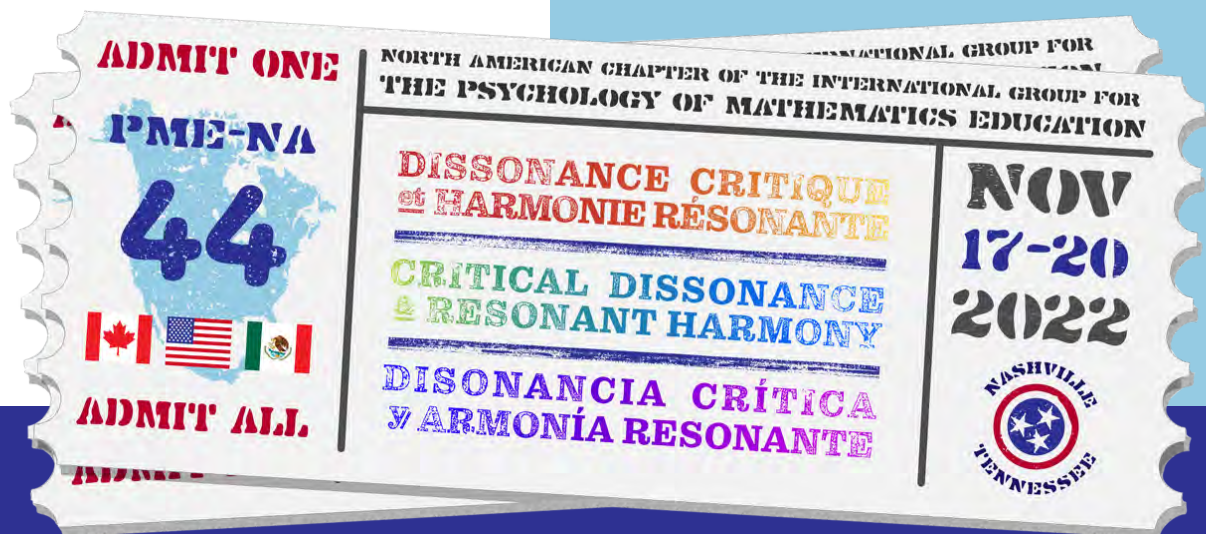2022

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CRITICAL DISSONANCE AND RESONANT HARMONY

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NORTH AMERICAN CHAPTER OF THE INTERNATIONAL GROUP FOR
THE PSYCHOLOGY OF MATHEMATICS EDUCATION

DISSONANCE CRITIQUE et HARMONIE RÉSONANTE

CRITICAL DISSONANCE & RESONANT HARMONY

DISONANCIA CRÍTICA y ARMONÍA RESONANTE

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A BAKHTINIAN LENS ON THE EFFICACY OF DIALOGIC INSTRUCTIONAL VIDEOS

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Inquiry into the role of dialogic instructional videos is still in its infancy. There is a need to better understand if dialogic instructional videos are viable and how to best understand the impact they have on students. To date, the limited findings paint the use of dialogic videos in a positive light, but the results are at times inconsistent. Within this project I attempt to leverage the theoretical writings of Mikhail Bakhtin to explain these inconsistencies and to shed a new explanatory light on why dialogic instructional videos can be effective.

Keywords: Technology, Online and Distance Education, Learning Theory

Introduction

Instructional videos have continued to grow in popularity, and for good reason. Videos allow students to engage with content at their own pace and repeatedly (Lin & Michko, 2010; Vidergor & Ben-Amram, 2020), they broaden who has access to information (Parslow, 2012), and videos present an alternative to traditional instruction (e.g., flipped classrooms, Fyfield et al., 2019). The more options the better, but some forms of instructional videos are better than others – particularly for conceptually deep subject material like mathematics.

The most common and widely used form of instructional videos within mathematics education are those that follow the model set forth by Khan Academy (Bowers, Passentino, & Conners, 2012). This form of instructional video contains a "talking hand", or a voice dictating with a virtual pen, describing a procedure that is presented on a virtual whiteboard. Under the goal of providing open access to content, the "talking hand" model of instructional videos has been extremely successful with millions of worldwide users (Kelly & Rutherford, 2017; Noer, 2012).

The main issue with this form of video – particularly for mathematical content – is its emphasis on procedures (Bowers, Passentino, & Connors, 2012). With videos typically lasting less than 10 minutes, it is difficult for deep conceptual meaning to emerge for the presented mathematical content (Danielson & Goldenberg, 2012). Within that time viewers can be reminded of, or learn new, procedures (e.g., how to find a derivative), but establishing conceptual understanding takes time (e.g., that a derivative is a function for instantaneous rate of change). Instead of challenging the status quo through a new medium of technology, the "talking hand" style of instructional videos serves as reinforcement for the conception of mathematics as a set of facts to be memorized and enacted given the proper context (Bowers, Passentino, & Connors, 2012).

Another issue for "talking hand" videos, and other forms of online instructional videos (e.g., asynchronous lectures), is the lack of student voices (Lobato, Walker, & Walters, 2017). These models of video emphasize the exposition of content by a knowledgeable teacher, as opposed to the inclusion of inexperienced student voices. Student voices are important because they can serve as voices that resonate with the thoughts and difficulties of the viewer – voices of fellow learners (Chi, Kang, & Yaghmourian, 2017). As online instructional videos and distance learning, more generally, grows in popularity there are less opportunities for students to engage

with and experience fellow students' voices (McKendree et al., 1998). Instructional videos could fill that void, but exposition focused videos do not.

An alternative to the dominant approaches to instructional videos gaining traction in math education are dialogic videos (e.g., https://calcvids.org/, Kolikant & Broza, 2011, Lobato, Walker, & Walters, 2017). Foremost, dialogic videos contain people engaged in a dialogue. This means that the videos contain conversations and attempts at creating new meaning or new ways of experiencing (Alrø & Skovsmose, 2004). Fundamentally, this form of instructional videos can emphasize students' voices. There are typically two people within these videos – one student and a teacher (e.g., Muldner, Lam, & Chi, 2014), or two students (e.g., Lobato, Walker, & Walters, 2017). Importantly, the voices of the students within these videos are engaged in a process of meaning making, and the meaning making process may produce deeper conceptual understanding for the viewer than simply viewing a set of procedures.

To date, there is a limited body of empirical research into the experiences of the viewers of dialogic videos. The central focus within this literature is on the learning outcomes of dialogic videos in comparison to those of monologic videos (e.g., Chi, Roy, & Hausmann, 2008; Craig, Driscoll, & Gholson, 2004; Muldner, Lam, & Chi, 2014; Muller, Sharma, & Reimann, 2008). Taking a quantitative approach, these studies have reported mixed findings (Gholson). The trend in the research suggests that dialogic videos lead to significant differences in learning outcomes, but the differences in findings across studies is not easily explained.

Within this theoretical paper I forward a lens into these contradictory findings based on the writings of Bakhtin that I believe can begin to explain the supposed contradictions and can be applied to future inquiry into students' experiences with dialogic instruction videos. This project is guided by the following research question: Does a Bakhtinian framework illuminate reasons for the inconsistency in learning outcomes of dialogic versus monologic quantitative studies and can Bakhtinian framework be applied to a wider range of literature on dialogic instruction videos.

Theoretical Framework

The following section presents a brief introduction to the philosophical writings of Bakhtin. This will include a definition of dialogue that will frame the Bakhtinian concept of voice and the subsequent introduction to the constructs of internally persuasive and authoritative voices.

Bakhtinian Dialogue

For Bakhtin, dialogue is an omnipresent interaction between an individual and the other (Morson, 2004; Mustova, 2007). Bakhtin (1981) defines the other as everyone external to an individual. While interacting with the other, words enter the individual's mind and begin to interact with the web of meaning emanating from that individual's experience with the word. As Bakhtin (1981) famously wrote:

> …language, for individual consciousness, lies on the border between oneself and the other. The word in language is half someone else's. It becomes 'one's own' only when the speaker populates it with his own intentions, his own accent, when he appropriates the word, adapting it into his own semantic and expressive intention. Prior to this moment of appropriation, the word does not exist in a neutral and impersonal language (it is not, after all, out of a dictionary that the speaker gets his words!), but rather it exists in other people's mouths, in other people's concrete contexts, serving other people's intentions: it is from there that one must take the word, and make it one's own. (p. 293)

As an individual engages with the use of a word they are simultaneously engaging with the

history of that word and the intended meaning behind the other's use of the word. Through dialogue, an individual can begin to appropriate the word through a personal interpretation and negotiation of historical and local meanings. In the colloquial sense, a conversation with another person can be seen as a dialogue, but a Bakhtinian dialogue is a subjective internal process that does not need another person's physical presence. Dialogue only requires words and meanings.

Bakhtin, working in the early 20th century, was a literary scholar (Bakhtin, 1981). Critiquing genres that are unchanging and containing fixed features (e.g., every epic contains a hero), Bakhtin appreciated themes and characters that grew and changed as the story, and the genre as a whole, progressed. For Bakhtin (1981), the epitome of literature was the genre of the novel because the novel contained evolving dialogue between characters, between author and character, and between author and reader. Clearly, in the case of a novel, author and reader are not directly interacting, but meaning is still being negotiated. Even though there is only one voice, that of the author, in a novel there can still be a dialogue. Bakhtin's primary example of this comes from the writings of Dostoevsky. Dostoevsky is famous for his use of polyphony (i.e., multiple voices) within his writings. Through this style of writing, Bakhtin suggests, multiple perspectives can emerge, and dialogue can take place between and within characters. This dialogic experience can then be experienced by the reader.

One affordance of a Bakhtinian definition of dialogue, is an expansion of what can be considered a dialogue. A dialogue can occur between two people, between a book and a reader, or between an individual and their thoughts. Importantly, Bakhtin's dialogue emphasizes the subjective nature of constructing meaning from previous experiences, and what matters most is how the voices are experienced.

Voices

A voice is an utterance or an action and the associated meaning (Kolikant & Pollack, 2015; Silserth, 2012). For Bakhtin, voices are either experienced as internally persuasive svoice (IPV) or as authoritative voices (AV). An internally persuasive voice is voice that is experienced as open for, and enters into a process of, negotiation (Bakhtin, 1981). Authoritative voices, on the other hand, are the voices that are not negotiated. This can happen because the voice is experienced as not open for negotiation or because an attempted negotiation fails.

For Bakhtin (1986), the process of negotiation with a voice is where deep knowledge and understanding is constructed. Therefore, fostering IPV should be a goal of educators (Morson, 2004; Mustova, 2007), but IPV are subjective experiences (Bakhtin, 1981). One individual listening to the same voice as another will experience what is being said or done differently. Included in this difference in experience is a difference in negotiability of what is being said. For example, an experienced rock climber may hear the beta (jargon for suggested method of climbing a route) for a difficult climb and understand that this advice is a suggestion that is not one size fits all. Climbers of different sizes have different strengths; thus, this beta may not be suitable for a taller climber and the beta needs to be adjusted accordingly – the beta needs to be negotiated with. On the opposite side, a newer climber may hear the beta and fixate on trying to reproduce the moves exactly as it appears in the beta. The experienced climber is experiencing the voice of the beta as an IPV because they are open to and able to negotiate with it. The newer climber, on the other hand, is then experiencing the beta as an AV.

AV are antithetical to dialogue because meaning is not being negotiated. If an individual is experiencing the other's voice as authoritative, then they are not actively engaged in the dialogue. Instead, the individual takes on a more passive role in the dialogue as an information receptacle. Internally persuasive voices, on the other hand, trigger the process of appropriating

the other's words and negotiating its meaning to fit one's own purposes. Bakhtin (1986) states that "Active agreement/disagreement (if not dogmatically predetermined) stimulates and deepens understanding (p. 142)". Agreement/disagreement that is predetermined are not open for negotiation and fall into the category of AV. When an active process is involved, on the other hand, the agreement/disagreement is produced by a negotiation process and would, thus, fall into the category of IPV. Together, this means that learning is best fostered by voices that are IPV. AV can produce learning, but when learning is "dogmatic" it is not as deep as the learning produced by an active negotiation process.

Considering this definition of dialogue, and the two kinds of voices, I forward a lens into the literature on student's use of dialogic videos that focuses on experiences of IPV. When greater learning is fostered, I will argue that more voices are being experienced as internally persuasive.

Methods

To find the papers reviewed within this theoretical paper a systemic review of the field was conducted. This included the use of the database ERIC-EBSCO. Allowable dates included in this search accounted for anything up to the date of the search (October 2020). Additionally, this search was limited to those with electronic access in the above database. Finally, the search terms were limited to "vicarious learning", "video", and "education" contained anywhere in the title or body of the text. This search resulted in 12 articles. Further limiting the scope of this search, the article abstracts were read and articles not focused on student learning were omitted. This process of omission was used to weed out articles focused on nursing education. Given the infancy of the field's inquiry into vicarious learning, the remaining 5 articles were read and an iterative bibliographic exploration was used to find an addition 9 articles. These 14 articles form the basis of this theoretical analysis.

Results

In the following section the limited literature on dialogic instructional videos is reviewed and then reinterpreted from a Bakhtinian perspective. This literature can be broken into two sets of findings: learning outcomes and learning practices.

Learning Outcomes

A number of research projects have sought to establish the effectiveness of learning from dialogic videos via quantitative comparative studies. Within these empirical studies, a commonality was the comparison of a treatment that used recordings (e.g., videos, audio tapes, etc.) that contains a single speaker (i.e., monologic) to resources that contained multiple speakers (i.e., dialogic). The trend within these findings suggests that dialogic videos are more favorable for learning outcomes than monologic, but there are several conflicting results.

Findings. The majority of studies found supporting evidence for the claim that dialogic videos are better than monologic (e.g., Chi, Kang, and Yaghmourian, 2017; Chi, Roy, & Hausmann, 2008; Cox, et al., 1999; Craig, Chi, & Vanlehn, 2009; Driscoll et al., 2003; Gholson & Craig, 2006; Muldner, Lam, & Chi, 2014; Muller et al., 2007; Muller, Sharma, & Reimann, 2008). For example, in one set of studies Chi and colleagues position their dialogic videos as tutoring sessions with one speaker being the tutor and all other speakers being tutees. They then compared the learning gains from viewers of the dialogic videos to viewers of a single tutor presenting the same set of information (Chi, Kang, & Yaghmourian, 2017; Chi, Roy, & Hausmann, 2008; Craig, Chi, & Vanlehn, 2009; Muldner, Lam, & Chi, 2014). These studies have found statistically significant differences in favor of the pre/post-test learning gains of the

treatments who engaged with resources that contained multiple speakers, suggesting that two speakers are better than one

Some projects have found conflicting results, with either no statistical difference between viewers of monologic and dialogic videos or a difference in favor of the learning gains of viewers who engaged with monologic videos (e.g., Cooper et al., 2018; Monaghan & Stenning, 1998; Muller, Bewes, et al., 2008). For example, Cooper et al., (2018) found a statistically significant difference favoring the students who viewed monologic videos of their professor. The literature, thus, suggests that two speakers are better than one, but two speakers are not a sufficient condition for improving learning outcomes of the viewers.

Bakhtinian Lens. For Bakhtin, more learning is indicative of the presence of more IPV. The findings that support the use of dialogic videos thus suggest that dialogues foster the experiences of IPV. Multiple speakers (e.g., dialogic videos) may foster IPV if the multiple speakers are engaged in a negotiation process, and if the indirect participation with voices that are already being negotiated makes it easier for IPV to develop. The presence of negotiation within dialogic videos can establish as a norm that the voices present within the videos are open for negotiation. This could be particularly important for students who are from traditional lecture classrooms that typically contain voices that are not open for negotiation (Morson, 2004).

At times, when multiple speakers were not a sufficient condition for fostering IPV, it is possible that other features were. For example, Cooper et al (2018) found learning outcomes were improved for viewers of monologic videos, but the students viewed monologic videos that contained their professor. Compared to Chi and colleagues, whose monologue videos contain an unfamiliar tutor and learning outcomes favored dialogue viewers, it's possible that the familiarity with the voice of the professor in Cooper and colleague's study influenced the learning outcomes of their quantitative findings. In other words, because the students were familiar with their professor, and perhaps because of norms established in their class, the voice of the teacher was positioned as open for negotiation.

In another study, Muller, Bewes, et al. (2008) found that the presence of alternative conceptions and resolutions was more important for learning outcomes than whether the viewers engaged with monologic or dialogic videos. This suggests that the number of voices was less important than the content of the voices. Particularly, the presence of alternative conceptions appears to foster IPV. If multiple conceptions and productive struggles are presented, then the viewers would disadvantage themselves if they simply accepted information without negotiation. In the case of multiple conceptions, accepting without negotiation would lead the viewer to take on conceptions that are not accurate. When that information is eventually corrected, within the video, the viewer may be left more confused. This confusion is not evidenced by the learning gains of students who watch and are exposed to alternative conceptions (e.g., Chi, Kang, and Yaghmourian, 2017; Chi, Roy, & Hausmann, 2008; Cox, et al., 1999; Craig, Chi, & Vanlehn, 2009; Driscoll et al., 2003; Gholson & Craig, 2006; Muldner, Lam, & Chi, 2014; Muller et al., 2007; Muller, Sharma, & Reimann, 2008). Further, I believe that the presence of multiple conceptions and struggle can again produce a norm of negotiating with what is being presented. With conceptions present that are understood by the viewer to be merely possibilities, then that conception is ripe for negotiation. The viewer can determine for themselves whether or not they hold that same conception through negotiation. Additionally, when a final conception is realized within the video, and other conceptions are dispelled, the reasoning that led to the concluding conception can serve as a model for viewer's future negotiation processes.

Practices

A small body of work has applied an analytical lens to the actions of observers by probing the effect that dialogic videos have on the behaviors of the viewers. The findings from this literature suggests that the individuals contained within the videos serve as a model for the viewers. The findings are limited, but the behavior modeled ranges from content specific practices like the construction grammar trees to broader practices like posing deep questions (Bandura, 1965; Braaksma, Rijlaarsdam, Van den Bergh, & van Hout-Wolters, 2004; Craig, Gholson, Ventura, & Graesser, 2000; Chi, Kang, & Yaghmouian, 2017; Kuhn & Modrek, 2021; Rummel & Spada 2005; Schunk Hanson & Cox, 1989). This suggests that viewers not only learn the content of dialogic videos, but that they can also learn behaviors that can benefit them as learners (e.g., productive problem-solving techniques).

From a Bakhtinian lens, these findings support the claim that dialogic videos can foster IPV. With voices defined as utterances or actions and their associated meaning, the reported modeled behaviors demonstrate the role that actions have on the viewers. Specifically, if the dialogue of the dialogic videos contains a negotiation process, then any modeled negotiation would be evidence that the viewer is experience the videos as containing IPVs.

Discussion

From a Bakhtinian perspective, dialogue is a subject experience. Whether a video contains a single expert explaining the process of Riemann approximation, or two students describing the difference between right-hand and left-hand approximations, both may be a dialogue, but one may be internally persuasive while the other is authoritative. What matters is the content of the voices and the subjective experience of those voices. What will foster more learning is when voices within the video are experienced as IPVs. The empirical literature comparing different feature of instructional videos, namely the comparison between treatments using monologic or dialogic instructional videos, are then useful in determining what can foster negotiation of voices.

While the analysis presented here is preliminary, the theoretical framework forwarded offers a starting point for future inquiry into student's use of dialogic videos. With a lack of empirical work assessing the mechanisms by which viewers of instructional videos learn, future work can extend the use of Bakhtin's voices to analyze and assess possible negotiations occurring between the viewer and the viewed.

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