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Online activity, motivation, and reasoning among adult learners

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ABSTRACT

College students' motivational beliefs influence their online behavior and ability to think critically. In the present study, doctoral health science students' reports of motivation, as measured by the California Measure of Mental Motivation, reasoning skill, as measured by the Health Science Reasoning Test, and Web-CT records of online activity during a Web-CT-based statistics course were explored. Critical thinking skill and disposition each contributed unique variance to student grades, with age, organization disposition, and analysis skill as the strongest predictors. The youngest students, those so-called millennial age, and born after 1982, were those with the lowest critical thinking skill and dispositions, and the lowest grades in the class. Future research must take into consideration discrepancies between skill and disposition and interactions with age or cohort. At present, and contrary to popular wisdom, older students may make better online learners than younger.

1. Introduction

Students' motivation to think critically has been shown to improve online learning (Cocea, 2006). One way to encourage critical thinking is by motivating meaningful and frequent online discussion (Dennen, 2007). Dennen points out that online discussions may, however, only be indirectly connected to student learning (2007). The purpose of the present study is to compare student performance among doctoral health science students in terms of critical thinking disposition and skill in an online statistics class. The main research question is whether critical thinking will complement measures of online activity to anticipate learning among graduate students ranging in age from 26 to 60.

Our recent research shows that students need to interact actively with online resources for instruction to be maximally effective (Ransdell & Gaillard-Kenney, 2009; Ransdell, Gaillard-Kenney, & Weiss, 2007). Ransdell et al. (2007) found that the number of original postings to discussion lists, but not the total count, was among the best unique predictors of exam performance. Dennen (2007) cautions that quality must be supplemented with quantity in order to make sense of the myriad tracking functions automatically provided by Web-CT, Blackboard, and other tools like them. The present research addresses this issue of multiple markers of online activity by testing a model including critical thinking disposition, skill, and some of the most common measures of online activity, total hits, readings, and postings.

Because of the especially tight time constraints of many online students, they need every motivation to participate in and benefit from postings to discussion. Some students may have critical thinking skills, but not the disposition to use them because of instructor requirements, or because online learning offers some latitude in how students may proceed. Giancarlo, Blohm, and Urdan (2004) developed an assessment of critical thinking disposition called the California Measure of Mental Motivation (CM3). The CM3 yields four theoretically meaningful dimensions, Learning Orientation, Creative Problem Solving, Mental Focus, and Cognitive Integrity. The four factors are reliable across a wide range of Western samples, and are correlated with known measures of student motivation and achievement. The present study compares the predictive power of the CM3 and the Health Science Reasoning Test (HSRT). The HSRT (Facione & Facione, 2006) was designed to measure critical thinking skill, a necessary, but insufficient predictor of student success (Giancarlo et al., 2004). HSRT questions do not require specific medical knowledge, but are stated in terms of real health care situations maximizing the reliability and validity of the tool in this population.

Nearly all health science students take a statistics course like the one in this study. The content is well-structured and relatively stable over time. Some students may be less motivated to take it than other courses, but since it is part of the core curriculum, it may be a good place to start in determining online activity, motivation, and reasoning among adult learners. This research will also describe any evidence for the often-found tendency of older college learners to underestimate their own performance relative to younger learners (for a review see Tyler-Smith, 2006).

There is some evidence that online learning requires even more learner motivation and self-direction than traditional classroom-based instruction (Bell, 2006). Berenson, Boyles, and Weaver (2008) found that older students taking online courses tended to

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have higher dispositions to think critically and perform better than younger students. Berenson et al. reason that the online environment may depend more on motivation than the traditional classroom and therefore older students with higher motivation may do better online than younger. Therefore, the present study will compare older students with younger students taking an online course in terms of critical thinking skills and disposition.

The first hypothesis is that course grades will be higher for older students which, of course, may be a proxy for cohort and experience. The second hypothesis is that online activity, and both critical thinking skill (as measured by the HSRT) and disposition (as measured by the CM3), will reliably predict course grades. Profetto-Grath (2003) has shown that nursing students have uneven skill and disposition. Critical thinking dispositions were found to be high, but skill was lagging behind. In the present study, skill and disposition are predicted to provide independent sources of explanation to exam performance and online activity.

2. Method

2.1. Participants

Fifty-six graduate students in a doctor of health science statistics course taught by the author were asked to volunteer for a one-hour online assessment including the motivation assessment, CM3, and the health science reasoning assessment, HSRT. Students who did not choose to participate were given the option of writing an extra one-hour assignment. Both student volunteers and non-volunteers received extra-credit in their class upon completion for one hour of time. All other class activities were as in the original course. The research protocol was approved by the university's Institutional Review Board in accordance with the Declaration of Helsinki.

The average age of the 48 students who volunteered to participate was 42.9, *SD* = 10.0. Average HSRT was 17.8/33, just below the 50th%tile in a comparable national sample (*SD* = 4.9). Average CM3 was 44.1, *SD* = 4.7, indicating that a majority of the students possessed strong dispositions to think critically, at least as measured by the CM3. Skill and disposition were not reliably correlated. Half of the students self-reported to be white and 2/3 were women. The average total number of hits to the website for course materials and discussions was 687 over 15 weeks (*SD* = 228). The average number of readings of discussion postings in the website was 273, *SD* = 116. The average number of original postings to discussion was 6, *SD* = 7. The main learning outcome variable was the final grade before the final with a mean of 85%, *SD* = 5.5. Table 1 shows the descriptive statistics for the main variables.

2.2. Procedure

Forty-eight student volunteers signed an informed consent and took the CM3 and HSRT online at their leisure during the 15 week online statistics course offered through Web-CT, a web-based communication tool. Total hits, total readings of the discussion postings, and total original postings to discussion were automatically provided by the Web-CT program. The author also recorded these three outcomes for those students who agreed to participant as volunteers.

Table 1
Descriptive statistics for main outcome variable "gradeb4final", chronological age "age", critical thinking skill "analysis" and "evaluation", and critical thinking disposition to organize "orga".

	Descriptive statistics		
	Mean	*SD*	*N*
Gradeb4final	85.0357	5.53654	56
Age	42.90	10.024	48
Analysis	3.60	1.425	48
Evaluation	4.58	1.381	48
Orga	41.9837	9.23964	47

2.3. Materials

The CM3 was used to assess motivation and is based on the California Critical Thinking Skills Test (Facione, 2000). The CM3 assesses mental focus, learning, creative problem solving, and cognitive integrity. Research shows the CM3 to have high reliability and to be predictive of standard self-efficacy measures (Giancarlo et al., 2004). The HSRT (Facione & Facione, 2006) is a reliable assessment of reasoning and critical thinking skills regardless of the specific area of expertise the respondent may possess. Health science students have been shown to be more motivated to perform at the level of their skill when the context includes everyday health care examples. Table 1 shows the descriptive statistics for the main subsets of the HSRT, Analysis and Evaluation and the main subset of the CM3, Orga, that are predictive of age and grade.

2.4. Data analysis

The statistical analysis employed a linear regression analysis to determine the unique variance accounted for in student grades by age, online activity, and the CM3 and HSRT (i.e., Hoffman, 2004).

3. Results

Thirty-two percent of the variance in student learning was accounted for by a model including age, reasoning skill and disposition, and online activity. A multiple regression analysis revealed a significant model for predicting students grades in the class, $R = .56$, $F(6, 40) = 3.11$, $p < .05$. Age and critical thinking disposition to organize were the single best predictors, each with partial correlations of .30 (see also Table 2 for bivariate correlations of .34 and .25, respectively). Those students who were older, and self-reported better organization, achieved better grades than those who were younger. Analysis reasoning skill from the HSRT was the next best predictor with .31, and Evaluation skill from the HSRT predicting grades, .20 (see Table 2). Online activity in terms of totals hits, readings, and postings to the web-based course yielded partial correlations of .18, .20, and .18, respectively.

For the purposes of description, participants were divided into four groups of high skill and disposition, low skill and disposition, low skill, high disposition, and high skill, low disposition based on a median split of the CM3 and the HSRT. The youngest students, the 11 who scored both low in disposition and skill, had an average age 38.6, *SD* = 9.1 (HSRT, 12, CM3, 37), including all the millennial students. Eleven students overestimated their skill relative to their disposition, were on average, 40.2, *SD* = 6.7, and tended to be men. Twelve students underestimated their skill, were among the oldest in sample (average = 48, *SD* = 9.8), and were more likely to be women. The 13 best performing students in the sample were, on average, 44 in age, *SD* = 12, and equally men and women.

4. Discussion

Among graduate health science students in a relatively small sample, critical thinking disposition and skill each contribute unique, non-overlapping sources of variance to learning outcomes in an online statistics course. Critical thinking disposition was uniformly strong among these mostly baby-boomer age students, but critical thinking skill was widely distributed. Baby-boomer age is typically defined as people who were born during the middle of the 20th century (http://en.wikipedia.org/wiki/Baby_boomer).