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William Birmingham, Grove City College
Professor of Computer Science and Electrical Engineering, Chair of Computer Science Department, Grove City College

Vincent DiStasi, Grove City College
Vice President and Chief Technology Officer, Professor of Chemistry,Grove City College

Gary Welton, Grove City College
Professor of Psychology, Assistant Dean of Institutional Assessment,Grove City College

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Abstract

For the past two years, we have studied student and faculty satisfaction with educational technology we regularly use in the classroom: the Tablet PC and active-learning software, such as DyKnow and Classroom Presenter. These studies are based on user surveys over a large number of courses given at our comprehensive college, ranging from science and engineering to the humanities. We have previously reported that about half the students are relatively neutral about the technology, a quarter dislikes it, and a quarter are very pleased. After reviewing the results of various measures, we found that individual differences in learning styles and student motivation correlate with whether a student is satisfied or dissatisfied with active-learning software. We found that students who are intrinsically motivated to learn, who like technology in the classroom, who like delivered notes (or at least faculty-provided notes), and who are active learners are more apt to be satisfied with active-learning software.

1. Introduction

For the past two years, we have studied student and faculty satisfaction with educational technology we regularly use in the classroom: the Tablet PC and active-learning software, such as DyKnow and Classroom Presenter. These studies are based on user surveys over a large number of courses given at our comprehensive college, ranging from science and engineering to the humanities. Since our students receive a Tablet PC and software when they enter the college, they use the Tablet PC as their primary and—for the vast majority of both faculty and students— only computing platform. Thus, the survey population is knowledgeable about the operation of the Tablet PC and associated software, and the technology has become an integral part of their academic lives.

In a recent paper[1], we reported that our latest results indicate about half the students are relatively neutral about the technology, a quarter dislike it, and a quarter are very pleased. After reviewing the results of various measures, we found that individual differences in learning styles, as measured by Felder's Index of Learning Styles[2] correlate with whether a student is satisfied or dissatisfied with programs like DyKnow or Classroom Presenter. We also suspected that a

student's motivation about learning (i.e., the student is intrinsically interested in the subject or simply fulfilling a requirement) would affect their satisfaction with active-learning software. In particular, we proposed that the greater a student's motivation, the more he or she will be satisfied with active-learning software. Our reason for this is that students who seem to be satisfied with active-learning software report that systems like DyKnow allow them to "think" more about the material in a lecture, as they are less concerned with taking a complete set of notes. This is in contrast to students who are less satisfied, as they comment that active-learning software makes it more likely for them to "drift off."

We recently completed a campus-wide study of student motivation. In this paper, we present the results of that study, and report on the relationship motivation has with student satisfaction. We begin with a description of the campus technology supporting education.

2. Campus Teaching Technology

Grove City College (GCC) is a private, comprehensive college now in its 16th year of a 1:1 computing program. Currently, the college provides an HP Tablet PC (tc4400) to all its nearly 2500 students and the majority of its faculty. For these students and faculty, the Tablet PC is their sole computing platform. It is common for students to use the Tablet PC both inside and outside the classroom, including personal uses, such as music services, gaming, and communicating with friends. In fact, a core part of the college's mission is to provide excellent technology to support education.

Many faculty members at GCC use classroom active learning support software, specifically DyKnow[3] and Classroom Presenter[4]. These systems have been in extensive use at GCC for more than two years, and are used in various courses in both the School of Science, Engineering and Mathematics and the School of Arts and Letters. Consider that over the past two years 177 courses (included multiple sections), 5,114 students (non-unique), and 30 faculty have used either DyKnow or Classroom Presenter.

Over the past two years, we have been assessing the faculty and student satisfaction of course management systems (CMS). Since Tablet PCs are integrated into the college curriculum as well as students' lives (i.e., they are comfortable with the affordances offered by the Tablet PC) and

the use of CMS is spread thorough the college, GCC is an excellent laboratory to assess this technology.

All the classrooms are equipped with network ports, wireless networking, and electrical outlets at each seat. The backbone is all fiber connected running at gigabit speeds with multiple trunks to each of the academic buildings. The campus network has ample bandwidth with capacity to grow in the future. In addition, all students and faculty have networked disk space that is available from any network connection on campus.

3. The Survey

In the Fall 2008 semester, 13 professors from eight departments used DyKnow in their courses. These eight departments included four in the science and engineering areas and four in the liberal arts and social science areas. These 13 professors used DyKnow in 30 courses, including 568 different students.

Students were surveyed three different times across the semester. These surveys were separated in time, in part to reduce the likelihood that students would perceive any links between general technology questions in one survey and particular DyKnow evaluation questions in another survey.

The first survey, conducted in October, was sent to the entire college student body (N = 2493). This survey employed the Soloman-Felder Index of Learning Styles (ILS), on which scores are collected for four types of learning preferences:

- active versus reflective
- sensing versus intuitive
- visual versus verbal and
- sequential versus global

These learning styles are measured on a scale from -11 (suggesting a preference for the first named method) to +11 (suggesting a preference for the second term). A total of 1400 students completed this questionnaire, for a response rate of 56%.

The second survey, conducted in November, was also sent to the entire student body. Most of this survey assessed the extent to which students are internally motivated to learn. This motivation score, which will be referred to as MOTIV8, included 22 questions from the *Motivated Strategies for Learning Questionnaire*[5] and three questions from the *Interest Factor of the Differential Emotions Scale-IV*[6]. These 25 items were originally constructed to refer to a student's experience in one particular class. We reworded the items so that they related to a student's general college experience. The items used a seven point scale (1 = Not at all true of me, 7 = Very true of me). The 25 questions were combined into one score on the basis of an observed *coefficient alpha* = .93. A few additional items were added to this survey.

One of these, which will be referred to as NOTETAKING, was a measure of the extent to which students rely on the notes provided by professors as compared to the extent to which students try to write everything down themselves. This was measured on a five point scale, 1 = *I rely on the electronic notes almost exclusively (when they are available)*, 5 = *I try to write/type all important details whether or not they are available electronically*.

Another question, which will be referred to as TECHBIAS, asked students to indicate their overall preference for the use of technology in the classroom. This was measured on a 6 point scale, 1 = *I STRONGLY prefer taking courses that use no information technology*, 6 = *I prefer taking courses that use information technology exclusively*. A total of 1298 students completed this questionnaire, for a response rate of 52%.

The third survey, conducted in December, was delivered only to students using DyKnow this semester (N = 568). This survey was conceptually the same as we used in previous semesters, with one significant change. In our previous applications, we asked students to rate each particular DyKnow course they took that semester. Students who had multiple DyKnow courses had the opportunity to complete the survey multiple times. This time students were asked to consider all of their current DyKnow courses and hence were allowed to respond only once to the survey. Once again there were three critical questions that asked students to rate their overall satisfaction with DyKnow on a seven point scale (1 = *DyKnow provides a very significant disadvantage*, 7 = *DyKnow provides a very significant advantage*) in comparison to three other options: the use of a traditional chalkboard, the use of transparencies, and the use of PowerPoint

or OneNote. These three questions were combined into one measure of overall satisfaction, which will be referred to as GLOBALSAT, based on an observed *coefficient alpha* = .80. A total of 239 students completed this questionnaire, for a response rate of 42%.

These surveys yielded complete data on 165 students, those who responded to all three of the surveys. The following analyses were conducted using this sample. The means and standard deviations are given in Table **1**.

Table 1: Descriptive Statistics.

	Mean	Stan Dev	Scale
TECHBIAS	3.79	1.15	1 to 6
Active vs reflective	0.44	4.63	-11 to 11
MOTIV8	5.06	0.80	1 to 7
NOTETAKING	3.75	1.21	1 to 5
GLOBALSAT	4.22	1.24	1 to 7

We performed a regression analysis (see Table **2**) with GLOBALSAT as the dependent variable. The first predictor variable entered into the equation was TECHBIAS. It is likely that some students rate DyKnow very positively, not because they especially like DyKnow, but because they are favorably biased in favor of any technology. Likewise, it is likely that some students rate DyKnow negatively, just because they do not like technology. Hence, this variable was entered as a control variable (or a covariate) so that we could then ask what variables predict DyKnow satisfaction above and beyond a general technology bias. The other variables, active versus reflective, MOTIV8, and NOTETAKING were then entered as additional predictor variables.

Table 2: Regression analysis.

	R^2	Variable	β-weight	t_{obs}	p
Model 1	.113	TECHBIAS	.336	4.56	< .001
Model 2	.190	TECHBIAS	.295	3.89	< .001
		Active v Reflective	-.168	2.25	.03
		MOTIV8	.178	2.36	.02
		NOTETAKING	-.203	2.74	.01

The significant negative weight for active versus reflective indicates that learners with a preference for active learning are more satisfied with DyKnow. The unique characteristic of the

interactive features of DyKnow do in fact make it possible for the student to become more active during the classroom time, so this finding is intuitive. It suggests that some types of students might not respond favorably to DyKnow because they have a preference for a more reflective thought style, over time, rather than the active real-time features of the interactive DyKnow program.

The significant weight for MOTIV8 suggests that students who are more concerned with learning the material are more satisfied with DyKnow. Whether it improves their grades or not, students find the use of DyKnow to be consistent with their desire to engage and learn the material.

The significant weight for NOTETAKING validates what we had proposed in a previous study[7]. Some students complain that professors give them "too many" notes in their prepared DyKnow slides. Because they already have so many notes, they are not motivated to pay attention in class. Other students report that they appreciate the more complete set of notes delivered in realtime during the lecture, because that frees them from the mundane task of note taking, enabling them to have more time to process and engage the material. In the current set of open-ended responses about their reactions to DyKnow, 24 students made the first observation as a complaint, while six students noted the latter observation as a benefit. The significant regression result indicates that those students who think they need to write down everything by hand to facilitate their memory are not as satisfied with DyKnow. Those who use the prepared notes to free their cognitive processing are the students who are more satisfied.

The covariate explained 11.3% of the variance in DyKnow satisfaction. The inclusion of the three predictor variables predicted an additional 7.7% of the variance, representing a moderate effect size. As a whole, the findings suggest that individual differences do play a role in DyKnow satisfaction, and the students who appreciate its features the most are those who are predisposed to like the use of technology, those who prefer an active learning methodology over a reflective style, those who are intrinsically motivated to learn the material, and those who try to build from and engage with the prepared notes rather than those who think that writing down everything facilitates their rote memory.

4. Discussion

Over the past two years, our research has indicated that the general student population is not as satisfied with DyKnow as is faculty, who appear to be very satisfied with DyKnow[8]. We supposed that technology bias and pedagogical style were factors in the students' level of satisfaction: students that "like" technology would be more satisfied with DyKnow. In a recent study, we looked at the satisfaction of computer-science (CS) students [9] with DyKnow. We suspected that these students were "technophiles" and that pedagogical style would be normalized across the faculty teaching CS classes. Yet, we found that this group had about the same satisfaction as the general GCC population.

Upon further study of the survey results, particularly the written comments, we considered that technology bias, while important, is not sufficient in itself. This led us to the current study where student motivation, student learning style, and note taking preference were considered. Clearly, all these factors are significant in predicting student satisfaction.

While we need more research both on our campus and other campuses to confirm our findings, the factors we presented in this paper are significant. We are also considering examining student performance related to DyKnow use.[10]

5. Summary

The research results in this paper show that there are a number of important factors in understanding student satisfaction with CMS, particularly, in our case, DyKnow. We found that students who are intrinsically motivated to learn, who like technology in the classroom, who like delivered notes (or at least faculty-provided notes), and who are active learners are more apt to be satisfied with DyKnow.

While in hindsight these results are not surprising, they do show where CMS systems are likely to be a success and where they may not be a success from the students' perspective. For example, in those classes where the instructor and material lend itself to active learning and the student population is biased toward visual learning, systems like DyKnow will be successful. We do suggest, however, that these types of classes do not fall into natural discipline lines. There are classes in the humanities that fit these criteria, and classes in engineering that do not.

Acknowledgements

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