International Society of the Learning Sciences

Examining Learners' Cognitive Engagement in Danmaku Comments

Zhenyao Cai*, Shiyao Wei*,
zc2535@tc.columbia.edu, sw3550@tc.columbia.edu,
Teachers College, Columbia University

Abstract: Danmaku is an emerging commenting system of video platforms, displaying users' comments on the top of the video. Limited studies have been conducted on learners' cognitive engagement with educational videos that embed Danmaku. In this paper, we used a content analysis method to categorize instructional behaviors that cause learners' responses and further evaluate cognitive engagement. We identified that certain instructional behaviors cause more responses and higher-level learners' cognitive engagement.

Introduction

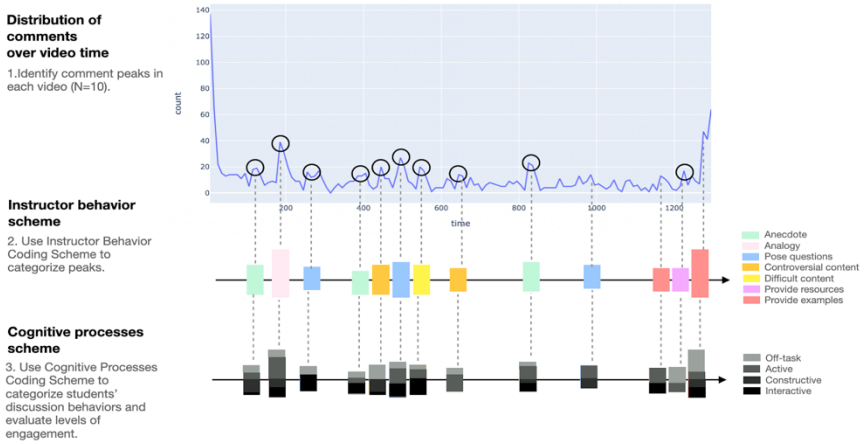
Aside from MOOC, User-Generated Content video platforms are becoming an important part of online informal learning. Commenting systems are embedded in video platforms to facilitate collaborative learning among viewers. Danmaku is a commenting system that allows viewers to post comments while watching a video. Comments will be displayed at the top of the screen for all current and future viewers. First introduced for interactive entertainment purposes, Danmaku has found its way into educational videos on a wide range of topics during the last ten years (Zhang & Cassany, 2018). This research explores the following questions: What types of instructional behaviors lead to more Danmaku discussions? How do learners' comments reflect their levels of cognitive engagement?

Methods

We collected 10,383 Danmaku comments from 4 educational video lectures uploaded on Bilibili, a widely used user-generated content video platform with Danmaku feature. Our data analysis follows three steps: 1) Identify comment peaks (N=10) in each video. 2) Use Instructional Behavior Scheme to categorize the instructional behaviors. 3) Use Chi's ICAP framework to categorize user comments in each comment peak and evaluate their cognitive engagement (see Figure 1).

Figure 1

Data Analysis Procedure



Comment distribution over video timeline

As shown in Figure 2, the X-axis is the video time split into 10-second clips, and the Y-axis denotes the counts of Danmaku in each interval. For the accuracy of the learners' behavioral study, we eliminated irrelevant data. We identified 40 comment peaks, 10 in each video, with 1,405 comments in total.

Instructional behavior coding scheme

Based on our preliminary observation of the relationship between user reactions and instructional behaviors, we identified 7 instructional behaviors that incite discussion comments.

Table 2

Coding scheme of types of instructional behaviors that incite viewers' participation

Instructional Behaviors	Description
Anecdote	Introduce an account of an interesting incident.
Analogy	Compare a concept with information that is familiar to learners.
Pose questions	Raise a question about a concept or idea to encourage discussion.
Controversial content	Talk about ideas or express opinions that lead to disagreement.
Difficult content	Introduce abstruse or abstract concepts that require prerequisite knowledge to understand.
Provide examples	Give examples to explain certain concepts.
Provide resources	Use physical or graphic education tools to assist teaching.

Cognitive engagement coding scheme

Referring to Chi's ICAP framework (2009), we developed a scheme to evaluate learners' cognitive engagement when they post comments and calculated cognitive engagement scores presented in each comment.

Table 3

Coding scheme for evaluating learners' cognitive engagement

Cognitive engagement	Behaviors	Description
Active (score = 1)	Endorse	Repeat the video content or endorse instructors' opinions.
	Paraphrase	Use their own words to repeat the concepts.
	Correct	Point out obvious flaws, such as pronunciations and typos.
Constructive (score = 2)	Explain	Add supplement information to help others understand an idea.
	Connect	Express thoughts linking to prior knowledge or experience.
Interactive (score = 3)	Meaningful Question	Post a relevant question that requires other viewers' answers.
	Meaningful Response	Answer questions raised by instructors and other viewers.
	Argue/defend	Defend a statement with specific arguments or references.
Off-task (score = 0)		Post comments that are irrelevant to the lecture content

Findings and discussion

Different instructional behaviors lead to different levels of cognitive engagement. Posing questions (M*score*=2.51, SD=0.51), introducing difficult content (M*score*=1.67, SD=0.57), and discussing controversial issues (M*score*=1.55, SD=0.78) lead to higher-level cognitively engaged commenting behaviors, meaning learners are taking further steps to construct knowledge actively. Telling anecdotes (M*score*=0.53, SD=0.17) and making analogies (M*score*=0.62, SD=0.14) score much lower. In one video lecture with advanced materials, learners respond to anecdotes (40%) and analogies (20%) more often. This might be explained by a lower cognitive threshold required to discuss anecdotes and analogies. In the video with more advanced content, the ratio of off-task comments over total comments is the highest (36.67%, Mean = 27.19%) and the cognitive engagement score is the lowest (0.92, Mean = 1.33).

We also found that learners are more reluctant to pose questions compared to answering questions. One question posted by learners has more than one response from other learners (Mean=2.63, SD=1). It is possible because in the Danmaku system, users do not get notifications when their posted questions are answered, so they have low motivation to post questions.

Our study suggests that Danmaku has the potential to benefit both instructors and learners in online video-centric learning environments. For instructors, Danmaku comments help them estimate what types of instructional behaviors cause positive discussions such that they can plan or redesign their course content and teaching strategies accordingly. For learners, Danmaku comments not only enable positive interaction between beginners and more experienced learners but also work as a rich resource for future learners.

References

Chi M. T. (2009). Active-constructive-interactive: a conceptual framework for differentiating learning activities. *Topics in cognitive science*, *1*(1), 73–105.

Zhang, L.-T., & Cassany, D. (2020). Making sense of danmu: Coherence in massive anonymous chats on bilibili.com. *Discourse Studies*, *22*(4), 483–502.

