

## Effectiveness of e-learning in College Classroom: English Learning through Open Source Management System

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### Abstract

An e-learning program for a college English course is statistically tested with Path Analysis to verify the effectiveness of its two sections: reading and vocabulary. Mid-term scores and final-test scores of the two sections for three terms are collected and examine how or if these 4 variables predict the final exam scores. The results produced a hierarchical order of variables; “Vocabulary mid-term” → “Reading mid-term” → “Vocabulary final” → “Reading final” → “Final exam.” This order is found to be chronologically paralleling the lesson plan of the course. The Reading section is found to have direct effects on the final exam score but not the Vocabulary section, which can be explained by the fact that the final exams did not contain vocabulary questions per se.

**Keywords:** e-learning, path analysis, reading, vocabulary

### Background and context

As Information Technology has advanced in the last decade or so, various educational learning tools facilitated by mobile technologies have been developed. One of them is a free and open-source software learning management system called *Moodle* (an acronym for *Modular Object-Oriented Dynamic Learning Environment*). It was developed by Martin Dougiamas in 2001 (Hamaoka, 2008; Miyazoe, 2011; Ose et al., 2015). *Moodle* belongs to an e-learning category called LMS (Learning Management System) or CMS (Course Management System), which is basically a platform created for e-learning programs (Ose et al, 2015).

Daugiamas developed this open source system based on a policy which he calls the “social constructionism,” because he designed the system to be used as a collaborative tool for both teachers and students (Inoue, 2013). It has quickly become one of the most popular open-source management software programs (Miyazoe, 2011). And as of 2011, it was being used in 210 countries, and more than one million teachers were utilizing the system around the world (Ibid.).

We created an e-learning program utilizing *Moodle* for a general study English course in 2007. The program has three sections; reading, vocabulary, and listening. We refer to the program as “English Learning Program on Moodle (ELPM)” for this paper sake.

In 2015 and 2016, we conducted questionnaire surveys among the students, and statistically compared the results of the surveys and the results of ELPM (Hosokawa et al., 2016; Hosokawa et al., 2017). In the survey, questions are asked if they like this system of learning, if they think the system is useful, if they feel the number of questions is appropriate, and if they feel the time limit set for the listening section is appropriate. The results show that the students find the vocabulary section most favorable and useful, followed by the listening section and the reading section (Hosokawa, 2016). Hosokawa statistically compared the average score of ELPM with the score of the final exam, in which a rank correlation coefficient analysis was conducted (Ibid.). The results, however, did not show any significant correlation between the results of ELPM and the final exam score. The study also examined the correlation between the survey results and the final exam score. The analysis again did not produce any significant correlation between the two variables, which suggests that many students in the class favors ELPM system, but their study through ELPM was not statistically proved to be effective.

A similar study was again carried out in the following year (Hosokawa et al., 2017). The survey taken among the students shows that they favor the vocabulary section the most, the reading section the next and the listening section the last; the reading and listening rankings are reversed from that of the previous year. The vocabulary section has been the most favorable section for two years in a row. The study concludes that it is probably due to the fact that the correct answer may easily be found in the vocabulary list of the textbook. The study also conducted a statistical analysis to examine rank correlation coefficients between ELPM and the final exam. The results show that quite a strong correlation between the score of ELPM and the final exam score exists. This is an improvement from the result of the same analysis conducted in the previous year. Another statistical analysis conducted to study the relationship between the survey taken among the students and the result of the final exam shows that those who have done ELPM diligently (without skipping some units) tend to have better results in the final exam though they may not necessarily favor the program.

Onuma (2017) reports similar results in that a significant correlations was found between the learning log of his Moodle program and the final test score. Shinoda, et al. (2017) conducted a survey for two years among 500 students who have used the online learning program similar to Moodle. The results showed that their hours of study on the subject significantly increased as they utilized the program. And as a result their understanding of the subject improved.

With these findings from the previous studies, the current study looks into the relationship between ELPM and the final exam in detail. Two tests are set for each section of ELPM to review the previous sections; mid-term and final test. The study examines these two tests of reading and vocabulary sections to substantiate the correlation between the two tests and final exams. The listening section was excluded from the study because neither a mid-term nor a final-test are set for the section.

### **Research questions**

In order to review the validity of ELPM objectively, the following research questions are set.

1. How does the score of each section affect the final exam score?
2. Which of the two sections is contributing more to the final exam score?

## Method

### Class session and lesson plan

There are 15 sessions in a term, and one session is 90 min. The textbook used for the class is not one of those sold in the market, but the one written by the teacher just for the course. It comprises of 15 units, and each unit is covered by each class session. Each unit comprises 3 sections: reading, vocabulary, useful expression. The vocabulary section consists of the words that appear in the reading and useful expression sections. First 14 units of the textbooks correspond to the 14 units in ELPM. The 15<sup>th</sup> unit, the last unit of the textbook is a summary of the textbook.

The teacher covers the entire unit in the first 30 minutes of each class session; read aloud and teach target grammar used in the reading and useful expression sections. For the next 30 to 40 minutes, students are asked to come up to the teacher one by one to read aloud the reading section. Any mispronunciation or wrong intonation is corrected by the teacher. Upon finishing the reading aloud activity, students may begin ELPM. While undertaking ELPM, students are allowed to look at the textbook or ask the teacher for assistance. The last class session of a term is used for reviewing the entire textbook. There is no 15<sup>th</sup> unit set out in ELPM, and students are expected to review the entire textbook to prepare for the final exam.

### ELPM system

ELPM comprises of 3 sections; reading, vocabulary, and listening. Each section has 14 units with 10 to 20 questions to answer. Each section has two tests; one in the middle (mid-term test) and the other in the end (final-test), which consist of 20 questions randomly selected from the units.

Figure 1 is the Reading Section Unit outline sample. Students choose a unit of their choice from this page. Figure 2 is a sample question of the Reading section. All the questions are multiple choice questions.

Figure 1

Figure 2

Students may select an answer until the correct answer is found, but the percentage of the score drops (0.2 points each) for each wrong answer. There are four choices to choose from, so students may choose 4 times until the correct answer is found. But each wrong choice costs minus 0.2 points, so the point for the 4<sup>th</sup> choice is only 0.4 point.

The beginning time and day is set for each unit according to the lesson plan. Students cannot enter units which are not taught in the class. The ending day is set on the last day of each term. Although students are encouraged to complete each unit within each class period, catching up chances are given for those who are absent.

The mid-term and final-test of the Reading section contains 40 questions each, all taken from the questions of each Unit. The test scores (mid-term and final) are calculated as a percentage and recorded. As for the Vocabulary section, there are 15 questions in each Unit. All the questions are multiple choice questions. Two types of vocabulary questions, questions asking for correct spelling and questions asking for Japanese meaning, are used. The test scores are calculated as a percentage and recorded.

Students may take sample questions before taking actual tests to get to know what kind of questions would appear in the test. Time limits are set for the test: 20 minutes for the Reading section and 15 minutes for the Vocabulary section. In order to help those who are slow learners, tests can be taken twice, though the order of appearance of the questions would change for the second test. And they are also allowed to look at the textbook, though there is a time limit. Figure 3 is a score report sample. Students, as well as the teacher, may monitor their (students) own scores on this page. Figure 4 is the Log record page. Teachers may monitor students' progress on this page.

Figure 3

英語A (会話) : 表示: 評定者レポート

ftu-moodle ▶ aa2016 ▶ 評定 ▶ 表示 ▶ 評定者レポート

処理の選択 ...

評定者レポート

ページ: 1 2 (次へ)

| 名/姓       | Unit 1 単 | Unit 2 単 | Units 1-2 単 | Unit 3 単 | Units 1-3 単 | Unit 4 単 | Units 2-4 単 | Unit 5 単 |
|-----------|----------|----------|-------------|----------|-------------|----------|-------------|----------|
| s 6015004 | -        | -        | -           | -        | -           | -        | -           | -        |
| s 6015001 | 8.50     | 8.50     | 5.95        | 6.70     | 7.30        | 7.70     | 7.00        | 6.00     |
| s 6015002 | 7.40     | 9.80     | -           | 9.00     | -           | 7.30     | -           | 7.70     |
| s 6015003 | -        | 5.40     | 5.25        | 4.30     | 8.33        | 7.70     | -           | 4.80     |
| s 6015004 | -        | 6.90     | -           | 9.90     | -           | 5.40     | -           | 4.90     |
| s 6015005 | -        | 7.70     | -           | 8.60     | -           | 7.50     | -           | 6.80     |
| s 6015006 | 10.00    | 10.00    | 9.00        | 8.00     | 6.17        | 10.00    | 7.00        | 9.00     |
| s 6015007 | -        | 8.90     | -           | 9.30     | -           | 9.30     | -           | 7.40     |
| s 6015008 | -        | 7.80     | -           | 8.30     | -           | 9.20     | -           | 7.60     |

Figure 4

福山平成大学

あなたは HOSOKAWA Mitsuhito としてログインしています。(ログアウト)

ftu-moodle ▶ 管理 ▶ レポート ▶ ログ

福山平成大学: すべての参加者, すべての日付 (サーバのシステム時間)

福山平成大学 (サイト) ▶ すべての参加者 ▶ すべての日付 ▶ すべての日時 ▶ すべての機能

ページに表示する

レコード 2337061 件を表示

ページ: (前へ) 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 ...23371 (次へ)

| コース        | 時間                   | IPアドレス          | 名称        | 操作                    | 情報        |
|------------|----------------------|-----------------|-----------|-----------------------|-----------|
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.18  | s 9016056 | quiz view             | Unit 11   |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.18  | s 9016056 | quiz view             | Unit 10   |
| ftu-moodle | 木 2016年 07月 7日 14:01 | 202.249.234.183 | s 6016016 | course view           | 福山平成大学    |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.146 | s 6016012 | quiz continue attempt | 625       |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.18  | s 9016056 | quiz view             | Unit 9    |
| wa2016     | 木 2016年 07月 7日 14:01 | 202.249.234.183 | s 6016016 | quiz view             | Unit 12   |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.18  | s 9016056 | quiz view             | Unit 8    |
| wa2016     | 木 2016年 07月 7日 14:01 | 202.249.234.183 | s 6016016 | quiz review           | Unit 12   |
| wa2016     | 木 2016年 07月 7日 14:01 | 202.249.234.183 | s 6016016 | quiz close attempt    | Unit 12   |
| wa2016     | 木 2016年 07月 7日 14:01 | 202.249.234.183 | s 6016016 | quiz continue attempt | 732       |
| wa2016     | 木 2016年 07月 7日 14:01 | 202.249.234.183 | s 6016016 | quiz continue attempt | 732       |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.18  | s 9016056 | quiz view             | Unit 7    |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.164 | s 6016027 | quiz view all         | Unit 2-4  |
| wa2016     | 木 2016年 07月 7日 14:01 | 202.249.234.183 | s 6016016 | quiz continue attempt | 732       |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.18  | s 9016056 | quiz view             | Unit 6    |
| wa2016     | 木 2016年 07月 7日 14:01 | 202.249.234.183 | s 6016016 | quiz continue attempt | 732       |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.146 | s 6016012 | quiz continue attempt | 625       |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.164 | s 6016027 | quiz view             | Units 2-4 |
| wa2016     | 木 2016年 07月 7日 14:01 | 202.249.234.183 | s 6016016 | quiz continue attempt | 732       |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.18  | s 9016056 | quiz view             | Unit 5    |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.164 | s 6016027 | quiz review           | Units 2-4 |
| ea2016     | 木 2016年 07月 7日 14:01 | 202.249.234.164 | s 6016027 | quiz close attempt    | Unit 2-4  |

### Variables for the analysis

The final exam of the course covers all the sentences that appear in ELPM. The results of the three final exams over 3 terms are collected and their average scores (%) are used for the analysis. Also, the results of the mid-term and final-test of ELPM are collected for 3 terms and their average scores (%) are used for the analysis. Thus, the variables for the analysis are as follows:

1. Average score of the final exam.
2. Average score of the final test of the vocabulary section.
3. Average score of the final test of the reading section.
4. Average score of the mid-term test of the vocabulary section.
5. Average score of the mid-term test of the reading section.

The number of students involved in the study slightly varies over the 3 terms from 120 to 125 due to the students dropping the course.

We used Path Analysis to examine the correlations among the above variables. Path Analysis examines variables and supplies information about the directed dependencies among the variables. It is especially a useful tool to study the directional relationship between the variables. The correlation is equal to the sum of the contribution of all the pathways through which the two variables are connected. We also utilized a statistical technique called Bootstrapping, which would verify the indirect effect and spurious correlation from the result of Path Analysis.

### Results and discussion

Table 1 shows the results of Path Analysis. Because indirect effects and spurious correlations cannot be calculated with one sample, we used the bootstrap approach, which repeats the sampling with a replacement for 1000 times.

**Table 1**

|                       | Path coefficient | Direct effect | Indirect effect | Spurious correlation |
|-----------------------|------------------|---------------|-----------------|----------------------|
| Reading m.→Reading f. | 0.683            | 0.268***      | 0.123***        | 0.292***             |
| Reading f.→Final exam | 0.478            | 0.187*        | 0.000           | 0.290***             |
| Vocab. f.→Reading f.  | 0.778            | 0.529***      | 0.000           | 0.248***             |
| Vocab. m.→Reading f.  | 0.686            | 0.105*        | 0.582***        | 0.000                |
| Reading m.→Final exam | 0.484            | 0.148*        | 0.063*          | 0.272***             |
| Reading m.→Vocab. f.  | 0.641            | 0.233***      | 0.000           | 0.408***             |
| Vocab. m.→Reading m.  | 0.726            | 0.726***      | 0.000           | 0.000                |
| Vocab. f.→Final exam  | 0.434            | -0.043        | 0.099*          | 0.378***             |
| Vocab. m.→Final exam  | 0.529            | 0.324***      | 0.205***        | 0.000                |
| Vocab. m.→Vocab. f.   | 0.731            | 0.562***      | 0.169***        | 0.000                |

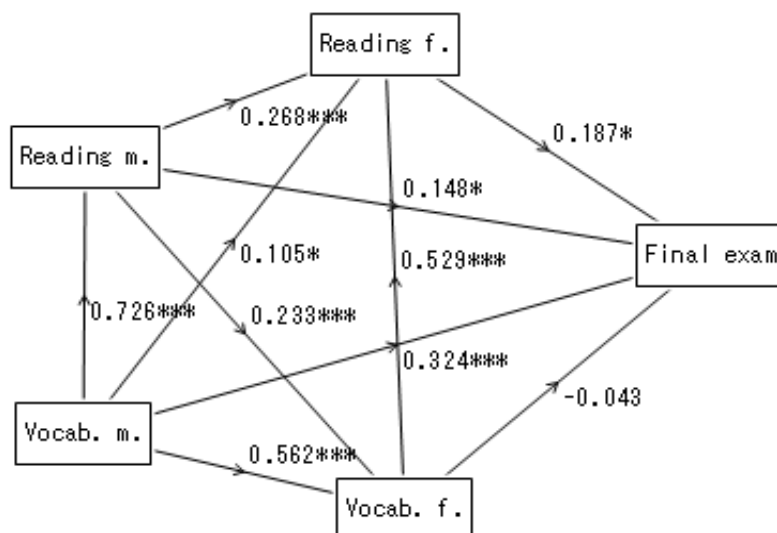
Reading m.=Reading mid-term, Reading f.=Reading final-test, Vocab. m.=Vocabulary mid-term, Vocab. f.=Vocabulary final-test

As Table 1 shows, direct effects are found in all the correlations except the correlation from the Vocabulary final-test to the Final exam. In the diagram of Figure 5, an arrow shows the cause among the variables. It shows no significant effect is found from the Vocabulary final-test and the Final exam.

No significant direct effect is found between “Vocabulary final-test” and “Final exam.” And the correlation between the two variables depends on the indirect effect and spurious

correlation (see also Table 2). Table 2 shows direct effects and spurious correlations among variables. It also shows that the indirect effects and spurious correlations between two variables have effects to other variables except the “Vocabulary final-test” due to non-existent of direct effect between “Vocabulary final-test” and “Final exam” (see also Table 1).

**Figure 5**



With a careful examination of the diagram and Table 1 & 2, we have come to believe that there is a clear hierarchical relationship among the variables as shown below.

**“Vocabulary mid-term” → “Reading mid-term” → “Vocabulary final-test” → “Reading final-test” → “Final exam”**

**Table 2**

|                       | Indirect effect |            |            | Spurious correlation |            |           |
|-----------------------|-----------------|------------|------------|----------------------|------------|-----------|
| Reading m.→Reading f. | Vocab. f.       |            |            | Vocab. m.            |            |           |
| Reading f.→Final exam |                 |            |            | Vocab. m.            | Reading m. | Vocab. f. |
| Vocab. f.→Reading f.  |                 |            |            | Vocab. m.            | Reading m. |           |
| Vocab. m.→Reading f.  | Reading m.      | Vocab. f.  |            |                      |            |           |
| Reading m.→Final exam | Vocab. f.       | Reading f. |            | Vocab. m.            |            |           |
| Reading m.→Vocab. f.  |                 |            |            | Vocab. m.            |            |           |
| Vocab. m.→reading m.  |                 |            |            |                      |            |           |
| Vocab. f.→Final exam  | Reading m.      |            |            | Vocab. m.            | Reading m. |           |
| Vocab. m.→Final exam  | Reading m.      | Vocab. f.  | Reading f. |                      |            |           |
| Vocab. m.→Vocab. f.   | Reading m.      |            |            |                      |            |           |

Reading m.=Reading mid-term, Reading f.=Reading final-test, Vocab. m.=Vocabulary mid-term, Vocab. f.=Vocabulary final-test

As Table 2 shows, the variables that appear in the indirect effect column have an indirect effect on the two variables. For instance, between “Reading mid-term” and “Final exam,” “Vocabulary final-test” and “Reading final-test” have indirect effects. Between “Vocabulary mid-term” and “Reading final-test,” “Reading mid-term” and “Vocabulary final-test” have indirect effects.

The variables appear under the spurious correlation column are the lower variables in the hierarchical order shown above. For instance, between “Reading mid-term” and “Final exam,” “Vocabulary mid-term” has a spurious correlation, but between “Vocabulary mid-term” and “Reading final,” no variables in the spurious correlation is found.

It is with much interest that the authors of the paper find the hierarchical order of the variables because of the order, in a way, parallels the lesson plan of the course. It starts out with the Vocabulary mid-term, which contributes to the Reading mid-term, which affects the Vocabulary final-test, which leads to the Reading final-test, which contributes to the Final exam. It goes along with the chronological order of the lessons; from the mid-term to the final-test and to the final exam at the end. Students in the class are accumulating the knowledge through lessons, which is tested in the mid-term, and their further accumulated knowledge is tested in the final test. And their overall knowledge of the course is tested comprehensively at the final exam. The reason for the vocabulary variable precedes the reading variable in the order is yet to be verified. But according to Hosokawa, Watanabe, Ozasa, & Fukui (2016), students liked the vocabulary section more than others, which may have something to do with the reason for the vocabulary variable being placed first. It may well be possible that many of the students begin with the vocabulary section first in class.

However, the vocabulary final-test score is not found to affect the final exam score but the reading final score does. This result can be explained by the fact that the final exam does not contain vocabulary questions. The vocabulary section of ELPM is set for students to familiarize themselves with the words which appear in the reading section. As for the reason for the Vocabulary mid-term, on the other hand, significantly affecting the Final exam, we can only speculate that since there is longer duration between the mid-term and the final exam than between the final test and the final exam, the mid-term score of the vocabulary section may have been able to have some effect on the score of the final exam whereas, the vocabulary final-test is taken only a few days prior to the final exam.

## Conclusion

In order to verify the research aim of the paper, two research questions are set;

1. How does the score of each section affect the final exam score?
2. Which of the two sections is contributing more to the final exam score?

The examination through Path Analysis with Bootstrap technique produced the diagram which made it clear that how each variable correlates with others. And it was verified that there is one main hierarchical order of variance; **Vocabulary mid-term→Reading mid-term→Vocabulary final-test→Reading final-test→Final exam**. It was a pleasant surprise for the authors who teach the class because the order corresponds to the chronological order of the lesson plan; from the mid-term to final test. It is also found that the reading final- test score significantly contributes to the final exam score, while the vocabulary final-test does not. This finding is quite understandable for the authors because the final exam did not have vocabulary questions.

The study provided important information for the teachers using ELPM in that it is a useful learning tool for students. On the other hand, the study could not examine the effectiveness of the listening section of ELPM because it does not have a mid-term or final test in the section. In order to make the study complete, an examination of the listening section is crucial. We plan to launch a similar study of ELPM once mid-term and final test in the listening section are set up.

This study is made possible by the help of our colleague, Dr. M. Fukui. Without his statistical expertise, the study could not be completed.

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