Assessing Student Transitions in an Online Learning Environment

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Abstract: Assessment surveys of students are often conducted in order to evaluate online learning activities. Most surveys measure responses to questions which are based on students' subjective impressions. The purpose of this study is to examine participants' assessments made during the transitional phase in an online learning environment which includes blended and fully online courses at a Japanese national university. Students were enrolled in two-unit Master's or Bachelor's degree courses which were taught by the same professor. The total number of students with valid survey data was 184 (92 Masters, 67 Bachelors for the blended learning course and 25 Bachelors for the fully online course). A survey questionnaire consisting of 10 questions measured the self-assessments of students' online learning experiences. Three factors were extracted. There are no significant differences in all factor scores between the beginnings and the ends of the courses. These results show the coherence of students' assessments during the course. The correlation coefficients of the first factor scores (e-learning evaluation) between the beginnings and the ends of the courses are not high, however (Masters: r=0.35, Bachelors for blended learning: r=0.46, and Bachelors for fully online: r=0.33). Therefore, some participants have changed their evaluations between the two surveys. When the differences in factor scores from the initial and final surveys are compared between students who rated the course highly at the beginning (high raters) and students who did not (low raters), the scores for the high raters decrease and the scores for the low raters increase. Also, the relationships between students' transitions and the metrics of their behaviour were investigated.

Keywords: online learning, student assessment, assessment in transition, blended learning, fully online learning

1. Introduction

The use of online learning environment is spreading widely in the curricula of modern university courses, in accordance with the development of information technology and online communications (Twigg 2001). When these technologies are introduced into the learning environment, learning performance and effectiveness can be discussed as a cost benefit (Bates 1999). Since it is well known that it is not easy to emphasize the cost benefit of a new technology or a new educational system, determining the impressions and level of satisfaction of stake-holders is often preferred to surveying participants' opinions, according to the first stage of the Kirkpatrick model which suggests that they be observed and measured (Watkins et al. 1998).

Therefore, assessment surveys of students are usually conducted in order to evaluate progress in the learning environment. Most surveys measure responses which are based on a students' subjective impressions. In particular, as the online learning environment is very different from the conventional learning environment, both students and teachers have to adapt their abilities. These assessments help to improve the teaching material, course content and supporting methodologies (Harrington & Reasons 2005; Anderson et al. 2006). Additionally, learning skills and student's attitudes should be observed throughout the learning process, and appropriate survey items should be developed to help design support programs for both students and teachers (Craig et al. 2008). Recently, these evaluation results have been used formally, for the purpose of assuring the quality of instruction. The role of assessment has been well recognized as an important management activity (Deepwell 2007). In these scenarios, both students' satisfaction surveys and assessing the level of student's academic performance are major indices, and can be used as measures of teaching quality at universities (Elton 1993).

Also, the issue of quality assurance is becoming more important in Japanese higher education, as teaching quality and improvements in methodology are major topics of concern for global universities (Marginson 2006). To provide learning opportunities for university students, the online learning environment is an appropriate tool (Kaneko 2009). The differences between students' and teachers' recognition of their roles in online education were measured over two years using an annual survey (Palmer and Holt 2009). According to the experiences of students and teachers, the results of students' evaluations have changed across three years (Nakayama et al. 2009).

As academic terms are not short, student's perceptions and skills of adaptation may change during the course. Their attitudes toward the learning environment may develop week by week, as conventional psychological phenomena such as the primary effect and the Hawthorne effect are often observed

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(Haebara et al. 2001). The subjective evaluations of the learning environment by those in a distance education system were significantly different between the initial and final class sessions (Shimizu and Maesako 1988). The online learning environment is evaluated using factors which include material evaluations and self assessment (Nakayama et al. 2006); these evaluations may change along with the progress of learning, and also may be affected by various metrics, such as the number of class sessions attended. These transitions in subjective evaluations may be related to learning performance and other metrics of students' characteristics, which were extracted during previously conducted studies (Nakayama et al. 2008, 2009).

The purpose of this study is to examine participants' transitional phase assessments in a blended learning environment and in a fully online learning environment at a Japanese national university. Also, the effectiveness of these transitions on learning performance is investigated. This is a small scale case study, however, because courses differ from university to university. In this study, the determination of the student's change in evaluation during a course is focused on initially, using conventional statistical analysis of the survey responses.

2. Method

2.1 Survey group

2.1.1 Courses and participants

A survey was conducted using two-unit 15-week Master's and Bachelor's courses, which were taught by the same professor at a Japanese national university. These two credit courses, which were organized as blended learning, were offered during the 2006 and 2007 Spring Terms. One course was "Information Society and Jobs", a Bachelor-level class for university freshman, and the other one was "Advanced Information Industry Studies", a Master's degree course for students in their first year of graduate studies. Most of the students were Engineering majors. The third course was "Information Society and Jobs", the same 2-unit Bachelor-level class for university freshmen, which was offered as a fully online course in 2006 and 2007. Students could choose to attend either the blended or the fully online course, in accordance with their preferences. Since freshmen in Japanese universities are busy attending various other courses, the fully online course can provide a flexible style of learning, if students are self motivated. Therefore, it is clear that fully online learning requires participants to possess a degree of information literacy and time management skills.

The total number of students with valid survey data was 184 (92 Masters; 67 Bachelors for blended learning, and 25 Bachelors for fully online learning).

2.1.2 Online courses

For the blended learning course, students attended face-to-face classes, and were also able to access the course content online outside of class. This online learning material was designed for a fully online course, and also for a blended learning course, to encourage students to maximize their learning experience. The materials, which were created in advance, consisted of lecture videos, slides and online tests which allowed students to check the progress of their learning achievement themselves. In particular, these online tests offered unlimited trial tests for students, and this system recorded the number of trials and the final test scores.

To encourage maximum participation in e-learning, in particular for the blended learning course, an explicit benefit was provided to students: online module test scores would count towards their final grades in the course. Also, students could make up for class absences by taking and passing online tests that corresponded with the face-to-face class sessions which were missed. This encouraged students to participate in online modules and tests, because if they missed a regular face-to-face class session it often affected their final test scores and the evaluation of their learning experience. Most students paid careful attention to their performance and final grades.

All students took part in the final test, which consisted two essay tests at the end of the course.

2.2 Survey instruments and data

All classes were surveyed using the same questions and constructs used in our earlier surveys (Nakayama et al. 2006). Several surveys of participants were conducted, and the results of these have already been reported (Nakayama et al. 2009). In this paper, we will focus on self-assessment of the online learning experience. To explain the differences in responses to questions, various indices were analyzed such as students' information literacy and learning performance, and their essay writing ability.

2.2.1 Learning experience

The construct used to measure students' online learning experiences consisted of a 10-item Likert-type questionnaire. This construct was originally developed by the authors to assess student's activity during a blended learning course. It has been used repeatedly and its validity, including the factor structures has been confirmed over three years. The questions are shown in Table 2. The questionnaire, which asked about student's overall impression of the online course, their own learning habits, and their learning strategies, required each item to be rated using a 5-point scale. The surveys were first conducted during the second week of classes and were then conducted again at the ends of the courses.

2.2.2 Information literacy

Information literacy as a characteristic of students was measured using a construct (Nakayama et al. 2008). Fujii (2007) has defined and developed inventories used to measure information literacy. For this construct, the survey consisted of 32 question items, and 8 factors were extracted: interest and motivation, fundamental operating ability, information collecting ability, mathematical thinking ability, information controlling ability, applied operating ability, attitude, and knowledge and understanding. This construct was surveyed during the second week of the courses.

Secondary factor analysis was conducted on the scores of the above eight factors which were calculated using the survey data. As a result, two secondary factors were extracted (Nakayama et al. 2008). The first secondary factor (IL-SF1) consists of "operational confidence and knowledge understanding"; the second one (IL-SF2) consists of "attitude issues".

2.2.3 Learning performance

Some indices regarding learning performance during these courses were measured. Three indices were used as indicators of learning performance: the number of days attended (NDA), the number of completed modules (NCM), and the online test scores (OTS).

For Master's students, the final test was conducted as a reporting-style essay. Master's students wrote summary reports which were selected from two out of 5 topics. For Bachelors, the final test was conducted with a proctor during the final exam period assigned by the university. All Bachelor students gathered in a lecture room, and wrote answers to four questions. Two questions included multiple-choice tasks and the other two were essay tests.

The essay tests were evaluated by experts using an automated system (Nakayama et al. 2009). First, the essay tests were assessed by two outside experts. They independently evaluated essays using a 3-point scale (0-2) which used 5 criteria: certainty, fitness for learning content, argument, various aspects and drawing illustrations. The sum of 5 scores were used as an expert assessment. Second, for the assessment of the essay, an automated scoring system (Ishioka and Kameda, 2003) was used. It is possible to use this system via a web site. As a result, another score which was calculated using assessment software, consisted of three factors: "rhetoric", "logical structure" and "content fitness".

All data were analyzed to extract differences in survey timings using simple statistical tests, such as *t*-tests, correlation analysis and factor analysis (Coolican 1994).

3. Results

3.1 Learning activities

To compare the learning activities of Master's and Bachelor students taking online courses, indices of learning, rates for the number of days attended (NDA), and rates for the number of completed modules (NCM) are summarized in Table 1. This table shows mean rates and STDs of indices, and the mean difference between Master's and Bachelor students in the blended learning environment is tested statistically using a *t*-test, in order to make a clear comparison. The results and *t*-values are indicated in Table 1. There are significant differences in NCMs between Master's and Bachelor students ($p<0.01$), while there are no significant differences in NDAs. According to our previous analysis (Nakayama et al, 2006), Master's students prefer online modules more than Bachelors do, and this result confirms the tendency. Rates of days attended were quite high, so there was no difference in this measurement for Master's and Bachelor students.

As a reference, the rate of the number of completed modules (NCM) for Bachelors in the fully online learning course is indicated in Table 1. The rate is comparable with the rate for the blended learning environment.

Table 1: Summary of learning activities

	Master (N=92)	Bachelor (N=67)		Bachelor(FO) (N=25)
N of days attended (NDA)	0.95	0.95	t(157)=0.7	N/A
	(0.08)	(0.06)		
N of completed modules (NCM)	0.91	0.84	t(153)=2.7**	0.86
	(0.17)	(0.15)		(0.10)

( ): STD, **: significant level $p<0.01$, FO: Fully Online course

Table 2: Question items and mean scores for Master's and Bachelors (blended and fully online) students at the beginnings and the ends of courses

Question items	Master(BL) I		Master(BL) F	Bachelors(BL) I		Bachelors(BL) F	Bachelors(FO) I	Bachelors(FO) F
Q1. E-learning is easy to follow and understand	3.2		3.4	3.2		3.4	3.8	4.1
Q2. I learn better in an on-line course	2.3	<<	2.8	2.5	<	2.9	3.3	3.2
Q3. On-line materials are useful to me	3.3		3.4	3.4		3.4	3.9	4.0
Q4. It is easy to schedule on-line learning time	3.5		3.7	3.2		3.2	4.2	3.9
Q5. On-line course content is interesting	3.2		3.2	3.2	>	3.0	3.8	3.7
Q6. Overall, on-line course is a favorable learning experience	3.4		3.6	3.6		3.4	4.0	4.0
Q7. I'm a conscientious student	2.7		2.7	2.8		2.8	4.4	4.0
Q8. It is my habit to do course preparation and review	2.6		2.5	2.7	>	2.5	2.7	2.5
Q9. I have my own method and way of learning	3.3		3.3	2.6		2.8	3.5	3.2
Q10. I have my own strategies on how to pass a course	3.7		3.7	2.7	<	2.9	2.9	2.8

Significant level <<: $p<0.01$; <: $p<0.05$; I: Initial, F: Final, BL: Blended Learning, FO: Fully Online course

3.2 Mean values for question items in transition

Mean values for the 10 question items reveal some differences in means between the beginnings and the ends of the courses, and are summarized in Table 2. To determine the changes in responses, statistical tests such as *t*-tests of the initial and final mean scores have been conducted and the significant differences are marked with "<" symbols according to the level of significance.
For example, for question item Q2 ("I learn better in online courses"), the means of both Master's and Bachelor students in the blended learning environment increased significantly from the beginnings to the ends of the courses.

This result suggests that most participants prefer to learn using online materials along with the course. On the other hand, means for Q5 and Q8 decreased at Bachelor student levels in the blended learning course. This means that some problems have occurred with Bachelor students in the blended learning

environment. A support system should be provided for these students because they are freshmen and do not have experience with the learning environment.

There was no significant difference in means between the beginning and the end of the fully online course, however most means of assessment were higher than the means of assessment for the blended learning course. Participants in the fully online course were satisfied with the learning setting and recognized the benefit of the course.

The results coincided with the results of our previous report (Nakayama et al. 2007), and the tendency for the responses to be the same was validated.

3.3 Factor score transitions

The model for the 10 survey questions, which had been used previously, consisted of three factors (Nakayama et al., 2009). Again the factor structure from the analysis of 456 participants across three years (Nakayama et al., 2009) was used. The contribution ratio and correlation across factor axes is summarized in Table 3. For this survey, the factor structure was used to determine students' attitudes toward temporal transitions.

Table 3: Correlations between factor scores

		L1	L2	L3
Q1. E-learning is easy to follow and understand		0.70	-.03	0.10
Q2. I learn better in an online course		0.48	0.20	-.08
Q3. Online materials are useful to me		0.61	0.10	-.10
Q4. It is easy to schedule online learning time		0.57	-.16	0.18
Q5. Online course content is interesting		0.68	0.11	-.05
Q6. Overall, online course is a favorable learning experience		0.82	-.07	-.02
Q7. I'm a conscientious student		-.04	0.51	0.07
Q8. It is my habit to do learning preparation and review		0.11	0.49	0.08
Q9. I have my own method and way of learning		-.01	0.18	0.62
Q10. I have my own strategies on how to pass a course		0.01	-.01	0.65
Correlation amongst factor axes	L1	1.0		
	L2	0.40	1.0	
	L3	0.21	0.39	1.0
Contribution ratio by each factor ignoring other factors		0.28	0.14	0.12
Total contribution			0.43	
L1: e-Learning overall evaluation; L2: Learning habits; L3: Learning strategies				

The factor scores in this survey are estimated using means of marked scale values for factor items. Here, the focus is on the initial and final factor scores. The factor scores for Master's and Bachelor students for blended and fully online courses at the beginnings and ends of courses are summarized in Figure 1. As the figure shows, there are no significant differences in mean scores between the initial and the final scores of courses using *t*-tests, while there is a significant difference in the third factor scores between Master's and Bachelor students for blended learning (Nakayama et al., 2007, 2009). This result confirms the coherence of participants' evaluations of their learning experiences for both blended and fully online courses.

The course was conducted across 15 weeks, and participants felt strange about recording their impressions of their progress during the course. A detailed analyses was conduced as follows. According to the procedure for factor analysis, factor scores correlate with each other partially because the structure of the three factors is extracted as a Promax solution (Nakayama et al., 2009). The correlational relationships in this survey were confirmed, as shown in Table 3. This result suggests that the second factor scores correlate with both the first and third factor scores.

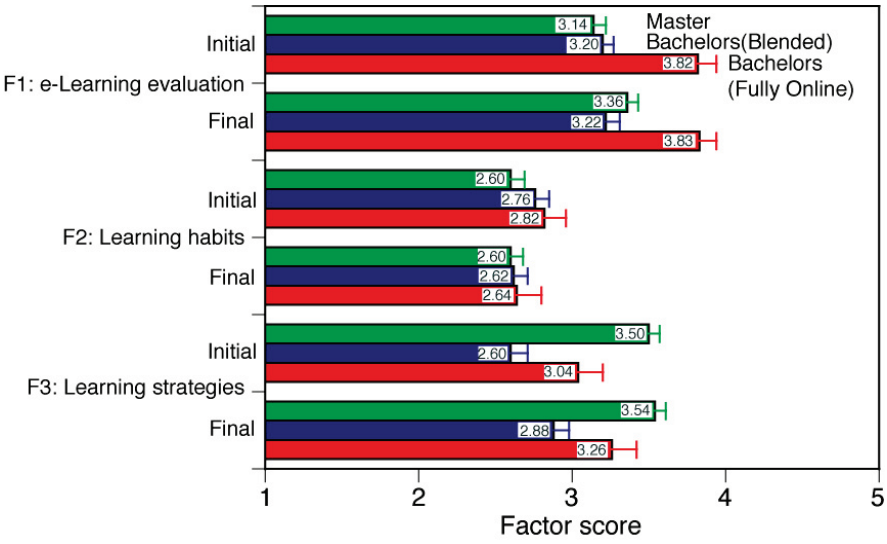

Figure 1: Comparison of factor scores between Master's and Bachelors (blended and fully online) students at the beginnings and the ends of courses.

3.4 Relationships of factor scores between the beginnings and the ends of courses

To determine the coherence of factor scores during a course, factor scores of the relationships were analyzed. Figure 2 shows a scatter gram, which illustrates pairs of the first factor scores between the beginnings and ends of the Master's and Bachelor (blended and fully online) courses. The regression lines were superimposed over the figures for Masters and Bachelors blended and fully online courses respectively. There were some differences in slopes of the three regression lines.

These superimposed figures suggest that factor scores between the beginnings and ends of courses do not coincide. Therefore, individual factor scores deviate during the courses.

On the other hand, the relationships between factor scores for Factor 2 is illustrated in Figure 3. Since scores of Factor 2 are calculated from responses to two items, the plots are sparse. Most plots are gathered along a diagonal line, and both scores are correlated, though some deviations can be seen in the figure. The regression lines almost overlap each other without much difference in the angles of the slopes.

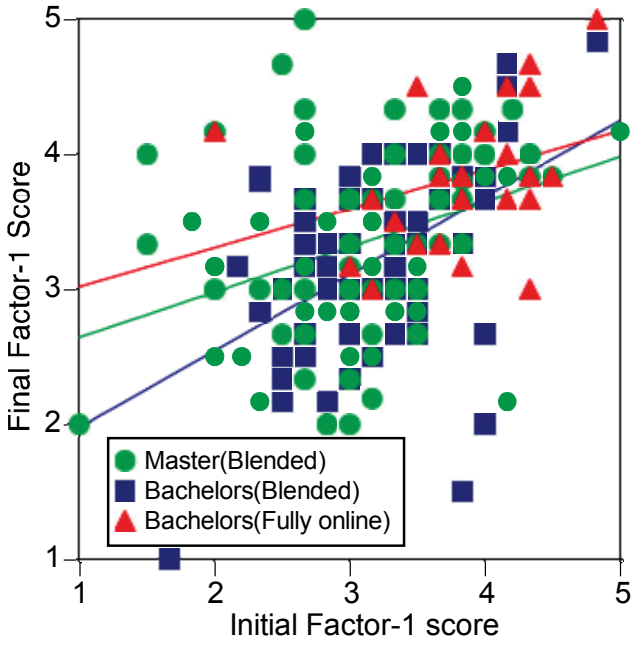

Figure 2: Scatter gram of factor 1 scores between the beginnings and the ends of courses.

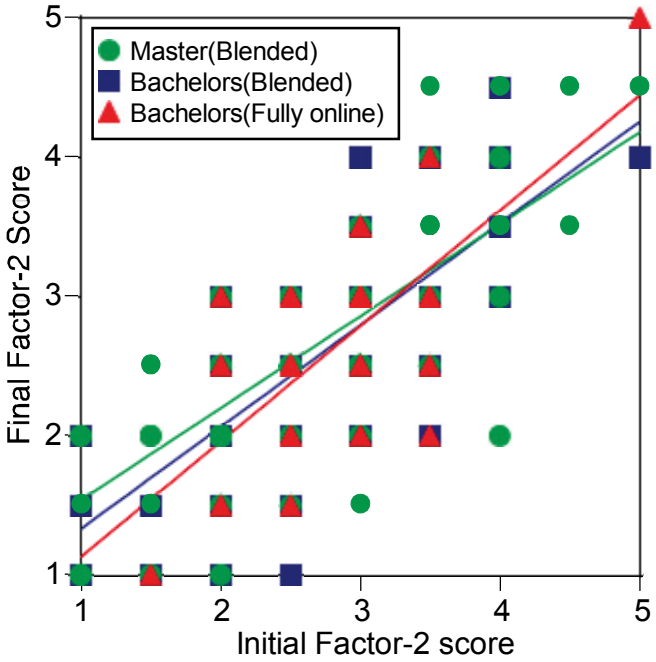

Figure 3: Scatter gram of factor 2 scores between the beginnings and the ends of courses.

To confirm this tendency, correlation coefficients of factor scores between the beginnings and the ends of the courses are summarized in Table 4 for Master's students, in Table 5 for Bachelor students in the blended course and in Table 6 for Bachelor students in the fully online course. The vertical cells show the factor scores at the beginning (I: initial), and the horizontal cells show the factor scores at the end (F: final). For the three tables, diagonal coefficients show the degree of deviation of the factor scores. As all coefficients between the second factor scores are above 0.7, this assessment aspect may be deemed to be stable. For the third factor score, the coefficient for Bachelor students in the blended course (r=0.37) is relatively small because many freshman Bachelors have acquired new learning strategies during the course, though a number of Bachelors who had already become information literacy experts participated in the fully online course instead of the blended course. For the first factor score in all Master's and Bachelor classes, the coefficients are relatively small (Master: r=0.35, Bachelors in blended: r=0.46, Bachelors in fully online: r=0.33), so student's assessments may have changed during the courses.

Table 4: Correlation coefficients of factor scores between the beginnings (I) and the ends (F) of courses (Master's)

Master (Blended)	F1(F)	F2(F)	F3(F)
F1: e-Learning overall evaluation(I)	**0.35**	**0.24**	*0.15*
F2: Learning habits(I)	*0.20*	**0.72**	**0.34**
F3: Learning strategies(I)	*-0.01*	**0.32**	**0.51**

Table 5: Correlation coefficients of factor scores between the beginnings (I) and the ends (F) of courses (Bachelor: Blended)

Bachelors(Blended)	F1(F)	F2(F)	F3(F)
F1: e-Learning overall evaluation(I)	**0.46**	*0.22*	*0.15*
F2: Learning habits(I)	**0.43**	**0.70**	**0.46**
F3: Learning strategies(I)	0.25	**0.33**	**0.37**

Table 6: Correlation coefficients of factor scores between the beginnings (I) and the ends (F) of courses (Bachelor: Fully online)

Bachelors(Fully Online)	F1(F)	F2(F)	F3(F)
F1: e-Learning overall evaluation(I)	*0.33*	0.34	*0.30*
F2: Learning habits(I)	*0.25*	**0.71**	**0.45**
F3: Learning strategies(I)	**0.44**	**0.61**	**0.55**

When observing correlation coefficients across the three factor scores, the coefficients between the first and the third factor scores are small for both Master's and Bachelors students in the blended course but not for the fully online course. As shown in Table 3, the original factor scores are weakly correlated as well. In Tables 4, 5 and 6, the initial second factor scores correlate significantly with all final factor scores except for the first factor in the fully online course. The initial second factor scores show the extent of participant's learning habits, and all factor scores increase during the courses when participants have acquired some additional learning habits, though the second factor axis correlates with the axes of the other two factors. Also, students whose learning habits are poor should be encouraged to improve them and be supported in doing this.

3.5 Students' transitions during courses

According to the above analyses, assessment transitions may provide some critical information when individual differences in factor scores are extracted and correlation coefficients are calculated between the differences in factor scores at the beginnings and ends of courses. These coefficients are summarized in Table 7.

All coefficients between the differences in the initial factor scores are negative values. This result shows that when the initial factor scores are low the differences are large. Again, Figure 2 shows some low raters in the initial survey who received high scores in the final survey. As the absolute value of the coefficients is large, this tendency is obvious in the upper panel of Table 7. Examples of the largest coefficients are the e-learning evaluation factor scores (F1) for Bachelor students in the fully online course (r=-0.65), and the learning strategy factor scores (F3) for Bachelor students (r=-0.60). All factor scores for Master's students are almost always large, such as r=-0.60, -0.47, and -0.54.

Table 7: Correlation coefficients between factor scores and differences in factor scores

	Score difference		
	F1	F2	F3
Initial: Master(BL)	**-0.60**	**-0.47**	**-0.54**
Initial: Bachelors(BL)	**-0.37**	**-0.34**	**-0.60**
Initial: Bachelors(FO)	**-0.65**	-0.21	**-0.44**
Final: Master(BL)	**0.54**	**0.28**	**0.44**
Final: Bachelors(BL)	**0.65**	**0.43**	**0.52**
Final: Bachelors(FO)	**0.46**	**0.61**	**0.49**
All coefficients are significant: p<0.05 except where underlined			

The coefficients between the differences and the final factor scores are also calculated, and all coefficients are positive and almost always high because when the final factor scores are high, the differences are large. Therefore, high factor scores come from final scores which have increased since the initial scores.

When survey assessments of the online learning environment are conducted, the timing of the survey may affect the results. Some participants become discouraged during the course, but the assessor will still receive a good assessment at the end of the course if evaluations come from satisfied students whose impressions have become more positive during the course. If the timing of the survey is at an earlier stage in the course, the structure of the responses may be the opposite.

3.6 Relationship between students' transitions and other metrics

To examine the relationship between students' transitions and other metrics, participants who have all metrics were selected. Therefore, the number of students decreased to 78 Master's and 45 Bachelors students for blended learning, and 25 Bachelors for the fully online course.

First, the impact of student's information literacy (IL) on students' transitions and on the assessment factor scores is confirmed. For Master's students in the blended learning environment, both information literacy, "operational confidence and knowledge understanding" (IL-SF1) and "attitude issues" (IL-SF2) affect both initial and final assessment factor scores. There was no relationship between information literacy and differences in factor scores though some correlational coefficients changed between the initial and the final surveys. Some negative coefficients appeared between the first factor (F1) and learning performance, such as NDA and OTS, because the indices of learning performance of participants decreased in accordance with degree of their preference for online learning (F1). There were no significant relationships for other factors. Also, performance in the essay test did not affect the factor scores of students' transitions.

For Bachelor students in the blended learning environment, the first information literacy measure: "operational confidence and knowledge understanding" (IL-SF1) affected factor scores of students' transitions. There are some positive coefficients between learning performance and students' transitions contrary to Master's students. Most positive coefficients suggest that scores for "learning habits" correlate with the number of days (NDA) of face-to-face sessions which were attended, and scores of "learning strategies" correlate with the number of completed online modules (NCM). The difference in the first factor positively correlates with the NCM (r=0.32), since these participants have recognized the benefits of online learning. Positive evaluation of online learning (F1) may influence essay scores, experts assessment scores (EXP) and automated evaluation scores (Auto scores), because the coefficients are negative.

Table 8: Correlational relationship between transitions of factor scores and learning performance (Masters)

	Initial			Final			Difference		
Masters (BL)	F1	F2	F3	F1	F2	F3	F1	F2	F3
IL-SF1	0.22	**0.40**	**0.27**	*0.01*	**0.28**	*0.17*	*-0.23*	*-0.15*	*-0.16*
IL-SF2	**0.23**	**0.48**	**0.23**	0.20	**0.49**	**0.29**	*-0.04*	*0.03*	*0.00*
NDA	*-0.17*	*-0.09*	*0.03*	**-0.38**	*-0.09*	*-0.03*	**-0.25**	*0.00*	*-0.06*
NCM	*-0.18*	*0.07*	*-0.04*	*-0.19*	*0.01*	*0.03*	*-0.02*	*-0.08*	*0.09*
OTS	*-0.02*	*-0.02*	*0.08*	**-0.36**	*-0.08*	*0.05*	**-0.37**	*-0.08*	*-0.04*
EXP score	*0.04*	*-0.02*	*-0.03*	*-0.04*	*-0.01*	*-0.11*	*-0.09*	*0.01*	*-0.06*
Auto score	*0.10*	*-0.15*	*0.09*	*0.01*	*0.04*	0.22	*-0.10*	*0.08*	*0.10*

IL-SF1: operational confidence and knowledge understanding, IL-SF2: attitude issue
NDA: N of days attended, NCM: N of completed modules, OTS: Online test score
EXP: Expert essay assessment score, Auto: Automated essay assessment score

For Bachelors students in the fully online course, there are a few positive coefficients between information literacy and factor scores of students' transitions. Because the differences in factor scores between the beginning and the end is small and the number of valid participants is not large, the number of significant correlational coefficients is small. During online courses, learning activities may not be affected because there are no face-to-face sessions and no collaborative learning activities amongst fellow students. According to this hypothesis, students' transitions may be due to collaborative learning activities where instructors and fellow students have collaborated during face-to-face sessions.

The confirmation of this hypothesis will be a subject of our further study.

Table 9: Correlational relationship between transitions of factor scores and learning performance (Bachelors: Blended learning)

	Initial			Final			Difference		
Bachelor (BL)	F1	F2	F3	F1	F2	F3	F1	F2	F3
IL-SF1	**0.35**	*0.21*	0.26	**0.43**	**0.39**	**0.42**	*0.14*	*0.18*	*0.12*
IL-SF2	*0.15*	*0.21*	*0.21*	*0.11*	*0.10*	0.28	*-0.04*	*-0.13*	*0.06*
NDA	*0.06*	**0.38**	*-0.13*	*0.03*	*0.15*	*-0.14*	*-0.03*	-0.29	*0.00*
NCM	*-0.06*	*-0.13*	**0.32**	*0.18*	*0.07*	*0.35*	**0.32**	0.23	*0.02*
OTS	*0.11*	*-0.12*	*0.25*	0.16	*0.01*	*0.23*	*0.07*	*0.15*	*-0.03*
EXP score	**-0.32**	*-0.20*	*-0.25*	**-0.41**	*-0.16*	*-0.01*	*-0.15*	*0.05*	*0.22*
Auto score	*0.10*	*-0.23*	*-0.19*	*-0.22*	*-0.10*	-0.12	**-0.31**	*0.16*	*0.07*

IL-SF1: operational confidence and knowledge understanding, IL-SF2: attitude issue
NDA: N of days attended, NCM: N of completed modules, OTS: Online test score
EXP: Expert essay assessment score, Auto: Automated essay assessment score

Table 10: Correlational relationship between transitions of factor scores and learning performance (Bachelors: Fully online learning)

	Initial			Final			Difference		
Bachelor (FO)	F1	F2	F3	F1	F2	F3	F1	F2	F3
IL-SF1	*0.11*	**0.43**	0.34	*0.21*	*0.30*	*0.27*	*0.05*	*-0.05*	*-0.07*
IL-SF2	*-0.03*	0.37	*0.29*	*-0.03*	0.34	0.34	*0.00*	*0.05*	*0.07*
NDA	-	-	-	-	-	-	-	-	-
NCM	*0.11*	-0.35	*-0.16*	*-0.04*	*-0.04*	*-0.29*	*-0.13*	*0.32*	*-0.15*
OTS	*-0.14*	*0.31*	*0.17*	*-0.03*	*0.10*	*0.09*	*0.11*	*-0.19*	*-0.08*
EXP score	*0.25*	*0.15*	0.38	*0.09*	*0.24*	*0.33*	*-0.16*	*0.15*	*-0.04*
Auto score	*0.07*	*0.12*	*0.23*	0.34	*0.15*	*0.29*	0.20	*0.07*	*0.08*

IL-SF1: operational confidence and knowledge understanding, IL-SF2: attitude issue
NDA: N of days attended, NCM: N of completed modules, OTS: Online test score
EXP: Expert essay assessment score, Auto: Automated essay assessment score

4. Conclusion

In this paper, assessments of participants' transitions were analyzed to determine the effectiveness of online learning which included blended learning and fully online courses. The mean factor scores, which were extracted as a measure of learning experience, remained at the same levels between the beginnings and the ends of the courses. The individual assessment scores for e-learning evaluations changed dramatically, though the scores for learning habits were relatively stable. The differences in factor scores during the courses correlate positively with the final scores, while these differences correlate negatively with the initial scores. Additionally, several indices of learning performance were surveyed, and there were some relationships between a number of these indices and participants' transitions in the blended learning course, while there were few such relationships in the fully online learning course.

Therefore, the course assessors should bear in mind the timing of the survey and the significance of the results. The process of transition during the course should be analyzed more closely. Also, some effective support procedures for participants need to be developed. A detailed discussion of these items will be the subjects of our further study.

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