An Investigation Of Online Homework: Required Or Not Required?

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ABSTRACT

In our research we investigate the use of online homework in principles of accounting classes where some classes required online homework while other classes did not. Users of online homework, compared to nonusers, had a higher grade point average and earned a higher grade in class. On average, both required and not-required users rated the online homework experience positively. Additionally, low-performing students appear to get more benefit than high-performing students from using online homework. Because of individual differences, no one study tool will be best for all students or in all situations. However, we conclude that use of online homework is an effective way to motivate students and may be particularly beneficial for less motivated or poorer performing students.

Keywords: Online Homework; Required Homework; Student Performance

INTRODUCTION

While research generally supports that student use of on-line homework increases performance, we are unable to identify research that addresses the issue of faculty choice of whether to require students to use online homework or whether to use it as an optional learning tool. The purpose of this research is to provide information that may assist faculty in making this decision. Our research examines characteristics and perceptions of user and nonuser students in class sections that required the use of online homework compared to user and nonuser students in class section where the online homework was available but was not a required part of the course grade. Additionally, we separately consider "low-performing" and "high-performing" students to identify any differential benefit from the use of online homework.

LITERATURE REVIEW AND RESEARCH QUESTIONS

The idea that the amount of time spent on homework increases student achievement is well supported in the literature (Cooper, 1989; Cooper et al., 2006). Additional studies specifically examining the use of on-line homework have reported: (1) a positive relationship between online homework usage and performance (Taraban et al, 2005; Potter and Johnston, 2006; Johnson et al., 2009), (2) that online homework is at least as effective as (Hauk and Segalla, 2005; Allain and Williams, 2006; Gutarts and Bains, 2010) or more effective than (Burch and Kuo, 2010; Cheng et al.,2004) traditional homework and quizzes in aiding student performance; and (3) that students generally perceive online homework systems positively (Smolira, 2008; Doorn et al., 2010).

However, we were not able to identify research that considers whether online homework should be a required or optional part of a college course or whether high-performing students or low-performing students differentially benefit from online homework use. Research has found that higher motivated, better performing students are most satisfied with online homework (Doorn et al., 2010), and students with higher intrinsic motivation and computer efficacy are more likely to perceive online homework systems as helpful (Peng, 2009). Possibly these motivated students appreciate the online tools as a more effective or efficient way to study. These same intrinsically motivated students would likely work homework problems and study whether or not an online homework system was available. Therefore, it may not be necessary to "require" these students to perform online homework tasks. In fact, it may ***not*** be in the motivated students' best interest to have required online homework assignments. Gutarts

and Bains (2010) indicate that highly motivated students may actually be stifled by online homework because they have "met expectations" and do not get pushed to their full potential (Peters et al., 2002; Tuckman, 1996).

Less motivated or extrinsically motivated students may need a different type of learning environment. Requiring these students to submit online homework may increase their motivation and effort in the class. For example, including homework in the student's grade increased the student's attention toward homework (LaRose, 2010), and increasing the percentage of the grade dedicated to homework increased student motivation and performance (Radhakrishnan et al., 2009). Peng (2009) found that students with lower motivation exerted more effort when using online homework. Therefore, encouraging or requiring less motivated students to use online homework may be beneficial.

The current study builds on earlier research by Dillard-Eggers et al. (2008) that finds a positive relationship between online homework use and student performance. In the current study we expand the sample and examine class sections that required online homework as part of the course *and* class sections that had access to online homework but did not include it as a course requirement. Our research questions compare characteristics and perceptions of students who choose to use online homework tools and those who choose not to use them. In addition, we separately consider the benefits of online homework to high-performing and low-performing students.

Research Question One

What characteristics differentiate between students who chose to use online homework tools compared to students who chose not to use them? Are these characteristics different for course sections where online homework was required compared to sections where it was not required?

Research Question Two

What are students' perceptions of the benefits of online homework? Are these perceptions different for course sections where online homework was required compared to sections where it was not required?

Research Question Three

Does the use on online homework differentially benefit low-performing or high-performing students?

METHODOLOGY

For our current research we surveyed 453 students in 16 accounting principles classes that were taught by eight different instructors. Six of the classes were financial accounting principles while ten of the classes were managerial accounting principles.[1] Students had access to "Personal Trainer" (Thompson-Southwestern Publishing) online software through an access code that came with the purchase of a new textbook, or the access code could be purchased separately if the student purchased a used textbook. Homework problems assigned were from the textbook and were answered via the online software. Some of the problems were quantitative in nature while some were fill-in-the-blank type questions. Students were able to work the problems unlimited times until they answered correctly. At the end of the allotted time, students' homework grade was determined as the percentage of questions answered correctly out of the total assigned.

For 225 of the students (seven of the classes), online homework was a required part of the course representing from 10% to 16% of the student's grade. For 228 of the students (the other nine classes), homework problems and use of the online software were recommended, but neither homework nor use of the online software was a required part of the course grade. We linked each student to the system-generated report indicating online homework usage and gathered descriptive information on each student. We also asked students for their perceptions of the use of online homework or their reasons for choosing not to use online homework. Although students were

[1] While not a specific part of this research, we tested and found no significant differences between financial and managerial accounting classes and no evidence of an instructor effect.

not randomly assigned to required or not-required classes, the students had no way of knowing in advance which class sections would require online homework and which class sections would have optional online homework.

Descriptive Statistics - Required Group

To understand the characteristics of users compared to nonusers, we split our research participants into required and not-required groups. Table 1 provides a breakdown of descriptive statistics of users and nonusers within the required group. Twelve percent (26 of 225) of the students in the required group chose not to use online homework even though it was required and was part of their grade, while 88% (199 of 225) of the students followed the requirements of the course. As one might expect, users were significantly different from nonusers in that they had on average a higher course grade (3.0 compared to 2.4 on a 4.0 scale), and a higher grade point average (3.2 compared to 2.9 on a 4.0 scale). Significant differences were also noted in the class level with juniors comprising a smaller percentage of users (21%) compared to nonusers (46%). In addition, users took somewhat more credit hours (15.2 compared to 14.2) than nonusers. Significant gender differences were noted in the required group; 77% of nonusers were male while only 44% of the user group was male. There were no significant differences in age, ACT scores, or major between users and nonusers in the required group; although it is interesting to note that none of the twenty-six nonusers in the required group were accounting majors.

Table 1: Descriptive Statistics – Required Group Only

Variable	Users	Nonusers	Total
N	199	26	225
Mean grade in course (1)(***)	3.0	2.4	2.9
Age	20.8	21.2	20.8
Credit Hours taken (*)	15.2	14.2	15.0
Prior Grade point average (1)(**)	3.2	2.9	3.2
ACT	24.9	23.5	24.8
Major			
Accounting	9 (4%)	0 (0%)	9 (4%)
Business	159 (80%)	22 (85%)	181 (80%)
Non-Business	31 (16%)	4 (15%)	35 (16%)
Class**			
Freshman	42 (21%)	4 (15%)	46 (21%)
Sophomore	94 (47%)	8 (31%)	102 (45%)
Junior	42 (21%)	12 (46%)	54 (24%)
Senior	21 (11%)	2 (8%)	23 (10%)
Gender (***)			
Female	111 (56%)	6 (23%)	117 (61%)
Male	88 (44%)	20 (77%)	108 (48%)

*** significant at the .00 level
** significant at the.05 level
* significant at the .10 level
(1) Calculated based on a four-point scale

The significant differences in the required group seem to indicate that nonuser students were less motivated to study accounting or possibly more distracted since they appear to have entered the university with the same academic abilities (as indicated by the similar ACT scores) but chose not to fully participate in the course requirements. The fact that nonuser students were predominately male is somewhat troublesome. While we are reluctant to draw inferences because of the small number of required nonusers, these results are consistent with findings such as Schleifer and Dull (2009) who found that females think more about learning and have greater metaregulation and metaknowledge, and a growing body of evidence that indicates girls are outperforming boys for a variety of hypothesized reasons (Warikoo and Carter, 2009).

Descriptive Statistics - Not-required group

Table 2 reports descriptive statistics for users and nonusers in the not-required group. Because online homework was not a required assignment in the class, these students were able to choose other methods of study

without directly impacting their course grade. Interestingly, 60% (137 of 228) of the students chose to use online homework, while 40% (91 of 228) chose not to use online homework. Users were significantly different from nonusers in that they had on average a higher course grade (3.3 compared to 2.8 on a 4.0 scale) and a higher grade point average (3.3 compared to 3.1 on a 4.0 scale). For the not-required group, there were no differences between users and nonusers in age, credit hours taken, ACT scores, major, class standing, or gender. As with the required group, the students who chose not to use online homework were poorer performing students (based on prior grade point average) who seemed to be less motivated.

Table 2: Descriptive Statistics – Not-Required Group Only

Variable	Users	Nonusers	Total
N	137	91	228
Mean grade in course (1)(***)	3.3	2.8	3.1
Age	22.7	21.5	22.3
Credit Hours taken	14.8	14.1	14.5
Prior Grade point average (1)(***)	3.3	3.1	3.23
ACT	24.4	24.6	24.5
Major			
Accounting	8 (6%)	1 (1%)	9 (4%)
Business	101 (74%)	68 (75%)	169 (74%)
Non-Business	28 (20%)	22 (24%)	50 (22%)
Class			
Freshman	15 (11%)	10 (11%)	25 (11%)
Sophomore	61 (44%)	44 (48%)	105 (46%)
Junior	38 (28%)	21 (23%)	59 (26%)
Senior	23 (17%)	16 (18%)	39 (17%)
Gender			
Female	85 (62%)	55 (60%)	140 (61%)
Male	52 (38%)	36 (40%)	88 (39%)

*** significant at the .00 level
(1) Calculated based on a four-point scale

To summarize our results for research question one, we found that for both required and not-required groups, users (compared to nonusers) reported a significantly higher grade point average and earned a higher grade in the class. These results are consistent with Doorn el.al. (2010) findings that more highly motivated students with a higher grade point average stated that they would be more likely to do online homework even if it was not graded (not part of course requirements). As discussed earlier, we find additional differences between users and nonusers in the required group; with required nonusers including a higher percentage of junior level students, taking fewer credit hours, and being predominately male.

User Perceptions

Panel A of Table 3 presents results of a survey of both required and not required users asking for their perceptions of the benefits of using online homework. We asked students to directly compare online homework with the more traditional "pencil and paper" homework with respect to its impact on learning. Scores were positive for both the required and not-required groups (2.21 and 2.90 respectively on a 5.0 scale; 1=much better and 5=much worse); however, students in the required group posted a significantly more positive score than those in the not-required group.

We obtained similar results when students were asked to provide an overall rating of their experience with online homework. We expect this overall assessment question to encompass issues such as comfort with the technology, and convenience of the online format along with the quality of their study time. Scores were positive for both required users and not-required users (scores of 2.07 and 2.60 respectively on a 5.0 scale; 1=very good and 5=very bad), and students in the required group posted a significantly more positive score compared to those in the not-required group.

Panel B of Table 3 presents a more detailed analysis of these two questions. For the "comparison to pencil and paper" question, students in the required group were much more positive with 67% (compared to 40% of students in the not-required group) indicating that online homework was "better to much better" than using "pencil and paper." Responses on the global question that asked students to rate their overall experience also indicated that students in the required group were much more positive with 71% (compared to 43%) indicating a "good to very good" experience with online homework.

We found these results to be somewhat counterintuitive. We expected students who chose to use online homework even when it was not a class requirement would have a more favorable perception than student users in classes where it was required. Users of online homework in class sections where it was not required could just as easily have chosen an alternative means to study. We expected not-required users would choose online homework if they believed it would be beneficial or if it matched their learning style. On the other hand, possibly students who were required to use online homework regularly throughout the semester became more familiar with the software and could have found it to be more helpful than they originally expected; this in contrast to students who were not required to use it and used it less frequently.

Not-required users, as a whole, seemed to be much more ambivalent about the benefits of online homework. For example, almost as many not-required users rated online homework worse to much worse compared to "pencil and paper" as those students who rated it better to much better (37% compared to 40%). In addition, 41% of not-required users were neutral (rating 3 on a 5-point scale, or midpoint of the scale) with respect to the overall experience using online homework. In contrast to the ratings of required-user students discussed above, these results do not represent a strong endorsement of the benefits of this technology. Because there was no course credit attached to online homework perhaps these students used online homework to some extent but also used other methods to study. This would have enabled them to make a more informed comparison between online homework and other study methods.

Table 3: Panel A - Users' Perceptions of Online Homework

Question One	**Required**	**Not Required**
	Much Better 1 to 5	**Much Worse**
With respect to learning, how does the use of online homework compare to "pencil and paper" homework?*	**2.21**	**2.90**
Question Two	**Very Good 1 to 5**	**Very Bad**
Overall, how would you rate your experience using online homework?*	**2.07**	**2.60**

* Significant at the .00 level

Panel B: Percentage of Users' Responses to Questions

Question One	**Much Better 1**		**to**		**Much Worse 5**
	Required				
With respect to learning, how does the use of online homework compare to "pencil and paper" homework?	**35%**	**32%**	**11%**	**19%**	**3%**
	Not Required				
	18%	**22%**	**23%**	**26%**	**11%**
Question Two	**Very Good 1**		**to**		**Very Bad 5**
	Required				
Overall, how would you rate your experience using online homework?	**27%**	**44%**	**25%**	**4%**	**0%**
	Not Required				
	14%	**29%**	**41%**	**13%**	**3%**

High-Performing Compared to Low-Performing Students

Research question three addresses potential differential benefits of online homework for low-performing compared to high-performing students. To address this question, we combined the required and not required user

groups, and then split them into two groups based on the average overall prior grade point average score (3.2). We ran regression analysis on both of these groups using the model: Improvement Score = f(User/Nonuser, Required/Not Required, Interaction)

The dependent variable, Improvement Score, is the difference between the student's grade in the class (on a 4-point scale) and their prior grade point average. A larger positive difference (or lower negative difference) is a measure of how much the student's class grade was better than "expected" as measured by their prior grade point average. User/Nonuser and Required/Not Required variables indicate whether the students were users or nonusers of the online homework and whether or not they were in classes that required online homework use as part of the course.

Table 4: Regression Results with Improvement Score as the Dependent Variable

Panel A – High Performing Students
Average Improvement Score

	Not Required	Required	Total
Users	.00	-.18	-.10
Nonusers	-.20	-.25	-.21

Factor	Sum of Squares	d.f.	F-statistic	Probability
Intercept	2.078	1	7.321	.007
Required/Not Required	.387	1	1.035	.310
User/Nonuser	.495	1	1.326	.251
Interaction	.121	1	.324	.570
Error	87.766	235		
Total	93.550	239		

R^2 = .023; Adjusted R^2 = .011

Panel B – Low Performing Students
Average Improvement Score

	Not Required	Required	Total
Users	.05	-.20	-.11
Nonusers	-.49	-.92	-.59

Factor	Sum of Squares	d.f.	F-statistic	Probability
Intercept	17.455	1	19.164	.000
Required/Not Required	3.310	1	3.635	.058
User/Nonuser	11.349	1	12.461	.001
Interaction	.197	1	.216	.642
Error	171.230	188		
Total	93.550	192		

R^2 = .043; Adjusted R^2 = .036

Table 4 reports the results of the regressions. As noted in panel A, for the higher performing students we find no significant difference in grade improvement between users and nonusers of online homework, and also no significant difference between students in required and not required classes. Higher performing students appear to score close to their GPA whether they use online homework or not.

On the other hand, as shown in panel B of Table 4, for low-performing students we note a significant difference in improvement score for the User/Nonuser variable (p=.001) and a marginally significant difference for the Required/Not Required variable (p=.058). Therefore, we conclude that both being a user of online homework and being in the not required group is related to higher improvement in class performance. Low-performing students who used online homework were able to score close to their current GPA (with users in the not required group scoring above their GPA) while nonusers scored significantly below their current GPA.

LIMITATIONS

Some aspects of our study may limit the interpretation of our results. First, our research included only students from principles of accounting classes at one university. Different results may have been obtained using different subject areas, upper level classes, or different university settings. Second, our study included only one type of homework software from one publisher. Different software publishers have different computer interfaces and feedback tools. In addition, students were not randomly assigned to required/not-required treatment groups.

SUMMARY AND CONCLUSIONS

Based on previous research we began this study with the premise that a positive relationship exists between homework preparation and student performance. Our research builds on previous research by examining the issue of choice; whether online homework should be a required assignment or an optional study tool. Within this context, our research questions consider characteristics of users and nonusers, user perceptions of the benefits of online homework, and the benefits of online homework usage on high-performing and low-performing students.

We find that users, compared to nonusers, tended to have a higher grade point average and earned a higher grade in the class. This holds true for both the required and not-required groups. Thus, users of online homework seemed to be students who were more motivated to study and do well in class. However, high-performing students scored a course grade close to their GPA regardless of whether they used the online homework or not. This finding is consistent with Doorn et al. (2010) who reported that students who were most satisfied with online homework were the higher motivated, better performing students and are likely to perform well in a wide range of learning environments.

On the other hand, poorly performing students (as indicated by a lower grade point average) were the ones who chose not to use online homework even though these students appeared to enter the university with the same ability (i.e. similar ACT score). Nonusers were almost exclusively *not* accounting majors and appear to be less motivated to use the software when it was not required. Based on written nonuser comments, some questioned the benefit they could derive from online homework, particularly in the not-required group where they had the option to work problems in the traditional manner and use other study methods. However, the low-performing students who did use the online homework scored closer to their current GPA (average Improvement Score = -.11) as compared to low-performing students who did not use the online homework (average Improvement Score = -.59).

Our results indicate that nonusers in the required group were predominately males. These students specifically chose not to perform required aspects of the course. While this finding is consistent with earlier research documenting gender differences in learning and performance (Schleifer and Dull, 2009; Warikoo and Carter, 2009) the small number in our required nonuser group limits our ability to draw firm conclusions in this regard.

On average, both required users and not-required users rated their experience somewhat positively and indicated that use of online homework was preferable to "pencil and paper." We had expected students who were given a choice whether or not to use the online tool (not-required users) would be the ones who reported greater satisfaction from the use of online homework. Instead we found that required users provided a significantly more positive response than not-required users. Possibly the required group contained students who would not normally have chosen to use the online homework tool, but when they did use it (because it was required) found it to be a beneficial or enjoyable experience.

We found in our earlier study (Dillard-Eggers, et al., 2008) that online homework is an effective study tool that is associated with increased student performance. However, whether to require online homework or to make it optional may depend on the student and the type of class. In classes where intrinsic motivation is high, requiring online homework may not be necessary. These "good" students will do well by either choosing to use the online system or using other learning methods that are consistent with their own learning style. The system is unlikely to increase their motivation and may even keep the students from being pushed to their full potential (Peters et al., 2002; Tuckman, 1996). Courses in one's major or upper level courses would likely already have highly motivated,

interested students. By making the online tools available, you are allowing the motivated students to choose the learning methods that work best for them individually.

In classes where intrinsic motivation is low, the instructor may want to rely on more extrinsic motivators. Lower level or required courses outside one's major may be strong candidates for implementing an online homework requirement. Requiring online homework in these courses may encourage the "average" or "below average" student to engage in more learning acquisition tasks. As noted earlier, 12% of the students who were in the required group did not use online homework. So, it seems there will always be a segment of the student population who will not be motivated by online homework even if it is a course requirement. However, if online homework is required, some less motivated or high risk students may perform better because they will use the learning tool when they normally would not have chosen to do so. We expect that some portion of the 40% nonuser students in the not-required group could also have benefited from the extrinsic motivation had online homework been a course requirement.

Overall, we believe the key to enhancing student performance is to motivate students to increase their effort in the course. Online homework is one option to accomplish this and may be very beneficial for the less motivated, poorer performing students. However, individual differences among students and different learning styles must be considered. No one study tool will be best for all students or in all situations. Thus, faculty may want to incorporate more than one study method in the course requirements, or possibly give students a choice of a variety of study methods that allows them to match their preferences and learning styles.

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NOTES