ENABLING COLLABORATIVE LEARNING SKILLS THROUGH TECHNOLOGY FOR IMPROVING THE INTRINSIC MOTIVATION OF E-LEARNERS

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ABSTRACT

In today's world, online teaching has become part and parcel of all education systems starting from nursery to higher education. The success of any online education whether live or recorded, depends mostly on the intrinsic motivation of the individual learners. This is because, majority of the learners' miss their interaction and collaboration with their peers and feel isolated and disconnected in online environment. This results in a large gap between the traditional and online teaching experience. To remove this sense of solitude in the learners, most of the current online teaching system emphasis on providing assignments, surprise quiz, etc. However, these evaluation procedures focus either on improving the individuality or competitive nature of the learners. This is well suited only for highly motivated learners. Psychological research studies shows that the collaborative learning focuses on consensus building, through cooperation among the learners and improve not only the social, emotional, cognitive and behavioral skills but also helps in high achievement and greater productivity. Collaborative learning also ameliorates the critical thinking, reduces anxiety, increases the self esteem and improves the personal responsibility of the learner to work in a team. To make all the learners' to actively participate and blend in the online learning system and to remove the sense of isolation and seclusion from the peers, traditional collaborative technique should be extensively included along with regular assessment activities. This collaborative supported learning system should be created with ease, using the latest technologies to encourage and assist wide variety of learners. A case study is done by introducing the collaborative learning in online teaching mode for a batch of first year engineering graduates and intrinsic motivation is measured as an engagement score by combining various factors such as satisfaction, happiness, motivation, confidence and communication level. Result shows that the engagement score has been improved by 11% in online systems with collaborative learning compared to online system without collaborative learning. In addition to this, students' Net Promoter Score is 83% in online system with collaborative learning.

Keywords: *Isolation, Collaborative learning, Online-learning, Intrinsic motivation, Social and Emotional Engagement, Engagement score, Net Promoter Score.*

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I. Introduction

Online learning is inevitable in today's world. The recent pandemic also accelerated the adoption of online learning system across the globe. Success of any online learning system, either synchronous or asynchronous primarily relies upon the engagement of the learner. Engagement of the learner refers to the degree of interest, optimism, passion, curiosity and attention shown by the learner during the learning process. High engagement is achieved only when the learner learns with high intrinsic motivation in all the stages of learning, starting from the active participation in class room sessions, discussions, quiz, assessments and feedback sessions etc. Engagement of a learner can be mainly categorized into following types [12],

(i). *Behavior Engagement* – describes the students' compliance and active participation in class activities, such as on-time attendance and completion of all assignments.

(ii). *Academic Engagement* – describes the students' attitude and performance in acquiring academic related knowledge and skill.

(iii). *Cognitive Engagement* – connotes the students' attitude towards learning and utilization of advanced learning techniques to successfully complete a task. It encourages youngsters to learn higher-order or critical thinking skills and problem-solving abilities by processing information deeply (as opposed to superficial learning)

(iv). *Affective / Emotional Engagement* – denotes the inner states and affective responses of the learners to their learning, such as motivation, enjoyment, interest and satisfaction.

(v). *Social Engagement* – signifies that a student has participated in a set of classroom activities.

(vi). *Agentic Engagement* – implies the students' contribution towards the enhancement of teaching and learning.

(vii). *Psychomotor Engagement* – suggests students' kinetic activity such as exercise, stretching or other physical skills.

In online learning system, behavior engagement of the students is measured by considering their login time and logout time, timely submission of assignments. Academic engagement is measured from the marks obtained in the exams conducted. Cognitive engagement is measured from the scores received by the students in challenging subjective and objective assignments. Agentic engagement is measured by the level of interaction of the student with the tutor or content. Psychomotor engagement is increased by providing physical activities during the synchronous video session.

The remaining work is structured as follows. Section II reviews the literature and position of our work with related works. Section III discuss about our present study. Section IV, discusses about how we assessed the engagement score and Net Promoter Score, followed by the conclusion in Section V.

II. Literature Survey

In [1], authors conducted a literature survey based on Cooper's framework and identified issues and challenges related to online learners, tutors and content. In [2], authors proposed the Learning Management System (LMS) for learners, instructors and administrators. The quiz making learning markup system, executing learning analytics with ad-hoc report system, visualization by artificial intelligence enabled system, and automating course administrative tasks were implemented by the authors for LMS. In [3], authors demonstrated the improvement in the performance of student's learning by self analyzing with online learning tools. The interaction between students in online platform is recorded and analyzed. The self-report factors of students after analysis showed the better contribution to academic performance. In [4], authors were interested in collaborative learning to see the technological and theoretical growth in education by statistical problem solving strategies. In [5], authors diagnosed about the mental health issue in online education such as psychological distress related to the demographic factors. In [6], authors did a case study from the perspective of online lecturers at Masamus University; Indonesia and identified that the poor learning habits of students, lack of technology skills in addition to lack of personal computer or Smartphone, internet leads to poor engagement of students in online learning. In [7], authors measured the behavior engagement and suggest the use of multiple social media to improve the social engagement. In [8], authors measured the behavioral engagement and cognitive engagement of the students by introducing personalized online homework assignments and assessed the improvement in the scores of the students. In [9] and [10], authors discussed about the Learning Management System by

adopting regularization of Machine Learning in analysis of learning. In this work LMS log data was analyzed to establish the relationship between the student's parameters in online environment. Collaborative learning of music enhanced the value for students by peer-to-peer learning which inculcated the new skills and resulted in the performance improvement of the whole group of participants [11]. In [13], authors defended that the collaborative learning in high school education won't be relevant to university level learning. The team with heterogeneous talented students tends to improve the performance of slow learners, promote the higher-level interaction. The positivity of inter-dependence is increased by various design factors and process factors that are contributed to the effectiveness of collaborative learning.

Most of the existing works concentrate mainly on the behavior and cognitive engagement. Psychological studies show that Emotional and Social Engagement (ESE) provides a foundation for safe and positive learning, and strengthen students' skill to triumph in higher education, careers and life. Research shows that high level of ESE can be achieved by collaborative learning. The collaborative learning focuses on consensus building, through cooperation among the learners and improves not only the social, emotional, cognitive and behavioral skills but also helps in high achievement and greater productivity. Collaborative learning also ameliorates the critical thinking, reduces anxiety, increases the self esteem and improves the personal responsibility of the learner to work in a team. This motivated us to introduce Collaborated learning in Online.

The collaborative learning in higher education can be implemented by providing challenging task among the students. It can be executed by shared ownership with peers. The deep learning of conceptual understanding is achieved by debates, critical questioning, and contradictory discussions within small groups of students. This enhances social engagement of the learner in the virtual environment. As a result of task completion, the learner attains happiness, satisfaction and self confidence which improve the emotional engagement of the learner.

III. Present Case Study

This case study was done on a batch of first year engineering graduates at Madras Institute technology, Anna University Campus. Google classroom and Microsoft Teams were used as online platforms for this study. In addition to these platforms, WhatsApp is also used for online communication. "**GE5153 – Problem Solving and Python Programming**" course was taken as subject of study and motivation levels of the students are assessed. In this batch 49.2% are female and 50.8% are male students. 89.2% of students studied in State board syllabus in their school and 10.8%

students studied in Central board. Regarding the language of instruction in school, 89.2% students studied in English medium, 9.2% studied in Tamil medium and 1% studied in other medium. About the location of the school, 69.2% of the students were from urban background and 30.8% of the students were from rural background. Here, more than 60% of the students have already used computer and studied in online platforms such as Google class room, Google meet, Web Ex, Microsoft Teams, etc in school.

During the start of the course, when the students were asked "*Are you a self motivated person in online learning?*", only 26.2% of the students answered as "yes".

For this study, first the students are taught in synchronous mode about programming concepts such as Sequence, Selection/Decision, Iteration or Repetition and Functions in Python Programming. These are basic concepts that can be used to solve any computational problem. Next, study contents such as eBooks' and power point presentations related to each topic were uploaded in the online platform.

To check the motivation level of the students, three different assignments were given to the students and their scores were accessed.

A. Individual subjective assignment

- Each student was asked to write python code to solve simple problems related to sequence, selection and iteration and their performance was evaluated.
- All the students completed the task within the stipulated time and the class average was 94.9%.

B. Individual Objective Assignment

- Objective questions (Multi choice questions) in each topic was prepared and given to the students.
- All the students completed in allotted time and the class average was 53%.

C. Realistic scenario based collaborative Mini project

The concept of menu driven program, for example working of, ATM Machines, Vending machines, Washing Machines, Menu bar in Computer, etc that are used widely in day to day activities was introduced.

- In these type of applications, a set of options will be provided to the users, and based upon the user's choice a particular option will be executed.
- To repeatedly provide menu options, iteration concepts have to be used.

- To execute a particular set of code that was selected by the user, decision control structures have to be used
- To divide the whole task into smaller subtasks, function concepts have to be used.
- The batch students were instructed to group as teams, where each team has 4 members.
- The students are asked to collaborate among themselves and identify a realistic scenario based mini projects on menu driven concept which encompasses all the concepts (decision, iteration and function) taught in the class.

The main intention to build a team is to make the students work together, to attain maximum effectiveness and creativity, to teach the students how to listen to each other, setting goals and clear expectations, assigning roles to the members of the group on different real world problems, to enhance the camaraderie between the team members and to increase the overall academic performance of the learner. The foundation of team based learning depends 80% on Emotional Quotient (EQ), and 20 % on Intelligent Quotient (IQ).

In collaboration based mini projects, we were able to see the creativity, enthusiasm and motivation of the students starting from the selection of the topics for their projects to the successful completion of the project. Each team came up with different ideas such as Mathematical game, Word Guess Game, Number Guess Game, Rock paper scissor, Snake and Ladder, Hand Cricket, Quiz about countries, Calculators such as Loan Calculator, Fees Calculator, Scholarship calculator and different services such as Trip management, Space travel booking, Event management, Hotel billing, e-commerce, Contact book, Different convertors like Electricity convertors and Programmer calculator were designed. The team members shared the project activities by subdividing the project into multiple subsections and each member took ownership of one or more subsections. The team members utilized the technology to communicate, interact, and share their portion of codes to their peers and to integrate the codes and executed the project successfully.

The intrinsic motivation of the students can be inferred from, self-measure of engagement after completing the task successfully on time. In addition, net promoter score can also be deduced based on students' willingness to recommend similar collaborative projects to the fellow students.

IV. Assessing Engagement score and Promoter Score

After completing all the three different type of assignments, a comprehensive survey was done to measure the social and emotional engagement of the students. By combining both social engagement factors and emotional engagement factors, an overall engagement score was calculated. To measure the emotional engagement, factors such as Satisfaction, Happiness, Motivation and Confidence level of student were considered. To measure the social engagement, interaction level of the students with the tutor and their peers were considered. To measure each factor, Likert five point scale with 1 as minimum and 5 as maximum as shown in Table 1 was used.

Table I. Five Point Likert Scale Used for each Engagement Factor in the Survey

	Likert five point scale	
Engagement Factor	**Min (1)**	**Max(5)**
Satisfaction	Not at all satisfied	Very satisfied
Happiness	Very Sad	Very Happy
Motivation	No Motivation	Very Highly Motivated
Confidence	Minimum	Maximum
Interaction with Tutor	Not Supportive	Very Supportive
Interaction with Peers	Not Supportive	Very Supportive

First the average score for each factor is calculated using the equation (1) and finally total engagement score is calculated as the summation of all the average scores using equation (2).

$$f_i = \frac{\sum_{k=1}^{n} x_k}{n} \qquad (1)$$

Where n is the total number of students and x_k is the score entered by each student for that particular engagement factor.

$$Engagement\ Score = \sum_{i=1}^{6} f_i \qquad (2)$$

Where, each f_i is an engagement factor such as Satisfaction, Happiness, Motivation, Confidence, Interaction with Tutor and Interaction with peers respectively. The average scores for each factor are shown in Table II.

Table II. Comparison of Engagement Score of Three Different Assignments

Emotional and Social Engagement Factors	Individual Subjective Assignment	Individual Objective Assignment	Scenario based Collaborative Mini Project
Satisfaction	4.17	3.65	4.45
Happiness	4.46	3.71	4.6
Motivation	4.03	3.8	4.28
Confidence	4.05	3.62	4.54
Interaction with Tutor	4.31	4.08	4.01
Interaction with Peers	3.29	2.71	4.23
Engagement Score	**24.31**	**21.57**	**26.11**

Table II, shows the engagement score for Realistic Scenario based Collaborative Mini Project is high compared to all other assignments and it is also depicted in Fig 1.

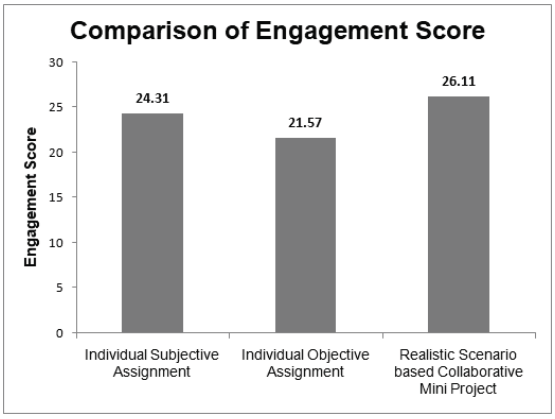

Fig.1. Comparison of Engagement Score of Three Different Assignments

From the data, we were able to infer that the overall engagement score has been improved by 11% in online learning systems **with collaboration** compared to online learning systems **without collaboration** (Individual assignments).

We also compared the engagement score attained by the male and female students separately for each of the three assignments. We noticed that the overall engagement score is more in collaborative based assignment compared to the individualistic assignments among both genders. We also noticed an interesting factor that, the engagement score of female students was always more than male students across assignments as shown in the Fig 2.

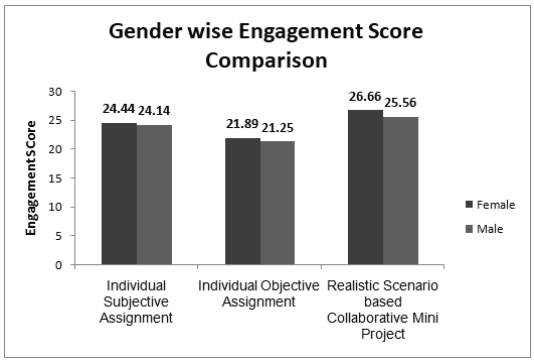

Fig.2. Comparison of Engagement score of three different assignments based on gender

We did a comparison of the engagement score attained by the rural and urban students for each of the three different assignments. We noticed that the overall engagement score is more in collaborative based assignment compared to the individualistic assignments among both the rural and urban students. Even though the engagement of urban students is more than the rural students in all the three different assignments, we notice that the difference in engagement score between rural and urban students for individual subjective assignment is 1.38, for individual objective assignment is 1.66 whereas the difference is 1.24 in collaboration based assignment which is the lowest among the three type of assignments, as shown in Fig 3.

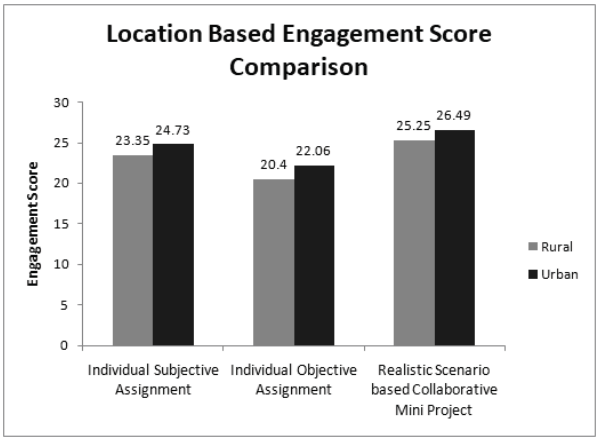

Fig.3. Comparison of Engagement score of three different assignments based on Location

The confidence level of the students was also measured before and after doing the assignments using Likert scale with the value 1 as minimum and 5 as maximum. It is noted that the confidence level is improved after completing each assignments. The result is shown in Fig 4.

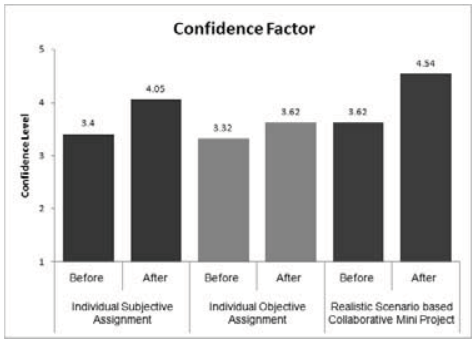

Fig.4. Comparison of the confidence level of students before and after doing each assignment

Another important measurement is, Students Net Promoter Score (sNPS). To measure this, students were asked to,

"*Rank the level of the recommendation you suggest your juniors or other classmates to do Realistic scenario based collaborated Mini Project*" in the scale of 1 to 5, where 1 is "I won't Recommend" and 5 is "Strongly Recommend". The responses were broken into three categories,

i. *Promoters* – Students who respond 4 and 5, which is an indication that they are fully satisfied
ii. *Passives* – the score 3 indicates the student is neither happy nor unhappy and they are neutral.
iii. *Detractors*- Student who respond 1 or 2 indicate that they are not satisfied.

sNPS is calculated using the equation 3.

$$sNPS = \%\ of\ Promoters - \%\ of\ Detractors \qquad (3)$$

Result shows that sNPS is 83% in online learning systems with collaboration. It is depicted in Fig 5

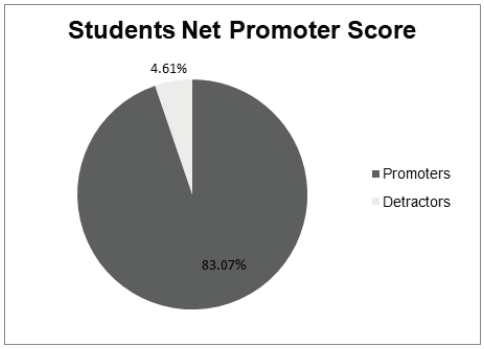

Fig.5. Students Net Promoter Score

During the start of the course only 26.2% of the students were self motivated. However, motivation percentage is increased after doing all the three assignments, it is noticed that motivation

percentage of doing assignments with collaboration is more compared to the motivation percentage of doing assignments without collaboration. The comparison of motivation percentage is shown in Fig.6.

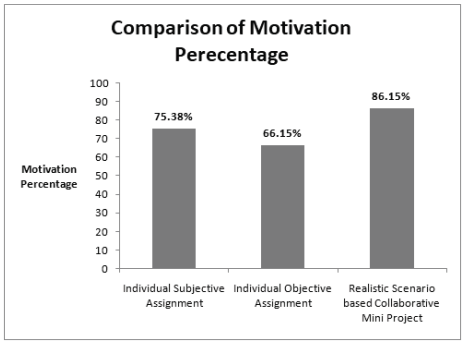

Fig.6. Comparison of Motivation percentage of the students for three different assignments

V. Conclusion

In online learning, to boost the academic performance and to improve the engagement of any category of students, male or female, urban or rural, intrinsic motivated or extrinsic motivated, it is suggested that the instructors have to provide a realistic scenario based mini-projects as assignments that can be done collaboratively by a team of students, in addition to traditional subjective and objective assignments. This will improve both the Emotional and Social Engagement (ESE). High level of ESE not only improves the academic performance but also increases the pro-social behaviors such as kind-heartedness, sharing, and empathy. It also helps to develop self-awareness, self-management, social awareness, relationship skills, responsible decision making, inculcate leadership skills and improves the intrinsic motivation. Collaborative learning method makes the learning experience more memorable. It is also associated with best positive outcomes for the student success and results in lifelong learning.

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