Notes and Textbook Usage in Mechanics Courses

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Abstract

The majority of academic instructors provide a syllabus at the beginning of every semester with details about class structure, reading assignments, homework assignments, exam schedule, etc. Instructors assume that students will use the resources to prepare for class and as a guide for learning the course content. In reality, students sometimes read the textbook and typically only use the notes to complete assignments without reviewing them before class. These actions leave the instructor introducing the topics during normal class contact hours instead of discussing the topics because the students are not prepared to engage in the material and have in depth discussions. Several mechanics courses (statics, strength of materials, and dynamics) were taught as flipped courses over two years in a mechanical engineering technology program. The expectation of these courses was that students would come to class prepared and ready to ask questions. A survey was given to these students in order to determine when students used the notes and textbook for these types of courses compared to the same questions about traditional courses that were not taught in this flipped manner. The results show that students are more involved in preparation when the expectation is stated for these flipped courses. This paper will review these results and discuss areas for future work.

Introduction

Textbooks and class-notes are the materials that normally guide instruction and learning in post-secondary programs. Textbooks have a history of being used in all levels of education[1] where about 90 percent of all post-secondary courses rely on a textbook.[2] Research has been performed on textbook usage by students in psychology[2, 3] and hospitality and management.[4] The results from these studies varied and one researcher stated: "If students do not read the textbook, then it is difficult for students to obtain the benefits that instructors aim to provide with textbook selection."[2] Textbooks are a resource that many students tend to ignore or only use as deemed necessary.

Research on course notes has made a transformation over the last few decades. Research used to focus on provided lecture notes before lectures verses students taking notes without instructor provided lecture notes.[5] Results indicated that the benefit of note taking was having the notes to review and study at a later time. Now much of the research with course notes relates to the availability of online notes and how students use or access the notes.[6-11] This type of research is correlated with the research on flipped courses. A flipped course is defined as a course where students learn content outside of the classroom (online videos, reading, etc.) and class time is used for activities besides lecturing. Flipped courses have received a lot of attention in the past few years[12-14] because of the changing dynamics between instruction and learning in the college setting. Therefore the design of course notes is significantly changing when compared to previous course designs and research.

Many participants of this study have taken mechanics courses using a flipped design as explained in reference.[15] The notes for the class were online interactive pdf files with embedded audio and video that were provided to the students through a learning management system (LMS). The

homework was submitted online to the LMS and graded automatically. Class time was spent working on additional examples or homework problems with "one on one" assistance from the instructor. The classes used for this study were statics, strength of materials, and dynamics with research participants from a four year university and a state operated community college. An Institutional Review Board (IRB) from both the four year university and the community college gave permission to solicit students in order to obtain the data. Appendix A provides a sample of the specific questions used in the survey. This paper will review these results.

Results

There were 31 students from the four year university that participated where 20 of these students were traditional and 11 were non-traditional. Non-traditional students were defined as a student that started a degree program more than two years after completing high school. On average, this student population works at least 10 to 20 hours per week with only 4 of the students not having any part-time position. Twenty-eight of the students had participated or were participating in at least one flipped course. The 3 students that had not participated were non-traditional students that had taken the mechanics courses prior to the implementation of the mechanics courses being taught as flipped courses as described in reference.[15] There were 8 students from the community college that participated where 5 of those students were traditional and 3 were non-traditional. On average, the community college students work 20 to 30 hours per week with only 1 of the students not having any part-time position. Seven of these students said that they had participated or were participating in a flipped course. All of the students were part of a flipped coursed that was implemented similar to the course of reference.[15]

The first analysis was with respect to the flipped courses. All survey questions can be seen in Appendix A and the students were instructed to mark all of the answers that apply. The questions asked were, when do you typically view the online flipped notes and when do you read the textbook for the flipped course? The available survey response answers were: never, before the assigned class, after the assigned class, before starting homework, when I don't understand homework, and before exams for review. Table 1 shows the results of these questions where the column headings are shortened versions of the survey response answers. The results are the percentage of students that chose that survey response and the percentages for the flipped courses do not include the 4 students that stated they had not taken a flipped course. The data shows that a majority of the students do not use the textbook until they have difficulties with the homework. Six percent of the students stated that they never used the textbook in a flipped course.

Table 1. Percentage of students that use the online notes or the textbook in a typical week for a flipped course.

	Never	Before Class	After Class	Before HW	HW difficulties	Before Exams
Online Notes	0	57	25	64	53	50
Textbooks	6	11	11	25	75	28

The second analysis reviewed the same questions for traditional courses. The available survey response answers were identical to the questions used for the flipped course. Table 2 shows the results of these questions as percentages and includes the responses from all 39 participants. The

results show that the use of notes before class drops significantly and 5 percent of the students never review the notes. The textbook usage increases for traditional courses slightly, but the majority of the increase is for students preparing to do homework where there is a 16 percentage point increase.

Table 2. Percentage of students that use the online notes or the textbook in a typical week for a traditional course.

	Never	Before Class	After Class	Before HW	HW difficulties	Before Exams
Notes	5	26	26	51	51	56
Textbooks	8	21	21	41	62	33

The third analysis was to search for differences between the traditional and non-traditional students in the flipped courses for the same questions. Table 3 shows the percentages of Table 1 separated between the traditional students and the non-traditional students. This table shows that the results for the traditional students do not change significantly except that the use of the online notes before class drops. The opposite is true for non-traditional students in that they review the online notes before class for a flipped course. Non-traditional students use the textbook at a much lower rate than traditional students in a flipped course except to assist with homework difficulties.

Table 3. Percentage of students that use the online notes or the textbooks in a typical week for a flipped course where the data for traditional and non-traditional students are differentiated.

	Never	Before Class	After Class	Before HW	HW difficulties	Before Exams
Traditional						
Online Notes	0	44	28	72	60	56
Textbooks	8	16	12	28	72	36
Non-Traditional						
Online Notes	0	82	18	45	36	36
Textbooks	0	0	9	18	82	9

The forth analysis was to search for differences between the traditional and non-traditional students in traditional courses for the same questions. Table 4 shows the percentages of Table 2 separated between the traditional students and the non-traditional students. These results again show that the data for traditional students does not change significantly. The use of notes or the textbook for non-traditional students shifts to times after the class covering the material.

Discussion

The results here show that non-traditional students are more likely to use the class-notes of a flipped course before class if the expectation is the notes will not be reviewed during class. The textbook usage for these flipped courses fall for both traditional and non-traditional students. The textbook usage for non-traditional students in flipped courses is almost zero until they have problems with the homework. Another key point in the data is that almost all students use the

online notes at some point during the week for their courses. This data point shows that the students do believe that the class-notes are useful and need to be reviewed.

Table 4. Percentage of students that use the online notes or the textbooks in a typical week for a traditional course where the data for traditional and non-traditional students are differentiated.

	Never	Before Class	After Class	Before HW	HW difficulties	Before Exams
Traditional						
Online Notes	4	32	20	56	60	64
Textbooks	4	16	16	32	68	44
Non-Traditional						
Online Notes	7	14	36	43	36	43
Textbooks	14	29	29	57	50	14

Conclusion

The results show that non-traditional students will review notes before class if there is an expectation that the notes are required. Traditional students will sometimes review the notes before the class, but will review them sometime during the learning process. Textbooks are typically used to assist with homework assignments by the non-traditional students. Therefore, flipped courses seem to be an ideal learning environment for non-traditional students as the instructor will be able to have more meaningfully engaged class discussions as these students come to class prepared.

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Appendix A: Survey Questions

1) **What is your grade level?**

Freshman Sophomore Junior Senior

2) **What gender are you?**

Male Female

3) **Are you a transfer student?** *(A student that did not start college at your current school)*

Yes _____(previous school) No

4) **How many credit hours are you currently enrolled?**

1-3 4-6 7-9 10-12 13-15 16-18 > 18

5) **Are you a traditional or non-traditional student?** *A traditional student is defined as a student that started a degree program within two years after completing high school and a non-traditional student is defined as a student that started a degree program more than two years after completing high school.*

Traditional Non-Traditional

6) **How many hours of paid employment do you typically work in a week in a position associated with your degree?**

not employed 0-10 10-20 20-30 30-40 > 40

7) **How many hours of paid employment do you typically work in a week in a position that is not associated with your degree?**

not employed 0-10 10-20 20-30 30-40 > 40

8) **Have you taken or are you taking a college course where lecture notes are recorded online and available before class** *(called flipped or inverted class)***?** *If you answer no, skip to page 4.*

Yes No

9) **How many flipped courses have you taken while in college** *(include courses you are currently taking)***?**

1 2 3 4 5 > 5

10) When do you typically view the online notes that are available in the flipped courses? *(circle all that apply)*

Never | Before the Assigned Class | After the Assigned Class

Before Starting Homework | When I Don't Understand Homework | Before Exams for Review

11) What parts of the online notes do you typically view? *(circle all that apply)*

None | Some Video Examples | All Video Examples | Some Audio Slides | All Audio Slides

12) When do you typically read the textbook when taking flipped courses? *(circle all that apply)*

Never | Before the Assigned Class | After the Assigned Class

Before Starting Homework | When I Don't Understand Homework | Before Exams for Review

13) What parts of the textbook do you typically read when taking flipped courses? *(circle all that apply)*

End of Chapter Problems (*excluding assigned homework*) | Worked Examples | None | Concept Explanations (*text in the chapter that explains the material*)

14) When do you typically view class notes that are available in traditional courses? *(circle all that apply)*

Never | Before the Assigned Class | After the Assigned Class

Before Starting Homework | When I Don't Understand Homework | Before Exams for Review

15) When do you typically read the textbook when taking traditional courses? *(circle all that apply)*

Never | Before the Assigned Class | After the Assigned Class

Before Starting Homework | When I Don't Understand Homework | Before Exams for Review

16) What parts of the textbook do you typically read when taking traditional courses? *(circle all that apply)*

End of Chapter Problems (*excluding assigned homework*) | Worked Examples | None | Concept Explanations (*text in the chapter that explains the material*)