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Examining primary students' after-class vocabulary behavioural learning patterns in user-generated learning context: a case study

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Abstract: In this paper, we explored the primary students' after-class vocabulary behavioural learning patterns using a mobile user-generated-content (m-UGC) tool. A total number of 21 Grade 4 students from an elementary school in Hong Kong were recruited. Case study approach was adopted. Data collection included students' learning logs on the m-UGC tool. Content analysis and visualization were used to analyze data. Three sub-groups of primary students' after-class vocabulary behavioural learning patterns were identified and future studies were explored.
Keywords: vocabulary learning, visualization, behavioral patterns

1. Introduction

Technology plays a vital and rapidly evolving role in the area of language learning. Vocabulary learning is one of the major challenges foreign language learners confront during a second language acquisition. Despite a growing body of research that examines the effect of technology on students' vocabulary learning performance, some have reported the benefits of technology in students' vocabulary learning (Huang, Huang, Huang, & Lin, 2012; Ali Mohsen, 2016; Franciosi, 2017). However, little is known on students' vocabulary behavioral learning patterns in authentic learning context. Rarely explored are studies aiming at tracing students' online vocabulary learning which captured real-life learning experiences in primary school education, which is the focus of this study.

2. Literature Review

2.1 English as a second language (ESL) vocabulary acquisition

There are varied approaches to ESL vocabulary learning. Studies on ESL vocabulary learning show that review, consolidation and application of words are critical for learners' vocabulary retention (e.g., Ma, 2014). "Good" language learners usually are involved in more out-of-class learning activities to practice the target language (Reinders, 2014). However, the opportunities for Hong Kong school students to learn English outside of classroom are rare (Chik, 2015).

2.2 Technology-enhanced ESL vocabulary acquisition in real life learning environments

In the digital age, studies on using technology, especially mobile technology and ubiquitous learning systems to enhance vocabulary learning in real life learning environments beyond the classroom are on the rise. Some studies have researched on investigating learners' vocabulary learning using artifact creation approach to allow learners to create meaningful pictures that are associated with the new word to enhance their vocabulary retention (e.g. Foomani & Hedayati, 2016). Adopting the approach, learners are provided with opportunities to choose the object they prefer, take a picture and link it to the new word learned in class in real life. In addition, in some studies, learners are also allowed to describe the context of taking the pictures related to the word and comment on and share their created artefacts (e.g., Mouri Uosaki & Ogata, 2018). Such learning process involves learners' choices for autonomous learning (Godwin-Jones, 2019). However, few studies have examined learners' learning strategies by understanding their behavioural learning patterns through learning analytics at a primary level, which can inform pedagogical decision refinement for future pedagogical practices.

2.3 Learning analytics and language learning

Godwin-Jones (2017) posits that data has played a significant role in the field of second language acquisition. With learning analytics, educators are able to be better informed with timely decision-making in refining the instructional design for improving pedagogical practices. For example, Hsiao, Lan, Kao, and Li (2017) developed a visualization analytic approach to understanding the impact of various learning strategies on college students' Chinese vocabulary in a virtual world. The research findings show that the visualization analytics method could help teachers visualise students' different learning strategies of vocabulary acquisition. Some studies have shown the effectiveness of learning analytics in a computer-assisted vocabulary learning context. For example, Mouri, et al. (2018) reported a study on evaluating the effectiveness of a learning analytics tool in connecting students' vocabulary learning acquired via eBook to those learned from real-life in higher education and the results were positive. Although learning analytics has been increasingly used in language learning especially in vocabulary learning, practical implications from extracting learners' behavioural learning patterns to inform pedagogical decision making in informal learning environment have rarely been explored. In addition, a few studies on adopting learning analytics to examine learners' behavioural patterns in language learning have been conducted in higher education.

In light of these issues, this study aimed at examining learners' vocabulary behavioural patterns out of class on a ubiquitous learning system via learning analytics at a primary level. The research question is: What were the students' after-class vocabulary behavioural learning patterns on m-UGC tool?

3. This Study

3.1 Participants and Learning Topics

A one-year case study approach was adopted in order to inquiry into the phenomenon of students' vocabulary learning process in real life context and identify their learning patterns (Yin, 2002). A sample of 23 students (4C01- 4C23) were recruited from one class of fourth graders at an elementary school in Hong Kong. The mean age of all the subjects is 9.5 years old. The study lasted for two weeks. English was used as the medium of instruction. To consider the research ethics of study that involved collecting data from the participants, a written informed consent form was obtained from both the participants and their parents,. Two students withdrew the study. In the end, 21 students were included in this case study. The topic of vocabulary learning reported in this paper was "places".

3.2 The m-UGC tool

The m-UGC tool is adapted from the System for Capturing and Reminding of Learning Log (see Ogata et al., 2011; Song & Yang, 2019) was used in this study. Students could add learning notes, upload pictures, describe the newly acquired vocabulary and comment on peers' learning logs by giving text-based comments on SCROLL (refer to examples in Figure 3 in results and discussion section).

3.3 Coding Scheme of students' behavioural learning patterns

Based on the main behaviour categories in terms of students' posting, descriptions and social behaviors (comment peers' postings on the m-UGC tool), three subgroups were identified: active social, active non-social and passive users by referring to the literature (Gerson, Plagnol, & Corr, 2017). Students who were active in the creation of comments were categorized into "social" users, and active users were those in the high engagement with the creation of learning logs (posting pictures and vocabulary) and descriptions.

Firstly, seven students were categorized as "passive users" because they did not post any comments and in which two students only post one posting respectively. The rest 14 students were divided into "active social" and "active non-social". Secondly, given the fact that 125 picture-and-text based postings, 90 text-based descriptions and 26 comments were collected in this study. The criterial of dividing "active social" and "active non-social" users was: if the number of students' postings were larger than 8, he/she could get 1 mark, otherwise they would get 0; in addition, students could get 1 mark if they made more than 6 pieces of text-based description, otherwise they would get 0; besides, students could get another 1 mark if they commented on others' learning logs. Hence, students' posting score ranged from 0 to 3 marks. Students who got 3 marks were categorized into the "active social" group. The rest of students were "active non-social" users. Finally, each subgroup consisted of 7 students.

3.4 Data Collection and Analysis

Data sources included students' vocabulary learning logs recorded (pictures, descriptions and comments) on the m-UGC tool. Both qualitative and quantitative data analysis methods were adopted. Firstly, student created vocabulary learning logs were counted, coded and categorized into postings (picture and vocabulary), descriptions and comments. Secondly, students' vocabulary learning logs were analysed using Gephi (https://gephi.org) to identify students' behavioural learning patterns.

4. Results and Discussion

The results of the students' after-class behavioural learning patterns on the m-UGC tool were presented in this section. There were 125 vocabulary learning logs (pictures and vocabulary) in total created by the students with 26 comments documented on the m-UGC tool. Among the 125 postings, 118 postings (94.4%) were related to the vocabulary learned on the topic of "Places". The rest of 7 postings were not included in the vocabulary list. The distribution of students' behaviour categories among three sub-groups are listed in the Table 1.

Table 1. *The distribution of students' behaviour categories across three sub-groups*

	Posting	Description	Comment
Active social (7)	72(57.6%)	70(77.8%)	24(92.3%)
Active non-social (7)	51(40.8%)	19(21.1%)	2(7.7%)
Passive users (7)	2(1.6%)	1(1.1%)	0

Students in sub-groups of "active social" and "active non-social" were active in creating picture-and text-based learning logs, while 77.8% of text-based descriptions were made by active social users, 21.1% were made by active non-social users. Females were dominated in the "active social" group, accounting for 71.4%, in contrast, males were more likely to be "passive users" (see Table 2).

Table 2. *Gender distribution across three sub-groups*

	Active social		Active non-social		Passive	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Female	5	71.4%	4	57.1%	2	28.6%
Male	2	28.6%	3	42.9%	5	71.4%

Gephi (https://gephi.org) was used to analyze students' learning logs and peers' connections on the m-UGC tool. The visualization was done using Gephi's default layout algorithm (Fruchterman reingold), which renders each node's position according to its relations and connections (Jacomy,Venturini, Heymann, & Bastian, 2014). First, students' logged data on the m-UGC tool was transformed into data that could be read by the visualization tool Gephi. As showed in Figure 1, 175 nodes were created, in which 21 nodes represented 21 participants, and 152 nodes of target words. Gephi created each edge to connect students and learning logs. For example, if 4C01 learner created word "Library", node 4C01 was connected to the node "Library". Figure 1 shows the relations between each student and each word that they were logged on the m-UGC tool. The size of node represented the "degree centrality" (its number of connections). Hence, 4C02,4C01,4C09, and 4C06 were in higher degree centrality than other students, indicating that these students were active in contributing their learning logs.

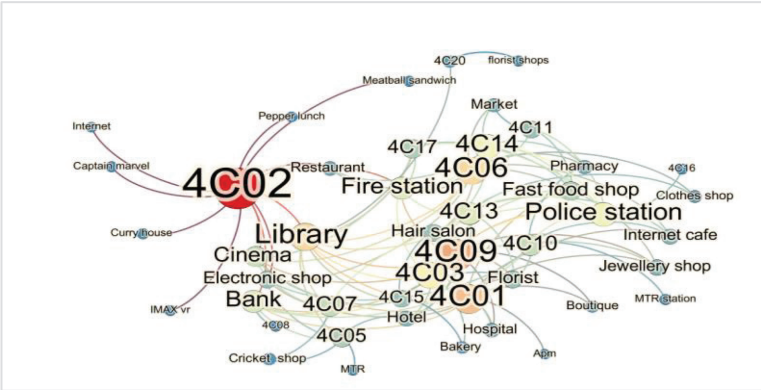

Figure 1. Visualization of students and learning logs

Take student 4C02 as an example (see Figure 2). The value of degree centrality was 19 as calculated by Gephi 0.9.2, meaning student 4C02 created 19 words and was the most active in posting learning logs in the class. The value of degree centrality indicated the number of edges connected to a node, with higher degree values relating to more influential nodes (Hernández-García, González-González, Jiménez-Zarco, & Chaparro-Peláez, 2016).

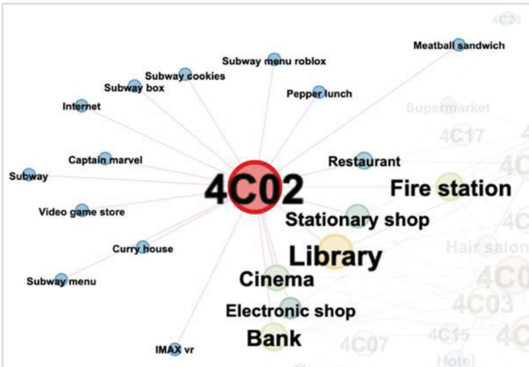

Figure 2. Visualization of student 4C02's learning log

The most active learners 4C02, 4C06, 4C09, and 4C01contributed 44.8% of the entire class's postings and created 56 learning logs in total. We also found that the learner 4C02 posted words related "restaurant" that other student did not post, such as "Subway", "Subway box", "Subway cookies" and "Subway menu roblox". It was worth mentioning that "Subway" is a fast food restaurant and is common in Hong Kong. Therefore, the learner 4C02 could relate pictures and vocabulary in real life context to what he/she learned in class (See Figure 3).

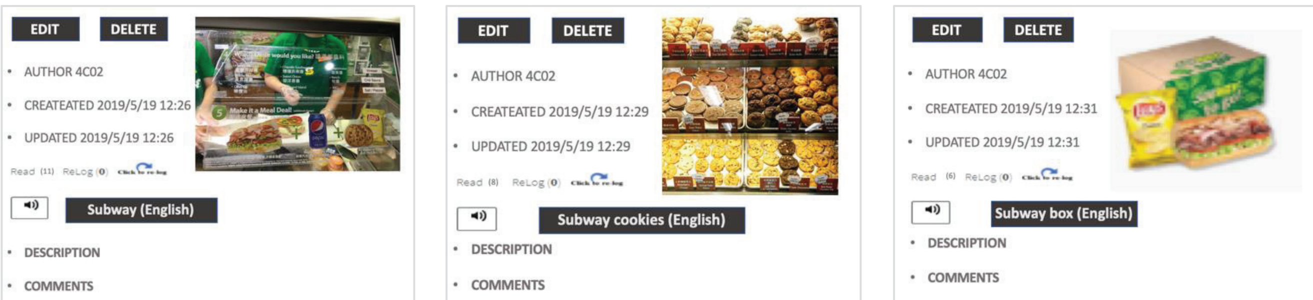

Figure 3. Examples of Student 4C02's learning logs related to "restaurant"

As for posted vocabulary, words such as “library”, and “police station” were in centrality among 21 students, indicating that 11 of 21 students recorded word “library” and 9 students recorded the phrase “police station” (refer to Figure 4).

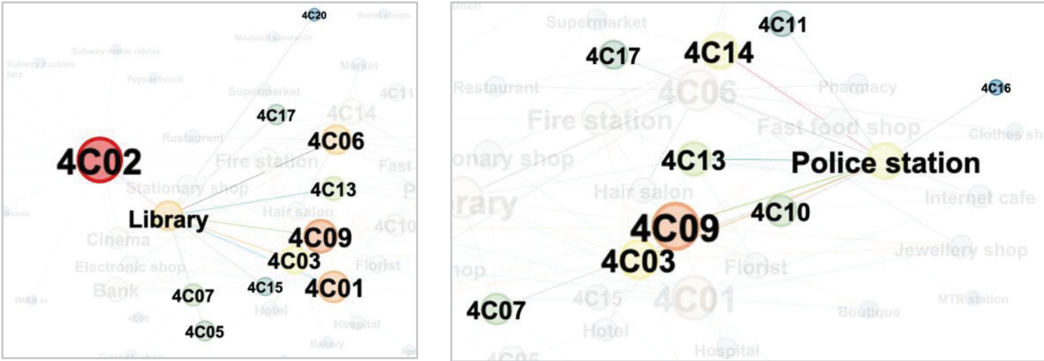

Figure 4. Example: visualization of words “library” and “police station”

The visualization analytics also effectively displayed the peers’ connections on the m-UGC tool (Figure 6). The directed relationships were represented by arrows pointing from a source node to a target node. For example, if 4C10 commented 4C01’s learning log, the source node would be 4C10 and the target node would be 4C01. The thickness of lines implied the average number of peers with which each learner interacted. Active social users created much thicker lines, indicating that two contributors were more likely to interact with each other as showed between student 4C01 and 4C10. Figure 5 provided information about which students were not involved in commenting on the m-UGC tool represented by unlinked nodes.

Seven students (4C01, 4C03, 4C07, 4C09, 4C10, 4C15, 4C17) were active in posting 26 comments in total. The size of 4C01’s node was the biggest in the class, indicating that 4C01 received the most comments from peers, in which the interaction between peers with 4C10 was in the highest frequency. In addition, as showed by the arrows, 4C01 had interactions with 4C03, 4C06, 4C09, 4C10, 4C13, 4C14, 4C15 and 4C17.

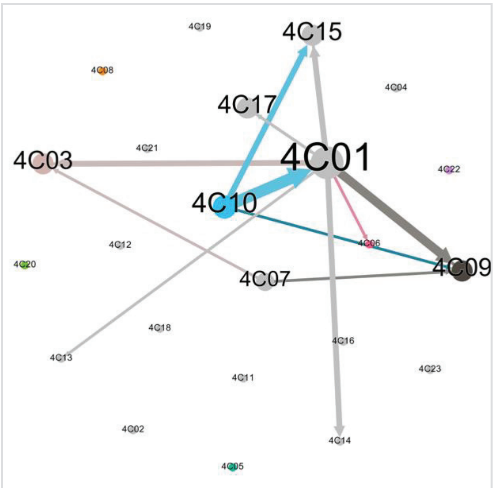

Figure 5. Visualization of peers’ interactions on the m-UGC tool

5. Conclusion and Future Studies

This study aimed at investigating students’ after-class vocabulary behavioural learning patterns on a user-generated-content (m-UGC) tool by tracking their learning process through learning analytics and visualization.

Based on students' number of posting, description and comments, three sub-groups were identified: active social, active non-social and passive users, which can help teachers make pedagogical-decision-making in future pedagogical practices. This study had limitations. Considering the tentative nature of this study, we only reported 21students' learning logs under one topic "places". In addition, the participation level in commenting of students was not satisfying, we should identify the reasons and collect more comments in the future studies. In the future, we will increase the sample size, explore the impact of the patterns on students' vocabulary learning performance and the relationship between students' after-class behavioural learning patterns and students' vocabulary performance will also be investigated.

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