Students' Personality and Chat Room Behavior in Synchronous Online Learning

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ABSTRACT

Synchronous chat rooms have been used to support students' collaborative learning. However, little work has empirically studied its relationship with students' sense of community and furthermore the role of personality in affecting students' chat room behavior. In this paper, we report results of a user experiment (with 489 students). We find that students who have actively used chat room possess significantly higher level of sense of community than inactive students. More notably, we identify the important role of students' personality in influencing both their chat frequency and chat content.

CCS Concepts

•**Human-centered computing → User studies**; •**Applied computing → Collaborative learning**;

Keywords

Online learning; synchronous learning; chat behavior; user survey; sense of community; personality.

1. INTRODUCTION

Online learning is defined as the process of using the Internet to acquire knowledge, access learning materials, and interact with others [1]. Over the past few years, online courses have mainly depended on asynchronous mode of instruction that allows students to study at their own pace [9, 18]. However, some studies show that students feel low sense of community (a feeling of belonging to a community in a course-based context [13]) due to the lack of real-time interaction, which leads to low student retention [20]. Some researchers have hence suggested that more community-oriented features should be used to create a more inter-connected learning environment [4].

Therefore, synchronous online learning (also referred to as live instruction), where instruction and learning occur at the same time, has been emphasized in recent online courses [17]. The real-time interaction may enable more efficient and active communication to reduce students' feeling of isolation and improve their engagement in online learning [4, 17].

In this paper, we focus on studying text chat, which is one of the popularly used communication tools in synchronous online learning [12]. Via real-time chat messages, students can exchange immediate feedback with their peers and instructors. They may hence see themselves as active participants rather than isolated users who communicate with the computer alone.

However, it is not conclusive whether chat room can really be used to build students' sense of community [3, 15]. Moreover, few studies have investigated the role of personal factors, especially personality, in influencing students' chat behavior. In order to address these issues, we have performed an experiment that records 489 students' chat room behavior when attending online classes, and their personality and post-course sense of community as acquired through questionnaire. The analysis identifies significant difference between active students of using chat room and inactive ones in terms of their sense of community. The results additionally reveal significant effect of personality on both students' chat frequency and chat content.

In the following, we first state our research questions, and then present experiment setup and results analysis. At the end, we draw the conclusion.

2. PROBLEM STATEMENT

Our research questions are illustrated in Figure 1. To be specific, we are interested in first verifying the correlation between sense of community and students' perceived learning outcomes. Related work shows that greater sense of belonging can alleviate students' feeling of isolation and increase their satisfaction with the academic program [14], but few have empirically identified whether high sense of community would help improve students' learning effectiveness, e.g., becoming more interested in the studied course (i.e., interest growth) and being motivated to accumulate more course knowledge (i.e., knowledge growth) [16]. The corresponding research question is:

RQ1: *Would students' sense of community be significantly correlated with not only their satisfaction with learning process, but also interest growth and knowledge growth?*

Secondly, it is interesting to identify whether text chat could be helpful for developing students' sense of community. In [3], an experimental comparison conducted between chat and no-chat groups shows that the two groups do not respond significantly differently as to sense of community. However, this experiment did not take into account students' chat frequency during the comparison. In another related work [15], synchronous chat is found more effective in building students' sense of community relative to asynchronous bulletin board, but the size of samples (7 students) is quite small. In our experiment, we cluster 489 students into two
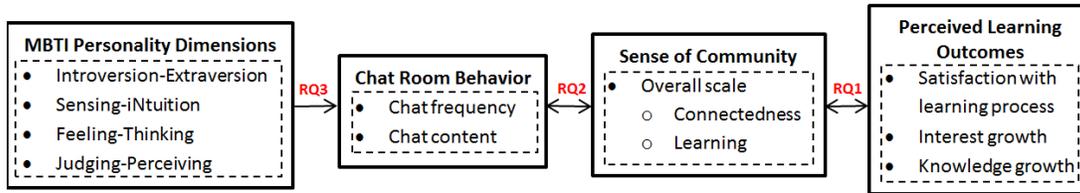
Figure 1: Our research questions.

groups, *active* and *inactive* chat groups, according to two chat frequency measures: the average number of messages each student posted per lesson and her/his show ratio (the ratio of a number of lessons the student has posted at least one message in a lesson to the number of all lessons s/he has attended). The related question is:

RQ2: *Would active chat group possess significantly higher level of sense of community than inactive group?*

Lastly, we investigate the role of students' Myers-Briggs Type Indicator (MBTI) personality [10] in influencing their chat room behavior. In comparison with Big-Five personality test [6], MBTI test has been more popularly used in the area of learning given that it is more indicative of a user's style when dealing with the outer world and her/his way of perceiving information and making decisions. Concretely, MBTI test defines a user's personality in four dimensions, *Introversion-Extraversion* (reflecting individual perceptual orientation), *Sensing-iNtuition* (presenting how individuals gather information), *Feeling-Thinking* (influencing how people make decisions), and *Judging-Perceiving* (indicating the way people connect with the outer world)[1].

To our knowledge, some studies have also attempted to relate personality to student performance and behavior in online communication [2, 8]. For instance, *extroverts* are found more active in discussions than *introverts* [2]. However, there are two major limitations. One is that they mainly focus on one personality dimension *Introversion-Extraversion*. The other three MBTI personality dimensions have rarely been studied. The second limitation is that they did not measure the effect of personality on students' chat content such as the appearance of *social* and *cognitive* presence words. Indeed, these two types of presence can indicate whether synchronous chat would foster collaborative and meaningful learning [12]. To be specific, social presence is defined as the degree of awareness of others in an interaction. It is concretely reflected by social process words (e.g., "talk" and "discuss") and affective process words (e.g., "awesome" and "terrified"). Cognitive presence refers to the extent of both reflection and discourse in the construction of meaningful learning outcomes. It is embodied by cognitive process words like "think" and "consider".

RQ3: *Would students' personality significantly affect both their chat frequency and chat content?*

3. EXPERIMENT DESIGN

3.1 Materials and Participants

The experiment was performed on a Chinese online learning website, called eBanshu (www.ebanshu.com), which pri-

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[1]Due to space limit, the detailed description of these four personality dimensions can be found in [10].
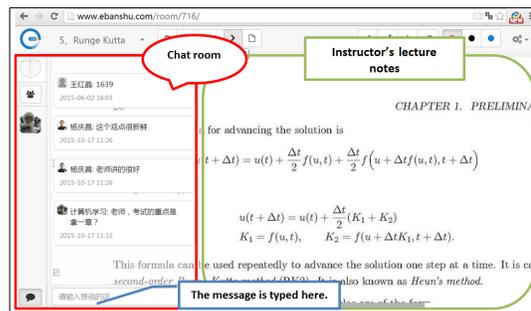

Figure 2: Snapshot of text chat interface in eBanshu (www.ebanshu.com).

marily provides synchronous learning facilities for university instructors to perform remote instruction. The instructor can use video camera and digitizer to give real-time lectures, and students can communicate with peers and the instructor through an embedded text chat interface (see Figure 2). At the end of the course, the student will take credit if s/he passes examination.

From March to June 2015, a total of 1,559 students were enrolled on 16 offered courses (e.g., "Comparative Literature", "Inorganic Chemistry", "Discrete Mathematics"). These courses can be classified into three subject types: liberal art (9 courses), science (6 courses), and engineering (1 course). The average course enrollment is 97.3 (min=50, max=209, st.d.=42.2). Each course lasted for over 12 weeks, with two lessons given per week (each lesson takes 1 hour). Among those 1,559 students, 489 students (409 females) participated in our survey. Their ages range from 20 to 25, and are from 11 different majors (e.g., Chemistry, English, Pedagogy).

3.2 Measurement

Before each course started, we asked students to fill in a questionnaire for obtaining their pre-course interest (from 1 "very low" to 5 "very high"), pre-course knowledge (from 1 "none" to 5 "all"), and personality. The personality was acquired via a 28-item Chinese version of MBTI test. Each dimension was concretely measured via 7 questions, with each question containing two response options [10].

Then, when students finished the course, we asked them to fill out a questionnaire about their sense of community, satisfaction with learning process (from 1 "very unsatisfied" to 5 "very satisfied"), post-course interest, and post-course knowledge. The sense of community was responded on Rovai's 20-statement Classroom Community Scale [13] (each statement was rated on a 5-point Likert scale from 1

Table 1: Correlation between sense of community and perceived learning outcomes ($^*p < 0.05$ and $^{**}p < 0.01$)

	Sat. learning process	Interest growth	Knowledge growth
Overall	0.293**	0.140**	0.121**
Connectedness	0.307**	0.148**	0.113*
Learning	0.267**	0.112*	0.114*

"strongly disagree" to 5 "strongly agree"). This community scale can be divided into two dimensions [13]: *connectedness* that refers to students' feeling of belonging to a community; and *learning* that is their feeling the community helps them to acquire knowledge and meet learning goals.

The perceived learning outcomes hence include students' satisfaction with learning process, interest growth, and knowledge growth. For the latter two, the "growth" is formally calculated as the difference between post-course and pre-course responses.

Moreover, we recorded students' chat room behavior for the purpose of analyzing their chat frequency and content. The behavioral data include the number of messages a student posted per lesson and each message's actual content.

4. RESULTS AND ANALYSIS

4.1 Sense of Community and Perceived Learning Outcomes

The reliability analysis of sense of community scale shows that its internal consistency coefficient (Cronbach's alpha) is 0.888, and the coefficients of the two sub-dimensions *connectedness* and *learning* are 0.724 and 0.811 respectively. These values are all above 0.70, suggesting that the corresponding statements have satisfactory internal validity [11]. Moreover, it shows that students' post-course interest is significantly higher than their pre-course interest (mean=4.08 vs. 3.77, t=8.7, p<0.01, via paired sample t-test). They also perceive the acquisition of significantly more knowledge after learning (mean=3.44 vs. 2.44, t=24.9, p<0.01).

We then calculated the correlation between sense of community and students' perceived learning outcomes, via Spearman's rank coefficient as it is applicable to both ordinal and numerical variables [19]. From Table 1, we can see that students' sense of community values are significantly positively correlated with their perception of learning outcomes in terms of all measures. Concretely, it indicates that students who feel stronger sense of community (not only at overall scale but also in the two sub-dimensions *connectedness* and *learning*) are likely to be more satisfied with their learning process, to be more interested in the studied course, and accumulate more knowledge after taking the course. The results thus well answer our first research question.

4.2 Chat Frequency and Sense of Community

The 489 students posted totally 28,033 chat messages. As each student was enrolled on only one course according to our record, their average number of messages per lesson is 2.38 (st.d.=2.99) and average show ratio during the whole course is 38.9% (st.d.=15.2%). For each lesson, the average number of students who posted at least one message is 29.2 (st.d.=16.8) and their relative percentage is 36.9%.

In order to explore the relationship between chat frequency and students' sense of community, we used k-means clus-
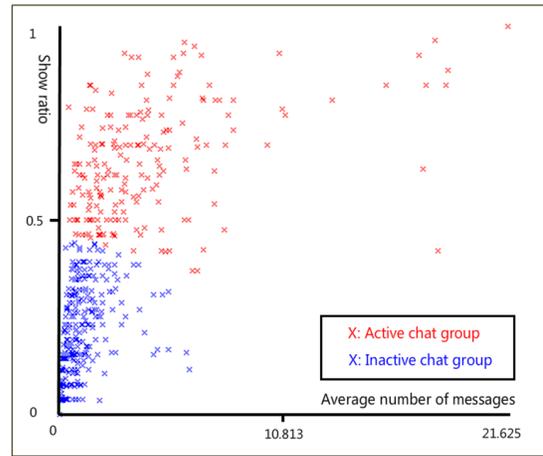

Figure 3: Clustering of students into *active* and *inactive* chat groups through 2-means clustering algorithm.

Table 2: Average number of chat messages (avg. message) and show ratio of group centroid (the number of users is in bracket)

	Full data (489)	Active chat group (205)	Inactive chat group (284)
Avg. message	2.38	4.17	1.08
Show ratio	38.9%	64.2%	20.6%

tering (k=2) to automatically partition all students into two groups according to both their *average number of messages posted per lesson* and *show ratio*. Figure 3 illustrates the clustering results, where red crosses represent students who are more active in posting chat messages than those marked in blue crosses. The detailed description of those two groups is given in Table 2.

Then, we compared the two groups' sense of community values. It shows that active chat users perceive significantly stronger sense of community than inactive chat group (mean=3.55 vs. 3.33, t=3.889, p<0.01 by t-test for two independent samples). We further compared the two groups in respect of the two sub-dimensions, *connectedness* and *learning*, which still shows significant differences. To be specific, regarding *connectedness*, the mean of active chat group is 3.50 (vs. 3.36 of inactive group, t=2.958, p<0.01). As for *learning*, it is 3.58 against 3.31 of inactive group (t=4.055, p<0.01). The results thus suggest that students who behave more actively in chat room are likely to feel higher level of community belonging and learning achievement.

4.3 Personality and Chat Behavior

The next question comes to whether personal factor will influence students' chat behavior. As mentioned before, we particularly consider personality because it is inherently related to the way a person deals with the outer world and perceives information. Our participants' distribution among the four dimensions of MBTI personality is: *Introversion* (331 students (68%))-*Extraversion* (158 (32%)), *Sensing* (254 (52%))-*iNtuition* (235 (48%)), *Feeling* (383 (78%))-*Thinking* (106 (22%)), and *Judging* (394 (81%))-*Perceiving* (95 (19%)).

Students' chat behavior was analyzed from two aspects:

Table 3: Personality, control variables and chat behavior
($^*p < 0.05$ and $^{**}p < 0.01$ through hierarchical multiple regression analysis)

	Chat frequency		Chat content						
			Message length	Social presence		Cognitive presence	Task engagement		
	Avg. message	Show ratio		Social process	Affective process	Cognitive process	Fully engaged	Somewhat engaged	Dis-engaged
Step 1: Control variables (standardized coefficients)									
Gender	-0.060	0.012	-0.011	0.028	0.005	-0.016	0.076	-0.008	**-0.148****
Pre-course knowledge	**0.105***	0.065	0.052	**0.177****	**0.160****	**0.171****	**0.128****	**0.153****	0.051
Pre-course interest	**0.135****	**0.117***	-0.075	0.073	**0.113***	0.074	**0.124****	-0.005	0.087
Subject type[+] Engineering	-0.064	**-0.221****	0.086	-0.006	-0.070	0.019	-0.086	-0.033	0.036
Subject type[+] Science	**-0.131****	-0.020	0.018	-0.039	-0.085	-0.036	**-0.173****	**-0.116***	0.085
ΔR^2 for Step 1	**0.070****	**0.080****	0.014	**0.049****	**0.067****	**0.046****	**0.081****	**0.035****	**0.042***
Step 2: MBTI personality (standardized coefficients)									
Introversion-Extraversion	**0.136****	0.053	-0.003	**0.133****	**0.123****	**0.128****	**0.094***	**0.109***	0.065
Sensing-iNtuition	**-0.092***	-0.051	-0.024	**-0.099***	**-0.097***	**-0.092***	-0.082	-0.063	-0.028
Feeling-Thinking	0.081	0.084	0.056	0.061	0.085	**0.111***	0.060	0.074	0.028
Judging-Perceiving	-0.006	-0.032	0.014	0.004	-0.029	-0.001	-0.066	0.002	0.037
ΔR^2 for Step 2	**0.030****	0.013	0.004	**0.028****	**0.027****	**0.034****	**0.022***	**0.019***	0.006
Total adjusted R^2	0.084	0.076	0.013	0.059	0.078	0.062	0.087	0.037	0.031

[+] Note: Liberal art is treated as the reference category.

chat frequency (i.e., the average number of messages posted in each lesson and show ratio) and chat content. For the latter, in addition to calculating each message's length, we used Chinese Linguistic Inquiry and Word Count (CLIWC) dictionary [7] to identify its social presence and cognitive presence by counting the occurrences of social, affective, and cognitive process words (see the definition in Section 2). We also measured the message's engagement degree with learning topic, and manually classified all messages into three types: "fully-engaged" (e.g., discussing a concept), "somewhat-engaged" (e.g., asking for help of technical support), and "disengaged" (e.g., greeting).

We then conducted hierarchical multiple regression analysis for which the control variables are *gender*, *pre-course knowledge*, *pre-course interest*, and *subject type*. Through this analysis, we are able to identify whether personality would account for any additional variances that cannot be explained by control variables.

The results are shown in Table 3. It indicates that personality explains significant proportion of variances (p<0.05) in terms of most of chat behavior measures. Concretely, the number of messages is positively influenced by *Introversion-Extraversion* dimension, and negatively by *Sensing-iNtuition*, implying that students who prefer moving into action (*extroverts*) and learning from details (*sensors*) are inclined to post more messages. Moreover, those persons also tend to use more social and cognitive presence words in their messages. Another observation is that cognitive presence words were frequently used by *thinking* people (in respect of *Feeling-Thinking* personality dimension) who are more impersonal and logical in talking. As for task engagement, the messages posted by *extroverted* students contain more content fully or somewhat relevant to the learning topic.

On the other hand, we find some control variables also significantly affect students' chat behavior. For instance, *males* posted more disengaged messages than *females*. Students with richer *pre-course knowledge* posted more social presence and cognitive presence related messages. Students who were more interested in the course before taking it (i.e., *pre-course interest*) posted more messages on average. As for *subject type*, relative to students who were enrolled on liberal art type courses, engineering students exhibited lower show ratio and science students posted less fully and somewhat engaged messages, implying that chat room may be more effective for liberal art students.

5. CONCLUSION AND FUTURE WORK

In conclusion, there are several interesting findings from this experiment: 1) Students' sense of community is significantly positively correlated with their satisfaction with learning process, interest growth, and knowledge growth. 2) Active chat students possess significantly stronger sense of community than inactive students. 3) Students' personality values, especially in terms of dimensions *Introversion-Extraversion*, *Sensing-iNtuition*, and *Feeling-Thinking*, significantly affect their chat behavior.

Thus, the findings not only verify the positive role of chat room in synchronous online learning, but should be constructive for related practitioners to develop more effective chat room given students' personality. For instance, for students who are less active in using chat room, they may consider providing some personalized supports. For *introverted* students who need more time to reflect and respond, instructors may publish learning materials ahead of each lesson for them to obtain certain course information, so as to increase their motivation to join the chatting during the lecture. For *intuitive* students who are interested in fresh and abstract things, choosing more imaginative and attractive discussion topics may potentially arouse their chat intention.

For our future work, more factors that may influence students' chat behavior will be investigated. For example, we will study whether students with different learning styles behave differently in chat room, given that learning style reflects the way students absorb and deal with course materials [5]. Moreover, it will be interesting to compare text chat with other community-oriented features such as video chat and discussion forum, so as to identify its relative pros and cons in improving student learning. We will also try to consolidate the experiment's findings among larger scale of samples who could be with diverse demographic properties (e.g., age, nationality, ethnic background).

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