

# Enhancing Learner Engagement Using the Discussion Leaderboard: A Social Cognitive Perspective

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**Abstract**—Over half of the college students in the U.S took at least one online course in 2019-2020. It is ever more important to deliver an interactive quality experience to a growing online learning community. Asynchronous discussion forum is a widely used tool to help accomplish that goal and to develop reciprocity and cooperation among students, a foundational practice in education. However, it is often challenging to make online discussion forums a venue for meaningful learning. A review of the literature points to low student participation and engagement as a top challenge. This study applies social cognitive theory to address the issue. In social cognitive view, there are three sets of (triadic) determinants: personal factors, behavior, and environmental events interacting mutually in online discussion forums. The study posits that a leaderboard can trigger personal and environmental influences on learner behavior changes to foster discussion forum participation. A student-facing discussion leaderboard was implemented in a graduate engineering elective at a private research university in the U.S. in Summer and Fall 2021. The findings indicate the leaderboard intervention instigates the interaction between self-efficacy (personal factor) and social modeling (environmental influence) and contributes to the improvement of learner engagement.

**Index Terms**—learner engagement, social cognitive theory, self-efficacy, social modeling

## I. INTRODUCTION

Over half of the college students in the U.S took at least one online course in 2019-2020, not including the sudden pivot to remote instruction due to the COVID-19 pandemic [1]. It is ever more important to deliver an interactive quality experience to a growing online learning community. Asynchronous discussion forum is a widely used tool to help accomplish that goal and to develop reciprocity and cooperation among students, a foundational practice in education [2]. It affords an array of benefits in cultivating a community of learners with diverse perspectives, providing opportunities for peer interaction, reflection, and critical thinking. However, it can be challenging to make online discussion forums a venue for meaningful learning.

A review of a wide body of the literature on asynchronous online discussion points to low student participation and engagement as a top challenge, attributed to a variety of factors, such as, student confusion about purpose and expectation, low self-confidence, lack of connection with peers or the instructor, difficulty with the threaded discussion format, and technical issues. Aloni & Harrington [3] present several strategies for making online discussion more effective, for instance, by improving the communication, forum structure, discussion prompts, and facilitation, all of which are teacher-ready recommendations. Some literature focuses on the importance of fostering critical thinking to promote deeper learning [4], [5]. Others turn to gamification to stimulate student participation in course activities [6]. Despite various strategies, the challenge of low engagement in online discussions often persists. This study approaches the issue from a social cognitive perspective.

## II. THEORETICAL FRAMEWORK

Social cognitive theory (SCT) emphasizes the personal/cognitive as well as social origins of human motivation, thought and action. According to Albert Bandura, the most prominent proponent of SCT, “people are neither driven by inner forces nor automatically shaped and controlled by external stimuli. Rather, human functioning is explained in terms of a model of triadic reciprocity in which behavior, cognitive and other personal factors, and environmental events all operate as interacting determinants of each other” [7, p.18].

SCT framework has been adopted in studies across the disciplines, for instance, in business, information science, and health science [8]-[13]. It has been applied to the design of health promotion interventions, such as maintaining good eating habits and managing chronic illnesses. This study applies SCT in examining factors impacting learner behaviors in online discussions. It posits that a student-facing discussion leaderboard can instigate the triadic reciprocal interactions (Fig. 1) and foster learner engagement (Fig. 2) via triggering self-efficacy (personal factor) and social modeling (environmental influence).

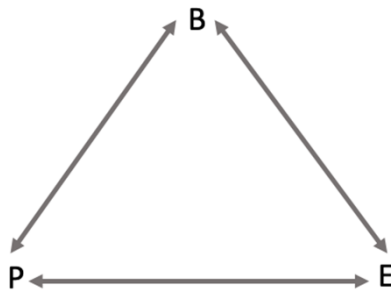


Figure 1. Three classes of determinants in triadic reciprocal causation [7].

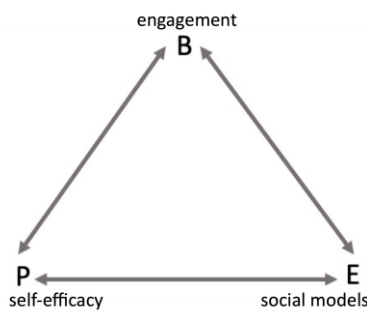


Figure 2. Self-efficacy and social modeling, i.e., personal, and environmental influences on learner engagement.

### III. METHODS

A quasi-experimental study was conducted in a graduate engineering course at a private research university in the U. S. in summer and fall 2021. The course was launched in the virtual live modality in summer 2020, with the instruction delivered in-person and synchronously online. It was migrated to fully online a year later in summer 2021. There were 12 modules in the summer and 14 in the fall semester. The first 12 modules each contained one or more discussion forums and modules 13 or 14 had none. Online discussion counted toward 15% of the total course grade. Discussion posts were graded with a rubric. There was no minimum required number of posts or replies. All materials and activities were hosted in the Blackboard learning management system.

The design of the quasi-experimental study followed a value-added approach [14]. In summer 2021, two (fully online) sections of the course were offered for the first time. A student-facing discussion leaderboard (Fig. 3) was implemented in Section 1 and Section 2 was used as the control group. Two sections of the course were offered again in fall 2021, a discussion leaderboard was placed in Section 2 and Section 1 was used as the control group. The control and experiment groups each had the same course materials including identical online discussion activities. The study groups had an extra feature: a student-facing discussion leaderboard.

The leaderboard data originated from Blackboard User Activity in Forums report, which was accessed through the course Control Panel, available to instructors and support staff, not to students. The User Activity in Forums report was extracted and stored in a Google sheet and connected to Tableau Public, a free application used to create the visualization (viz). The Tableau viz, hidden from the public view and filtered by modules, was embedded in the Blackboard course home page, which became the leaderboard. The course home page was set to be the default entry point. The leaderboard was among the first things students would see when they visited the course site. It displayed the names (blurred in Fig. 3) and number of messages posted by top 5 participants in each week's online discussions. The data were refreshed once a week. The leaderboard layout was simple by design to minimize cognitive overload [14].

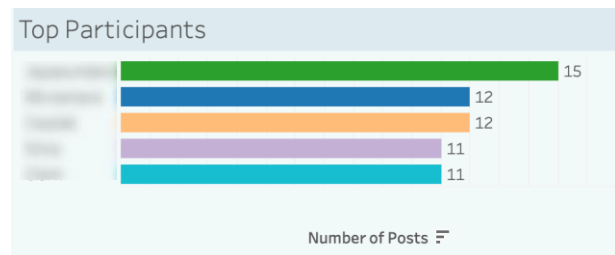


Figure 3. Module 3 discussion leaderboard (Summer 2021 Section 1)

This study, spanning two semesters from summer to fall 2021, sought to answer the following questions:

- 1) Does adding a student-facing leaderboard to online discussion stimulate learner engagement? And subsequently does the added instructional feature promote learning?
- 2) What are the learners' perceptions of the impact of self-efficacy (personal factor) on their discussion board participation (behavioral factor)?
- 3) What are the learners' perceptions of the impact of social modeling (environmental factor) on their discussion board participation (behavioral factor)?

### IV. RESULTS

#### A. Student Activity and Performance

The course learning analytics provides a window to student activity and performance. Table I presents data originated from two reports: User Activity in Forums and Course Activity Overview as well as the Grade Center in Blackboard. It compares average student activities and grades between the control groups (Summer 2021 Section 2 and Fall 2021 Section 1) and the study groups (Summer 2021 Section 1 and Fall 2021 Section 2).

TABLE I. DISCUSSION FORUMS POSTS, GRADES AND OVERALL TIME SPENT ON COURSE ACTIVITIES

	Control Groups	Study Groups	Difference
Total number of students	30	34	
Number of modules with discussion forum(s) (per term)	12	12	
Average # of posts by all participants	54.24	59.44	5.20%

Average # of posts by Top 5 participants	71.84	80.70	8.86%
Grades: discussion forums	89.88	91.83	1.9%
Course activities in hours	136.97	200.96	63.99%

### B. Discussion Leaderboard Survey

An anonymous online “Discussion Leaderboard Survey” was conducted with the study groups at the end of summer

and fall 2021. No incentive was offered for completing the survey. Responses (Table II) were scored using a 5-point Likert scale from “strongly disagree” (1) to “strongly agree” (5).

TABLE II. DISCUSSION LEADERBOARD SURVEY (SUMMER & FALL 2021, N=20)

Questions	Mean	SD												
1. The leaderboard motivated me to engage in the course discussions.	3.85	1.27												
<table><thead><tr><th>Response</th><th>Percentage</th></tr></thead><tbody><tr><td>Strongly Disagree</td><td>10%</td></tr><tr><td>Disagree</td><td>5%</td></tr><tr><td>Neutral</td><td>10%</td></tr><tr><td>Agree</td><td>40%</td></tr><tr><td>Strongly Agree</td><td>35%</td></tr></tbody></table>	Response	Percentage	Strongly Disagree	10%	Disagree	5%	Neutral	10%	Agree	40%	Strongly Agree	35%		
Response	Percentage													
Strongly Disagree	10%													
Disagree	5%													
Neutral	10%													
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Strongly Agree	35%													
2. I posted to the discussion forums more often.	3.90	1.07												
<table><thead><tr><th>Response</th><th>Percentage</th></tr></thead><tbody><tr><td>Strongly Disagree</td><td>5%</td></tr><tr><td>Disagree</td><td>5%</td></tr><tr><td>Neutral</td><td>15%</td></tr><tr><td>Agree</td><td>45%</td></tr><tr><td>Strongly Agree</td><td>30%</td></tr></tbody></table>	Response	Percentage	Strongly Disagree	5%	Disagree	5%	Neutral	15%	Agree	45%	Strongly Agree	30%		
Response	Percentage													
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Agree	45%													
Strongly Agree	30%													
3. I feel confident to post first or early in each module's discussions.	3.85	0.88												
<table><thead><tr><th>Response</th><th>Percentage</th></tr></thead><tbody><tr><td>Strongly Disagree</td><td>0%</td></tr><tr><td>Disagree</td><td>5%</td></tr><tr><td>Neutral</td><td>30%</td></tr><tr><td>Agree</td><td>40%</td></tr><tr><td>Strongly Agree</td><td>25%</td></tr></tbody></table>	Response	Percentage	Strongly Disagree	0%	Disagree	5%	Neutral	30%	Agree	40%	Strongly Agree	25%		
Response	Percentage													
Strongly Disagree	0%													
Disagree	5%													
Neutral	30%													
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4. I feel confident to post to the discussion forums after observing my classmates.	4.00	0.86												
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5. I learned more as a result of my participation in the discussions.	4.00	1.08												
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Strongly Disagree	5%													
Disagree	5%													
Neutral	10%													
Agree	45%													
Strongly Agree	35%													
6. I learned a lot from my classmates' discussion posts.	3.85	1.18												
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7. I was comfortable with the leaderboard showing participant names.	4.35	1.04												
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## V. DISCUSSION

### A. Engagement

Engagement can be defined most simply as a learner's active participation in an activity [15]. The study hypothesized that a student-facing leaderboard can foster learner engagement. Both self-reports and behavioral measures [16] provide support for the hypothesis.

The study groups were more active in the discussion forums, with students posting more and spending more time on the course site. 75% of the respondents in the leaderboard survey (Table II) agreed or strongly agreed that the leaderboard motivated them to engage and 75% reported that as a result they posted more often to the discussion forums. The leaderboard dynamically shaped a competitive environment that piqued student interest and motivation. Motivated learners set goals each week. They contributed to the discussions, monitored peer activities, and responded to others' messages. There was a 5.2% increase among the entire class, 8.7% increase among the top participants in the average number of posts by the study groups (Table I). The list of student names on the leaderboard (often  $\geq 5$  due to tie) varied from week to week.

In addition to posting more, the study groups spent more time on the course site as well. They spent an average of 201 hours per active student versus 137 hours from the control groups, a 64% increase. Overall time spent on course activities included time spent on reviewing course materials, completing assessments, etc. in addition to engaging in discussions.

Did an increase in engagement increase student learning? Student self-reporting provides support that the leaderboard promoted their learning. The study groups reported that they learned from their own and their peers' contribution to the course discussions (Table 2). 80% of the respondents reported that they learned more as a result of their own participation, and 70% agreed that they learned a lot from discussion posts by their peers. In addition, the study groups earned slightly higher scores (Table I) in course discussions.

### B. Self-Efficacy

Self-efficacy is a person's beliefs about their capabilities to exercise control over events affecting their lives, forming the foundation of human motivation and accomplishment [7] and it is situation and task specific [7], [17]-[19]. The discussion leaderboard confronted the students with a weekly challenge (to top the board) and a choice of whether to engage in the competition.

Previous literature reveals low self-confidence as a factor impacting learner engagement in online discussions [3]. The leaderboard survey gauged the learners' perceptions of self-efficacy via a single question, a practice consistent with prior study where self-efficacy was assessed [20]. The question was "I feel confident to post first or early in each module's discussions" (Table II). 65% of the respondents in the leaderboard survey agreed and strongly agreed. Those who felt self-efficacious were more motivated and confident to act. They posted to the

discussions and responded to others' messages and achieved at higher levels. Their achievement in turn provided a renewed source of self-efficacy. The leaderboard promoted a cyclical competitive dynamic that enhanced self-efficacy, hence learner motivation to participate in the course discussions. Some may view the leaderboard as an external stimulus. This study showed the intervention can trigger personal/cognitive influence on learner motivation. Motivation, whether intrinsic or extrinsic, can promote learning and engagement [21].

### C. Social Modeling

According to social cognitive theory, people can learn by observation via modeling and they "expend a great deal of effort exploring their environment and seeking information relevant to the pursuit of their goals" [7, p.103]. Students with high self-efficacy beliefs set goals and posted to the discussion forums early and often. They became great models for other students, who often observed and learned from their peers. Lack of connection with peers or the instructor is one of the major factors impacting learner engagement in online discussions [3]. The early discussion posts by those with high self-efficacy beliefs shaped the discussion environment and laid the foundation for peer-to-peer connection and active participation. Those who felt less self-efficacious studied their peers' posts, connected with other viewpoints, gained confidence, emulated their peers' behaviors, and made their own contributions. The "leaders" in the discussion forums were social models whose performances influenced their peers. 75% of the respondents in the leaderboard survey reported that they felt "confident to post to the discussion forums after observing my classmates" (Table II).

## VI. CONCLUSION

This study applied social cognitive theory to an experiment to influence learner engagement in asynchronous online discussions. The findings reveal that the leaderboard intervention contributed to strengthen cognitive-personal (self-efficacy) and environmental (social modeling) influences on student behavioral changes (engagement in discussion forums: reading, posting, monitoring, replying). The leaderboard primed the learner's sense of self-efficacy, a key source of human motivation while strengthening the environmental influences through social modeling. The study shows that the design of an effective learning environment should take full advantage of multiple factors as well as their mutual influence upon each other. These factors are dynamic and interconnected.

Although the results are modestly encouraging, the study has a few apparent limitations. It was a very small-scale experiment. Due to course enrollment constraint, there was a limited pool of participants in the trial groups and there was no random assignment of participants. The impact of the leaderboard could be strengthened if discussion forum activities were tabulated and posted dynamically in real time. A systematic analysis of the discussion content is likely to yield further and stronger

evidence on whether the leaderboard as an additional instructional feature, increases learning. Viewed with caution, the findings indicate a potential student-facing scalable intervention for low participation and engagement, an issue facing online discussion, with an ever-expanding user base.

#### CONFLICT OF INTEREST

The author of this paper declares no conflict of interest.

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