

Exploring Online Student Engagement Scaffolded by Teacher Management Communication Style

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Abstract—Prior studies of online student engagement generated insufficient information in longitudinal study about the scaffolding factors of the teachers. To address this gap, this study proposed the approach of Teacher Management Communication Style originally from organizational studies about the employer-employee dynamic. A longitudinal study was conducted for 8 weeks combining the 5-point Likert scale of Online Student Engagement, the self-designed Student Actual Online Learning Experience and Student Perceived Offline Learning Experience administered to 117 learners in a research university in three temporal stages. Statistical analysis, resulting from repeated measure ANOVA and Paired Samples t-tests, showed that there was a significant increase in Online Student Engagement in general and all the four factors of Skill, Emotion, Performance and Participation between stage 1 and stage 3. Further analysis showed the fluctuating yet increasing trend of Online Student Engagement in general and the three factors of Skill, Emotion and Participation between both stage 1 and stage 2, but no significant difference between stage 2 and stage 3. In addition, the study results indicated that the learners' perceptions towards online learning and their intention to share the learning experience was significantly higher than those towards perceived offline experience. The findings shed lights on the pedagogy scaffolded by Management Communication Style and delineate the picture at a fine-grained level of online learning engagement.

Keywords—learning experience, online student engagement, pedagogy, scaffolding, teacher management communication style

1 Introduction and literature review

Student Engagement generally refers to the state of mind motivating and keeping learners focused in learning activities [1, 2, 3]. E-learning, on the other hand, offers the potentials to teach and learn via online management system [4, 5]. The combination of student engagement and online learning has been further examined in previous studies [6, 7], including the ones during the recent pandemic. Therefore, there is a considerable body of literature regarding the impact of Covid-19 on online learning activities [8, 9,

10]. The above studies demonstrate that the pandemic has stimulated the growth of online teaching and learning, where the distance between teachers and students hinders the exchange of face-to-face information.

However, previous studies on student engagement in online settings have limitations and merit further research. The majority of literature works are cross-sectional studies, focusing exclusively on the beginning or end of the learning sessions [11, 12, 13]. Data collected at a fixed point in time do not describe the changing nature of learners' engagement in learning. Furthermore, the variable of student engagement is considered isolated pertaining to the students only. It remains unknown about the interaction between student engagement and other variables associated with teachers. Specifically in this study, the scaffolding factors regarding instructional methodology and pedagogy as managed by the teachers remain yet to explore.

Therefore, the management communication style was used in this study as a scaffolding factor to support online engagement. Originally derived from the field of organizational research, management communication style refers to the way that managers communicate with employees in the workplace in order to ensure the smooth operation of a business. There are four general categories of management communication styles: to tell, to sell, to consult, and to join.

Table 1 illustrates how the Management Communication Style theory corresponds to the various levels of decision making and responses between management and employees. This suggests a positive correlation between openness in decision making and participation by employees [14, 15, 16]. In the follow-up studies, other factors such as employee satisfaction were examined as well as the relationship between different amounts of communication in the workplace. Earlier studies have established a positive relationship between the employee-centered managers' communication style and employee satisfaction [17].

Table 1. Features and categories of management communication style

Type	Features	Employee Participation
To Tell	To announced business decisions to employees from top down	Completely passive compliance
To Sell	To convince employees carrying out business decisions	Partially passive compliance to
To Consult	To negotiate and consult with employees about the business decisions	Partially involved
To Join	To involve the employees in the decision-making process about business decisions	Actively involved

Furthermore, studies in the educational field attempt to extend the concept of Management Communication Style to classroom teaching [18]. This is because similarities exist between two scenarios regarding communication settings, participants on both sides, and information channels. These studies suggest that the interactions between teachers and students in classroom settings are similar to those between employers and employees in work settings. These findings merit further investigation.

As a result, the present study contributes to the existing body of literature by applying a new perspective of the Management Communication Style to the study of student engagement in online learning settings. The longitudinal study of 8 weeks was conducted with 117 participants in response to the Covid-19 pandemic in the context of online learning-based scaffolding pedagogical practices.

2 Research questions

Data obtained from three distinct stages provided a complete picture of online engagement and implied dynamic patterns in overall learning sessions. Further, a pairwise comparison was performed between perceptions of the perceived online learning activities and those of the perceived offline learning activities in order to triangulate and broaden the sphere of the research. Moreover, a comparison of perceived online learning with perceived offline learning was also conducted in order to increase the scope of the research.

Situated in mobile-technology assisted learning settings, this study aims to address the following research questions:

- Q1: Is there any significant difference in online student engagement before and after the learning activities?
- Q2: How does online student engagement vary throughout the whole procedure?
- Q3: Is there any significant difference in the learners' perceptions towards online course delivery and the equivalent offline course?

3 Methodology

3.1 Contexts and participants

The quasi-experiment was conducted for 8 lectures on weekly basis with a total number of 117 learners from 3 intact language classes, which are valid for statistical analysis in empirical study. The outburst of Covid-19 confined the learners to home for remote learning online. Basically, the teacher applied the online activities by mean of three learning tools: Tencent meeting online for course delivery, WeChat for group discussion after class, and mobile apps of Rain Classroom for PPT slides sharing and pop-up quiz and tests.

Altogether 117 first-year postgraduate students of a highly prestigious university in P. R. China participated in the present study. Data complete for final analyses showed that 106 (73 male and 33 female) postgraduate students with an average age of 23.34 (SD = 1.48) of finance background. They originated though from various disciplines of engineering, chemistry, material science, computer science besides finance.

3.2 Instruments

The present study employed a mixed method to collect data, as detailed below.

Demographic information questionnaire. The 4-item demographic information questionnaire was designed to collect the participants’ demographic information including name, gender, discipline in undergraduate and age.

Online Student Engagement Scale (OSE). The 19-item Online Student Engagement Scale modified from the original scale by [19] and used in [20] was employed in the present study. The scale covered 4 aspects of course engagement in online settings and was distributed to the participants in Week 1, Week 4, and Week 8 respectively.

Student Actual Online Learning Experience (SAOLE). The self-designed 5-point Likert Scale was employed at the end of the course lectures to record the students’ attitudes and evaluations towards the online learning experience. SAOLE consisted of 5 items ranging from “Strongly Disagree” to “Strongly Agree” with values of 1- 5 assigned to the descriptors respectively. The SAOLE scale covered the items of the class being interesting, innovative, confidence in future learning abilities, willingness to continue the teaching mode, willingness to share with others.

Student Perceived Offline Learning Experience (SPOLE). Together with SPOLE, another self-designed 5-point Likert Scale was distributed to the participants, who are expected to report their perceived attitudes if they take the same course offline. SPOLE consisted of the same 5 items of the perceived attitudes towards the offline learning experience towards the class being interesting, innovative, confidence in future learning abilities, willingness to continue the teaching mode, willingness to share with others.

Placed on a 5-point Likert scale, each item of OSE, and SAOLE and SPOLE scales had five alternatives, ranging from ‘Strongly Disagree’ to ‘Strongly Agree’ with values of 1-5 assigned to the descriptors respectively. The basic features of the measures are presented in Table 2, which revealed very high reliability for each measure in each stage.

Table 2. Instrument Reliability

Measures	Stages	No. of items	Reliability
OSE*	Stage 1	19	0.97
	Stage 2	19	0.96
	Stage 3	19	0.96
SAOLE**	Stage 3	5	0.88
SPOLE***	Stage 3	5	0.90

* Online Student Engagement Scale

** Student Actual Online Learning Experience

*** Student Perceived Offline Learning Experience

3.3 Procedure

The present study employed an experimental design and collected data over a 8-week period of time in a semester. At the beginning of the class, a form of consent was distributed to 3 natural intact classes of first-year postgraduate students. A total amount of 120 participants agreed to participate in the present study.

In Week 1 (Stage 1), the participants filled in OSE for the first time as well as the individual demographic questionnaire. They were also encouraged to follow the public WeChat account of Rain Classroom and joined the virtual class by scanning a QR code provided by teachers.

In Week 4 (Stage 2), the participants filled in OSE for the second time as mid-test in assessing the course engagement in online settings.

In Week 8 (Stage 3), the participants filled in OSE for the third time as the post-test. Besides, the participants filled SAOLE and SPOLE about assessing the course online and offline respectively. A total number of 106 datasets were generated valid for further analysis.

3.4 Treatment of an integrated online learning management

The integrated online learning management system includes Tencent meeting, the social media of WeChat and the mobile learning app of Rain Classroom. Tencent meeting, one of the most popular online meeting platforms, enabled the delivery of the online courses and empowered by audio and video messages in synchronous way. The social media of WeChat serve two purposes of staying tuned with the communications in text or in voice message in and after the class and dynamic groupings of students in voice chatting and discussion synchronously across various class sessions as well. Along with online meeting platform and social media, the mobile learning app of Rain Classroom enabled storing the PPT slides to the students' end for permanent. Besides, the class pop-up quiz was able to send to the students' end instantly. The function of "screen bullets" allowed students to send comments or queries from the students' end and project the comments to the slideshow automatically during the lecture.

3.5 Data analysis

The survey data were examined and analyzed via the data processing program of SPSS 2020. Repeated measure ANOVA analysis was performed in examining the dynamic trend of the course engagement in online settings. Paired samples t-tests were also conducted to explore the differences in comparing the students' attitude towards the courses online with courses offline.

4 Results

In this study, repeated measure ANOVA and paired samples t-tests were conducted to examine the changes and fluctuations of online learning engagement.

4.1 Correlations between OSE scales

First, correlations between OSE scales have been examined as displayed in Table 3.

Table 3. Correlation between OSE scales (N=106) ***

	OSE2	OSE3	OSE4	OSE
OSE1	0.94**/0.91**/0.93**	0.66**/0.67**/0.61**	0.81**/0.81**/0.81**	0.97**/0.95**/0.95**
OSE2	1	0.64**/0.68**/0.58**	0.76**/0.80**/0.83**	0.95**/0.94**/0.96**
OSE3		1	0.64**/0.74**/0.65**	0.75**/0.80**/0.69**
OSE4			1	0.91**/0.93**/0.93*

* p<0.05; ** p<0.01; *** Each column presents the coefficients in stage 1, 2 and 3 respectively, separated with a slash; coefficient of determination: small = r<0.1; medium = r = 0.3; large = r>0.5. OSE1=Skills; OSE2=Emotion; OSE3=Performance; OSE4 = Participation

Table 3 showed that the four factors in OSE scales generated high reliability scores ranging from 0.77 to 0.94 in three stages. Prior statistical analysis in principal component analysis yielded 4 factors with eigenvalues exceeding 1. The resultant 4 factors were 6-item OSE1 indicating skills, OSE2 emotions, OSE3 performance and OSE 4 participation. As shown in Table 2, the OSE factors were highly significantly correlated with each other (r = 0.58~0.94, p<0.01) and with the overall OSE (r = 0.69~0.97, p<0.01) in all the three stages, with a large effect size for all the coefficients indicating the robustness of the scale.

4.2 Dynamic trend of OSE among three stages

A one-way repeated measures ANOVA was conducted to compare the changes of the course engagement in online settings in Week1, Week 4, Week 8 sequentially.

As shown in Figure 1, the adjusted Greenhouse-Geisser generated the significant increase in OSE scale in overall OSE (F (1.53,160.79) = 11.01, p<0.001, $\eta^2=0.10$) as well as in the factors of Skill OSE1 (F (1.67,175.08) = 5.60, p<0.01, $\eta^2=0.05$), Emotion OSE2 (F (1.47,154.41) = 10.77, p<0.001, $\eta^2=0.09$) and Participation OSE4 (F (1.67,175.08)=5.60, p<0.01, $\eta^2=0.05$). The effect size of the Online Course Engagement change was small to moderate, as implied by [22] and [23]. The factor of Performance though, showed no significant difference while the learning activities proceeded OSE3 (F (1.00, 105.00) = 0.23, p>0.05, $\eta^2=0.00$).

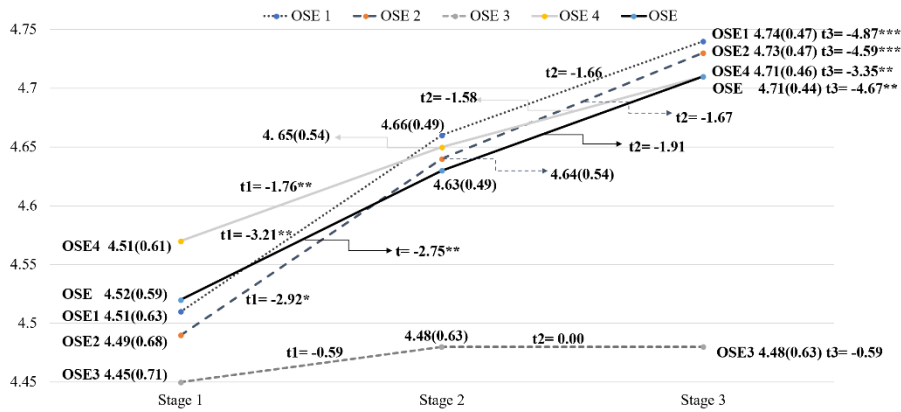


Fig. 1. One-way repeated measures of OSE scale factors in three stages****

* $p \leq 0.05$; ** $p \leq 0.005$; *** $p \leq 0.001$; ****Each column presents the coefficients in stages 1, 2 and 3 respectively, separated with a slash; coefficient of determination: small = $r \leq 0.1$; medium = $r = 0.3$; large = $r \geq 0.5$ [21]. OSE = OSE scale in overall; OSE1=Skills; OSE2=Emotion; OSE3=Performance; OSE4=Participation

The Post hoc was conducted for three of the paired samples comparison ($p=0.016/3$). A significant increase was found in OSE scale in overall and the three factors of Skill, Emotion and Participation among both pairs of stage 1 and stage 2, as well as stage 1 and stage 2. The first pair between stage 1 and stage 2 indicated that there was a significant increase in OSE scale in overall ($M=4.52$, $SD=0.59$; $M=4.71$, $SD=0.44$); $t=-4.67$, $p \leq 0.001$, and the three factors of Skill ($M=4.51$, $SD=0.63$; $M=4.74$, $SD=0.47$); $t=-4.87$, $p \leq 0.001$, Emotion ($M=4.50$, $SD=0.68$; $M=4.67$, $SD=0.47$); $t=-4.59$, $p \leq 0.001$ and Participation ($M=4.51$, $SD=0.61$; $M=4.71$, $SD=0.46$); $t=-3.35$, $p \leq 0.005$) respectively. The second pair between stage 1 and stage 2 also showed a significant increase in OSE scale in overall ($M=4.52$, $SD=0.59$; $M=4.63$, $SD=0.69$); $t=-2.75$, $p \leq 0.005$, and the three factors of Skill ($M=4.51$, $SD=0.63$; $M=4.66$, $SD=0.69$); $t=-3.21$, $p \leq 0.005$, Emotion ($M=4.50$, $SD=0.68$; $M=4.64$, $SD=0.54$); $t=-2.92$, $p \leq 0.05$) and Participation ($M=4.51$, $SD=0.61$; $M=4.65$, $SD=0.54$); $t=-1.76$, $p \leq 0.005$) respectively. There was no significant difference in the pair of Week 4 and Week 8 in OSE scale in overall and the three factors of skills, emotion and participation. The third factor of performance did not yield any significant difference between stage 1 and stage 2, between stage 2 and stage 3 respectively.

4.3 Paired sample t-test between actual online learning and perceived offline learning experience

As shown in Table 4, the respondents scored higher on all scales in Actual Online Learning experience than in Perceived Offline Learning experience. And the differences were all statistically significant ($t = 2.37 \sim 4.31$) except in the scale of Continue the Same Teaching Mode with a medium effect size ($d = 0.24 \sim 0.41$). Alternatively, compared with Perceived Offline Learning Experience, the Actual online learning experience was significantly more interesting and innovative. The participants showed

significantly more confidence in the future learning abilities and they were significantly more willing to share their actual online learning experience with others. Yet the participants showed no significantly difference the willingness to continue the same learning mode between the online and offline learning experience.

Table 4. Paired Sample T-Test between Actual Online Learning and Perceived Offline Learning Experience****

	Actual **** Online L. E.		Perceived Offline L.E.		Paired sample t-test (df=102)		
	M	SD	M	SD	t	P	d****
Class Interesting	6.29	.89	5.99	1.19	2.52	.013*	0.25
Class Innovation	6.49	.79	5.94	1.28	4.31	.000***	0.40
Confidence Future Learning Ability	6.17	.94	6.00	1.19	2.37	.020*	0.24
Continue the teaching mode	5.97	1.45	5.69	1.52	1.39	.167	0.13
Sharing L.E.	6.35	1.07	5.78	1.44	4.20	.000***	0.41

*p≤0.05; **p≤0.005; ***p≤0.001; ****Effect size of Cohen’s d: small= d≤0.2; medium= d= 0.5; large= d≥0.8 [21]; ***** Learning Experience

5 Discussion

5.1 Theoretical implications

Figure 2 illustrates the four levels of classroom management and communicating with students shown in the Management Communication Style [18]. The teachers' excessive lecturing in class has a negative impact on the student engagement. Consequently, the more the teacher controls the content of instruction, the less students are involved in learning activities, and therefore contribute less to knowledge production. Managing the teaching materials and involving the students have become two crucial elements of teacher-student communication in the classroom. Therefore, the focus of this study shifts from the students to the teachers providing scaffolding support.

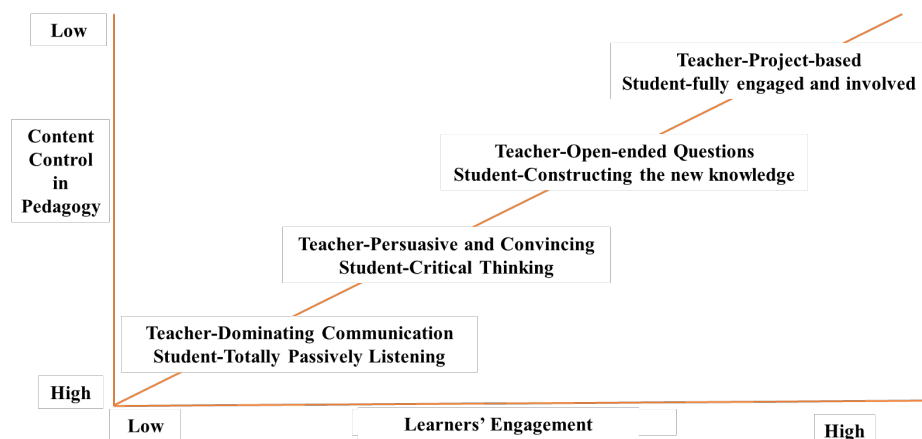


Fig. 2. Relationship between learners' engagement and teacher's communication style

5.2 Changes and variations of student online engagement

In response to first research question, statistical analysis yielded the significant difference between pre- (stage 1) and post-test (stage 2) of the Online Student Engagement in general, as well as the four factors representing skills, emotions, performance, and participation. It was found in the study that learners were increasingly involved in online learning activities, which was consistent with previous findings that participants retained increasingly positive attitudes toward online learning experiences over time [24, 25].

In addition to the before-and-after comparison, this study also provided insight into the changing patterns of Student Online Engagement during the entire period of learning. Specifically, the response to second research question revealed that there were fluctuating but significant increases of Online Student Engagement in general and the three factors of Skill, Emotion, and Participation between stage 1 and stage 2 exclusively. Performance, however, showed no significant increase on either comparison between stage 1 and stage 2 or between stage 2 and stage 3.

5.3 Comparison between online and perceived offline learning experience

The third research question addresses learners' perceptions of online course delivery as well as offline learning experiences. The study results indicated that learners' evaluations of the class on two dimensions, namely their interest level and their intention to share the learning experience, were significantly higher than those made of perceived offline experiences. The results above support the claim that online courses are increasingly preferred and efficient as indicated in previous research [26]. Nonetheless, the intention to continue the teaching mode indicated that there was no significant difference in online and offline instruction. The study results add to previous evidence regarding the lack of significant differences in student achievement between online and

offline learning [27]. Overall, the findings of this study provided no evidence to support or substantiate the advantage of offline learning over online learning.

6 Conclusions

This study contributes to the existing body of literature by extending the framework of Management Communication Style to support the facilitation of online learning activities. The study also found that pedagogical practice significantly contributed to student engagement in online learning. Moreover, in the present study, a fine-grained analysis of the changes and variations of Online Student Engagement has been done as an alternative to a traditional cross-sectional study. Additionally, the data gathered from the comparison of online and perceived offline experiences has proved to triangulate and corroborate the learning engagement.

Nevertheless, the limitations of this study caution against generalizing their findings to other learning settings, including those with a longer time period or learners of juvenile age. A subsequent empirical study should examine the online learning engagement over a longer period, for example, sixteen weeks or more. Moreover, it remains to be examined to what extent learners at young ages demonstrated the same level of engagement in learning online during the same period.

Future research efforts could contribute to the existing body of literature by comparing learners in terms of demographic information including gender, age and education, as well as by comparing the different durations of learning which range from one hour to sixteen weeks.

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