An Analysis of Learner Attributes and Interactions in Synchronized e-Learning*

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This study analyzed how e-learning at junior high school level is affected by learner attributes and interactions. Previous research has highlighted the need to adapt lesson design to learner attributes. As subjects for our study, we therefore chose learners at the junior high school level, whose learning situation differs from that of adults or university students in that their motivation is less clearly defined. We first tested whether the effectivity of model lessons varied with different learner attributes, and then examined the relationship between interactions and effectiveness. With regard to differences due to learner attributes, a factor analysis of the students' normal learning situation yielded three factors: (1) difficulties in comprehension and assimilation (the student studies but fails to make progress); (2) lack of willpower or weak motivation (the student is unable to study for various reasons); (3) avoidance of study or effort (the student is unwilling to apply him/herself to studying). The factor scores were then submitted to cluster analysis; comparison of the resulting groups identified differences in their factor profiles, lesson evaluations, test score improvement rates, and frequency of chats. To examine the relationship between interactions and effectiveness, we performed a simple regression analysis between the frequency of chats (open or closed) and indices of lesson evaluations or effectiveness. For English, a correlation was found between the frequency of closed chats and the rate of improvement in comprehension test scores.

Key words: synchronized e-learning, learner attributes, interaction, junior high school students

1. INTRODUCTION

1.1. Background to the Research

In recent years, e-learning has shown increasing promise as a learning aid tool in elementary and junior high school education. The present authors have carried out a series of practical studies on interactive learning, including a two-year joint project on learning via remote exchange comprising 450 sessions, mainly involving junior high schools in Fukushima Prefecture.

While practical classroom initiatives such as student research are well under way in junior high school education, there has been relatively little empirical research at this level compared to the senior high school and corporate job training sectors. In this study, we adopted an approach previously used to study e-learning at university level by looking at learner attributes and the effects of interactions, in the hope of gaining additional information by applying the same approach to junior high school students.

1.2. Previous Studies and Significance of the Present Research

In this era of rapid advances in information and communications technology, it is possible to validate classroom teachers' insights scientifically by exploring every potential application of traditional models such as situated learning theory and social constructionism (Kogo 2005; So and Ebe 2006).

Learning can be interpreted as “a process of participation in a community of practice” (Lave and Wenger 1991). Learning thus becomes an interaction with the situation, rather than passive listening or rote memorization, and can be viewed metaphorically as the learner’s taking part in a kind of game.

Further, the assistance of mediators (adults or more skilled peers) and mediating devices plays a critical role in the child’s development (Vygotsky 1978). These approaches have valuable implications for e-learning (sometimes referred to as “virtual school”) for junior high school students.

Their value lies in the fact that, unlike university students and adult learners, who are...
motivated by career or lifestyle goals (such as earning a qualification or credits, a promotion, or a chance to study abroad), junior high school students are asking themselves, with genuine uncertainty, "What good will it do me to understand this formula/remember this word?"

Thus, in their case, it is especially vital that the learning environment provide "mediators" and "mediating devices."

The upper part of Table 1 compares the traditional concept of learning with the situated learning theory mentioned above. In this study, the situation common to the students is the synchronized lesson, and assistance is provided by the teacher and digital tools. The lower part of the table explains the interactions designed for this study in terms of mediating devices and mediators.

Figure 1 shows an "interaction-driven learning and development cycle" based on the model of Harré (1983). The learner obtains knowledge externally (appropriation), internalizes it (transformation), and then engages in self-expression (publication) and sharing (conventionalization). According to Sugai (2000), "learning and development are realized by repeating the cycle of these phases," and "the model is suggestive for Internet-based learning also."

The lesson design in the present study depended on this "interaction-driven learning cycle" model. Instead of verbatim transcription and qualitative analysis of conversations, the design we chose allowed quantitative, systematic analysis of interactions.

An example of such an interaction is the "closed chat," in which a learner who does not understand something in the lesson brings the problem directly to the teacher, without the others knowing. By helping solve the problem, the teacher assists the learner in the first half of the cycle, "appropriation" and "transformation." Similarly, "open chats" are designed as tools to help the learner enact the "publication" and "conventionalization" phases.

A study by Nakao and Adachi (2006) on programming exercises furnishes evidence for the cycle of self-expression and conventionalization. They found that having learners report and share their progress via a "Work Report Page" influenced their "perception of the learning tool as useful" and "desire to learn."

1.3. Practical Research on Interaction Design

Previous work on the design of interactions can be broadly classified under three headings: "learner attributes," "academic subject attributes," and "generic attributes of learners."

First, several previous studies on lesson design take differences in affective learner attributes into account. By reviewing the literature, Kogo (2005) classified e-learning at the university level according to the underlying learning theories in psychology. He found that the weight of interaction in the lesson design increases depending on whether the developers relied on (in ascending order of interactivity) behavioral, cognitive, or situated learning theories. In a study of blended learning at university level, using a questionnaire, Adachi (2007) did a factor analysis of the benefits of lessons as perceived by the learners; he underlines the need to take group characteristics into account in designing lessons for effective blended learning. Kato et al. (2006), in a study of university students posting to an electronic bulletin board, did a correlation analysis of the emotional state of those who posted messages and interpretations of those emotions; they conclude that electronic bulletin boards can be utilized more effectively if learning materials are designed to allow for the emotional state of students who post messages, thus reducing misunderstandings.

With regard to design based on differences in
academic subject attributes, firstly, for English, Kojima et al. (2007) point out the usefulness of three-dimensional learning materials for studying English prepositions at university level and note that their results showed the effectiveness of such materials to differ between projective prepositions (above/below) and topological prepositions (on/off). Kobayashi et al. (2007) provided university students with an audiovisual learning aid system and observed that the lower TOEIC score group tended to focus on the visual content, while the higher TOEIC score group tended to focus on the audio content.

Next, in the field of mathematics/arithmetic, Uchino and Matsuda (2007) reported, based on interviews with elementary and junior high school teachers, that graphic materials and drawing input features are useful in the teaching of functions. Sasaki et al. (2006) gave arithmetic lessons by traditional classroom and remote methods to fifth graders in Japan and Thailand and found, by factor analysis, that while the “enjoyment” factor remained consistently high when measured three times during the study period, the “confidence” factor gradually increased over the same intervals.

These previous studies on academic subject attributes in e-learning suggest that audiovisual elements play a role in both English and mathematics/arithmetic, and that elements of manipulation and repetition also have a role in the latter subjects.

In the area of learners’ generic attributes, in interviews with mature university students, who have time constraints, Yanagimachi and Akakura (2006) demonstrated the usefulness of a bulletin board tool that enables questions to be solved immediately. Also, in a questionnaire survey of teachers, Okura and Hirose (2007) showed that subtitled learning materials are effective for learners with disabilities.

1.4. Aims of the Research

In the practical studies mentioned above (§ 1.1), the authors focused on the need for adequate interaction design (Okada 2007), and observed a wide range of interactions in which skilled learners facilitated the learning of beginners (Takeshita 2007). Two issues relevant to the guarantee of quality emerged from these studies: matching assistance to the learner’s needs, and appropriate interaction design.

Accordingly, in this study, we conducted lessons for junior high school students featuring both synchronized and nonsynchronized contents, with the aim of obtaining concrete suggestions for process design.

First, to determine the learner attributes of the students, we divided them into groups and compared the groups to see whether they differed in their evaluations and score improvement.

Next, to elucidate the role of interactions, we looked at whether chat frequencies and test scores were related within each group and for each academic subject.

2. OUTLINE OF LESSON IMPLEMENTATION

2.1. Outline of the Lessons and Pedagogical Aims

The study examined a series of monitored lessons conducted between December 21, 2007, and January 6, 2008. Four 30-minute lessons were given in each of English and mathematics, with the students divided on each occasion into classes of four types according to fixed criteria. There were 97 participants, of both sexes, in the first year of junior high school; they were located in different parts of Japan and all had the use of a personal computer.

On December 21 and 22, we conducted a guidance session and level test; on January 6, we conducted an achievement test and administered a follow-up questionnaire.

Students could freely choose between an evening session (30 minutes starting at 17:30) and a night session (30 minutes starting at 20:00).

As shown in Table 2, taking the time of year into consideration, we designed the learning contents to allow revision of work covered in the first and second terms and preparation for the third term.

2.2. Learning Environment and Learning Flow

The learners accessed the Internet from their home computers and studied in a format that combined synchronized lessons and nonsynchronized learning contents.

Each lesson was divided into three parts with different purposes: the prep video, the live lesson, and the revision video. Figure 2 shows the learning flow.

(1) Pre-test and Post-test

As a gauge of learning effectiveness, we

<table>
<thead>
<tr>
<th>Table 2. Learning Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
</tr>
<tr>
<td>Unit 1</td>
</tr>
<tr>
<td>Unit 2</td>
</tr>
<tr>
<td>Unit 3</td>
</tr>
<tr>
<td>Unit 4</td>
</tr>
</tbody>
</table>
conducted tests of a fixed level of difficulty, though with different questions, before and after each lesson.

(2) Prep Video and Revision Video

The learners watched these prerecorded videos in their own time. Each was 15 minutes long and could be viewed any number of times.

(3) Comprehension Test

This test checks the learner’s level of comprehension of the prep video. The session format was designed so that learners took a 20-minute test before each live lesson. Based on their results, they were divided into classes according to comprehension level and type of weak points.

(4) Synchronized Lesson

Chats were used. Each live lesson lasted 30 minutes, with 25 students participating in each teacher’s class. The students watched and listened to the teacher’s explanation via live video, but they could not see one another and were identified to the others only by user names. They had access to the other students’ answers to the teacher’s questions and quizzes and to the other students’ comments in free–form chats.

3. ANALYSIS OF THE QUESTIONNAIRE

3.1. Outline of the Questionnaire

On January 8, after completion of the lesson program, a paper questionnaire was administered to the learners to obtain their evaluation of the lessons.

The questions covered their normal learning situation (26 items), their expectations prior to the lessons, their level of enjoyment, perceived usefulness, satisfaction, and willingness to use the same format again. Evaluations were made using a numerical scale of five levels (5: “strongly agree”; 4: “somewhat agree”; 3: “neither agree nor disagree”; 2: “somewhat disagree”; 1: “strongly disagree”). Ninety–three completed questionnaires were received, for a response rate of 96 percent.

3.2. Factor Analysis

To determine the latent factors affecting the learning attributes of the learners, we carried out a factor analysis by the principal factor method. Varimax rotation converged in 13 iterations.

A minimum factor loading of 0.40 was used to identify items belonging to a factor; this enabled 21 of the 26 question items to be extracted. One of these items had a value greater than 0.40 for two factors; we therefore adopted the larger of the two loadings.

Four factors were extracted as result, but we discarded the fourth as it had only two items.

Factor 1 was construed as “difficulties in comprehension and assimilation (the student studies but fails to make progress)”; Factor 2 as “lack of willpower or weak motivation (the student is unable to study for various reasons)”; and Factor 3 as “avoidance of study or effort (the student is unwilling to apply him/herself to studying).”

On calculating Cronbach’s α coefficient to examine reliability, we found an internal consistency of 0.878 for Factor 1, 0.835 for Factor 2, and 0.818 for Factor 3.

3.3. Typology of Normal Learning Situations by Factor Scores

First, we calculated factor scores for the
individual learners and divided the learners into groups by cluster analysis (Table 4).

The groups were characterized by the following factor score profiles: In Group 1, all three factors were positive; that is, because the learners could not understand the material even when they studied it, they had lost the will to try and developed an aversion to study. Group 2 was positive for Factor 1 and strongly negative for Factor 2, indicating that although the members of this group tended not to understand even when they studied, they were willing to try. In Group 3, all three factors were negative; in other words, the learners were not particularly averse to studying.

A one-way analysis of variance showed that, for all three factors, the groups differed significantly at the 5 percent level in their mean factor scores. A multiple comparison indicated significant differences among all the groups.

We next looked at whether the groups differed in their perceptions and evaluations of the lessons (Table 5).

When we did a one-way analysis of variance to see whether the mean evaluations differed significantly among the three groups, we found “usefulness” to be a significant main effect at the 5 percent level. (F(2, 80) = 4.302, MSe = 0.583, p < .05)

Table 3. Factor Analysis for the Normal Learning Situation

<table>
<thead>
<tr>
<th>No.</th>
<th>Content of Item</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>I can’t make what I’ve learned show up in my test scores.</td>
<td>.735</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>I can’t tell which are the important points that will be in the regular tests.</td>
<td>.771</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3</td>
<td>There are questions I can answer in practice tests but not in regular tests.</td>
<td>.688</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4</td>
<td>The lesson moves on before I’ve understood, and the things I don’t understand pile up.</td>
<td>.628</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q5</td>
<td>I study but what I learned doesn’t stick.</td>
<td>.630</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q6</td>
<td>I don’t have enough time to study and can’t cover all the material for tests.</td>
<td>.606</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q7</td>
<td>I don’t do extra study to make sure that what I’ve learned really sinks in.</td>
<td>.466</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q8</td>
<td>I can’t concentrate on studying at home.</td>
<td>.456</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Cluster-based Typology and Factor Scores

<table>
<thead>
<tr>
<th>No. of Learners</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 29 Mean</td>
<td>.035</td>
<td>.648</td>
<td>.720</td>
</tr>
<tr>
<td>S.D.</td>
<td>.519</td>
<td>.696</td>
<td>.707</td>
</tr>
<tr>
<td>Group 2 7 Mean</td>
<td>.082</td>
<td>.620</td>
<td>.270</td>
</tr>
<tr>
<td>S.D.</td>
<td>.379</td>
<td>.699</td>
<td>.514</td>
</tr>
<tr>
<td>Group 3 47 Mean</td>
<td>-.334</td>
<td>-.611</td>
<td>-.480</td>
</tr>
<tr>
<td>S.D.</td>
<td>.736</td>
<td>.813</td>
<td>.710</td>
</tr>
</tbody>
</table>

Table 5. Comparison of Evaluations by Learner Attributes

<table>
<thead>
<tr>
<th></th>
<th>Expectation</th>
<th>Enjoyment</th>
<th>Usefulness</th>
<th>Satisfaction</th>
<th>Willing to use format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 Mean</td>
<td>4.0</td>
<td>4.2</td>
<td>4.0</td>
<td>4.1</td>
<td>4.3</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.0</td>
<td>0.8</td>
<td>0.9</td>
<td>0.8</td>
<td>0.6</td>
</tr>
<tr>
<td>Group 2 Mean</td>
<td>4.0</td>
<td>4.7</td>
<td>4.0</td>
<td>4.3</td>
<td>4.3</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.2</td>
<td>0.5</td>
<td>1.4</td>
<td>0.8</td>
<td>0.5</td>
</tr>
<tr>
<td>Group 3 Mean</td>
<td>3.8</td>
<td>4.6</td>
<td>4.5</td>
<td>4.4</td>
<td>4.3</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.0</td>
<td>0.7</td>
<td>0.5</td>
<td>0.6</td>
<td>0.7</td>
</tr>
</tbody>
</table>

A multiple comparison (Tukey’s HSD) showed a significant difference at the 5 percent level between Groups 1 and 3, with Group 3 having the higher mean value.

Looking next at the score improvement rate (Table 6), a simple comparison found a higher rate for English in all groups.

In a simple comparison, by group, of the average rate of score improvement in the pre- and post-tests, every group showed improvement in both mathematics and English. Thus, a certain amount of learning effectiveness was demonstrated for all participants, assuming that the course providers did not deliberately make the post-tests less difficult. Because the mean and median values diverged, we excluded outliers (four in each subject); in the subsequent comparison, Group 3 had the highest improvement rate, while the influence of the outliers was great for English in Group 1 (in both subjects, three of the four outliers belonged to this group). The large improvement in pre-/post-test scores in Group 1 seems to imply the existence of a leveling-up effect.

We performed a one-way analysis of variance to see whether the groups differed in their frequency of interactions. The results showed a significant
difference at the 0.5 percent level in the number of closed chats initiated in English lessons. A multiple comparison (Tukey's HSD) showed a significant difference at the 0.5 percent level between Groups 1 and 2, with Group 2 having the higher mean. (F(2, 80) = 5.030, MSe = 370.689, p < .05)

4. THE RELATIONSHIP BETWEEN INTERACTIONS AND EFFECTIVENESS

4.1. Bivariate Correlation Analysis

Table 7 on the following page presents the results of a simple regression analysis of interactions (open and closed chats) and test data (scores and improvement rates) for English and mathematics. Allowing for the possible influence of learner attributes, we analyzed and compared the results for the learners as a whole and for the groups. In the table, a double asterisk (**) after the correlation coefficient denotes significance (two-sided) at the 0.5 percent level, and a single asterisk (*) denotes significance (two-sided) at the 1 percent level.

Vertically, the items in the table are divided into open and closed chats. Horizontally, the correlation coefficients are presented for the learners as a whole and for each group. In Group 2, no significant correlation was seen for any item. Further, the results for Group 3 had many tendencies in common with those for all learners.

(1) Relationship between Open Chats and Effectiveness

In the results for all learners, the number of open chats during live lessons correlated negatively with the rate of improvement of pre-/post-test scores. This was true for both English and mathematics.

(2) Relationship between Closed Chats and Effectiveness

In the results for all learners, for English, the number of closed chats correlated positively with both pre-/post-test scores, and negatively with the pre-/post-test score improvement rate.

When there is a large number of closed chats, the scores in pre-and post-tests are also high. Because the students already have a high scoring ability, they show little improvement between pre- and post-tests.

Also, in English, the number of closed chats was positively correlated with the mean comprehension test score in Units 3 and 4, both for the learners as a whole and for Group 1, while in Group 3 it was positively correlated with the rate of improvement between the means for Units 1–2 and Units 3–4. Thus, there is a relationship between an active approach to preparation as the series of lessons progresses and the number of closed chats.

4.2. Discussion

(1) The Role of Open Chats

In both English and mathematics, the number of open chats correlated negatively with scores in post-tests and comprehension tests (mean scores for Units 1–2 and Units 3–4). A large number of open chats seems to mean that the learners are making slow progress. If the process is not designed appropriately, students may conceivably be distracted from the teacher's explanation by reading other students' chats or they may introduce topics not strictly focused on the lesson.

(2) The Role of Closed Chats

In English, the number of closed chats correlated positively with scores in pre- and post-tests and comprehension tests (mean scores for Units 1–2 and Units 3–4). Learners who engage in frequent closed chats have an inherently high scoring ability, and in their lesson participation they place a relatively high value on contact with the teacher. The learning effect that accompanies lesson participation is also seen.

Accordingly, we divided the comprehension test scores (mean scores for Units 3–4) into upper, middle, and lower groups for analysis (mean ± 0.5 SD). The number of closed chats was 23 in the lower group, 34 in the middle group, and 36 in the upper group. We did a one-way analysis of variance to see whether these learner groups differed significantly in their average level of satisfaction with closed chats. The results showed a significant difference between the lower and middle groups (F(2, 90) = 2.230, MSe = 0.373, p < .05). The mean value was greater for the lower group (.996), possibly implying that the lower group seeks more guidance from the teacher. This finding suggests the need for interaction design that encourages lower-stream students to engage in closed chats.
Table 7. Correlation between Interactions and Test Results (Meta-Analysis)

<table>
<thead>
<tr>
<th>All Learners (n=80)</th>
<th>English</th>
<th>Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open charts</td>
<td>Positive Correlation</td>
<td>Negative Correlation</td>
</tr>
<tr>
<td></td>
<td>Pre-T score (-.249)**</td>
<td>Comprehension TUnits 1-2 (&gt;.272)**</td>
</tr>
<tr>
<td></td>
<td>Comprehension TUnits 3-4 (&gt;.225)**</td>
<td></td>
</tr>
<tr>
<td>Closed charts</td>
<td>Pre/post-T improvement rate (-.309)**</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 1 (n=29)</th>
<th>English</th>
<th>Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive Correlation</td>
<td>Negative Correlation</td>
</tr>
<tr>
<td></td>
<td>Pre-T score (4.17)**</td>
<td>Comprehension TUnits 3-4 (.554)**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 2 (n=17)</th>
<th>English</th>
<th>Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive Correlation</td>
<td>Negative Correlation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 3 (n=41)</th>
<th>English</th>
<th>Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive Correlation</td>
<td>Negative Correlation</td>
</tr>
<tr>
<td></td>
<td>Comprehension T improvement (.367)**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre-T score (.333)**</td>
<td>Comprehension TUnits 1-2 (.401)**</td>
</tr>
<tr>
<td></td>
<td>Comprehension TUnits 3-4 (.312)**</td>
<td></td>
</tr>
<tr>
<td>Closed charts</td>
<td>Pre-T score (.357)**</td>
<td>Comprehension TUnits 1-2 (.337)**</td>
</tr>
<tr>
<td></td>
<td>Comprehension T improvement (.365)**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre/post-T improvement rate (.337)**</td>
<td></td>
</tr>
</tbody>
</table>

5. CONCLUSIONS AND FUTURE ISSUES

5.1. Conclusions of the Study

First, our conclusions regarding the typology of learning situations were as follows:

- Three factors were extracted by factor analysis. These are thought to represent characteristics of the students' normal learning situations and their attendant concerns.
- Learning situations could be classified into three groups.
- Group 1 had high scores for all three factors, namely, "difficulties in comprehension and assimilation," "lack of willpower or weak motivation," and "avoidance of study or effort." These are learners who, on failing to understand the material even though they studied it, lost the will to try and became averse to studying. Nevertheless, almost all the upper outliers for the rate of pre-/post-test score improvement belonged in this group (leveling-up effect).
- Group 2 was negative for "lack of willpower and weak motivation"; thus, even though they did not understand the material, they were willing to try. They engaged in a large number of closed chats in English lessons.
- Group 3 was negative for all three factors; these were students who felt they were getting results from studying and who had a positive approach. This group evaluated the lessons as "useful" with a mean score significantly higher than that of Group 1.

It is clear from these results that the effectiveness of synchronized e-learning differs among the groups.

Next, we drew the following conclusions with regard to the relationship between interactions and effectiveness:

- In both subjects, the number of open chats initiated was negatively correlated with post-test scores or other measures of progress. Learners with a low level of scoring ability tend to favor open chats.
- In English, the number of closed chats initiated was positively correlated with the rate of improvement in comprehension tests. A sense of contact with the teacher is related to understanding and willingness to make an effort, resulting in better performance.
- As reported in previous studies, interactive learning was shown to be effective even in the short term in English, but if effectiveness is to be achieved in mathematics, it may be necessary to consider repetition exercises or other forms of interaction.
These results suggest a need to enhance learning effectiveness through appropriate interaction design.

5.2. Future Issues

(1) Short Duration of the Study

As pointed out by Kogo (2005), a “long-term program” can be cited as one of the characteristics of e-learning based on situated learning theory. As this study analyzed a lesson program lasting about two weeks, in future it will be necessary to collect data over a longer period in order to shed light on the complex learning process.

(2) Comparison between Control and Experimental Groups

Comparison with a control group would allow the effects of interaction to be tested from another angle; for example, learners could be divided into two classes, one with and one without chats, and the classes could be compared in terms of satisfaction and academic results. We intend to devise further studies along these lines while paying attention to the learners’ convenience and issues of fairness.

5.3. Concluding Remarks

As discussed above, in attempting to construct an interactive learning model to support better learning, we focused on the effectiveness of a nonconventional form of teacher–student interaction, and we also considered differences among learner attributes.

Students in the first year of junior high school still find it difficult to study alone; moreover, after-school activities and socializing with friends leave them with little time to study. As a result, many are unable to find meaning or pleasure in studying. However, we believe that, even for children who are unable to learn on their own, a learning cycle can be established through the interactions offered by e-learning.

We intend to continue our work toward constructing an efficient learning model that does not merely promote the acquisition of knowledge but makes study enjoyable and stimulates the desire to learn, thus enabling children and parents to share the thrilling moment when “the penny drops.”

REFERENCES


