Study on the changes of performance and learning behavior mode in asynchronous interactive learning

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Abstract: As a way of learning, asynchronous interaction has played an important role in the distance teaching. Learning performance in the process of asynchronous interaction will directly affect the learning outcomes. The process of asynchronous interaction learning activity is divided into three stages. We collect the data from the discussion board where students have asynchronous interaction in the different three stages. Social network analysis and content analysis are used for data analysis. The results indicated that the performance of learners and learning behavior mode in the asynchronous interaction were different in different stages of the course development. Teachers need to adopt specific teaching strategies according the differences.

Keywords: Asynchronous interaction, learning behavior mode, learning performance

1. Introduction

In 2019, there have been reports indicated that more than 12,500 MOOCs have been launched in China, with more than 200 million students taking them. Asynchronous interaction allows learners to have enough time to think, integrate and reconstruct knowledge system, which is considered as an effective learning activity to promote learners' online learning effect.

2. Literature review

The current research on asynchronous interaction is divided into three aspects:

1) Interaction model and structure: Chen(2004) constructs a hierarchical teaching interaction tower that progresses from operation interaction, information interaction and concept interaction, revealing how learning occurs in distance learning.

2) Interaction activity design: In the early asynchronous interaction studies, most researchers focus on the design of asynchronous interactive learning activities, which aims to promote the effectiveness of online teaching activities. In asynchronous interaction, students are both consumers and creators of learning content (Popescu, & Cioiu,2011), and knowledge is built during the interaction.

3) Interaction effect evaluation: In online learning, learners left a large amount of data on the learning platform. These large amount of information hidden in the network interaction behavior can explain the learner's behavior and even predict the learning outcome. These data represent the learner's learning status and the methods used to analyze it become the focus of researchers.

In this context, our research questions are as follows: At different stages of asynchronous interactive learning activities,

1. How does the social network structure of learners' interaction change ?
2. How does the learning behavior mode of learners change?

3. Research design

This study takes the example course, *Theory and Practice of Educational Technology*, a compulsory course for graduate students majoring in educational technology, which carries out asynchronous

interactive learning activities. There are 25 students. We choose three discussions from all the semester (1 from the beginning of the semester, 1 from the middle and 1 from the end). The requirements for these three topics are the same and the topics are similar. The number of discussions and the content of discussion were collected for analyzing.

4. Results

4.1 social network analysis

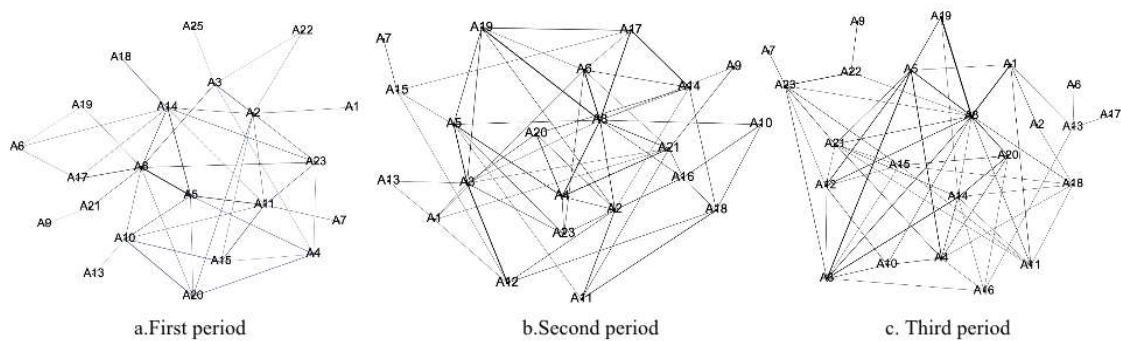In this study, Gephi 0.9.2, a network analysis tool, was used to analyze data. Figure 1 and Table 1 show the results.

Figure 1. Social interaction network diagram in three periods

Table 1. *Basic attribute values of SNA in three periods*

Attributes	First period	Second period	Third period
Node	22	22	23
Link	67	100	93
Network density	0.145	0.216	0.184
Modularity	0.309	0.236	0.252
Clustering coefficient	0.185	0.273	0.232
Path length	2.453	1.998	2.167

We can see that there is no obvious difference in the frequency of interaction between learners at the first period. And there is little communication between learners and only a few specific learners, so the communication scope is small and the internal structure of the social network is loose.

In the second period, the interaction frequency between learners increases obviously. Learners begin to step out of their previous communication circle and interact with learners in other communication circles. The whole social network becomes more compact internally.

At the third period, the number of communication circles formed by learners decreases, while the number of learners in the same communication circle increases. It indicates that with the development of the course, learners have formed a relatively stable circle of communication with frequent interactions within the circle, which is consistent with the previous researchers' conclusion that the time of student interaction is more in the middle of the term and less at the beginning and end of the term (Luo, & Jiang ,2008).

4.2 Content analysis

The interaction analysis model based on social constructivism developed by Gunawardena is adopted in this study. Further, another coding is added to represent the learner's non-learning behavior. The scheme is displayed in Table 2. Two researchers familiar with coding rules coded separately. After coding, the Kappa value was 0.835.

Table 2. *Coding scheme*

Coding	Description
S1	Sharing/Comparing of information
S2	The discovery and exploration of dissonance
S3	Negotiation of meaning/co-construction of knowledge
S4	Testing and modification of proposed synthesis or Co-construction
S5	Agreement statement(s)/applications of newly constructed meaning
S6	Non-related learning

In order to further study the interaction patterns of learners at different stages of asynchronous interactive learning, the researcher analyzed the content data using lag sequential analysis. The results are shown in Figure 2.

a.First period   b.Second period   c. Third period

Figure 2. Behavior mode
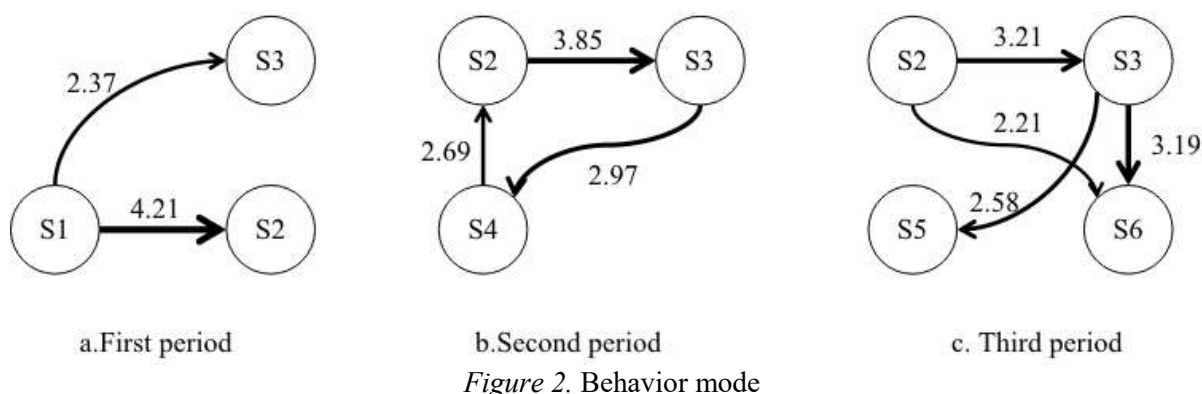
In different periods of carrying out asynchronous interactive learning activities, the main types of student posts change from S1 in the first period to S3 in the second. It shows that in the first period, most students are still in the stage of disseminating their own knowledge and are not used to learning on the online platform. After half a semester of online learning, learners may have adapted to the way of online communication and learning. The connection between learners is closer. Compared with the first period, the total amount of posts is growing and the depth of the types of posts is also increasing.

5. Conclusions

This study studies the relational interactive data and content interactive data generated by the asynchronous interactive learning activities of 25 graduate students in the class of 2019 from East China Normal University. The changes of learners' learning performance and interaction patterns during the asynchronous learning process are found in online discussion. Under the background of the in-depth integration of Internet + education, the scope of online learning is expanding and the number of online learning activities is increasing. In this background, the changes in learners' learning performance in asynchronous interactive learning activities deserve researchers' attention.

The interaction pattern of learners develops more structured and hierarchy during the whole semester. On the whole, there are still some problems with learners in asynchronous interactive learning activities. Studies have shown that the presence of teachers can change the dynamic system of discussion networks. In the online teaching process, the importance of teachers has not decreased, but changed roles. The most important role of future teachers is to guide, inspire, impart knowledge, develop themselves and be role models. Teachers are transformed from the imitators of knowledge to the developers of asynchronous learning activities, and from the commanding ones to the equal constructors of knowledge with students. Therefore, in order to realize the interactive mode upgrade at each stage, teachers can conduct appropriate guidance at different stages of the course. For example, in the early stage of asynchronous interaction, learners tend to shy away from expressing their ideas in the public platform. Teachers need to pay timely attention to such students to help get to know each other quickly and adopt certain methods, such as changing the organization mode and content form etc.

6. Limitations and future work

This study has some limitations. Interactive content data encoding of this study is a way of man-made code, which is suitable for small data. With the advent of the era of big data, this way is more human cost. Future research can implement machine learning to the learners' interaction data with much data, which will have a better data support.

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