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Investigate the Influence of Interactive Immediacy on Collaborative Knowledge Construction in Online Discussions

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Abstract: Online learning platforms can be divided into two categories according to the interactive immediacy, platforms with weak immediacy and platforms with strong immediacy. This study selected one of these two kinds of platforms to investigate the differences of interaction characteristics and collaborative knowledge construction in online discussions. A total of 46 first-year master students' online discussion texts were collected and coded as Pena-Shaff's and Gunawardenaet's coding scheme, which led to the following conclusions: (1) online discussions with strong immediacy facilitated the formation of interactions with multiple rounds and periods of participation; and (2) online discussions with strong immediacy had more categories of interactions and deeper levels of collaborative knowledge construction than those with weak immediacy. In addition, this study gave some recommendations about online discussions in both platforms to facilitate collaborative knowledge construction.

Keywords: Collaborative knowledge construction, interactive immediacy, online discussion

1. Introduction

An important factor influencing online discussions is the immediacy of online learning platforms, according to which this study classifies platforms into two categories. The first is the web-based platforms with weak immediacy, such as Wikipedia, Moodle, Learning Cell System, etc. This kind of platform with different modules not only provides services to students but integrate a variety of teaching functions, such as supporting students' collaborative learning (Hu Li et al., 2016). The second category is the social media applications for mobile with strong immediacy such as Twitter, Facebook, WeChat, etc., they are convenient and extremely popular among college students (Demir, 2018; Xue & Churchill, 2019). When applied to teaching, it can closely connect learners and teachers and support the interaction between them and promote students' social learning (Muls et al., 2020).

It can be seen that online learning platforms with different interactive immediacy may provide different support to students, and its impacts on online discussions, such as the online interaction and the level of collaborative knowledge construction remain to be investigated.

2. Literature Review

There are numbers of studies that have discussed online discussions with varying degrees of interactive immediacy. Students interact more frequently in online discussions when the interactive immediacy is strong, especially social and emotional interactions. Frequent interactions can also increase student motivation and responsibility (It-analysis, 2001); when the interactive immediacy is weak, students can express more complex, reflective views in online discussions (Hrastinski, 2008). However, this does not mean that strong immediacy has no effect on the cognitive development. Researches have shown that in synchronous learning environments with strong interactive immediacy, timely feedback can immediately correct students, consolidate learned knowledge, thus facilitate group decision-making, brainstorming and analysis (Chen et al., 2005); also, students' collaborative knowledge construction can be facilitated through real-time self-regulation and collaborative regulation (Lee et al., 2017).

However, it is not sure whether different interactive immediacy can influence the degree of cognitive development of online discussions.

Researchers usually analyze the degree of cognitive development in collaborative learning by assessing students' collaborative knowledge construction (Puntambekar, 2006), and online discussion designed for this study is also online collaboration. The current researches have not discussed the collaborative knowledge construction of students when interactive immediacy is different, so this study chose two online discussion platforms with different interactive immediacy, WeChat app with stronger immediacy and Learning Cell System with weaker immediacy to investigate two research questions:

Q1: What's the difference of interactive characteristics when interactive immediacy in online discussions is different?

Q2: Is there difference in levels of collaborative knowledge construction when interactive immediacy in online discussion is different?

3. Methodology

3.1 Participants

46 first-year master students participated in this experiment, whose majors are education-related: *educational technology*, *curriculum and pedagogy* and *educational principle*. They have similar professional backgrounds and are proficient in Learning Cell System and WeChat.

3.2 Procedure

Firstly, all students took part in the same course "Technological foundations of education". After learning the theme of "STEM Education Cases, Connotations and Teacher Preparation", they were given a related discussion question "What is the dilemma of STEM education development in China in your opinion?"

Students were randomly divided into two groups SI (strong immediacy) and WI (weak immediacy), with each group 23 students. WI discussed this question on Learning Cell System and SI discussed on WeChat. After a week, the discussion messages were collected and coded by four researchers. Two researchers analyzed the messages of SI, and the others analyzed the messages of WI.

3.3 Instrument

Pena-Shaff's and Gunawardenaet's coding schemes are widely used to analyze interaction features and collaborative knowledge construction in collaborative learning, so this study used their coding schemes to analyze discussion messages. Pena-Shaff and Nicholls (2004) divided discussion into interactive messages and non-interactive messages, including a total of 11 categories of messages: Question, Reply, Clarification, Interpretation, Conflict, Assertion, Consensus Building, Judgment, Reflection, Support and Other. Gunawardena divided the process of knowledge construction into five phases, including Sharing/Comparing, Dissonance, Negotiation/Co-construction, Testing Tentative Constructions, and Statement/Application of Newly-Constructed Knowledge (Gunawardena, Lowe, & Anderson, 1997). This study used the former to analyze the interactive characteristics and the latter to analyze the layers of knowledge construction in two groups. Researchers coded the messages as the definitions of these categories and phases. When coding as Pena-Shaff's coding scheme, for instance, the message of "……The introduction of STEM is a good way to facility innovation, but there are several obstacles: Firstly, it's the gap in professional development of teachers. STEM teacher standards have not been established and STEM teacher training programs are lack……" was coded as "Clarification", "……We can leverage the market, advising researchers to work with companies to develop adaptable STEM products and resources to improve STEM courses……"was coded as "Interpretation" and "agree with you! " was coded as "Support". After negotiation and calculation, Pena-Shaff's and Gunawardenaet's coding consistency were respectively 0.87 and 0.85.

4. Results and Analyses

4.1 Number and Length of Messages

The numbers of discussion messages in two groups are shown in Table 1. There were 65 messages in WI and 36 messages in SI. Average message length in SI was longer than WI. Possible reasons for this phenomenon were: (1) the number of messages which students replied in WI accounted for two-thirds and they were generally shorter; (2) students in SI focused more on describing their own views, resulting in an increase in message length.

Table 1

The Number of Messages in Group WI and SI

Group	Message Number	Total Length	Average Message Length	Longest Message Length	Shortest Message Length
WI	65	13443	206.8	879	22
SI	36	8047	223.5	700	5

4.2 Primary analyses

4.2.1 Analyzing Interaction Characteristics

As for the first question, this study analyzed interactions during discussion using message maps and Pena-Shaff's coding scheme.

The message maps can be seen in Figure1 and Figure2. The first line of the message map is the time stamp, DT represents the discussion topics, such as figure "(1)" is discussion ID. The green ellipse indicates the initiation message, and the white is the follow-up message, the figure in ellipse is student's ID, the line between two ellipses represents discussion thread of the two students, and the arrow points to the respondent. As shown in Figure 1, student # 2 posted a message (2) in WI on 5th Dec, student # 3 commented on the post on 6th Dec, and then student # 2 responded to this comment on the same day.

According to message maps, it can be seen that：

(1) Discussion threads showed differences in time span. In WI, students usually replied to earlier messages, so these messages received more replies. For example, students #18, #19 and #6 were online on 11th Dec, they would check and respond to the message sent on 5th Dec, which were replied six messages for each and also replied most. Whereas students in SI usually responded to latest messages, as shown in Figure 2. Therefore, there's a larger time span between discussion threads in WI.

(2) Students in SI have more interaction rounds than WI. Students in WI interacted with each other up to 1 round, such as on 5th and 6th Dec, when student #2 interacted with student #3, while the interaction rounds were up to 3 in SI, as shown in Figure 2. At 21:03 - 22:48 on 10th Dec, students #20 and #21 interacted three rounds.

(3) Students in SI were more likely to discuss at different times than in WI. Only four students discussed in different time in WI, and they were students #1, #2, #3 and #6 whereas there were six students' discussing in different time in SI, such as students #1, #3, and #20.

Regarding as interaction categories coded as Pena-Shaff's scheme, you can see relevant data in Table 2, this study compared the percentage of each category in two groups, findings are as follows:

(1) The most interaction categories were same in two groups, they were "Clarification", "Interpretation" and "Support". And the number of "Clarification" was largest in two groups, with respectively 46.32% in SI and 35.94% in WI and the percent of SI was 10 more than WI. The percent of "Interpretation" and "Support" of WI exceeded SI respectively 5% and 10%.

(2) There's 11 interaction categories in SI but only 7 in WI, and the percent of "Question", "Conflict", "Assertion", "Consensus Building", and "Reflection" was actually low even in SI.

"Question" shares respectively 2.11% and 2.34% in group SI and WI. In SI, "Conflict", "Assertion" and "Consensus Building" all accounted for 1.05 percent and the percent of "Reflection"

was 2.11%, while there's no reflective discussion in WI. There were also other categories only can be found in SI sharing relatively high, such as "Response" with 6.32%.

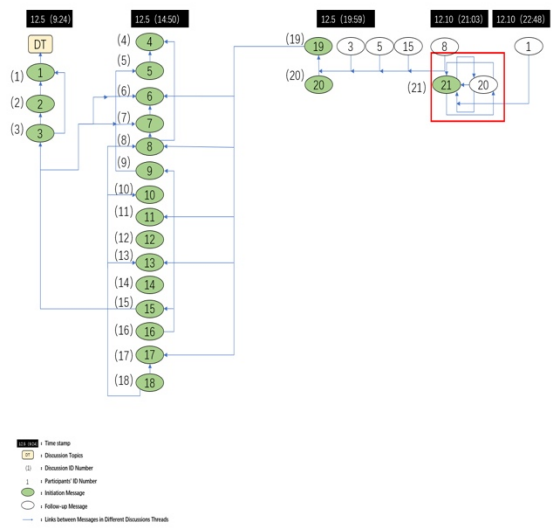

Figure 1. Message Map of Group WI.

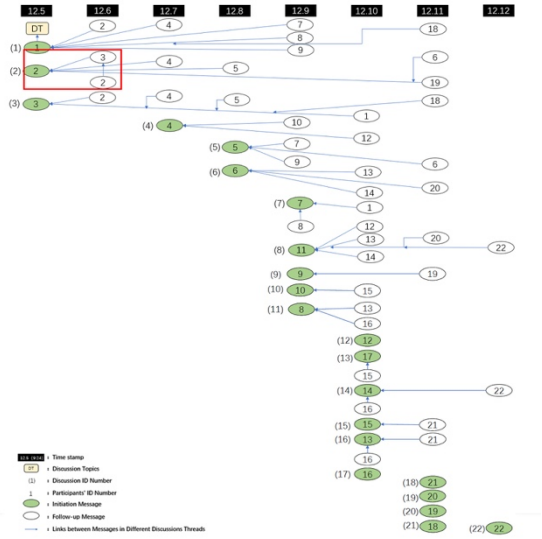

Figure 2. Message Map of Group SI.

4.2.2 Analyzing Levels of Collaborative Knowledge Construction

As for the second question, this study used Gunawardenaet's coding scheme to analyze the levels of collaborative knowledge construction in two groups. As shown in Table 3, by comparing the percent of messages at each level of collaborative knowledge construction, it can be found that:

(1) Group SI had a deeper level of knowledge construction than WI with reaching the stage PH3. Although the number of messages of SI was less than WI, it reached a deeper level of interaction.

(2) Neither WI nor SI reached the deepest stage of collaborative knowledge construction, and the two groups respectively accounted for 69.44% and 95.38% on stage PH1.

5. Conclusions and Future Work.

5.1 Conclusions and Suggestions

After investigating the interactive characteristics and levels of collaborative knowledge construction with different immediacies in online discussions, this study found:

(1) Strong immediacy helps form multiple rounds, multi-period participation, and multiple categories of interaction.

Students in SI can ask questions, respond to others and get feedback timely. Timely information exchange can trigger intense discussions among students, which generates more interaction categories and more interaction rounds. Also, platform with strong immediacy allows students to engage in discussing quickly at different time, whereas students in WI hardly get timely feedback and they are more inclined to describe their own views.

(2) Strong immediacy is conductive to a deeper level of collaborative knowledge construction.

As the first conclusion suggests, timely feedback from strong immediacy provokes thought from students and thus deepens the level of collaborative knowledge construction. But the time interval between posting and replying of weak immediacy is longer, so it is difficult to arrive deep collaborative knowledge construction during the short experiment period.

In short, platforms with stronger immediacy are conductive to interacting and deepening collaborative knowledge construction in online discussions, although knowledge construction is not so ideal in this experiment. In response to this problem, the roles of teachers and opinion leaders can be

Table 2

Categories of Interaction in Two Groups

Group	Categories of Interaction										
	Question	Response	Clarification	Interpretation	Assertion	Conflict	Consensus Building	Judgment	Reflection	Support	other
	3	0	46	31	0	2	0	11	0	17	4
WI(%)	2.34	0	35.94	24.22	0	1.56	0	8.59	0	24.22	3.13
	2	6	44	18	1	1	1	5	2	14	1
SI(%)	2.11	6.32	46.32	18.95	1.05	1.05	1.05	5.26	2.11	14.74	1.05

Table 3

Levels of Collaborative Knowledge Construction In Two Groups

Phase	SI		WI	
	Message Number	Percentage	Message Number	Percentage
PH1: Participants share information and ideas with each other and describe the topics discussed	25	69.44%	62	95.38%
PH2：Participants identify and analyze inconsistencies in ideas, concepts or descriptions and deepen their understanding of the problem	6	16.67%	3	4.62%
PH3：Participants construct knowledge Collaboratively through meaning negotiation	3	8.33%	0	0
PH4：Participants examine and modify newly constructed ideas	0	0	0	0
PH5：Participants reach agreement to apply newly constructed knowledge	0	0	0	0

considered. Previous studies show teachers behavior can affect the quality of online discussions. Scaffolds and novel perspectives from teachers help students think deeply. Guidance and feedback from teachers also enhance their enthusiasm (Yang, Lv, Wang, & Wang, 2009; Yu, Li, & Wang, 2010). Also, opinion leaders often form direct or indirect social relationships through online communication, causing ripple effects to others (Li, Ma, Zhang, Huang, & Kinshuk, 2013). Therefore, deepening the levels of knowledge construction through the intervention of opinion leaders is worth investigating.

It is participants' course tasks that may result in the inconsistence with the previous research (Hrastinski, 2008). In addition, this experiment shouldn't be too long because it is only a theme of this course, which helps platforms with strong immediacy perform better.

5.2 Limitations and Future Work.

This study investigated the interactive characteristics and levels of collaborative knowledge construction in online discussion with different immediacy. The small sample and data may cause that our conclusion cannot be open to more conditions. Questionnaires and interviews can be considered to analyze factors that affect collaborative knowledge construction in these two platforms.

It is inferred that types of discussion question can also lead to different results. The question in this study was open and moderate. How sharp and challenging questions work and whether different types of questions will lead to different results can be explored.

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References

Chen, N., Ko, H., Kinshuk *, & Lin, T. (2005). A model for synchronous learning using the Internet. Innovations in Education and Teaching International, 42(2), 181–194. https://doi.org/10.1080/14703290500062599

Demir, M. (2018). Developing a scale for using Facebook as a learning tool. Educational Technology Research and Development, 66(6), 1457 – 1477. https://doi.org/10.1007/s11423-018-9616-8

Gunawardena, C. N., Lowe, C. A., & Anderson, T. (1997). Analysis of a Global Online Debate and the Development of an Interaction Analysis Model for Examining Social Construction of Knowledge in Computer Conferencing. Journal of Educational Computing Research, 17(4), 397–431.

Hrastinski, S. (2008). The potential of synchronous communication to enhance participation in online discussions: A case study of two e-learning courses. Information & Management, 45(7), 499–506.

It-analysis (2001) Synchronous vs asynchronous learning. Available online at: http://www.it-analysis.com/article.php?articleid=2236 (accessed 7 November 2004).

Lee, L., Lajoie, S. P., Poitras, E. G., Nkangu, M., & Doleck, T. (2017). Co-regulation and knowledge construction in an online synchronous problem-based learning setting. Education and Information Technologies, 22(4), 1623–1650. https://doi.org/10.1007/s10639-016-9509-6

Muls, J., De Backer, F., Thomas, V., Zhu, C., & Lombaerts, K. (2020). Facebook class groups of high school students: Their role in establishing social dynamics and learning experiences. Learning Environments Research, 23(2), 235 – 250. https://doi.org/10.1007/s10984-019-09298-7

Puntambekar, S. (2006). Analyzing collaborative interactions: Divergence, shared understanding and construction of knowledge. Computers & Education, 47(3), 332–351.

Pena-Shaff, J., Martin, W., & Gay, G. (2001). An epistemological framework for analyzing student interactions in computer-mediated communication environments. Journal of Interactive Learning Research, 12, 41–68.

Tian, Y. (2017). Study the Interactive Behavior of learning Community in The Knowledge Forum. Shandong Normal University.

Yu, M., Li, W., & Wang, X. (2010). A Case study of online discussion quality and its influencing factors on primary school students. Chinese Electrical Education, (03):47-51.

Yang, H., Lv, S., Wang, L., & Wang, C. (2009). Study the influence of teacher's teaching organization behavior on the construction of learner's high-level knowledge in CSCL. Chinese Electrical Education, (1):64-68.

Yanyan Li,Shaoqian Ma,Yonghe Zhang,Ronghuai Huang,Kinshuk. An improved mix framework for opinion leader identification in online learning communities[J].Knowledge-Based Systems,2013,(43):43-51.