Exploring the relationship between key constructs of self-assessment components, motivation, and self-regulation in engineering

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Abstract

Assessment of learning and assessment for learning has been found to provide useful feedback to both learners and instructors when carried out consciously, dynamically, and most importantly, deliberately. Thus, providing students with an opportunity to self-assess their academic work can be very invaluable to their development. Self-assessment is a process by which students are given the opportunity to assess their own performance based on an agreed criterion. Appraising one's performance is vital in engineering education. Apart from promoting academic integrity, self-assessment has the potential of increasing student motivation to learn and to develop them as self-directed learners. Research has shown that students should be able to carry out personal, unguided reflections on their performance, level of knowledge, skill, and understanding to improve the effectiveness and quality of their learning. However, little is known about how students' reflections, motivation and self-directed learning are related within engineering context. In this study, data from the students' responses to surveys were analyzed to determine the association among the variables of interest. The calculated Pearson correlation coefficient from the data shows that self-assessment components of self-reflection, positive perception of self-assessment, and intrinsic motivation have strong significant correlations. Both motivation variables of task value and control belief have a medium to high correlation with the self-assessment components, and with effort regulation. The practical and theoretical implications of this study are also discussed.

Introduction

Self-assessment can foster self-reflection and develop a more self-regulated approach to the students learning process. Being able to reflect and evaluate oneself is vital to becoming successful in college. While some students are overconfident, others are underconfident about their academic ability and strengths [1]. Overconfident students are usually confounded when instructors' assessment of their academic task did not meet up with their expectations. Since one of the critical goals of higher education is to instill in college students the ability to be introspective and be able to evaluate their progress relative to their career goals [2], self-assessment can be a useful tool in helping students to improve or promote their task values and provide the opportunity for them to improve their self-regulatory skills during progress evaluation. Self-assessment involves giving students the opportunity to evaluate their own academic performances [3] by assessing their own works and awarding scores [4]. Also, self-assessment could be used as an avenue for conveying feedback on students' work [5], with the goal of deepening learning and enhancing performance [6]. Self-assessment, as a self-regulatory activity, can also help students focus on their academic goals and performances. By imbibing a reflective attitude to learning, students can self-regulate and work towards improving and actualizing their performances goals.

Self-regulation is an independent process in which such students organize and manage their mental abilities to learn [7]. Self-regulation enables students to be aware of their performance and goals, regularly working on improving their performances to achieve their stated goals. Self-

regulation initiated through self-assessment also has the potential to motivate students to become lifelong reflective learners and practitioners. Also, self-assessment and self-regulation have been linked with promoting engineering students' motivation to learn [8].

Researchers have shown that self-assessment activity could help students become more reflective and that such reflections can have positive effect on student motivation, beliefs, and self-regulation [9, 10]. However, for self-assessment to be a useful and meaningful activity, students need to be intrinsically motivated to do so. Hence, we set out in this study to examine the relationship between self-assessment construct of intrinsic motivation with other self-assessment constructs of self-reflection, and positive perception, and with effort regulation and task value.

Theoretical background

In this section we described the theoretical perspective of past work on self-assessment, self-regulated learning and motivation which provided the background needed for our study.

A. Self-Assessment

Self-Assessment is an assessment approach [11], in which learners get the opportunity to grade and evaluate the quality of their own work [12]. By self-assessing, students are able to judge their work against a set goal or criterion provided by the instructor or otherwise. Self-assessment of learning can provide useful feedback to both learners and instructors when carried out consciously, dynamically, and most importantly, deliberately. [13] argues that self-assessment primes learners to monitor the process and product of their learning, and this could help them dig deeper in learning and enhance their performance. For beginning students, self-assessment may be regarded as a "burden" imposed by instructors as learners find it difficult to justify the rationale for engaging in such activity. However, as students engage more and more in this activity, they are likely to improve with time and become advanced learners, enjoy the task of self-assessment and possibly be intrinsically motivated to personalize the experience and continue this act. Thus, self-assessment provides wide variety of mechanisms and techniques through which students describe (i.e., assess) and possibly assign merit or worth to (i.e., evaluate) the qualities of their own learning processes and products" [14, 15]. When the purpose of self-assessment is communicated clearly to the students, it has the potential of helping the learners to self-regulate their learning processes to achieve optimal result. With the use of self-assessments, students are more likely to become self-regulated and take ownership of their own learning when they have the opportunity to assess their own work. Good feedbacks during self-assessment activities in the classroom provides the opportunity for students to learn reflectively, use the criteria provided by the instructor to evaluate their performance and determine how to improve their subsequent performance. Research finds self-assessment to be vitally important for both immediate and lifelong learning [16, 17]. Hence, instructors that adopt self-assessment activities within their classrooms can help learners develop critical skills of self-reflection, self-regulation, and intrinsic motivation. These skills are necessary for fostering positive learning outcomes such as academic achievement and performance.

B. Self-Assessment and Self-Regulated Learning (SRL)

Self-regulated learning is the extent to which students take ownership of their learning processes to become more effective learners. Self-regulation skills help students to be better self-regulators of the cognitive, motivational, and behavioral aspects of their learning. These skills also motivate

the students to be metacognitively and behaviorally active participants in this learning process [18, 19]. “Students who can self-regulate their learning have greater understanding of their underlying learning processes.” [20].

Self-regulated learners are high achieving learners because they often possess the ability to process lots of information at the same time while simultaneously focusing on their set goals despite the distracting activities that competes with their attention. For example, they may hold and understand concepts including the strategies for solving them as well as scoring well on tests and making good grades simultaneously [21]. Self-regulated learners with good self-regulatory skills are more self-efficacious for learning than are students with poorer self-regulatory skills [21]. [22] and [23] in their separate works, asserted that self-regulated learners are aware of the processes that determines their performance, and as such know how to construct positive attributions when undertaking the task of self-reflection by ascribing success to ability and effort and difficulty to use of unproductive learning strategies.

Relating self-regulation to control belief, [24] found that individuals with stronger internal control beliefs attribute their circumstances to effort and hold themselves responsible for their successes and failures; whereas those with stronger external control beliefs attribute their situations to forces beyond their control, such as fate, destiny, or some others. Control beliefs is the extent to which an individual believes that he or she has control over their intellectual competence necessary to bring about desired outcomes [24, 25]. Students’ control belief impact students’ task value of self-assessment and learners’ level of effort regulation that goes into it. To help learners acquire stronger internal control beliefs, self-assessment with good and targeted feedbacks must be administered formatively which will cumulatively help to strengthen the ties between learners’ control beliefs and their task value of self-assessment, and eventually lead to better self-regulation of learning.

C. Self-Assessment and Motivation

Motivation is an integral part of every learning activity, and it influences student learning and performances. Motivation is defined as the reason or the motive behind achievement behaviors. It is needed for achieving the desired result irrespective of the reward. When students are motivated, they tend to engage in behaviors such as perseverance and task engagement, that are helpful for learning, but when they are not motivated, they become disengaged and sometimes adopt maladaptive behaviors that are detrimental to learning and performance. Two important motivational constructs have been discussed in the literature: Intrinsic motivation, which is internally inspired, and extrinsic motivation, which is externally instigated [26]. When students are intrinsically motivated, they engage in academic tasks for the inherent satisfaction and pleasure they derive from it and not for any external rewards. Intrinsic motivation has been shown to lead to increased interest and learning enjoyment [27]. Similarly, research has shown that student motivation is influenced by self-assessment. For example, [28] showed that the impact of self-assessment on motivation was large ($d = 0.59$). Also, other motivational constructs, such as self-efficacy, have been linked with self-assessment [4, 29, 30].

Research Questions

From a theoretical perspective, it is important to understand how self-assessment components of self-reflection, positive perception and intrinsic motivation and motivation variables of task value and control belief and self-regulation variable of effort regulation are interrelated and how

together and individually they impact on students' intrinsic motivation towards continuous self-assessment. Our enquiry will be guided by two research questions:

1. What is the nature of the relationships between the self-assessment components, motivation, and self-regulation?
2. What is the strength of these relationships?

Method

In this section, we described the study design, the data collection process, the measure used in the study and the analysis performed on the collected data.

Participant description and Data Collection

The participants for this study are first year degree electrical and computer engineering students from a public university in the Southern eastern part of the United States. The course was taught for the period of 13 weeks and focuses on engineering statistics. Following IRB approval, the survey was administered through Qualtrics. One hundred and nineteen (119) electrical and computer engineering undergraduate students from a Southeastern University in the United States 87 percent of the participants are male students while 13 percent of the students are female. Most of the students identified as white (55%) while the other participants are Asian or Pacific Islander (22%), Black or African American, Hispanic, Mexican American and others (23%).

Measures

The participants completed a questionnaire on Motivated Strategy for Learning Questionnaire (MSLQ) [31] and items designed to measure student perception of the utility of self-assessment exercise. All the items were measured on a 7-point Likert scale from strongly agree to strongly disagree and were administered via the Qualtrics online survey platform. The control belief was assessed by four (4) items from the MSLQ (e.g., If I try hard enough, then I will understand the course material). Task value was examined by six items from the MSLQ to assess students' evaluation of how interesting, important, and useful the self-assessment activity was (e.g., It is important for me to learn the course material in this class.). Effort regulation is assessed by four items on the MSLQ to measure students' ability to control their effort and attention particularly when working on new and uninteresting tasks (e.g., Even when course materials are dull and uninteresting, I manage to keep working until I finish). Intrinsic motivation is assessed by one item from the MSLQ tasks (e.g., I would prefer to self-assess my work in future assignments even if the instructor gives me no credit for doing so).

Analysis

The analysis was conducted in IBM SPSS Statistics for Windows V 28.0. First, the data were checked for assumptions for performing correlational studies: linearity, normality, and outlier check. The linearity of data was checked using the scatterplot, the data graphs show that our data were linear. The assumption of normality was examined using skewness and Kurtosis values. Several researchers have suggested that skewness values between -2 and +2 and Kurtosis values between -7 and +7 are acceptable numbers for establishing the normality of data [32-34]. Next, we examined the outlier using plots of cooks and leverage scores. All assumptions for the correlational study were met. Next, the descriptive statistics of means and standard deviations

were computed for all the variables and are reported in Table 1. To ensure the adequacy of the scales used, we also computed the reliability of each construct included in our study. Finally, we conducted a Pearson correlation to determine the magnitude and direction of the relationships among self-assessment constructs of self-reflection, positive perception, intrinsic motivation, motivational constructs of control belief and task value, and self-regulation construct of effort regulation.

Table 1: Descriptive Statistics of Self-Assessment, Motivational and Self-Regulation Constructs

	Self_Reflect	**Positive_Perc**	**Intrinsic_Motiv**	**Contr_Belief**	**Task_Value**	**Effort_Reg**
Mean	5.55	5.04	4.5	5.44	5.29	5.08
SD	1.25	1.55	1.8	1.04	1.1	1.05
Skewness	-1.75	-1.1	-0.52	-0.72	-0.53	-0.86
Kurtosis	3.69	0.84	-0.48	0.48	-0.05	1.04

Note: Self_Reflect = Self-Reflection, Positive_Perc = Positive Perception, Intrinsic_Motiv = Intrinsic Motivation, Contr_Belief = Control Belief, and Effort_Reg = Effort Regulation.

Results

We observed positive, high, and significant correlations among the self-assessment components, that is, the relationship among self-reflection, positive perception, and intrinsic motivation are positive and strong as seen in Table 2 below. Also, the relationship between the self-assessment components and motivational constructs of self-reflection, positive perception, intrinsic motivation, and control belief, except task value where the relationship is strong, positive, and significant.

Table 2: Pearson's Correlation Coefficients and Reliability of Self-Assessment, Motivational and Self-Regulation Constructs

	Cronbach (α)	**1**	**2**	**3**	**4**	**5**	**6**
1. Self-reflect	0.90	1					
2. Positive-Perc	0.94	.72**	1				
3. Intrinsic-Motiv	1.00	.60**	.79**	1			
4. Contr-Belief	0.80	.35**	.51**	.35**	1		
5. Task-Value	0.92	.46**	.69**	.55**	.61**	1	
6. Effort-Reg	0.65	.38**	.49**	.43**	.35**	.56**	1

Note. **< .01

Discussion and Conclusion

The aim of this study was to examine the nature and the strength of the relationships among the constructs of self-assessment, motivation, and self-regulation. The results of our study suggest that the self-assessment components of positive perception, intrinsic motivation and self-reflection have medium to strong relationships with student's task value, effort regulation, and control belief. The implication of this, particularly within engineering context, is that providing students with the opportunity to self-assess their own work can help engender student motivation and self-regulation. This supports the conclusion made by [28] that self-assessment has a stronger link to motivational outcomes. Thus, we observe that students with high positive perception of self-assessment will also have a high tendency to engage in self-reflective activities. We noted that high positive perception is strongly correlated to high intrinsic motivation with . 79 correlation value. This indicates that students with high positive perception of self-assessment usually have high intrinsic motivation towards self-assessment. It then suggests that instructions, assessments, and feedback should be designed with an end-goal in mind: "To motivate the student deliberately yet intrinsically." An intrinsically motivated student may likely become a lifelong, highly reflective, and self-directed learner when intentionally guided during and after self-assessment. The result of the study also shows that self-reflection and intrinsic motivation moderately positively correlated with control belief while positive perception is slightly but strongly positively correlated with control belief. This indicates that positive perception of self-assessment by learners poses a stronger influence on the learners' control belief compared to self-reflection and intrinsic motivation. Moreover, learners' positive perception of the task of self-assessment is strongly correlated with task-value which is slightly strongly influenced by their control belief. Finally, effort-regulation which is dependent on task-value has a medium correlation with task-value. This also implies that learners' perceived usefulness will likely drop with increased difficulty when engaging in self-assessment.

Given that this is a work in progress, our next action is to examine the predictive value of these constructs on educational outcomes such as student achievement, classroom engagement and conceptual understanding within engineering context. We would further examine if observed results from the study are moderated by student characteristics such as gender, ethnicity, social economic status, and so on.

The implications of this work suggest that incorporating self-assessment within engineering classroom will not only increase students' intrinsic motivation, task value and control belief but will also increase students' self-regulation of effort. Hence, engineering instructors are encouraged to incorporate self-assessment within their classroom as this would not only help them in achieving their aim of increasing student performance but also help the students to become self-directed learners which is essential for them to become lifelong learners.

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