Amalgamated Learning Framework—A Pedagogical Solution and Social Incentive Mechanism for College Learners in Evolutional Blended Learning

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Abstract One of the demanding tasks of evolutional blended learning (BL) is how to improve learner participation from a social perspective. The difficulty of this task is due to a lack of online social incentives and to how challenged and resourceful learners can be identified and grouped easily for F2F and online collaboration. This paper proposes an amalgamated learning (AL) framework that has (i) a social incentive mechanism that uses Herzberg motivation-hygiene and cooperative competition theories to motivate learners; (ii) a pairing algorithm to adequately pair resourceful and challenged learners for F2F and online P2P collaboration based on specific difficulties; and (iii) a learning pedagogy to ensure content and human interactions and to enable recognition of learners’ online actions to aid the incentive and the pairing mechanisms. The authors developed a prototype LMS for an experiment, and our results showed that influential and consequential motivation factors in the AL framework group influenced better learning and knowledge outcome compared to an evolutional BL group.

Keywords: amalgamated learning, blended learning, P2P collaboration, social incentive, cooperative competition, pedagogy

1. Introduction

Blended learning (BL) is generally defined as the combination of F2F and online learning (1). This is because skills, strategies and techniques used effectively in online learning might not work well in traditional F2F learning, and vice versa (2). Online learning enhances communication to ensure social constructivism (3), but does not have enough social factors within an educational context to improve participation (4-6). Therefore the application of BL enables the missing online social factors to be complemented in the F2F learning. There are generally two categories of BL application. The first is revolutionary BL where some specific but complementary technologies, F2F and online teaching and learning theories and methodologies are systematically combined for the purpose of satisfying a specific BL need. The second is an evolutional BL, often in colleges, where learners take active control of their learning on the Internet after the traditional F2F classroom lecture.

In the evolutional BL, college learners are considered matured and perceived to be able to manage their online learning (7), thus not much attention is given to their online participation. This has resulted in complex learning practices, but they still satisfy another BL definition: “learning facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning, and founded on transparent communication amongst all parties involved with a course” (3). Thus the lack of a formula for the mode of delivery vis-à-vis suitable teaching and learning styles for this BL creates an opportunity to redesign how BL courses should be delivered in colleges (7), especially with a focus on elements of social interactions (3).

In this paper the authors propose an amalgamated learning (AL) framework that enables learners to access contents through computer terminals and collaborate among themselves and their instructor, synchronously and/or asynchronously, physically and virtually in the physical F2F classroom, and extend their collaborative learning onto the Internet (8). Three synergized models are suggested to improve learning participation by utilizing learners’ online actions. The first is an online incentive model that uses Herzberg motivation-hygiene theory coupled with cooperative competition in the instructional design to motivate learners for goal-relevant actions. The second is a pairing algorithm that pairs learning “challenged” learners and resourceful learners to collaborate to achieve their learning goals. The third is a learning pedagogy that connects both F2F class-
room and Internet learning through online learning that tracks learners’ online actions. Based on these models, a prototype learning management system (LMS) is developed for a learning experiment. Results show that a group of college learners in AL framework have better learning participation and knowledge outcome when compared with another group in evolutional BL.

2. Research Background

In most BL cases learners spend more time online than in F2F interactions. During the online learning, learners usually encounter content or cognitive difficulties, and can easily drop-out if there is no supportive content and appreciable human assistance\(^\text{2,3}\). Even if learners persist in their learning, some of them can suffer from knowledge confidence discrepancies\(^\text{14}\).

To enable human assistance in BL, Vygostsky’s zone of proximal development (ZPD) has been used\(^\text{3}\). This is a distance between a learner’s independent development and a potential development determined when in collaboration with an adult, or more capable peers. However, in a community of students there are different personalities, like egoistic, selfish, and low and high self efficacy learners, who have to be motivated for learning participation.

Participation is a process that comprises doing, communicating, thinking, feeling and belonging\(^\text{15}\), and some studies have shown how to achieve it. One way is by compulsion, where learners must engage online to achieve learning goals\(^\text{3,7}\). Another is by online incentive, such as social status, to encourage learners\(^\text{6,16,17}\). This paper combines both approaches by use of online social incentive, pairing algorithm and a learning pedagogy.

2.1 Need for online social incentive

In most BL situations teachers’ online time is usually limited. Additionally, learners who already know topics and learners with higher self-efficacy who understand topics faster might have low online turnout to support their peers, unless they are given roles with appropriate online social incentives\(^\text{6,16,17}\). This will ensure the cognitive, social and affective of their learning\(^\text{3}\). One way to implement this is to reconcile behaviouristic and social constructivist approaches, through considering stimulation, motivation and reward for online behaviour as well as the need for educational discourse along Vygotsky’s ZPD\(^\text{4}\).

2.2 Need for pairing learners for collaboration

Studies have shown that collaboration among learners improves learning more than individual and/or teacher-centered learning. This is because college learners in their community have differences in cognitive abilities\(^\text{18,19}\). There are challenged learners, those who have encountered content, social or cognitive difficulties during learning, or those who have low learning self efficacy. There are also resourceful learners, those who have higher metacognitive ability or required solution, or those who might give some sorts of assistance, to support the challenged learners through collaboration. The collaboration enables learners to challenge, develop, acquire and check ideas among themselves\(^\text{20}\), and with their instructor on issues beyond their control. However the inadequate human interaction due to contact difficulty among learners, and between learners and instructor\(^\text{6}\), necessitates online pairing\(^\text{21}\).

2.3 Need for amalgamated learning pedagogy

In order to reward incentives and pair learners online to improve participation, there has to be a protocol in the instructional design that helps to recognize learners’ online goal-relevant actions\(^\text{16,17}\). However, the current efforts were not meant to serve AL framework’s pedagogical requirements that connect F2F classroom and Internet through online learning in order to recognize learners’ actions, pair learners based on specific difficulties, and automatically reward and assign roles to learners.

2.4 Research questions

- How can learners in AL be motivated to engage in online goal-relevant activities, especially how can resourceful learners be motivated to be online frequently to support their peers?
- How can resourceful and challenged learners be easily identified and paired, based on specific difficulties, for online P2P collaboration at any stage of the learning?
- What instructional design is essential for AL to improve communication in order to recognize learners’ online actions to enable the social incentives and pairing?
3. AL Framework Design Methodology

The AL framework is founded on behaviourist and social constructivist strategies within a community of practice with emphasis on online social incentives. The blend is a F2F networked classroom or computer pool and Internet learning, which allows learners to move to and from the classroom and the Internet. To ensure participation in the AL framework, learners are modeled as an organization and with goal-relevant activities as learning, understanding with confidence and supporting (teaching) others, while their teacher is a “manager”. Considering this model it was hypothesized that: 

If learners in AL are aided with an interaction tool and are given online roles to support their peers, and their online individual and support efforts are recognized for online social incentives: (i) such social incentive will put the learners into cooperative competition to learn harder; support and consult peers to improve participation with the aim of receiving better reward; and (ii) the learners in AL will enjoy interpersonal relationships and have learning security to get them a better knowledge outcome than learners in evolutional BL. Thus an online social incentive, a pairing algorithm and a learning pedagogy models were proposed to test this hypothesis for the AL framework (Figure 1).

3.1 Online social incentive model

The online social incentive model (SIM) consists of two social psychological theories. The first is Herzberg’s motivation-hygiene theory. This theory emphasizes using hygiene factors (salary, security, interpersonal relationships, social status) and motivation factors (achievement, recognition, responsibility, advancement) to encourage members to give out their best to achieve the organizational goal. Second is a cooperative competition (CC) that allows members, who by nature are competitive and can cooperate with their peers, to share and exchange resources and improve common practices, such as problem solving skills, to achieve their goals without trespassing against each other. CC in the AL framework is just to support the competitive nature of learners that might be triggered by the incentive. The SIM has three functions—learner online actions evaluation, learner promotion, and CC.

3.1.1 Learner online actions evaluation

Learner online actions are the goal-relevant activities that lead to the organizational goal. The main goal-relevant activities implemented in the AL framework for any learner on a topic are knowledge comprehension (i.e. function A_{DP}), knowledge confidence (i.e. function B_{DP}), and teaching or supporting peers (i.e. function C_{DP}). These main activities are also broken into sub activities for reward points in order of importance as shown in the following activity-reward functions (ARF).

\[
A_{DP} = a_1, p \text{ if (knowledge comprehension 1)} + a_2, p \text{ if (knowledge comprehension 2)} + \ldots + a_n, p \text{ if (knowledge comprehension n)}
\]

\[
B_{DP} = b_1, p \text{ if (Confidence Choice 1)} + b_2, p \text{ if (Confidence Choice 2)} + \ldots + b_m, p \text{ if (Confidence Choice m)}
\]

\[
C_{DP} = c_1, p \text{ if (support 1)} + c_2, p \text{ if (support 2)} + \ldots + c_g, p \text{ if (support g)}
\]

where, \(f\) and \(g\) are integers for number of sub activities respectively

Function A_{DP} is linked to an online multiple-choice assessment (OMA) that takes the first two levels of Bloom’s taxonomy. Function B_{DP} is linked to discrepancy checks that include Skip, Understood, Not understood and Not Clear available on each topic (page), and every learner must select one before proceeding to the next topic. Any choice triggers the learner-content communication function below.

If a learner selects \(U\) or \(C\) or \(S\), then learner will take OMA to confirm the choice.
If the learner passed the OMA, points are awarded, through A_{DP} and B_{DP} and learner continues to next topic.
If the learner failed the OMA then learner will be considered as selecting \(S\), and has to select an action from a set of system supporting actions such as: i-Collaborate with Peers Immediately (for
This communication function ensures diagnostic, formative and summative assessments\(^{(26)}\), and reduces knowledge discrepancies\(^{(14)}\). The diagnostic feature allows resourceful learners to be identified quickly so that they can be assigned roles of supporting their peers. The formative feature enables feedback that allows resourceful learners, the LMS and instructor to give support. Any learner who supported another learner synchronously or asynchronously gets rewarded through \(C_{\text{ID}_{p}}\) automatically after the challenged learner passed the OMA. The summative feature allows the instructor to use learners’ performances as part of the overall course grading.

### 3.1.2 Learner promotion

The first stage is to make a hierarchical social position (status) structure, \(\Phi_1, \Phi_2, \ldots, \Phi_{\beta+1}\). The positions can take any motivational social titles, e.g. Beginner, Assistant, Master, etc. All learners start from the lowest social position, \(\Phi_1\), and a learner will be promoted if the learner’s total reward score hits some limits determined dynamically online. From the ARF, the minimum and maximum total reward scores per topic will be, \(MnS_{p} = a_{k,p} + b_{k,p}\) and \(MxS_{p} = a_{k,p} + b_{k,p} + c_{k,p}\) respectively if reward points are in ascending order. It can be seen that \(MnS_{p} < MnS_{p+1} < MxS_{p}\). This enables the online dynamic positioning as learners can complete learning without necessarily being on position \(\Phi_p\), and resourceful learners can be on position \(\Phi_p\) without necessarily completing all topics. The next stage is to design a dynamic positions and promotion scale (Figure 2).

Let the maximum scale point (MxSP) = \(\Omega\), where \(\Omega\) is a real number and it holds the total reward score (TRS) of the learner with the maximum reward score. And let the minimum scale point (MnSP) = 0 at any learning stage.

At the beginning of the class \(\Omega = \sum_{p=1}^{\beta} MnS_{p} = \text{number of topics}\).

This is because the value of function \(C_{\text{ID}_{p}}\) cannot be guessed in advance as the learners’ support attitude cannot be foreseen, and \(C_{\text{ID}_{p}}\) is not a precondition to move to the next topic during learning. The \(\Omega\) value is then divided by \(\beta\) (number of social statuses) to get a range magnitude, say \(r\), for a social position. The ranges are then distributed to the social positions as follows, \(\Phi_1 = r, \Phi_2 = 2r, \ldots, \Phi_\beta = \beta r\). These ranges are dynamically recomputed when a greater TRS replaces the previous \(\Omega\) value during learning.

Any time a learner completes any topic, the learner’s activity log data will be checked automatically and the current positions are computed and displayed, which may promote or demote a learner. If a learner reaches the highest position, \(\Phi_\beta\), a facilitating role will be assigned automatically even if all the topics have not yet been completed because it is important to start preparing the mind of such a learner towards the facilitating role. How to search and support challenged peers will be displayed, and such a learner can also consult the instructor or other peers on \(\Phi_\beta\) when facilitating difficulties occur.

### 3.1.3 Cooperative competition

Competition makes college learners more readily engaged to achieve their learning goals\(^{(16)}\). But CC enables a group of learners, who by nature are competitive and cooperative, to share and exchange resources and improve learning practices to achieve their learning goals without trespassing against each other\(^{(23-25)}\). CC in the AL framework caters for the learners’ competitive nature by enabling learners to gain payoffs through learning moves to maintain or upgrade their scores or social positions, while assuming that other learners are trying to maximize their score as well\(^{(27)}\). In AL a learner, \(ID\), can freely decide on moves to maximize payoff on any topic, \(p\), to improve his/her position from the following list.
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- Learn topics again to improve knowledge comprehension to better $A_{dp}$ score.
- Select appropriate or a better knowledge confidence check after (re)learning topics to better $B_{dp}$ score.
- Support challenged peers who have made contact for help or posted questions to BBS to better $C_{dp}$ score (i.e. the case of general support by any learner).
- Search for and support challenged peers to better $C_{dp}$ score (i.e. only for learners with the facilitating role).

3.2 Online Peer-to-Peer (P2P) pairing algorithm

The pairing algorithm pairs a challenged learner with a resourceful peer or instructor for P2P collaboration to solve encountered difficulties. This will help challenged learners to have an understanding of the context at a close approximation to that of their resourceful peers\(^{(28)}\).

3.2.1 Challenged learner to resourceful learner

Suppose that a challenged learner, $X$, on a social position, $\Phi_x$, has a difficulty on topic $P_x$. The algorithm picks a closer resourceful learner, $Y$, on a position, $\Phi_y$, and topic, $P_y$, to collaborate with $X$. Here $X$,

<table>
<thead>
<tr>
<th>Selection Priority</th>
<th>Determinant</th>
<th>Cognitive Reasons (According to Priority)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$\Phi_x=\Phi_y$, $D=1&amp;2$, min($K$)</td>
<td>$X$ and $Y$ are co-equal, and $Y$ is familiar with the same difficulty.</td>
</tr>
<tr>
<td>2</td>
<td>$\Phi_x=\Phi_y$, $D=1$, min($K$)</td>
<td>$Y$ is a senior to $X$ and familiar with the same difficulty.</td>
</tr>
<tr>
<td>3</td>
<td>$\Phi_x&lt;\Phi_y$, $D=1&amp;2$, min($K$)</td>
<td>$Y$ is a junior to $X$ and familiar with the same difficulty.</td>
</tr>
<tr>
<td>4</td>
<td>$\Phi_x&lt;\Phi_y$, $D=1$, min($K$)</td>
<td>$Y$ is a majo-country and closer to $X$.</td>
</tr>
<tr>
<td>5</td>
<td>$\Phi_x&lt;\Phi_y$, $D=2$, min($K$)</td>
<td>$Y$ is a minor-country and closer to $X$.</td>
</tr>
<tr>
<td>6</td>
<td>$\Phi_x&lt;\Phi_y$, $D=0$, min($K$)</td>
<td>$Y$ is any learner to share a difficulty with.</td>
</tr>
</tbody>
</table>

Y $\in$ \{StudIDs\}, $P_x$, $P_y$ $\in$ \{TopicsIDs\} and $\Phi_x$, $\Phi_y$ $\in$ \{Social Positions\}. Let $D=0$, 1, and 2 which represent learners' familiarity with a specific difficulty as defined in the Essential Data Objects and Programming Logic.

The resourceful learners are listed in a window, for challenged learners to select from. The list order is done by the LMS. Therefore to reduce high uncertainty for the LMS, $D$ value is strictly considered in the selection priority in Table 1. A learner with $D=1\&2$ has the highest priority, because that learner has had, and has given a solution to, the same difficulty before. A learner with $D=1$ is next, because that learner has had such difficulty and might have solved it from various versions of solutions from peers. A learner with $D=2$ follows, before a learner with $D=0$; though the latter may be more appropriate, the LMS cannot know. In that case learners can make direct contacts to their peers.

3.2.2 Resourceful learner to challenged learner

A learner-facilitator model (Figure 3) whose functions pick relevant data from the LMS's log files to feed a facilitating interface (Figure 5) is designed to complement those difficulties that can be observed in the F2F classroom. This enables resourceful learners and the in-
3.3.2 Content exploration

Participation effort will be recognized for promotion which will affect their course credits. The goal-setting narrows learners' attention and directs their efforts to mainly goal-relevant activities, and influences their persistence towards the goal, especially if the ultimate goal is divided into sub-goals.

3.3.3 Learning challenge

This is the stage where individual learners interact with online contents from the first topic through the last topic, inside and outside the classroom, within the set goal to master self-regulation, and to create their own mental schema of the topics. The stage tracks learners' previous knowledge, topic comprehension and knowledge confidence through the functions $A_{IDP}$ and $B_{IDP}$ (elaborated under section 3.1.1).

3.3.4 Learning socialization

This is a situation in the exploration stage where learners encounter content or cognitive difficulties and may not know the next action to take, which could lead to drop-out. The LMS (Figure 5) supports learners to overcome a difficulty by highlighting or describing difficulties and to select an action from the system supporting actions (section 3.1.1), which include choosing system or human assistance. Difficulties are tracked and stored as separate entities, whose attributes are the difficulty-item, topic, document, learner ID and time to facilitate the pairing algorithm (section 3.2), and the entities serve as the context of discussion. Otherwise when a learner is idle, a timer-agent compares the learner’s average learning rate with that of the group. If there is a “big” difference it sends help messages to the learner’s screen for the learner to select an appropriate action.

3.3 Learning pedagogy

The pedagogy consists of the working protocols in the community which is meant to improve communication to enable cooperative learning (Figure 4). It allows self-efficacy building through learner-content interaction and social speech through synchronous and asynchronous human interactions. It has five stages that form a learning cycle and binds both Internet and F2F classroom learning to track learners' online actions. The respective stages are discussed from sections 3.3.1 through 3.3.5.

3.3.1 Goal setting

This is the beginning of the learning where the instructor explains briefly in the F2F classroom about the topics and how to achieve learning goals. At this stage computer novices have the opportunity to master online learning skills with the support of their instructor and peers in the F2F classroom. All learners start learning on the lowest social status, and are informed that their participation effort will be recognized for promotion which will affect their course credits. The goal-setting narrows learners' attention and directs their efforts to mainly goal-relevant activities, and influences their persistence towards the goal, especially if the ultimate goal is divided into sub-goals.

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3.3.4 Learning socialization

This is the human interaction stage which occurs online and in the F2F classroom. It is influenced by the learning challenge stage, P2P pairing, and other social factors that affect learning in the community.

Online—This occurs when a challenged learner, $X$, selects a resourceful learner (RL) presented by the LMS, or is located by a RL or instructor for a synchronous dialogue. If $X$ has posted a question to the BBS or through mail, any RL or instructor can respond asynchronously.
Any dialogue and the IDs of learners involved are stored, and RL is rewarded through function $C_{ldp}$ after $X$ has passed the OMA (section 3.1.1).

**F2F**—In the AL framework, learners interact physically to socialize, clarify discussions that might have started online, resolve conflicts and support each other. They also meet with their instructor to discuss outstanding issues including persisting difficulties that occurred during the online session. The instructor is able to access all stored difficulty entities from the system’s log files to (re)strategize the F2F.

### 3.3.5 Evaluation

Evaluation is in two phases. One is individual learner evaluation through the OMA (section 3.1.1) at the exploration stage. The other is the overall course evaluation by the instructor where online social statuses are considered in addition to scores of exams or other activities, if any, which might take the third to sixth levels of Bloom’s Taxonomy.

### 4. Experiment Method

#### 4.1 Experiment groups

The purpose of this experiment was to test the hypothesis declared under section 3 to find out how the AL framework affects the participation and knowledge outcome of a group of learners compared to the learning outcomes of another group of learners in evolutional BL.

A total of 45 enrolled students for a beginners Java programming course were used. All the learners were familiar with computer learning, and some of them already knew other programming languages. In the 2008 academic year, 20 of the enrolled students were randomly divided into Group A, for the AL framework, and Group B, for evolutional BL (10 students each). Due to the small number of students and difficulty in getting more students in 2008, another 25 students were enrolled in the 2009 academic year where Group A had 13 students and Group B had 12 students. Group A, in both years, used the same LMS (Figure 5) that hosts example-based documents. These learners could also access other contents from anywhere on the Internet to complement the class contents. Group B, in both years, was engaged in a traditional F2F lecture and Q&A session after which they were given handouts and homework. Lecture notes were put online where they could interact through the BBS, chatroom or mail outside the classroom without tracking their online actions. Both groups took an exam at the end of the first week of the course.

The authors were the designers, teachers and facilitators of both groups. This involvement has the disadvantage of not providing critical external feedback, however it is still a valuable tool to improve practice and interpret the learning and social dynamics from an inner perspective(7). Data collection was done through interviews, questionnaire responses, extracts from the system’s log data, and observing learners both online and in the F2F classroom. The authors presumed that the first one week’s learning outcome was enough because learners would be committed as their weekly efforts contributed to their course credits at the end of the course. Additionally, it would reveal the learners’ true reactions.
Table 2. Activity-Reward Functions Setting.

<table>
<thead>
<tr>
<th>Knowledge Comprehension</th>
<th>if comprehension 1: ( a_{1,p} = 2 )</th>
<th>i.e. OMA score from 90 to 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>if comprehension 2: ( a_{2,p} = 1 )</td>
<td>i.e. OMA score from 80 to 89%</td>
</tr>
<tr>
<td></td>
<td>if comprehension 3: ( a_{3,p} = 0.5 )</td>
<td>i.e. OMA score from 70 to 79%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge Confidence</th>
<th>if choice 1: ( b_{1,p} = 2 )</th>
<th>i.e. If Skip selected and OMA passed.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>if choice 2: ( b_{2,p} = 1 )</td>
<td>i.e. If Understood selected and OMA passed.</td>
</tr>
<tr>
<td></td>
<td>if choice 3: ( b_{3,p} = 0.5 )</td>
<td>i.e. If Not Clear selected and OMA passed.</td>
</tr>
</tbody>
</table>

Teaching or Supporting

<table>
<thead>
<tr>
<th>if support 1: ( c_{1,p} = 3 )</th>
<th>i.e. a resourceful learner searched for and supported a challenged learner.</th>
</tr>
</thead>
<tbody>
<tr>
<td>if support 2: ( c_{2,p} = 2 )</td>
<td>i.e. any learner supported any other learner.</td>
</tr>
<tr>
<td>if support 3: ( c_{3,p} = 1 )</td>
<td>i.e. a learner's learning object (BBS or chat) was utilized by others and OMA passed.</td>
</tr>
</tbody>
</table>

4.2 Learning management system setup

Reward points for activity-reward functions, elaborated under section 3.1.1, were assigned as described in Table 2.

Three social positions (section 3.1.2) were considered, and their corresponding ranges were set as follows. **Beginner**, with a social status range of 0 to \( \Omega/3 \), **Assistant**, with a social status range of \( \Omega/3 \) to \( 2\Omega/3 \), **Master**, with a social status range of \( 2\Omega/3 \) to \( \Omega \).

5. Results and Discussion

5.1 Factors that motivate learning participation

The causes of participation were observed and categorized into two. One is influential factors, which are context-base factors implemented intentionally by instructors, educators, policy makers or researchers to encourage learning. The other is consequential factors, which are learners’ reaction and belief factors that are influenced by their personalities, the influential factors and the environment. “How” and “What” question tags were used to ascertain influential and consequential factors respectively through questionnaire responses and interviews.

5.1.1 Participation factors in group A, 2008 & 2009

At the end of the week’s course, both the consequential and influential factors (Table 3) showed that learners found the online of AL framework encouraging and supportive. The cooperative competition was also

Table 3. Questionnaire Results of Group A.

<table>
<thead>
<tr>
<th>I. Influential Factors</th>
<th>Question: How did the social status affect your learning?</th>
<th>Responses</th>
<th>% of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Encouraged me to learn quickly and to do more learning</td>
<td>41.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Made me focus on essential parts to complete my learning</td>
<td>6.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Encouraged me to learn and help others</td>
<td>48.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Made the e-learning more interesting for me</td>
<td>3.5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. EFFECT OF ROLE ASSIGNMENT</th>
<th>Question: How did the role of supporting others affect your learning?</th>
<th>Responses</th>
<th>% of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Made me enjoy searching for my peers to help them</td>
<td>16.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Made me to understand and cooperate with my peers better</td>
<td>19.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Helped me to further understanding of the topics</td>
<td>35.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gave me confidence on what I know about the topics</td>
<td>16.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Helped me to gain better sense of belonging</td>
<td>12.9</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. COOPERATIVE COMPETITION</th>
<th>Question: What made you work hard in this learning?</th>
<th>Responses</th>
<th>% of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Getting a higher score in order to have better Social Status</td>
<td>34.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seeing some of my peers were ahead of me or had a higher Social Status</td>
<td>39.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Being one of the best students in the class</td>
<td>26.1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. LEARNING SECURITY</th>
<th>Question: What gave you satisfaction in the online learning environment?</th>
<th>Responses</th>
<th>% of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>There are people online to support me when I had some difficulty</td>
<td>52.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The flexibility of the system.</td>
<td>20.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The rise in social position gives satisfaction.</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I did something useful with my time to help someone when I am free.</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Curious about this type of e-learning.</td>
<td>4.0</td>
<td></td>
</tr>
</tbody>
</table>
AMALGAMATED LEARNING FRAMEWORK—A PEDAGOGICAL SOLUTION AND SOCIAL INCENTIVE MECHANISM FOR COLLEGE LEARNERS IN EVOLUTIONAL BLENDED LEARNING

Stud002: dear Master
Stud002: what is the difference between print and println?
Stud004: print prints a string and println prints a string and puts the linebreak in the end
Stud002: thnx
Stud004: for ex. Print ("hey"); print("dude"); outputs "hey dude" but println("hey"); "hey"); outputs "dude"
Stud002: how can I become Master, master?
Stud004: studing makes perfect my dear follower
Stud002: thanx you master, you have my eternal respect and I'll be forever thankful

Figure 6. CL Selected and Consulted a RL.

Stud001: can I help you?
Stud003: what is input output
Stud001: input is the input data to your program and output is the result of your program
Stud003: can I do the quiz with such
Stud001: I can not remember the exact question of the quiz though
Stud001: I can not remember the exact question of the quiz though
Stud003: so make a summary of what is it about
Stud001: let say the functionality of your program is adding 2 numbers then the input are those two numbers to be added and the output is the result of the addition, for example 2+3=5, 2 and 3 are inputs and 5 is the output.
Stud003: thanks
Stud001: no problem

Figure 7. RL Searched for and Supported a CL.

healthy as learners were rather motivated to learn and support their peers through cooperation, though they were not told to compete. 60% and 54% of the students in years 2008 and 2009, respectively, attained Master status while the rest, in both years, attained Assistant status. This implies that an average of 56.5% of the total learners of both years supported their peers in one way or the other.

Figures 6 and 7 show some dialogues between challenged learners (CLs) and resourceful learners (RLs). Learners also used the BBS for their asynchronous discussion. The learners reported that they preferred to post questions to the BBS when they wanted to do their own research on the question as they waited for responses, or when their peers were busy or offline. Learners dialogues were very responsible, and lacked the chat noise and confusion often characterizing unguided BBSs and chatrooms(10), though some incorrect answers were observed in some responses. This responsible attitude might be influenced by learners’ awareness that their online actions were recognized. A careful analysis of the learners’ dialogues in relation to the responses in Table 3 revealed three consequential factors as follows.

Cognitive: Learners acknowledged the fact that they were able to challenge, develop, acquire, and check ideas(20) with peers to comprehend and complete topics with confidence.

Affective: Learners knew that their efforts were being recognized by their instructor and peers as some of their peers called them “Master” both online and in the F2F classroom. Some of these learners on Master status showed their satisfaction, if not pride, openly in the class with comments like “it feels good to be called a Master.”

Social: Some CLs might not have sought support if not contacted by an RL, and CLs expressed appreciation to the RL, though the RL might have helped because of the reward. It was common to find such learners extending their interactions in the F2F classroom. The authors think such interactions can improve the relationship and social skill and may lead to reciprocations.

Finally, though almost all of the learners expressed satisfaction with the AL framework, 26% hinted that:

- The system put too much pressure on them because they had to earn more points for a higher position.
- Some contacts from their peers and the timer-agent disturbed their attention.

5.1.2 Participation factors in group B, 2008 & 2009

Consequential factors were ascertained from Group B in both years; the authors did not implement any influential factors for these learners. They were asked “What influenced your hard work during this learning?” 80% of the total learners indicated that they were motivated by the homework, but the rest indicated the topic difficulty or their willingness to be among the best learners in the class. Interestingly none of the learners contacted the instructors online, and a few of these learners did not even go online, behavior also experienced by Delfino and Persico(7). The majority that went online gave the following main reasons.

i. They did not grasp topics during the F2F lecture.
ii. There were some difficult items in the lecture notes.
iii. There were some difficult questions in the homework.

As regards what gave them online learning satisfaction, “freedom of learning and interaction with peers to solve problems” was the answer from many learners of Group B who went online.

5.2 Knowledge performance between A and B

The statistical analysis of exam scores (marks 0–100%) at the end of the course (Table 4) showed that the
Table 4. Group Knowledge Performances.

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average: 89.0</td>
<td>Average: 68.0</td>
</tr>
<tr>
<td></td>
<td>Variance: 54.4</td>
<td>Variance: 62.2</td>
</tr>
<tr>
<td></td>
<td>(N=10)</td>
<td>(N=10)</td>
</tr>
<tr>
<td>2008</td>
<td>P-Value (2-tailed): 1.03E-5</td>
<td></td>
</tr>
<tr>
<td>Academic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>Average: 91.5</td>
<td>Average: 73.0</td>
</tr>
<tr>
<td></td>
<td>Variance: 64.1</td>
<td>Variance: 215.7</td>
</tr>
<tr>
<td></td>
<td>(N=13)</td>
<td>(N=12)</td>
</tr>
<tr>
<td></td>
<td>P-Value (2-tailed): 1.2E-3</td>
<td></td>
</tr>
<tr>
<td>2008+</td>
<td>Average: 90.4</td>
<td>Average: 70.7</td>
</tr>
<tr>
<td></td>
<td>Variance: 58.9</td>
<td>Variance: 145.9</td>
</tr>
<tr>
<td></td>
<td>(N=23)</td>
<td>(N=22)</td>
</tr>
<tr>
<td>2009</td>
<td>P-Value (2-tailed): 1.6E-7</td>
<td></td>
</tr>
<tr>
<td>Years</td>
<td></td>
<td></td>
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</tbody>
</table>

knowledge outcome of Group A outperformed that of Group B in both years. The authors think that it was because Group A was stimulated through compulsion and social incentives to participate more online than learners in Group B who had freedom to go or not to go online.

5.3 Hypothesis outcome

The experiment results justified the truthfulness of the hypothesis, and showed that the AL framework, which recognizes online actions, assigns online roles and pair learners for P2P collaboration and rewards online incentive, improved learning participation and knowledge outcome compared to the evolutionary BL environment.

6. Conclusion

This paper proposed as amalgamated learning (AL) framework that has an online social incentive mechanism, a pairing algorithm and a learning pedagogy to improve learning and to solve the participation problem of evolutionary BL.

The social incentive mechanism uses Herzberg motivation-hygiene and cooperative competition theories, and utilizes learners’ online efforts for online social position and online role assignment.

The pairing algorithm enables challenged learners and resourceful learners to know and consult with each other to solve specific problems during learning.

The learning pedagogy joins the F2F classroom and the Internet through online learning and recognizes learners’ online actions to improve communication.

An experiment evaluating learners in evolutionary BL and learners in the AL framework showed that the gap between technology and social psychology can be narrowed in the AL framework to improve participation and knowledge outcome. Furthermore, the combination of P2P collaboration and the BBS with the support of online learner pairing and social incentive mechanisms within Vygotsky’s ZPD framework enables an effective learning tool for improving the cognitive, social and affective factors of learning in college classrooms.

In the future, the authors will investigate which college learning situations or courses can be improved when learners are stimulated to participate online (i) by compulsion, i.e. obliged to use an online facility for a course(5,7), (ii) by online social incentive, i.e. receiving online reward for motivation(6,17), and (iii) by the combination of both (i) and (ii), in BL environments.

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References


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