leftwich's explain:

Preservice teachers enter teacher education programs with beliefs about teaching and learning that have been constructed from their own experiences as K–12 students, which, for the most part, have been fairly teacher-directed (Bruner, 1996; Windschitl & Sahl, 2002). To change these established beliefs, teacher educators need to engage preservice teachers in activities that explicate and challenge these beliefs. (Ertmer & Ottenbreit-Leftwich, 2010, p. 269)

Requiring pre-service teachers to practice teaching is not a novel idea. However, with Kat, we're able to better support practice teaching in unusual, educational ways. We call our practice teaching assignments "rotating assignments" (Figure 1). Each week there are several rotating assignments, facilitated by different teams of students. A team never has more than one assignment per week, but over the course of the semester, each team facilitates each type of assignment.

The largest rotating assignment is Discussion Guides. The team of students has about 30 minutes to facilitate one or more activities on this week's lecture topic. Their goal is supporting review and processing on the topic, especially the practical implications for their peers, as future classroom teachers. We exhort Discussion Guides to minimize lecture-style teaching. Instead, they facilitate discussions, organize games (e.g., Jeopardy), show video clips, and so on. Each Discussion Guide also develops questions for the Final Exam, related to the topic. As part of their lesson, the Guides coach their peers as they practice answering the questions.

The Final Exam is completely written our students. Each student contributes three questions. Each question is a short, hypothetical scenario a teacher could face. Earlier in the semester, in Kat, each student self-reports their focus area: early childhood, elementary, or secondary. When a student submits a question for the Final Exam, Kat marks the question with the student's focus area. We approve each question before it's added to the pool for the Exam. On the Exam, each student receives a set of 3 unique questions. Kat randomly assigns questions from the pool, matching the focus area of the student. Students can't receive their own questions. A student responds to 2 of the questions in a limited time. Each response is a short essay, in which the student describes their immediate response, possible preventative or follow-up strategies, and relevant big ideas from our course.
Case Guides is another rotating assignment. Each week we read one case study. The Case Guides submit two questions about the case to Kat, where other students can see them. The other students answer the questions in Kat. In class, the Case Guides facilitate a short activity related to the case study (e.g., a role-play of a similar situation). Then the Guides facilitate a discussion of their questions. By the next class, the Guides score their peers' answers in Kat. Kat gives the Guides direct, limited access to the gradebook. This kind of access isn't possible with another LMS. When the Guides have scored all their peers' answers, Kat automatically gives them points for finishing this assignment.

As another rotating assignment, a student is assigned to be a Peer Rater for two or three weeks in the semester. There are six to eight Peer Raters each week. During class, the Peer Raters secretly assess the Discussion Guides based on two goals: increase student participation and support processing. The Peer Raters are anonymous and randomly assigned. The Peer Raters submit their scores and comments in Kat. The Discussion Guides read their scores and comments in Kat. The average scores given by the Peer Raters is a significant part of the Discussion Guides' points for their lesson. When the Peer Raters submit their scores, Kat immediately adjusts the average score for the Discussion Guides in the gradebook.

The Peer Rater assignment gives our students more ownership of the class, especially the quality of the Discussion Guides lessons. The Guides are trying to demonstrate their teaching abilities to the instructor. But it's just an important that they facilitate a meaningful learning experience for their peers. In many ways, their peers are in a better position to assess the Guides' success. The Peer Raters are usually learning about the week's issues and ideas for the first time, so if the Guides' lesson is educational, they experience the benefits directly. Because Kat handles the scores and comments, the Discussion Guides get timely, anonymous, authentic feedback: what worked or didn't,
and why. If necessary, we can see which Peer Rater said what. However, we've never had a problem with a student abusing their anonymity. Our students rise to our expectations: they take this responsibility seriously, and many use the safety of anonymity to offer honest, insightful constructive criticism.

3. Efficiency

The first author built Kat to meet a few needs and goals. Kat has grown to be a central part of our teaching. Kat isn't a substitute for the many essential decisions we make and the tasks we complete as human instructors. However, Kat allows us to focus on higher-level decisions and tasks, by managing a great deal of housekeeping and most of the student-driven assignments, like the Case Guides' questions. In this way, Kat is like another assistant. We depend on Kat to take care of many things, and our students frequently interact with Kat and with each other without our direct involvement.

Here are some examples of how Kat improves our efficiency. Kat allows students to sign up for their own teams. Kat manages the weekly details of the rotating assignments. While logged in, students can see exactly what they're responsible for each week, including links directly to the directions. Kat automatically excuses students from certain assignments based on the rotation (e.g., Case Guides are excused from answering their own questions). Most assignments are submitted and scored in Kat. Students submit their questions for the Final Exam directly into Kat. Once we've approved the questions, Kat handles the random assignment of questions for the Exam.

Many of our assignments would be possible without Kat, but the inefficiency would be prohibitive. For example, a low-tech approach to the Peer Rating assignment might require us to collect the feedback from the raters (on paper or via email), record points for the raters, calculate and record the average points for the Discussion Guides, make an archival copy of the feedback, remove the raters' names, compile the feedback, and forward the feedback to the Guides. Ideally, we'd do all that as quickly as possible, so that the Guides received feedback promptly. Instead of that low-tech approach, Kat does all of this every week, for every section of our course, automatically. We could use a similar low-tech approach for creating the Final Exam, including manually randomly assigning questions based on focus area. Again, the efficiency gains with Kat are significant. The housekeeping for the rotating assignments, with their different pieces (e.g., submitting questions, scoring peers' answers) would be a tangled process without Kat.

One of the first author's original motives for building Kat was using a gradebook that worked exactly the way he wants. Kat has significantly increased efficiency here, too. For example, at the end of a day of classes, we have a large set of scores to enter, for many teams of Guides in many sections. With another LMS, it would take considerable time to enter these scores: one assignment at a time, perhaps even one section at a time. However, the first author created a single page in Kat that lists all the teams for all the rotating assignments for a particular week, with places to enter their scores. It takes a minimal amount of time to enter all the scores before going home. The students who taught that day can promptly see the results in the gradebook. The first author has created similar custom pages for similar complex-yet-routine tasks.

We don't use Kat to work less. Rather, we try to work smarter. We want to spend most of our time on higher-level tasks, like improving our lectures, responding to students' individual concerns and questions (e.g., via email), and giving detailed feedback on complex assignments like essays. Kat allows us to organize and manage lower-level tasks in a variety of smart ways. For example, each datum about our course is in just one place, like the lecture topic for Week 4. Kat retrieves and reports this datum in all the contexts where it's needed: on the Calendar, in the list of rotating assignments, in the form for submitting exam questions (which must be related to the lecture topic), in a weekly checklist for students, and so on. When we need to change the lecture topic, we change it in one place, and it's changed everywhere. Like most teachers, we have seen our students' confusion when directions or other materials have inconsistent or outdated information. Kat helps minimize this problem.

There's another small but significant efficiency with Kat and similar LMSs: we use very little paper. Students submit work digitally, and we give scores and feedback digitally. Before the first author built the necessary features in Kat for assignments like answering the Case Guides questions, students would submit papers. Now we save over 150 pages of paper per week. In contrast, like any LMS, Kat increases how much electricity and computing resources we use, increasing our carbon footprint. However, we're proud to be more green, there's no chance of misplacing a paper, and we don't have to spend class time returning papers. (We collect essays digitally, via Turnitin.com, and return them via email.)

Efficiency can have negative connotations in education. Over-valuing efficiency is detrimental to learning. For example, it would be more efficient to drop the essay format of our Final Exam and instead use a multiple-choice test. But essay responses have a higher validity for assessing our students' readiness to teach, so we need to spend time scoring their essay responses. Yet our time and energy is a zero-sum game: we need to save time and
4. Learning Outcomes

In technology planning, experts use return on investment (ROI) to evaluate the benefits of a tool. A tool may be very expensive, yet if it's very effective, then the ROI is still high. The first author didn't have to spend much money to build Kat, but he has spent a lot of time and energy. When we consider the ROI for Kat and our related teaching strategies, we consider how effectively we achieve rigorous, relevant learning outcomes.

Our students respond to Kat and the rotating assignments in a variety of ways. In general, early in the semester, students experience high anxiety about navigating Kat and orienting themselves to rotating assignments. During this adjustment phase, email helps a lot. Students can ask questions and get answers quickly. Non-traditional students seem to be especially at risk for high anxiety, especially if they have limited comfort and confidence with learning management systems or other interactive websites (e.g., Facebook). There are probably mutually-amplifying anxieties: disorientation about a new technology (Kat) and trepidation about practice teaching.

Over time, many students' anxieties diminish. We follow the same routine each week, so it becomes predictable. After they've had time to process on our expectations, students seem to realize that the workload isn't beyond their abilities. The workload is just dynamic: there are only a few rotating assignments, but different teams complete their assignments in different weeks. Initially, the practice teaching seems to intimidate them, but they're pleasantly surprised by what they can achieve. For example, most teams struggle with going over time, not coming up short.

We teach educational psychology, so by the midpoint of the semester, we've explicitly taught concepts like authenticity, discovery learning, and placing students in the "Wobbly Place" (i.e., the Zone of Proximal Development: a level of challenge where students can succeed with guidance). We highlight the rotating assignments as a student-centered strategy that puts them in the Wobbly Place. We believe Kat and our related teaching strategies increases authenticity, engagement, critical thinking, and retention.

Authenticity is increased because our students have responsibility for part of the course. This includes being responsible for how well their peers learn, and what they themselves learn from the practice teaching. The palpable immediacy of planning a lesson and delivering it gives our students the opportunity to explore and experiment with the gritty realities of teaching. They experience more of what happens "behind the scenes." We provide detailed feedback via rubrics with comments. However, in some ways, the most educational feedback they get is through the experience itself: how their peers respond to the lesson, and how the Guides feel about their own teaching. The experience of being a Guide scaffolds our students through current best practices in outcomes-focused planning (i.e., Understanding by Design, or backwards design). Students write questions for the Final Exam, and then plan and teach a lesson that prepares their peers to answer those questions.

Engagement is increased because our students are both eager to experience teaching first-hand, and because they're anxious about the complexity and challenges of teaching. Hopefully, we provide enough structure and support on the rotating assignments that students are operating in Wobbly Place. They should experience a facilitating level of anxiety, at which their arousal sharpens their focus and elicits their best performance.

Critical thinking is increased because our students have the opportunity to consider how best to teach, based on the content (e.g., the big ideas in topic of the week, the nuances of the case study), and based on what they extrapolate about their peers' interests and abilities. We urge them to consider their audience: students just like them. Every student is interested in useful insights and compelling strategies they can use in the very near future when they have their own classrooms.

Retention is increased both for the students who teach as Guides and the students who learn from the Guides' lessons. The Guides take ownership of the content for the week. We push them to thoughtfully analyze the content, identify or synthesize relevant big ideas, and choose or develop creative activities to help their students. Our students tell us that the content they teach as Guides is the content they understand and retain the best.

Thus, Kat supports valuable learning outcomes. However, evaluating the ROI on Kat is unique, because the first author likes working on Kat, partly as a hobby. He's not sure how much time he's spent developing Kat. Adding features or modifying existing features is a natural part of his teaching. For example, he spends some of his planning time before the semester starts building or revising features, often based on student feedback from the previous semester. He's probably spent at least over 50 hours over the past four years in actual programming. Sometimes he's added essential features, based on specific assignments or housekeeping needs. At other times, he's just been having
some fun: polishing a feature that could be more elegant, or just experimenting to see if he can solve a problem in a
creative way. There are some features he will probably never try to duplicate, like discussion forums. When we need
a discussion forum for a course, we use a forum in the LMS our university provides, and use Kat for everything else.

Kat is an educational experience for us. Like many teachers, we take great satisfaction in finding routines
that work. There's a cycle to teaching the same course, semester after semester. Within that cycle, the first author
enjoys analyzing and solving problems, "tuning" the course over successive semesters. He visualizes learning
outcomes, considers ways to assess those outcomes, and designs experiences to prepare students to excel at those
assessments. Over successive cycles, he becomes ever-more familiar with the problem space and possible strategies.
Kat is a concrete way to see a cycle and to see how we're solving problems (e.g., "this is how we're managing this
assignment this semester"). The computer code for Kat, line by line, reflects some of solutions. Kat isn't essential for
this visualization; another instructor could use detailed notes or a written flowchart. But compared to other
visualizations, Kat is uniquely satisfying because the visualization is functional. The visualization of a solution is the
solution. In this way, Kat is literally a working model of many parts of the first author's teaching philosophy.

5. Research Plans

We're proud of how we teach using Kat, and we believe the learning outcomes are significant. But we only
have limited data to support our beliefs: we only have informal observation and anecdotal data. We're seeking more
extensive, rigorous data, using mixed methods, with our students' prior consent. Beginning in Spring 2011, we'll be
gathering this data, including using pre- and post-surveys, gradebook data, essay analysis, and interviews with some
students. Our main hypothesis is: Pre-service teachers who personally experience student-centered strategies have
increased confidence as teachers and are likely to use student-centered strategies in their own teaching. Furthermore,
we believe our strategies are effective for all students regardless of background (e.g., gender, major). Our data
should support our claims about learning outcomes, above. We're excited to start this research, so that we can begin
sharing our strategies and results with other teachers. We believe others will value our results, including possible
patterns in our students' performance on assignments, and our students' reactions to learning with Kat and the
rotating assignments.

Conclusion

No LMS can guarantee better teaching and learning: higher authenticity, greater efficiency, or more
rigorous, relevant learning outcomes. Indeed, "there is no single technological solution that applies for every
teacher, every course, or every view of teaching" (Mishra & Koehler, 2006). How we teach using Kat demonstrates
our particular approach to better teaching, and Kat's advanced features enable innovative solutions. Few teachers
have the motivation, skills, and time to build their own LMSs. However, how we teach with Kat illustrates
principles that all teachers should reflect on, and Kat illustrates potential directions for the future design and use of
LMSs. We hope other teachers find our work with Kat interesting and inspirational, and we look forward to sharing
data to further unpack and verify our pedagogy.

References


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