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Engage Engineering Students In Homework: Attribution Of Low Completion And Suggestions For Interventions

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ABSTRACT

Homework is an important out-of-class activity, crucial to student success in engineering courses. However, in a first-semester freshman engineering course, approximately one-fourth of students were completing less than 80% of the homework. The purpose of this study was to examine students' attribution of their low completion of homework and suggest corresponding interventions to help students with different attribution types. A qualitative approach was applied using semi-structured interviews for data collection. The interviewees were students who were on track to complete less than 80% of the homework. Students in the study attributed their low rates of completion to multiple factors. We coded and summarized students' attributions of homework incompleteness according to Weiner's attribution theory and suggested corresponding interventions for students with different attribution types. Results show that most students attributed their failure to complete their homework to external reasons rather than internal reasons. A large portion of student's attributions for low homework completion was due to poor time management skills. Some students attributed low homework completion to unstable factors such as illness, transition, or adjustment problems. A small portion attributed low homework completion to uncontrollable reasons, such as sickness and homework difficulty. Students' reasons for homework incompleteness varied across the three dimensions of Weiner's attribution theory suggesting that a variety of intervention techniques is required. In addition to use of widely adopted interventions such as first year seminars, tutoring, and tutorial sessions, intervention techniques based on attribution theory may be necessary to employ, to help students avoid negative emotional and behavioral consequences of homework incompleteness.

Keywords: Attribution; Motivation; First Year Students; Homework

INTRODUCTION

 Engaging in homework assignments is one of the most important parts of students' out-of-class learning. It is a critical avenue for deepening students' understanding of in-class knowledge, it helps students build their own knowledge system, and in general, homework contributes to overall academic success (Cooper, Robinson, & Patall, 2006; Vatterott, 2009). While participation in homework has been shown to have positive impacts on learning, many educators have difficulty in getting their students to complete assigned homework problems. Research on academic motivation has provided several interventions for encouraging students to complete homework assignments, but this research does little to highlight the reasons why students perform at different levels of homework completion rates in a particular course or to suggest which interventions are most appropriate for these different reasons. This paper discusses a qualitative research study that sought to understand the reasons why students do not complete homework assignments. Using attribution theory as a guiding framework, this study sought to understand the student-defined reasons that lead to homework incompleteness in order to better define intervention strategies aimed at these factors.

LITERATURE REVIEW

Homework and Learning

It is well documented that completing homework is an effective way to facilitate students' understanding of course content and to increase students' performance in end-of-course exams. For example, consistent positive correlations were found between students' completion of homework and their academic achievement from elementary school (Vatterott, 2009), high school (Maltese, Tai, & Fan, 2012), and into college (Arasasingham, Martorell, & McIntire, 2011; Rawson & Stahovich, 2013). Researchers have also found that students learn differently when working on homework compared to studying for course exams (Leinhardt, Cuadros, & Yaron, 2007). This is due to the spaced effect of working on homework assignments throughout the duration of a course versus the limited nature of exam study right before an exam. The benefits of homework completion are not limited to classroom performance alone. Richards-Babb, Drelick, Henry, and Robertson-Honecker (2011) have shown that students who engage in completing the assigned homework for a course also develop more effective study skill strategies that are valuable for subsequent courses. Conversely, an improvement in study skills has also been linked to an improvement in the quality of homework attempted by students (Ramdass & Zimmerman, 2011). Therefore, the process of engaging students in doing their homework can be seen as a cyclical process, where students gain skills by doing their homework and these skills in turn improve students' ability to successfully complete homework.

It is important to note that not all types of homework assignments are the same. The types of homework problems assigned will be specific to the content presented in a particular course. For example, there is a diverse range of types of first year engineering programs. Types of programs include engineering design, exploration of the engineering profession, global interest topics, and engineering specific scientific topics, just to name a few (Reid & Reeping, 2014). As the course in question for this paper focuses on engineering specific scientific topics, and more specifically, engineering physics, we provide a brief summary of the types of problems assigned for homework in these types of courses.

Engineering-specific scientific courses are designed to solve different types of problems. Problems range from puzzle problems to well-structured problems to ill-structured problems (Jonassen, 1997). Puzzle problems are typically defined as decontextualized problems that have one correct answer and one solution path to that answer. They require an algorithmic process in order to come to a solution. Well-structured problems are defined as problems that present a certain context, have all elements of the problem defined, and are seeking a specific answer with very few possible solution processes to the final answer. Well-structured problems have possible-knowable solutions and have a preferred, prescribed solution process. Finally, ill-structured problems are situated with a certain context, having many pieces of information missing needed to come to a solution, and do not have one defined answer or solution process. With ill-structured problems, multiple paths and solutions would be appropriate based on assumptions made by the solver and there are multiple criteria for evaluating the final solution presented. As each of these types of problems are distinctly different and engage students in different ways, we can assume that the challenges that students might face when completing these different types of problems might be different. The current study focuses on well-structured problem homework assignments.

Even with the defined benefits of homework completion and learning, many educators struggle to encourage their students to complete homework assigned for courses. Researchers and educators have tried many methods to entice students to complete more homework assignments. For example, C. S. Ryan and Hemmes (2005) investigated the effects of a contingency on homework completion. In Ryan and Hemmes's (2005) study, they informed students that some homework assignments would be graded, and some homework assignments would not be graded. A quiz was given after each homework assignment to assess the learning of the student participants. They found that students performed better on quizzes where the homework assignments were graded than on quizzes where homework assignments were not graded. Therefore, they concluded that grading of homework assignments is not only an effective way to encourage students to complete their homework but also an effective method for increasing learning. In another study conducted by Akioka and Gilmore (2013) self-determination theory (R. M. Ryan & Deci, 2000b) was used to design a homework system that:

1. Gave students the freedom to choose the homework problems they would work on
2. Provided extended feedback on assignments to build competence
3. Provided more interaction between teacher and student to build relatedness

The results of the intervention showed no decrease in motivation to complete homework over the course, which they consider a success as the intervention protected students from losing motivation over the course of the term.

Setting the context of the current study, the Engineering Fundamentals Program (EFP) is a common-first-year engineering program for all entering engineering students at the University of Tennessee in Knoxville. While in EFP, all students take two semesters of engineering-based physics. A subset of students also take two different introductory programming courses through EFP. The engineering physics courses have a typical enrollment of 500-650 students in each major semester. The course is organized such that:

1. All students attend a common lecture where faculty present the physics conceptual material and work example problems,
2. Smaller sections of students meet with graduate teaching assistants to work sample problems and complete hands-on laboratory experiments,
3. All students complete individual homework assignments through an online homework system and
4. Teams of students complete several engineering design projects throughout the semester.

As the completion of homework is the focus of this research study, we next discuss the homework requirements for the course.

A customized, web-based homework system was used for the classes (Schleter & Bennett, 2006). This system provides individualized homework (Goulet, 2010); each student has the same problem but different parameters. All assignments have multiple parts, and answers for each part can be submitted separately. Each part has a 2% penalty for each incorrect answer submitted. A bonus system was used (Bennett, Schleter, Olsen, & Guffey, 2012; Schilling, 2010) whereby students can earn a 10% bonus for all homework completed more than 24 hours in advance of the due date. A late penalty decreases linearly from 0% penalty to 25% penalty over the first 48 hours after the homework was due. The penalty remains at 25% through the module and then increases to 50% after the end of module until the end of the semester.

Resources were provided for students who needed help with their homework, including a discussion board, student-led help sessions, and Supplemental Instruction (group tutoring) (Arendale, 1994). The discussion board is available 24 hours-a-day and can be used by all students, graduate assistants and faculty. The discussion board was monitored for several hours in the evenings on which homework was due. The student-led help sessions were evening sessions in the engineering building where teaching assistants helped students who had problems with homework. The Supplemental Instruction sessions were provided through a partnership between the College of Engineering and the university's Student Success Center.

Since initiated, the homework bonus system has resulted in over half of the homework being completed within the bonus time (Bennett et al., 2012). The largest positive effect of the bonus was on the lowest 20% of the class in terms of exam scores. There was a 22% increase in homework completion in this group. However, there remain almost 25% of the students who are not fully engaged in completing homework, which is defined as not completing at least 80% of the homework. Historical data has shown that students who complete at least 80% of the homework have a 97% pass rate, while students who complete less than 80% of the homework have a 33% pass rate (Bennett, Li, Schleter, & Guffey, 2013).

Though there have been numerous interventions conducted to increase homework completion among students, researchers have also focused on an underlying factor that can cause students to complete more or less homework in a course: motivation.

Homework Completion and Student Motivation

Significant research has focused on the impact of student motivation on homework completion. Research on homework completion and academic motivation has primarily focused on the areas of intrinsic and extrinsic motivation and self-regulated learning (Bembenutty & White, 2013; Bembenutty & Zimmerman, 2003; Ramdass & Zimmerman, 2011).

Intrinsic motivation is defined as a desire to do some activity because it is enjoyable, while extrinsic motivation is the desire to do some activity because it will produce an outcome or reward (R. M. Ryan & Deci, 2000a). Several researchers have found that students with a higher level of intrinsic motivation tend to be more actively engaged in homework (Bembenutty & Zimmerman, 2003; Xu, 2005). Theory would suggest that improving a student's intrinsic motivation toward homework would improve homework completion, it follows that helping students develop a sense of self-directed learning is efficacious. Self-regulated learning (SRL) is defined as the "self-directive processes and self-beliefs that enable learners to transform their mental abilities...into an academic performance skill..."(Bembenutty & Zimmerman, 2003). In their study on SRL and homework completion, Bembenutty and Zimmerman (2003) found that students who engaged in SRL strategies were better able to complete their homework assignments, which in turn correlated to higher performance on exams and final course grades.

While theoretical research in intrinsic and extrinsic motivation as well as self-regulated learning has helped us understand the rationales for tools and incentives to increase homework completion, these frameworks do not help us understand the complexity, the different internal and external factors that students see as important determining factors for making decisions about homework completion in a course. In order to investigate these internal and external factors, we turn to the framework of attribution theory.

Students' Attribution on Homework Incompletion

Causal attribution theory is one of the major motivation paradigms, proposed by Heider (1958) and developed by Weiner (1985). Causal attribution theory incorporates cognitive theory and self-efficacy theory (Bandura, 1977) to explain how students attribute the factors of success and failure that may influence their expectancy for their future and their motivation, which in turn contributes to the amount of effort they put into academic activities.

According to Weiner's (2010) attribution theory, causal attributions have three dimensions: loci of causality, stability, and controllability. The locus of causality differentiates attributions as internal (e.g., frustration) or external (social activities). Stability differentiates stable (e.g. ability) and unstable (illness) reasons. Controllability identifies whether the outcome is due to controllable factors (e.g. overload of coursework) or uncontrollable factors (difficulty of homework). Additionally, Weiner (2010) proposed four factors related to attribution theory: ability, task difficulty, effort, and luck. Ability is an internal and stable factor over which the students do not have much control. Task difficulty is an external and stable factor that is out of students' control. Effort is an internal and unstable factor, which depends on students' control. Luck is an external and unstable factor, over which students have little control.

One major difference between attribution theory and other motivation theories is that attribution theory relates attribution dimensions and factors to emotional states. For example, Weiner (1985) found that internal success attribution will result in pride while internal controllable attribution will result in guilt and regret. Stable attribution of failure will result in hopelessness while unstable attribution will result in hope. Controllable attribution of failure will result in guilt and shame. A number of studies have investigated emotion in relation to students' completion of homework (e.g., regulation of emotions, (Xu, 2005; Xu & Corno, 2006); affective components of attitudes, (Cooper, Lindsay, Nye, & Greathouse, 1998); emotional experience, (Goetz et al., 2012)). From this research, it is reasonable to assume that how students attribute their reasons for their completion level of homework will influence their emotions and will affect their effort level on homework in the future.

In the present study, we are interested in students' perception of homework incompletion factors and seek to answer the following research question:

What reasons do students identify for low homework completion in a first year engineering course?

RESEARCH METHODS

Study Design

In order to answer the research question, a qualitative study was conducted using semi-structured interviews as the primary method of data collection. Semi-structured interviews differ from fully structured interviews, which have a rigorous set of questions and do not allow for deviation from the interview protocol; semi-structured interviews provide more flexibility for the interviewers to ask probing questions in order to gain deeper understanding about topics of interest (Given, 2008). The interviewer has the flexibility to ask questions out of order and to ask probing questions based on the responses participants provide during the interview.

Interview Protocol Development

The interview protocol for this study was developed by members of the research team in a collaborative and iterative effort. It consisted of a set of 20 questions that was developed to ask general questions about homework participation in the course. The interview protocol development was informed by the theoretical framework for this study. The developed interview protocol includes questions related to students' perceptions of homework and the course, students' processes of doing homework, and perceived barriers in the process of completing homework. Sample interview questions included:

- *Sometimes “things happen” in a semester that make it difficult to get tasks accomplished or to focus on studying. Would you say that you have experienced personal circumstances that have interfered with completing homework assignments this semester? If so, explain.*
- *What are some other types of circumstances that have made it difficult for you to complete your homework?*
- *Is there anything about the classroom instruction that influences your ability to complete the homework?*

Participants

Participants for this study included first-year engineering students at the University of Tennessee. The specific population for this study included students who did not consistently complete homework assignments in a first-year engineering course. Students were recruited for this study based on their percentage of completed homework assignments throughout the first half to two-thirds of the semester. In semester 1, students were invited to participate in the study if they had a low completion rate (less than 80%) on at least 5 out of the first 21 homework assignments. In semester 2, students were invited to participate in the study if they had low completion rate (less than 80%) on at least 3 out of the first 12 homework assignments. As homework participation decreases over the semester, these students were on track to complete less than 80% of the homework in the entire semester, and thus had a much lower chance of passing the course. The cutoff for inviting students for interviews was partly determined to obtain a sufficient sample size. Students were recruited through an email that briefly introduced the purpose of the interview and invited the students to schedule an interview time with the Graduate Research Assistant. The email also indicated that all the participants would receive extra credit if they participated in an interview. There were 78 students in semester 1 and 48 students in semester 2 who were invited to the interview, with a total of 30 students agreeing to participate. The course instructors were not involved in the interviews, and the interviews were conducted in a neutral location, away from the engineering campus.

Among the 30 students, only 3 students were females while the other 27 were males. The largest majority of participants were Caucasian (67%), and all participants were in an age range of 18-29. The education levels of students' parents varied from elementary school to PhD, with 47% of the mothers and 40% of the fathers having college degrees or above. Finally, 30% of the participants were first generation college students.

Procedure

The recruitment process started with identifying students who have problems in completing homework. Students who agreed to the interview would set up the interview time and schedule with the researchers through email. Students

signed the interview consent form at the beginning of the interview to allow the research team to view the interview transcripts.

The duration of the interviews was 30 to 60 minutes. All interviews were recorded and extensive notes were taken by the interviewer. The recorded interviews were transcribed and reviewed for accuracy. Interview transcripts were imported into Nvivo qualitative data analysis software.

Data Analysis

The research team derived and refined the categories in an iterative way based on the narratives. Then, the research team applied the attribution theory framework to summarize and categorize the major research findings on students’ perceived barriers of completing homework. Open coding using *a priori* codes from the theoretical framework was used to initially identify student-described behaviors within the categorization scheme provided by the framework. Axial coding was then applied to understand themes within the *a priori* codes.

Coding validity and reliability were assured through team review and consensus building (Shenton, 2004). In addition, the following methods were used to ensure the trustworthiness:

- Building familiarity with the culture of participating organizations. The lead researcher was the research assistant of the program, reviewed the related program materials, and made several visits to the program buildings.
- Proper management of the interviews by explaining the research purpose and asking clear questions.

RESULTS

During the interviews, students were asked about personal problems that they identified as having interfered with their ability to complete the homework. In the majority of quantitative studies applying Weiner’s attribution theory, surveys were used to investigate individuals’ attribution on four basic aspects: ability, task difficulty, effort, and luck (e.g., Wolters, Fan, & Daugherty, 2013; Schatt, 2011). Developed differently from quantitative studies, qualitative studies often ask about a variety of attribution types beyond the four basic types (Dunn, Osborne, & Rakes, 2013). Students in our study also discussed ability, effort, and task difficulty as reasons that interfered with their homework completion. Any discussion of luck contributing to homework incompleteness was not present in this study. Similar to other qualitative studies, we also categorized various types of attributions, summarized in Table 1, based on Weiner’s (2010) attribution theory. Students’ attribution of homework incompleteness can be described by Weiner’s (2010) three dimensions and falls into 8 possible categories.

Table 1. Students’ Attribution Categories Based on Attribution Theory

	Internal		External	
	Stable	Unstable	Stable	Unstable
Controllable	<ul style="list-style-type: none"> • Lack of time management skills 	<ul style="list-style-type: none"> • Laziness (effort) 	<ul style="list-style-type: none"> • Part-time job (fixed schedule) • Social activities • Overload of coursework • Routine family responsibilities 	<ul style="list-style-type: none"> • Part-time job (flexible schedule)
Not Controllable	<ul style="list-style-type: none"> • High school physics knowledge • Easily distracted 	<ul style="list-style-type: none"> • Illness • Stress or frustration • Transition or adjusting 	<ul style="list-style-type: none"> • Church • Fraternity • Difficulty of homework • Late classes 	<ul style="list-style-type: none"> • Non-routine family responsibilities • Death of pets

External Versus Internal Attribution

Most students in our study attributed their failure to complete their homework to external reasons rather than internal reasons. Some students reported that they had a part-time job, which took their time and effort away from homework, saying:

“I have 4 classes and I have two jobs right now”

“Well they consider it part-time but yeah I work that, I was working that much and I have cut it down (time on study homework).”

Others reported family responsibilities along with part-time job load, which distracted them from homework, quoting:

“I said before, my mom got dismissed from her job and my father is disabled, I had to end up picking up a job ... so this is actually my first semester having a job and school so it's kind of getting a little difficult balancing the two I suppose.”

Some other students attributed to external distractors such as social activities:

“I always have a busy schedule, I'm doing a fraternity too so...”

“UT Men's Choir”

Our findings were consistent with Dunn et al.'s (2013) study that the majority of the students attribute their academic success to internal factors such as effort but attribute failures to external reasons. Reviews by Miller and Ross (1975) and Zuckerman (1979) suggested that individuals tend to make internal attributions for success and make external attributions for their failures. According to those authors, people prefer to associate their success with personal effort while ignoring personal behaviors and the co-occurrence of failures. Because we were asking interview questions about students' incompleteness of their homework, it was understandable that students in our study were more likely to make external attributions.

When taking a closer look at students' external attributions, we found that a significant portion of students' attribution for the low homework completion was actually due to poor time management skills. For example, students who reported that part-time job and social activities took up their time and effort on homework study might have prioritized different tasks and found the balance between study and work/life. Students who discussed their family responsibilities might examine their time management skills and how to plan their roles and responsibilities as students and family members. For some students, increased external supports might be advisable.

Educators, such as the instructors for these engineering courses, try to provide students with multiple sources of class support such as open office hours and discussion board forums. But instructors also struggle with students, especially the ones who have low homework completion, who rarely made use of these resources. If students attribute their low homework completion to internal, controllable, and unstable reasons such as time management skills, they will likely take different approaches to improve their skills, therefore improving their homework completion behaviors. It is possible that those students who had external attributions (regardless of whether those are controllable or not) are only concerned about external factors and will ignore the useful resources that are designed to assist with homework completion. In short, there is some disconnection among students' perceived need for help (and willingness to acknowledge these needs) and the help that educators are providing. Our study provides a venue for educators to understand students' perceived needs in improving their homework study and thus targeted interventions could be developed to meet students' needs. These results also give instructors new ways to start conversations with students, by understanding student perspectives and asking students to examine their own attributions.

Stable Versus Unstable

Weiner (2010) proposed that stability dimensions were most pertinent to individuals' expectancy shifts (Weiner, 1985, 2010; Weiner, Russell, & Lerman, 1979). If a student attributes their failure to stable factors such as personal ability, they would have a hopeless emotional response and their motivation for success at a later time would decrease (Hareli & Weiner, 2002). Ability is closely related to self-efficacy proposed by Bandura (1977) as people's beliefs about their capability to reach a certain level of achievement. Such beliefs determine how people feel, think, and motivate themselves. In contrast, if students attribute their failures to unstable reasons such as personal effort, their motivation for later success will not be decreased. Students will think the failure is temporary and they are more likely to engage in adaptive behaviors given the belief that they could achieve success in the future by increasing personal effort or better adjusting to a new environment.

In our study, there were students who attributed their failures to unstable factors such as illness, transition, or adjustment problems at the beginning of college life. Many interviewees discussed their problems adjusting to the college environment, noting factors such as larger class sizes and living away from their families. One student said that:

"I'm not used to having all of this hard stuff at once and I'm not very well at adjusting."

Another student reported:

"[T]his is my first full semester here at [UT]... I miss[ed] classes at the beginning of the semester because I didn't know where to park, stuff like that."

We also had students who attributed their low completion of homework to stable reasons such as poor high school physics knowledge:

"I don't have much of a background in physics so that was, that was honestly the main reason".

Even though personal ability is considered a stable and uncontrollable reason under Weiner's (2010) attribution theory, some researchers argue that it could be improved and changed (Dweck, 1986; Folmer et al., 2008). In our study, high school physics knowledge cannot be changed—unless special, pre-college programs were set up or some other "bridge" opportunities were developed, but we can encourage students to spend more time out-of-class attending help sessions and online discussion forums to enhance their knowledge in the course content areas.

Controllable Versus Uncontrollable

According to Weiner (2010), if a student perceives the cause of their academic failure as controllable reasons, they are more likely to change the current situation. For example, both lack of personal effort and sickness are internal and unstable causes for failure, but personal effort is more controllable than sickness. A student will likely devote more time and work harder to overcome failure but less likely to overcome sickness such as flu. Only one out of the 30 interviewed students attributed the low homework completion to lack of personal effort. The student said that:

"I got lazy with some of this homework and I didn't do it."

Several students attributed their homework incompleteness to lack of time management skills. Students talked about multiple activities interfering with their homework study activities, and they explicitly explained that they were not able to perform multiple tasks well because of poor time management skills.

"Because I'm in orchestra and so some of the activities conflict with me doing my homework and studying and just my poor time management skills."

"I guess work, like, work that I do for my professors, that's not personal problems. That would fall under time management."

A small portion of interviewed students attributed low homework completion to uncontrollable reasons such as sickness and homework difficulty. One of the students told the researcher that:

“I got sick also all in like a short period of time and so I started not being able to keep up with my subjects and my homework started going down the drain.”

Some other students complained about homework difficulty. One said:

“[A]t the beginning it wasn't too hard but then towards the end the problems seemed to get harder.”

Two students talked about the stress and depression completing homework. One student said:

“It's not that I lost my confidence, it's that it's so confusing, like I don't understand anything and it doesn't register like at all.”

Another student believed that “*depression demotivated*” himself.

It is expected that students who attribute the academic failure to controllable causes such as lack of effort or time management skills would be more likely to work harder to achieve in the future. Our homework bonus policy also proved to be an effective approach to increase students' personal effort at academic study (Bennett et al., 2013). Instructors could also consider other ways to improve students' time management and motivation to engage more in homework study. Encouraging students to learn time management skills is one possibility. Developing self-regulated learning skills is another possibility. While one delivery method for skills training is a first year studies course, engineering students could access training and support in time management and self-regulation in other ways. Performance monitoring and performance review are both aspects of self-regulation skills that could be addressed within a course (Zumbrunn, Tadlock, & Roberts, 2011). Instructors, the authors suggest, could add prompts for students to self-regulate during the course by setting goals and planning (Gollwitzer, 1999; Pintrich, 1999), require students to track their own time-on-task (Zimmerman, 1986) and add other self-evaluations. Self-evaluation options include “exam wrappers” after major tests, short reflection assignments, and CATS (classroom assessment techniques) (Ahmad, 2011; Angelo & Cross, 1993; Whitley & Parton, 2014).

We also saw that some students attributed their low homework completion to uncontrollable reasons such as homework difficulty, sickness, and transition problems. If the uncontrollable reasons are external and unstable, it is acceptable for students to maintain their level of effort because their motivation and confidence for success in the future probably would not change. However, students who believe the homework was too difficult to finish probably will become stressed and depressed, and this then likely will decrease their future efforts. In fact, during our interview, we asked all interviewees to rate the difficulty of the homework and students generally considered homework as a medium to difficult task rating difficulty from 5-7 on a 10 point scale with 10 as the most difficult. We believe that it is necessary to help this small group of students who thought the engineering homework was too difficult, by encouraging individual instruction. This can be done through help sessions, tutoring centers, and supplemental instruction. Researchers have found that the use of supplemental instruction (SI) either through mandatory attendance, very convenient (right after class) hours and places, or web-based SI are effective approaches to help student learning (Hodges, Dochen, & Joy, 2001; Tinto, 2012).

SUMMARY AND CONCLUSION

In our study, students discussed different reasons for not completing their homework. These reasons, according to Weiner's (2010) attribution theory, were divided into different categories. It is well documented in the literature that attributions have both psychological and behavioral consequences (Weiner, 2010; Wolters, Fan, & Daugherty, 2013). Attributions impact students' expectation of future success and emotions associated with later successes. Attributions can also be predictors of students' future effort on tasks, students' persistence in studying, students' choice to stay in the major/college, and procrastination. Students who attributed low homework completion to personality and lack of physics knowledge (internal, stable, uncontrollable attribution) are less likely to be motivated to study for the subsequent homework. In contrast, students who attributed low homework completion to lack of effort (internal,

unstable, controllable attribution) are more likely to devote more effort (e.g., studying, attending help sessions, etc.) given the belief that these will result in better homework performance.

We interviewed 30 engineering students who completed less than 80% of their first year engineering course homework and asked their identified reasons for low completion of homework. We coded and summarized students' attributions of homework incompleteness according to Weiner's attribution theory and suggested corresponding interventions for students with different attribution types. Students in the study attributed their low rates of completion to multiple factors: most students attributed their failure to complete their homework to external reasons rather than internal reasons. A large portion of student's attributions for low homework completion was due to poor time management skills. Some students attributed low homework completion to unstable factors such as illness, transition, or adjustment problems. A small portion attributed low homework completion to uncontrollable reasons, such as sickness and homework difficulty.

While our study focused on summarizing students' attributions of their homework incompleteness, we were also interested in how students with different attribution styles can be helped. Along with the analysis of students' attributions on low homework incompleteness, we proposed some approaches widely adopted in higher education such as the First Year Seminar and Supplemental Instruction. We also acknowledge the importance of alternating maladaptive attribution such as internal, stable, and uncontrollable attribution to avoid the negative emotional and behavioral consequences associated with those attributions. It is documented in the literature that Attributional Retraining (AR), a psychotherapeutic cognitive treatment, is one of the effective intervention approaches (Haynes, Daniels, Stupnisky, Perry, & Hladkyj, 2008). AR is based on Weiner's (1985, 2010; Weiner et al., 1979) attribution theory and is gaining ground in the area of higher education. It is designed to alternate students' attributions and encourage students to attribute their failure to internal, unstable, and controllable reasons. The underlying assumption is that changes in attribution for poor academic performance will result in increases in motivation to engage in academic study, which eventually will help improve students' academic performance. The AR intervention includes two components: AR induction and AR consolidation (Haynes et al., 2008). Students will watch videos about the relationship between attribution and academic performance first (AR induction) and learn how to switch from internal, stable, uncontrollable attributions (e.g., ability) and to internal, unstable, controllable attributions (e.g., lack of effort) (AR consolidation). Typically, in the AR induction videos, students will be able to observe undergraduate students discussing how academic performance can be affected by attribution. Following the video, students will learn from a presentation or handout about types of attribution. In this resource, students will see two lists of attributions for poor academic performance. One of the lists will show internal/stable/uncontrollable attributions and the other will show contained examples of internal/unstable/controllable attributions. The presenter will then explain how those internal/stable/uncontrollable attributions can be changed into internal/unstable/controllable attributions. Lastly, students will learn how to apply this approach by completing writing assignments about their own attributions and potential changes for maladaptive attributions.

The AR intervention approach has been substantiated to be an effective approach to increase college students' motivation in academic study (Wilson, Damiani, & Shelton, 2002). Wilson et al. (2002) reviewed the studies applying AR approach in higher education and summarized the impact of AR on students' academic outcome. We believe it will be especially useful to help students who have maladaptive attribution approaches, i.e., students who attribute low homework completion to stable and/or uncontrollable reasons. Implementing AR intervention to help students with maladaptive attribution schemas will be one of the next steps/future studies.

In summary, our study provided a way to understand first year engineering students' various types of attribution for low homework completion. The findings will provide insight to engineering educators (i.e., first year engineering course instructors) about why certain interventions are not effective and develop customized intervention for students who have different types of attribution. Furthermore, based on our findings, we proposed an intervention approach, Attribution Retaining, to help adjust students' maladaptive attribution schemas and this will be the follow-up of the present study.

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REFERENCES

- Ahmad, K. (2011). Facilitating student learning in science education by using POGIL (Process Oriented Guided Inquiry Learning) and CATS (Classroom Assessment Techniques). *The FASEB Journal*, 25(1 Supplement), 672.678-672.678.
- Akioka, E., & Gilmore, L. (2013). An intervention to improve motivation for homework. *Australian Journal of Guidance and Counselling*, 23(01), 34-48.
- Angelo, T. A., & Cross, K. P. (1993). *Classroom assessment techniques : A handbook for college teachers*. San Francisco: Jossey-Bass Publishers.
- Arasasingham, R. D., Martorell, I., & McIntire, T. M. (2011). Online homework and student achievement in a large enrollment introductory science course. *Journal of College Science Teaching*, 40(6), 70.
- Arendale, D. R. (1994). Understanding the supplemental instruction model. *New Directions for Teaching and Learning*, 1994(60), 11-21.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191.
- Bembenuity, H., & White, M. C. (2013). Academic performance and satisfaction with homework completion among college students. *Learning and Individual Differences*, 24, 83-88.
- Bembenuity, H., & Zimmerman, B. J. (2003). The relation of motivational beliefs and self-regulatory processes to homework completion and academic achievement.
- Bennett, R. M., Li, W., Schleter, W., & Guffey, S. (2013). *Characteristics of students who do not do homework*. Paper presented at the ASEE Annual Conference, Atlanta, GA.
- Bennett, R. M., Schleter, W., Olsen, T., & Guffey, S. (2012). Effects of an early homework completion bonus. Paper presented at the Proceedings, *ASEE Annual Convention*, Paper AC.

- Cooper, H., Lindsay, J. J., Nye, B., & Greathouse, S. (1998). Relationships among attitudes about homework, amount of homework assigned and completed, and student achievement. *Journal of Educational Psychology, 90*(1), 70.
- Cooper, H., Robinson, J. C., & Patall, E. A. (2006). Does homework improve academic achievement? A synthesis of research, 1987–2003. *Review of Educational Research, 76*(1), 1-62.
- Dunn, K. E., Osborne, C., & Rakes, G. C. (2013). It's not my fault: Understanding nursing students' causal attributions in pathophysiology. *Nurse Education Today, 33*(8), 828-833.
- Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist, 41*(10), 1040.
- Folmer, A. S., Cole, D. A., Sigal, A. B., Benbow, L. D., Satterwhite, L. F., Swygert, K. E., & Ciesla, J. A. (2008). Age-related changes in children's understanding of effort and ability: Implications for attribution theory and motivation. *Journal of Experimental Child Psychology, 99*(2), 114-134.
- Given, L. M. (2008). *The Sage encyclopedia of qualitative research methods*: Sage Publications.
- Goetz, T., Nett, U. E., Martiny, S. E., Hall, N. C., Pekrun, R., Dettmers, S., & Trautwein, U. (2012). Students' emotions during homework: Structures, self-concept antecedents, and achievement outcomes. *Learning and Individual Differences, 22*(2), 225-234.
- Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54*(7), 493-503. doi:10.1037/0003-066X.54.7.493
- Goulet, R. (2010). *Individualized homework: An effective learning strategy*. Paper presented at the American Society for Engineering Education.
- Hareli, S., & Weiner, B. (2002). Social emotions and personality inferences: A scaffold for a new direction in the study of achievement motivation. *Educational Psychologist, 37*(3), 183-193.
- Haynes, T. L., Daniels, L. M., Stupnisky, R. H., Perry, R. P., & Hladkyj, S. (2008). The effect of attributional retraining on mastery and performance motivation among first-year college students. *Basic and Applied Social Psychology, 30*(3), 198-207.
- Heider, F. (1958). *The psychology of interpersonal relationships*. Wiley, New York.
- Hodges, R., Dochen, C. W., & Joy, D. (2001). Increasing students' success: When supplemental instruction becomes mandatory. *Journal of College Reading and Learning, 31*(2), 143-156.
- Jonassen, D. H. (1997). Instructional design models for well-structured and III-structured problem-solving learning outcomes. *Educational Technology Research and Development, 45*(1), 65-94.
- Leinhardt, G., Cuadros, J., & Yaron, D. (2007). One firm spot: The role of homework as lever in acquiring conceptual and performance competence in college chemistry. *J. Chem. Educ, 84*(6), 1047.
- Maltese, A. V., Tai, R. H., & Fan, X. (2012). When is homework worth the time?: Evaluating the association between homework and achievement in high school science and math. *The High School Journal, 96*(1), 52-72.
- Miller, D. T., & Ross, M. (1975). Self-serving biases in the attribution of causality: Fact or fiction. *Psychological Bulletin, 82*(2), 213-225.
- Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International journal of Educational Research, 31*(6), 459-470.
- Ramdash, D., & Zimmerman, B. J. (2011). Developing self-regulation skills: The important role of homework. *Journal of Advanced Academics, 22*(2), 194-218.
- Rawson, K., & Stahovich, T. (2013). Predicting course performance from homework habits. Paper presented at the 120th ASEE Annual Conference.
- Reid, K., & Reeping, D. (2014). A classification scheme for “introduction to engineering” courses: Defining first-year courses based on descriptions, outcomes, and assessment. Paper presented at the American Society for Engineering Education Annual Conference & Exposition. Indianapolis, IN (1-11). Washington DC: American Society for Engineering Education.
- Richards-Babb, M., Drelick, J., Henry, Z., & Robertson-Honecker, J. (2011). Online homework, help or hindrance? What students think and how they perform. *Journal of College Science Teaching, 40*(4), 81.
- Ryan, C. S., & Hemmes, N. S. (2005). Effects of the contingency for homework submission on homework submission and quiz performance in a college course. *Journal of Applied Behavior Analysis, 38*(1), 79-88.
- Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology, 25*(1), 54-67. doi:http://dx.doi.org/10.1006/ceps.1999.1020
- Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68.
- Schatt, M. D. (2011). High school instrumental music students' attitudes and beliefs regarding practice: An application of attribution theory. *Update: Applications of Research in Music Education, 29*(2), 29-40.
- Schilling, W. (2010). Using performance bonuses to decrease procrastination. Paper presented at the American Society for Engineering Education.
- Schleter, W., & Bennett, R. (2006). *Using web-based homework in an introductory engineering physics course*. Paper presented at the Proceedings, ASEE Annual Convention, Paper.
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information, 22*(2), 63-75.

- Tinto, V. (2012). Enhancing student success: Taking the classroom success seriously. *The International Journal of the First Year in Higher Education*, 3(1), 1.
- Vatterott, C. (2009). *Rethinking homework: Best practices that support diverse needs*. ASCD.
- Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review*, 92(4), 548.
- Weiner, B. (2010). The development of an attribution-based theory of motivation: A history of ideas. *Educational Psychologist*, 45(1), 28-36.
- Weiner, B., Russell, D., & Lerman, D. (1979). The cognition-emotion process in achievement-related contexts. *Journal of Personality and Social Psychology*, 37(7), 1211-1220.
- Whitley, H. P., & Parton, J. M. (2014). Improved knowledge retention among clinical pharmacy students using an anthropology classroom assessment technique. *American Journal of Pharmaceutical Education*, 78(7), 140.
- Wilson, T. D., Damiani, M., & Shelton, N. (2002). Improving the academic performance of college students with brief attributional interventions.
- Wolters, C. A., Fan, W., & Daugherty, S. G. (2013). Examining achievement goals and causal attributions together as predictors of academic functioning. *The Journal of Experimental Education*, 81(3), 295-321.
- Xu, J. (2005). Homework emotion management reported by high school students. *School Community Journal*, 15(2), 21.
- Xu, J., & Corno, L. (2006). *Gender, family help, and homework management reported by rural middle school students*. Paper presented at the Journal of Research in Rural Education.
- Zimmerman, B. J. (1986). Becoming a self-regulated learner: Which are the key subprocesses? *Contemporary Educational Psychology*, 11(4), 307-313. doi:[http://dx.doi.org/10.1016/0361-476X\(86\)90027-5](http://dx.doi.org/10.1016/0361-476X(86)90027-5)
- Zuckerman, M. (1979). Attribution of success and failure revisited, or: The motivational bias is alive and well in attribution theory. *Journal of Personality*, 47(2), 245-287.
- Zumbrunn, S., Tadlock, J., & Roberts, E. D. (2011). Encouraging self-regulated learning in the classroom: A review of the literature. *Metropolitan Educational Research Consortium (MERC)*.

APPENDIX A

Summary of Why Students Don't Do Their Homework

Categories (in order of frequency)	Definition	Selected Quotes
Transition/adjusting	Students have problems adjusting to the college environment such as larger class size and live away from families, which is completely different from high school.	<p>Just because I'm not used to having all of this hard stuff at once and I'm not very well at adjusting.</p> <p>Yes the transition is really, and I can definitely tell from now and the start of the semester that I've realized a lot about what my work habits and my work ethic and how I need to apply myself in different areas in order to succeed.</p> <p>Oh yes, just getting used to college was huge. Being away from Mom, first of all. I'm an only child. I love college. I have been busy every minute of it. I've always had something to do.</p> <p>I've had a lot of hiccups, this is my first full semester here at UT... I'm gonna tell you, I miss classes at the beginning of the semester because I didn't know where to park, stuff like that.</p> <p>Homecoming week big and this was. I mean there's little things in that that kind of kept me busy and I guess, one thing too, obviously adjusting to college was kind of a big thing. Cleveland Tennessee, where I'm from is not really anything quite like Knoxville. I don't know. The first semester is really hard for like a transition, sort of, I mean. I really hate that I'm struggling now with the homework, cause I could have easily fixed it if I would have known, like how quickly you get in trouble if you miss a couple of those.</p> <p>I'm not used to an auditorium style classroom either. It's kind of a big deal. It's hard dealing with 450 other students. It's hard to concentrate.</p>
Balance between Job and Coursework	Students who have a part-time job in addition to their course work have problems devoting reasonable time to their schoolwork.	<p>I was stretched a little too thin beforehand because where like I said before my mom got dismissed from her job and my father is disabled, I had to end up picking up a job after I got, I think at the end of last fall, so this is actually my first semester having a job and school so it's kind of getting a little difficult balancing the two I suppose.'</p> <p>I have 4 classes and I have two jobs right now too.</p> <p>Well they consider it part-time but yeah I work that, I was working that much and I have cut it down...</p>
Overloaded Coursework	Students who registered for more than 4 classes have overloaded coursework or just have problems balancing different coursework.	<p>And then on top of that I picked up an extra English class even though I didn't need one to become full time...</p> <p>Other classwork. I've got 5 classes.</p> <p>Not as good as I'd like it to but I'm finding sometimes I don't have enough time to work on everything equally.</p>
Balance between homework and Social Activities	Students have church, fraternity, or other social activities so that they could not devote reasonable time to their coursework.	<p>I always have a busy schedule, I'm doing a fraternity too so I'm always doing fraternity things too so I'm either in class, doing fraternity stuff, doing homework or sleeping. I never have time to just breathe pretty much. 'I am in the UT Men's Choir so we do sometimes we have certain things ...</p>

(Appendix A continued on next page)

(Appendix A continued)

<p>De-motivated Because of Stress and Frustration</p>	<p>Students get frustrated or stressed.</p>	<p>This class has made me realize that I do not want to be an engineer anymore and this is definitely not the field for me. It's not that I lost my confidence, it's that it's so confusing, like I don't understand anything and it doesn't register like at all.</p> <p>Just depression, that stuff. De-motivated.</p> <p>I've had maybe one day when I was just really stressed from any other possible problems ...</p>
<p>Family Responsibilities</p>	<p>Students have to take on family responsibilities which conflict with doing homework.</p>	<p>Yeah the death in the family, my second grandma in two months. Last semester at the end of finals my dad's mom passed away ...</p> <p>I don't like making excuses but maybe, my mother is 43 and she just had my little brother ... Well she lives in Memphis and so I try to go home on the weekends to check up on her make sure she's okay</p>
<p>Lack of Time Management Skills</p>	<p>Students believe that they could not have coursework completed because of poor time management skills</p>	<p>And others because I'm in orchestra and so some of the activities conflict with me doing my homework and studying and just my poor time management skills.</p> <p>I guess work, like, work that I do for my professors, that's not personal problems. That would fall under time management.</p>
<p>Illness</p>	<p>Students are sick so that they cannot study.</p>	<p>I've been sick. I shake a lot so if I shake it's really difficult to type</p> <p>a lot of the thing this semester is like I've had no time, a lot of big things have been coming up on me, but like, because I was doing great on the homework, I was getting like the 110% and stuff but then I lost a lot of time because I had a bicycle theft and a motorcycle theft and I got sick also all in like a short period of time and so I started not being able to keep up with my subjects and my homework started going down the drain.</p>
<p>No Physics Class in High School</p>	<p>Students don't take physics classes in high school.</p>	<p>... like I said I don't have much of a background in physics so that was, that was honestly the main reason</p> <p>I think it's because I didn't have a lot of Physics in high school. I know a lot of kids that I've talked to that they're doing decent. It's a lot of work.</p> <p>I didn't have physics in high school and it's really a physics based class and I think that's why I'm having so much trouble because this is the first time I've been introduced to a physics area.</p>
<p>Easily Distracted</p>	<p>Students are easily distracted when studying.</p>	<p>I guess because I can get easily distracted during a lecture when I'm like really excited about something else.</p>
<p>Laziness (Effort)</p>	<p>Students do not complete coursework because of personal laziness.</p>	<p>I got lazy with some of this homework and I didn't do it.</p>

NOTES