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Questioning in Bakhtinian dialogic pedagogy and argumentation theory

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Abstract
This paper examines differences between Bakhtin's dialogic view and argumentation theories with respect to questioning and analyzes the significance of these differences for the theories of pedagogy. In argumentation theories, a question is thought to be shared among the parties in a discussion. In the fields of argumentation and education, in particular science education, not only is a question shared, but also an answer is integrated into one among the participants (Schwarz and Baker 2017). Bakhtin's view on questioning, advanced in his later writings, shows how new questions emerge continuously in answers to the previous questions so that a question is not shared by a questioner and an answerer. Using the Bakhtinian framework in the analysis of some Japanese pedagogical thoughts and classroom interactions, it is shown that each student can develop her/his own unique understanding of the topic – not the shared, integrated understanding – by finding out a new question in seemingly wrong answers, or by discovering different questions in the same problem. Finally, the reason why new questions emerge in question-and-answer exchange is investigated within a constructivist perspective from cognitive science.

Keywords: dialogue, questioning, Bakhtin, deliberative argumentation, outsideness, personal history of understanding

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Introduction

This paper proposes an important difference between dialogue and argumentation that has been overlooked so far and examines its significance for pedagogy. We should first draw a clear difference between dialogue and argumentation and then explore how this distinction can be bridged.

Some researchers (Schwarz & Baker, 2017) argue that a conversation is dialogic when it is performed with interpersonal care and mutual respect. Furthermore, such an inquiry becomes intellectual when it follows the rules of argumentation. For those researchers, the dialogue itself is not an intellectual inquiry but only refers to social regulation between the participants of the inquiring conversation for them. In opposition to these views, this paper proposes that dialogue is itself an intellectual and critical inquiry, although it is distinct from argumentation, and the difference between the two comes from their orientation toward questioning. In argumentation theory, the participants in an argumentative discussion share the

same question. On the contrary, in dialogue, new questions continuously emerge in the exchange of questions and answers, and a focus on newly emerging questions makes a dialogic inquiry rich and fruitful.

The problem of questioning is central to Japanese pedagogies where the term *Hatsumon*, or *asking a question*, has been and is popularly used as one of the teacher's important teaching acts (Toyoda, 2007). Here the term "question" means the problem or issue in the learning material which the teacher presents to students to make them explore/discuss/think in the lesson. This act often appears as an I-term of the IRE/IRF sequence. The presentation of the problem or the issue in asking questions does not necessarily take an interrogative form. Making a claim can be the presentation of the problem or the issue. In this case, making an affirmative claim, "It is an A", is equivalent to asking a question about whether "it is an A or a non-A." This paper uses the term "question" as the problem or the issue in the learning material and the term "questioning" as the generation and presentation of the problem or the issue in the learning material. In difference to the case of *Hatsumon,* however, this paper supposes that questioning is not entirely an activity of teachers but also an activity of students. Students generate and present the problem or the issue in the learning material, sometimes intentionally but other times unintentionally or rather unconsciously.

Theories of argumentation insist that participants in a discussion share the same question. For example, van Eemeren et al. (2014) hold that participants have common starting points at the opening stage of a critical discussion (van Eemeren et al., 2014, p. 529). This view is followed by pedagogical approaches based on argumentation theory. In science education, in particular, participants are not only assumed to share the same question but also expected to arrive at the single same answer at the end of the argumentative discussion. For example, Schwarz and Baker (2017) insisted that argumentation in the lesson has a dialogical and, at the same time, a dialectical aspect and the argumentation converges into one final answer because of its dialectical nature. The epistemological function of the argumentation depends on its dialectical nature, and the dialogical aspect works only on the interpersonal horizon, like having the respect to other participants.

My view of dialogue is based on Bakhtin's views of questioning in his later writings (Bakhtin, 1986, p. 168) as well as on the pedagogical thinking of certain teachers in Japan. For Bakhtin, the answer to a question always produces a new question. This would include even wrong answers to a question. When the participants in a dialogue do not adhere to the original question but identify a newly emerging question in a wrong answer and pursue it, a new inquiry can begin, in which each participant can develop her/his own unique understanding.

The difference between the dialogical view of questioning and the argumentation theory is that, in Bakhtin's view, the question is not shared by the participants. Although this characteristic seems to produce confusion in dialogue, it actually advances dialogue. As Bakhtin wrote, a new question is always emerging in a dialogue (Bakhtin, 1986, p. 168). In Bakhtinian dialogues, the dialogue works not only on the interpersonal horizon, for example, respecting others, but also has the epistemological function of understanding the world. In a dialogic class, each student can develop his or her own understanding by becoming aware that she/he does not share the same question with the others. Thus, students can discover the questions newly emerged in them by, for example, interpreting the teacher's question and exploring it. Each one's answer different from others can be explored as the true answer to each one's unique question and does not finally converge into one unified answer – which normally happens in a dialectical process. The dialectical process of convergence into one unified answer sometimes occurs in any class. What is important, though, is for participants to become aware of, objectify, and develop each one's unique questions.

The dialogic type of students' understanding has been truly realized in the class lessons of some Japanese teachers. These teachers listen to students' answers and identify their unique questions or encourage students to formulate their unique questions for the given problems. These experiences make it possible for the students to develop their own, unique understanding. These, dialogic teachers have developed their pedagogical views by accumulating and reflecting on their practices. While they are not influenced by Bakhtin or any other dialogic thinkers, their views approach Bakhtin's view, in particular with respect to their views regarding questioning.

This paper describes the Bakhtinian view of dialogue and dialogic pedagogy by problematizing the characteristics of questioning in Bakhtin and Bakhtinian dialogic pedagogy to compare them with theories of argumentation and the pedagogy based on them. In what sense and how do the participants of a dialogue develop their own unique understanding by realizing the new question that they have developed during the exchange of question and answer? What characteristics of human understanding allow new questions to be developed in question-and-answer exchanges?

In the following section, the most relevant argumentation theories are analyzed to show that they all maintain that participants are supposed to share one question during their discussion. Then, Schwarz and Baker's (2017) view on pedagogy based on deliberative argumentation is discussed, in particular in the field of science education. Next, Bakhtin's view of questioning is examined, considering three specific aspects: first, new questions emerge continuously in an exchange of questions and answers; second, the process in which such a new question does not emerge is monologic; third, new questions emerge due to the mutual outsideness of the questioner and the answerer. Then, the dialogic pedagogical views – specifically on the topic of questioning – of some Japanese teachers are introduced. Then, the processes of students' understanding within science education are examined from a dialogic perspective. The scientific context is particularly relevant because, in science, it is generally considered that only one correct answer corresponds to a given question, making it an appropriate field for testing the idea that new questions develop from wrong answers, making such answers in a way correct with respect to the newly emerged questions. Finally, we return to the problem of why new questions emerge continuously in a question-and-answer exchange and examine this issue from a constructivist perspective. It is argued that the mutual outsideness of the questioner and the answerer is a result of each person's unique history of understanding acquired from experience, which leads to unique questions and unique understanding resulting from such questions for each person.

Argumentation theories and the dialogic pedagogical thoughts based on them

Questioning in theories of argumentation

According to some researchers (van Eemeren et al., 2014; Schwarz & Baker, 2017), the theories of argumentation can be classified into two types: monological and dialogical. Toulmin (1958) and Perelman (1977) provide monologic theories, while van Eemeren and colleagues (van Eemeren et al., 2014; van Eemeren & Snoeck Henkemans, 2017) and Walton (2000, 2006) propose dialogic theories. This terminological distinction is not Bakhtinian but only indicates whether a theory supposes only one (monological) or multiple (dialogical) participants in the argumentation. For example, Schwarz and Baker (2017, p. 66) claimed that Toulmin diagrams are "produced by a single person rather than of interactive dialogue between different people." Walton clearly stated that "a dialogue is a type of goal-directed conversation in which two participants (in the minimal case) are participating by taking turns" (Walton, 2006, p. 2). Between the two schools, questioning is an explicit focus of the latter, for example, Plantin (2005). According to Schwarz and Baker, Plantin asserted that argumentation dialogue is a confrontation of discourses, from which a question to be debated emerges. The discourse and counter-discourse are justifications for the answers, either 'Yes' or 'No' (Schwarz & Baker, 2017, p. 98).

Questioning is also a central concept in Walton's theory (2006), even though his definition of the term is different and narrower than the one defended in this paper, which instead would correspond to Walton's issue. For Walton, the *issue* is one of the five main characteristics of the dialogue and is defined as a "governing question" about what should be done (Walton, 2006, p.188). The issue is made up of two statements, called the theses, whose truth (or rather acceptability) is unsettled (Walton, 2006, p.3). Plantin (2005) asserted, as shown above, that a question emerges from the confrontation of discourse and counter-discourse. It shows that Walton's term "issue" corresponds to Plantin's "governing question", and this paper's term "question." For Walton, questioning is one of the moves to set and develop the issue, along with asserting a proposition in which something is asserted positively or negatively to set the issue. Different from asserting a proposition, questioning sets the issue by raising "doubts about argument but not going so far as to rebut it by putting forward a counter-argument" (Walton, 2006, p. 17).

Walton's characterization of questioning is suggestive of grasping the important characteristic of questioning in this paper's sense. Walton asserted that questions have *presuppositions,* and such presuppositions should be shared by the questioner and the answerer. If we ask, "when will Mr. Yamada leave Tokyo?" we presuppose that Mr. Yamada will leave Tokyo, and this presupposition is shared by both the questioner and the answerer. When the answerer responds, "this afternoon," s/he admits the presupposition. Walton's definition of a presupposition is "a proposition that a respondent becomes committed to in the dialogue in virtue of giving any direct answer to the question" (Walton, 2006, p. 211). Thus, a presupposition determines the meaning of a question. Sharing a presupposition indicates that participants share the question. Walton thought that the participants can commit to a fair argument to reach a collaborative conclusion by virtue of sharing a question. The concept of a presupposition is important for discovering illegal acts in an argument, such as posing *a loaded question*, namely a question that contains a presupposition not shared by the answerer. That is, a fair argument is possible only when the participants share and acknowledge presuppositions.

Walton's statement that participants need to share the meaning of question is applicable to both his concept of an "issue" and our notion of "questioning." Other dialogic argumentation theorists adopt the assumption that a question should be shared by the participants in an argument, even though the term question is not explicitly used. For example, van Eemeren et al. (2014) consider that an argumentation moves in stages: "a difference of opinion manifests itself through an opposition between one or more standpoints" (van Eemeren et al., 2014, p. 529), at the confrontation stage, and then "the division of the discussion roles of protagonist and antagonist is agreed upon" (van Eemeren et al., 2014, p. 529) at the opening stage. The opposing standpoints indicate the possible answers to one question, which shows that setting and sharing a single question is naturally assumed in this process. Moreover, the rules of a critical discussion proposed by van Eemeren and Snoeck Henkemans (2017) state that participants should accept a given presumption as the starting point of an argument. This can be taken to indicate the necessity of sharing a question.

It should be added that the questioning's characteristic of being shared by the participants does not imply that the question does not change in the flow of argumentation. It can, but it should be shared by the participants in each moment of the argumentation flow.

Dialogic pedagogy influenced by argumentation theories

Even though many types of research in dialogic pedagogy are based on argumentation theories (Asterhan, et al., 2020; Boyd, 2016; Chin & Osborne, 2008; Duschl & Osborne, 2002; Felton & Crowell, 2022; Haneda, et al., 2017; Howe, et al., 2019; Omland, et al., 2022; Rapanta & Felton, 2021; Resnick, Michaels, & O'Connor, 2010), this study focuses on Andriessen, Baker, and Schwarz's view (Andriessen &

Baker, 2006; Baker, Andriessen, & Schwarz, 2019), and in particular on Schwarz and Baker (2017), in which the relation between dialogic pedagogy and argumentation theory was very clearly developed.

Schwarz and Baker are developing a learning theory based on van Eemeren et al. (2014)'s approach to argumentation. On this view, a type of discourse "in which differences of perspective are handled critically and at the same time collaboratively" (Schwarz & Baker, 2017, p. 20) – named *deliberative argumentation* - is claimed to be desirable for use in education. According to Schwarz and Baker, the theory of the processes by which students learn by engaging in argumentative dialogue does not exist yet and it is necessary to integrate theories of learning, communicative interactions, and argumentation to build the foundation for it (Schwarz & Baker, 2017, p. 18).

Let us see their view more closely, considering first their perspective on questioning based on argumentation theories, particularly of Plantin (2005), as noted above (Schwarz & Baker, 2017, Chapter 3). For them, questioning is located at the center of argumentation, as arguments emerge when questioning produces a diversity of answers (Schwarz & Baker, 2017, p. 79). They do not refer explicitly to the basic characteristic of questioning in argumentation theories that I pointed out above, namely, the participants' sharing of the question. It seems that this is taken for granted by them, especially considering the fact that van Eemeren et al. (2014) is one of their theoretical bases.

One important point made by them on questioning is that questions can evolve into more theoretical or conceptual issues in the flow of argumentation, and this characteristic is of great importance for education (Schwarz & Baker, 2017, p. 81). As noted above, the participants' sharing of a question and the development of questions in the flow of argumentation are independent issues. As far as I understand, their assertion means that participants always share a question which is changing in the flow of argumentation. It does not assert that the shared question becomes not shared in the process.

There seems to be one more important feature on questioning in their view in addition to the sharing of a question. They seem to think that, in science education in particular, participants' answers to the shared question are finally integrated into one. From the perspective of this paper, this idea is quite different from Bakhtin's view on questioning. To clarify this issue, it is necessary to know the basic framework of their notion of *deliberative argumentation*. As already seen above, differences of perspective are handled critically and at the same time collaboratively in deliberative argumentation. That is, there are two aspects - the critical and the collaborative one - in this argumentation. These two aspects can be replaced by two terms: dialectical and dialogical, respectively. Schwarz and Baker thought that Alexander's (2005) view of dialogic teaching is not enough, and that there must be not only the dialogic aspect but also the dialectical aspect which should be integrated with the former. Here, "dialectic" means an exchange between people to handle disagreement, and "dialogic" means multi-voicedness in language production (Schwarz & Baker, 2017, p. 103). As Schwarz and Baker referred to the Bakhtinian concept of multi-voicedness (Bakhtin, 1984), their characterization of "dialogic" is not the same as the one used in argumentation theories – in which it means the conversation of two participants - but it is more Bakhtinian. However, it is necessary to investigate more to know in what sense their concept of dialogic is Bakhtinian, and also the meaning of their concept of dialectic.

Schwarz and Baker's view can be observed most clearly in the discussion of the role of argumentation in the field of science education. These authors mention a critical discussion as the argumentative practice that can be used in the field of science education, which echoes van Eemeren's *pragma-dialectical model* of argumentation (van Eemeren et al., 2014). In this view, there is no room for pluralism in science, as "arguments naturally lead to the public selection of strong arguments and the disqualification of weaker ones" (Schwarz & Baker, 2017, p. 116). Put simply, there is a single truth in

science, and propositions outside it are considered to be in error. Thus, in the scientific argument, scientific truth should be supported and actually supported by the majority, and other thoughts are judged to be errors and belong to a marginalized minority. As a consequence, the minority who answered erroneously gets pressured and avoids participating in scientific discourse. The "only reasonable way" (Schwarz & Baker, 2017, p. 116) to solve this situation is to add in a dialogic approach by "instilling dialogical norms through practices such as listening to each other's contributions, respecting each idea put forward" (Schwarz & Baker, 2017, p. 116) and so on.

In their view, arguing whether some assertion is reasonable, scientifically significant, or not, that is, exploring the understanding of the objects, belongs exclusively to the dialectical aspect of argumentation. The dialogic aspect of argumentation is to take an attitude of respect, consisting in avoiding situations in which interlocutors choosing erroneous, minority views drop out of the argument. Having respect for the wrong views of a minority does not imply finding out, through collaborative reasoning, potential correctness in the minority's seemingly wrong views. Respecting others is only an interpersonal deed and not an epistemological deed of understanding the world.

This characteristic is clearly shown in a study presented as an example (Berland & Lee, 2012) centering on a science lesson for fifth and sixth graders. In this lesson, children were asked to discuss what an animal that invaded a hypothetical ecological system would eat, using a simple computer simulation. In this study, the students who had wrong ideas felt more listened to by other students and were more comfortable in changing their positions when their ideas were legitimized by other students. Note that "legitimization" only means making a concession. For example, students with the correct view might say to those with incorrect ones that their idea might be partially right. The authors explained making a concession as *saving face* (Goffman, 1974) of the students with the wrong views. The students with the correct view here did not identify the actual correct aspects of the incorrect views of the other students. A concession is simply an aspect of regulating the interpersonal relationship.

Schwarz and Baker (2017) considered dialogicality in deliberative argumentation detached from its epistemological function. The intellectual pursuit of the truth is given in the enacting of the dialectical aspect. They referred to the concept of multi-voicedness as noted above, but it only means for them to respect others in the interpersonal horizon. This view on dialogue is quite different from Bakhtin's views.

The central idea of Bakhtin's dialogue is that the participants have equal rights vis-à-vis the truth of the topic (Bakhtin, 1984). This idea is the core of the concept of multi-voicedness of Bakhtin. This statement does not refer to saving face but to the epistemological right of the participants to understand the world.

It might be said that in the characterization of dialogue, at least in the field of science education, Schwarz and Baker are correct, and Bakhtin is not. As Schwarz and Baker argued, there is no room for pluralism in science, such that, in science education, students' answers must ultimately be brought to exemplify a single correct answer, the one provided by science. On this view, Bakhtin's dialogic thought, according to which each participant has an equal right vis-à-vis the truth, would not be tenable. However, behind this view lurks a fundamental understanding of questioning, namely, that a given question is or should be shared by all participants in a dialogue. Moreover, in science education, it is also thought that only one correct scientific answer to a shared question can exist. It is needless to add that this view does not mean that the argument goes straight from one shared question to one final answer. There will emerge many different views, sometimes funny and/or wrong, in the process of argumentation. However, argumentation in science education is thought to converge finally and be integrated into one view, which corresponds to the one that is – if not absolutely correct – at least the one that mirrors the temporary scientific majority view.

However, as described above, Bakhtin's view of questioning is different from the common view. This makes it possible to apply his view on dialogue even to science education. In this view, a question is not shared by a questioner and an answerer: new questions continually emerge in the exchange of the questions and answers, and multiple correct answers can exist, whose "correctness" depends on the questions that emerge. In science education as well, students produce new questions that are unique to each participant and whose answer may be correct, even if it is not identical to the one provided by institutional science. In the next section, my interpretation of Bakhtin's views on the questioning is presented.

Bakhtin's view on questioning

What does it mean that question and answer are not logical relations?

To the best of my knowledge, Bakhtin explicitly discussed questioning in only two places. One place appears in *Toward a Methodology of Human Sciences* (Bakhtin, 1986). Though this document is a very short one, I believe that it has great significance for his thinking on dialogue.

> *Question* and *answer* are not logical relations (categories); they cannot be placed in one consciousness (unified and closed in itself); any response gives rise to a new question. Question and answer presuppose mutual outsideness. If an answer does not give rise to a new question from itself, it falls out of the dialogue and enters systemic cognition, which is essentially impersonal.
>
> The various chronotopes of the questioner and the answerer, and various semantic worlds (*I* and *other*). From the standpoint of a third consciousness and its "neutral" world, where everything is *replaceable*, question and answer are inevitably depersonified (Bakhtin 1986, p. 168).

What does it mean to say that "question and answer are not logical relations?" When an answer connects logically to a question, whether the answer to the question is correct or not is determined logically. When there are no logical relations, in contrast, the answer will deviate from what the question logically requires. Thus, the answer can no longer be classified as correct or wrong.

How do non-logical relations between the question and the answer occur? Before approaching this issue, let us look more closely at the case when the question and the answer do bear a logical relation. Here, whether the answer is correct is determined unequivocally, including in cases where there is no correct answer, or there are multiple answers. The question finishes when the answer is determined. The questioner and the answerer become one "closed consciousness," in the sense that they share a presupposition regarding what is the correct answer. In other words, they are in the same systemic cognition. For Bakhtin, this means that they are in a monologic relation. In this way, the question and the answer form part of a single, unified consciousness, and each person's uniqueness can only exist in the form of an error. On this point, Bakhtin (1984) wrote, "Idealism recognizes only one principle of cognitive individualization: error. True judgments are not attached to a personality, but correspond to some unified, systemically monologic context. Only error individualizes" (p. 81).

Idealism is the most typical case of monologism for Bakhtin (1984): "ideological monologism found its clearest and theoretically most precise expression in idealistic philosophy" (p. 80). In monologism, true judgment, or the correct answer, belongs to one unified consciousness, regardless of whether the answer is given by an individual or is the product of a group discussion. Here, the question is not explicitly stated, but it must exist, corresponding to the judgment or the answer, which are part of the same, unified system. In fact, for the answer to be correct, it should belong to a single, unified system as the question. By contrast, individuality, or an answer that is unique to the individual and cannot be reduced to part of a system, can only appear as an erroneous answer to the question.

Question and answer are not logical relation: An example from a classroom lesson

How do non-logical relations arise between a question and an answer? In this case, the questioner and the answerer do not share a unified systemic cognition. Thus, the answerer understands the questioner's question differently from how the questioner understands it. The questioner and the answerer do not share the same question. A new question emerges in the answerer that corresponds to the answerer's answer, and thus the original question in the questioner and the answer in the answerer lose their logical relation. The answer deviates from the original question.

Let us make this more concrete by analyzing a classroom lesson in which a new question emerges in an apparently erroneous answer to a teacher's question. The example below (discussed in Miyazaki 2019) shows a typical instantiation of a process in which a new question comes into being in a student's answer that differs from the teacher's original intention. This appears in an early phase of a sixth-grade lesson on the poem *Haru* [*Spring*] by the poet Fuyue Anzai, as taught by Yukio Tsukamoto, whose pedagogical thought is shown below.

> *Haru* [*Spring*]
> Chouchou ga ippiki Dattan kaikyou wo watatte itta.
> [A butterfly has gone alone over the Dattan Strait][1]

At the beginning of the lesson, the teacher wrote the poem on the blackboard and asked the students to read it aloud. Here, the word "*chouchou*," meaning butterfly, posed a difficulty, as it was written in the older notational system, and the students did not pronounce it properly, saying instead "*tefutefu*," a meaningless word. So, the teacher asked students by saying, "This (Chouchou) is counted as *ippiki*. What do you think this is?"

The word "*ippiki*" is a contraction for *ichi-hiki* or one-*hiki*, where *hiki* is a counter used for many types of animals and bugs and, therefore, is appropriate for use for a butterfly. The students provided three answers: a butterfly, a fish, and a bird. Tsukamoto asked the question three times. The second time, while some students say it was a fish, the majority answered that it was a butterfly. Tsukamoto asked why they thought it was a fish, the students said that it passed over a strait that a bird could not pass over. The students and the teacher then discussed the meaning of "strait." Then, the teacher asked a third time, and the majority of students replied, that it is a fish. The teacher responded by telling them that it was a butterfly. However, he did not end there, adding "the way you feel is great! Maybe a bird, and a fish would be able to go over the strait, but a butterfly cannot. It is really a good reading." See Miyazaki (2019) for details on this lesson.

Tsukamoto's response was not provided for the students to save face for their incorrect answer, nor to prevent students with the correct answer from losing respect for the students with wrong answers. Tsukamoto really discovered in the students' wrong answers a new question. Tsukamoto's intended question here was: how is *tefutefu* pronounced? The students instead asked the question: what is *tefutefu* that can pass a strait? Tsukamoto's intended question and the students' answer have no logical relation. The students' answer deviated from Tsukamoto's intention. When planning the lesson, Tsukamoto did not expect the students to think about the challenge posed by the strait in this early phase of the lesson. In this sense, Tsukamoto did not share a unified systemic cognition with the students.

[1] The current author translated all the Japanese texts used in this paper into English

Outsideness

As shown in the previous two sub-sections, an answer deviates from a question in an exchange of question and answer, a new question emerges in the answer to the previous question so that a questioner and an answerer do not share the same question. Then, how does the deviation of the answer from the original question occur? Let us see how Bakhtin answers to this question. As quoted above, Bakhtin wrote of the *chronotopes* of the questioner and the answerer, and their various semantic worlds (I and the other). Bakhtin appears to propose that the answerer's response deviates from the questioner's intention because the two live in different chronotopes, that is, different semantic worlds. Chronotope is "a way of understanding experience" (Morson & Emerson, 1990, p.367) in which time and space are inseparable and are regarded "as forms of the most immediate reality"(Bakhtin, 1981, p. 85). As it is a way of understanding experience, each person experiences it uniquely so that the questioner and the answerer each have a different chronotope. It is needless to add that this is opposed to the monologic case, in which true judgments are not attached to a personality (Bakhtin, 1984). The answerer and the questioner in a dialogue are unique individuals who do not share the same systemic cognition, so the answerer's response necessarily deviates from the questioner's intention, and the answerer has a unique understanding of the original question.

Where the questioner and the answerer exist in the different chronotopes, they each exist outside of the other's semantic world. *Outsideness* is a key concept in *Response to a question from the Novy Mir editorial board* (Bakhtin, 1986), another essay in which he refers explicitly to questioning. The theme of this essay is creative understanding of a foreign culture. He argued against the view that it is necessary to enter the foreign culture and view the world through its eyes, criticizing this view as one-sided and untrustworthy. To understand a foreign culture, one should be located outside the object of understanding. "In the realm of culture, outsideness is a most powerful factor in understanding" (Bakhtin, 1986, p. 7).

Regarding questioning, Bakhtin (1986) wrote in this essay that "We raise new questions for a foreign culture, ones that it did not raise itself; we seek answers to our own questions in it; and the foreign culture responds to us by revealing to us its new aspects and new semantic depths" (Bakhtin, p. 7). A person who belongs to culture B can have a question about culture A, which a person who belongs to culture A cannot ask. In other words, someone who exists outside of culture A has different questions from a person who exists inside culture A. In dialogue in general, as previously noted, a questioner and an answerer have different chronotopes, such that the answerer understands the question differently from the way that the questioner intended and creates a new question. The fact that a person from a different culture poses a new question that someone who belongs to the culture cannot is an example of a dialogic relationship between the questioner and the answerer.

However, Bakhtin did not investigate whether persons in different cultures are aware of their mutual outsideness. While he seemed to presuppose that outsideness is self-evident for both persons, this is not necessarily so. It is possible that individuals may not understand certain differences between both cultures, although they may know that they belong to different cultures. In such cases, the one who is being questioned may consider the question strange or wonder why it is being asked. Alternatively, the one who asks may think that the response does not provide a real answer to the question. Such responses are manifestations of what Bakhtin described as the question and answer being out of logical relation. While questions from the outside produce a creative understanding, both those from the different cultures must recognize their mutual outsideness and learn of the existence of new, creative questions in seemingly strange questions.

Thus, in Bakhtin's view, question and answer are not logical relations, and new questions emerge in answers to previous ones, as the answerer understands the given question differently from the

questioner. This is because the questioner and the answerer are unique individuals, living outside of each other's semantic worlds.

At the end of this section, let me add how Bakhtin thought about the dialectics that Schwarz and Baker (2017) emphasized in their view on the dialogic pedagogy, based on my understanding of Bakhtin so far. From my understanding of Bakhtin, their dialectics belongs to what Bakhtin named monologic idealism. As noted above, Bakhtin noted that only an error individualizes in idealism. This applies to their view on the dialectics, which shows another problem of their pedagogy. In this pedagogy, where the question and answer should belong to a single unified system, each person's intellectual uniqueness is only allowed to exist in the form of an error. Intellectual multiplicity, a definitive feature of the dialogue, is not allowed there. It should be added, however, that Bakhtin did not deny the dialectics completely. In *Toward a Methodology of Human Sciences*, he wrote as follows. "Dialectics was born of dialogue so as to return again to dialogue on a higher level (a dialogue of *personalities*)" (Bakhtin, 1986, p. 162). He apparently thought of the dialectics as one kind of dialogue. However, this dialogue does "return again to dialogue on a higher level" (Bakhtin, 1986, p. 162). In Hegelian dialectics, what the dialectics returns is the synthesis or the integration of the opposing terms. Bakhtin asserted that there is no such integration here.

Bakhtin seemed to admit that there are oppositions between different views developing in the dialogical process, but it is only a component of the dialogue and not equal to the dialogue. As noted before, the existence of opposition between proposition A and proposition B means the existence of questioning, which is correct between A and B from the standpoint of this paper. It seems that what Bakhtin asserted is not that proposition C is finally integrated from the opposition between A and B, but that the new question, which one is correct between A' and B,' emerges from the old question. In the former case, A, B, and C are in one unified consciousness. In the latter, the opposition between A and B and the opposition between A' and B' exist mutually outside of each other. From the standpoint of this paper, the emergence of the new question: "Which one is correct – A' or B'?" – is the result of the deviation of the answer to the original question: "Which one is correct – A or B?" When the questioner has the question: "Which one is correct – A or B?" and the answerer has the question: "Which is correct – A' and B'?", a correct answer for each of them cannot be the same.

Bakhtinian dialogic pedagogy and the process of understanding in it

A teacher's view on questioning similar to Bakhtin's

How do the differences between the views of questioning discussed so far lead to differences between the views on understanding what occurs in the classroom lesson? In Schwarz and Baker's (2017) thoughts on dialogic pedagogy, the intellectual process of understanding is not considered to be a dialogic process but a dialectical one, in which a single correct answer for a single question collaboratively sought. How does understanding develop in Bakhtinian dialogue, in which a new question emerges in the answer to a previous question? It would seem that only intellectual confusion would result when an answer deviates from what the questioner requests. However, this is not so. Each participant not only encounters a different question in dialogue but also becomes aware of her/his own question through an encounter with the other's. In this way, they do not develop one unified understanding in collaboration, but each develops his/her own, unique understanding.

I examine this issue by analyzing pedagogical views developed in Japan. While these were not drawn from Bakhtin's own works or thinking, they are dialogic in his sense. In particular, their views on questioning are quite similar to Bakhtin's, discussed above. Though several teachers developed similar views independently, I introduce the pedagogical view of Yukio Tsukamoto, a retired elementary school principal, whose lesson on the poem *Haru* is shown above, as he articulated unique views on questioning

most clearly. Not only Tsukamoto but also many other Japanese teachers think that the teaching-learning process in the lesson consists of the triadic relationship between the students, the learning material, and the teacher. For them, the lesson becomes dialogic if the teacher is an authentic learner of the students' own learning material in a triadic relationship (Miyazaki, 2019; 2020). Tsukamoto discusses the relationship between the students' questions and the teacher's questions with respect to the learning materials as follows:

> When the teacher asks the question to children, she/he has the expected answer. However, the teacher's question has multiple meanings so that it contains various different questions other than her/his intended one. The child interprets the teacher's asked question, chooses one among many possible implied questions as her/his own, and answers it. Sometimes, the child choses a question that differs from the teacher's intended one. In that case, the child' answer is not likely to match the teacher's expected answer; the teacher thinks the answer is incorrect. However, if the child's answer can be traced back to the child's question which brought the answer,… the teacher can become aware of a new view of the learning topic hidden in the child's incorrect answer and can put this new view in the flow of the lesson. The child and the teacher become the inquirers of the same question. (Tsukamoto, 2014, p. 25)

His remarks feature three important points. First, he noted that students do not passively accept the teacher's questioning as it is. Tsukamoto considered that the student must interpret the teacher's question in her/his own way and necessarily produces a new question in this way. Thus, while the student's answer seems to be an answer to the teacher's question, it is in fact an answer to a question that the student produces her-/himself. This is the source of the deviance between the teacher's intended question and the student's produced answer. Second, he pointed out that this deviance often presents to the teacher as a wrong answer. However, this answer is likely not to be incorrect with respect to the question that the student produces.

These two points indicate that Tsukamoto's views on questioning are largely the same as those of Bakhtin. Tsukamoto adds another point that is important for the pedagogy. When the teacher can understand the student's answer not as a wrong response to the original question but as a correct answer to the student's own question and can make the student's new question explicit for other students, a collaborative exploration can begin.

The third point is particularly important for the development of understanding of students and the teacher in classroom lessons. While it is widely recognized that listening to children is important, what is important is listening to the students' questions from the standpoint of dialogic pedagogy. The teacher should become aware of the new question within the student's answer that differs from the teacher's own question and presents it back to the student and to other students in the class. The student who has unconsciously generated the new question can become aware of her/his generated question through the teacher's presentation thereof. Likewise, other students can observe the new question or, rather, the new interpretation of the teacher's question. The teacher thus becomes aware of the new meaning of her/his original question in encountering the student's new question as well. The class can develop a new understanding of the learning material by exploring the new question. How Tsukamoto's idea is materialized in the class was shown partly in the case of *Haru* above. In this lesson, the teacher pointed out to the students that their answers, which are seemingly incorrect, are not necessarily so, but reasonable on their own terms. The teacher discovered that his apparently easy question could have a different and unexpected but reasonable question.

New question in the wrong answer: One example from physics

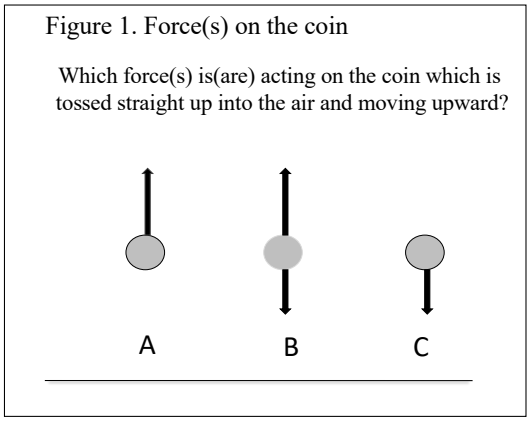
Let us examine the development of understanding through listening to a different question found in a wrong answer in concrete cases. Here, the examples are taken from the field of science. As noted, the

argumentative dialogic pedagogy holds that the process of understanding is dialectical, which means that the same question is shared by students, and there is only one correct answer, in particular, in science lessons. Thus, science is an important site for testing the universality of the idea that there are new, different questions within seemingly wrong answers.

The first example does not come from a classroom context; it is a hypothetical case drawn from the field of physics. It is selected to show the process of understanding more clearly. It concerns a well-known problem that has been studied for many years in the study of misconceptions in the field of cognitive science and the learning sciences (Clement, 1982; McCloskey, 1983).

A coin is tossed straight up into the air and is moving upward. Which force(s) is(are) acting on the coin?

Figure 1. Force(s) on the coin



Many respondents select B among the three choices given: gravity and an upward force act on the coin simultaneously. This is incorrect: the correct answer is C – that only gravity is acting on the coin. The coin keeps moving upward even in the absence of any upward force due to Newton's first law, or the law of inertia. The coin starts moving upward when it is thrown upward and would continue with the same velocity if there were no gravity. As the coin is continually acted upon by gravity, which continuously adds downward acceleration, the upward motion slows and then is turned into a falling motion.

While this is an elementary problem in Newtonian physics, it is infamous in the study of the learning sciences, as many adults - including students currently taking elementary physics - answer it incorrectly. Most people have learned the law of inertia in the middle school, but they do not apply it correctly even in such an easy problem. Have they simply forgotten the knowledge they had from school?

However, this story is not so simple. Rather, this error has reasonable grounds. The law of inertia presupposes an ideal world in which there is no resistance among objects. However, in the real world, surrounding objects, such as air, do exert resistance, so that uniform motion does not continue without a force acting continuously on an object. When the experimenter, or the teacher asks the question: which force(s) is(are) acting on a coin that is moving upward, she/he presupposes that this event is occurring in the ideal world. However, many people who answer the question do not account for this added presupposition, even if they are explicitly informed of it and think about the question, presupposing that it is happening in the real world, in which the resistance has many effects. After all, the people who answer the question live in the real world, and it is natural for them to interpret this problem situation occurring in the real world. In the real world, motion stops soon if no force acts on continuously. Thus, answer B, which considers an upward force as acting on an object moving upward, is correct if the question is understood

to refer to this case. In other words, answer B deviates from the question as intended. Those who chose answer B produced a different question from the one posed by the experimenter/the teacher and answered their own question. B is incorrect for the question as intended, but it is correct for the answerer's own generated question.

How can class lessons be organized using this material? One, maybe common, use of this query and response is to bring students to understand why answer B is incorrect so that they can replace the incorrect answer with the correct one. However, the teacher could develop another type of lesson in response to becoming aware of the students' own question, which is different from the one posed by the teacher or the textbook. In this type of lesson, the students and the teacher can collaboratively explore the difference between the real world and the ideal world that is presupposed by Newtonian physics. By this means, the students and the teacher can examine collaboratively how, in the real world, the resistance of surrounding objects affects the appearance of the law of inertia. In exploring the differences between the two worlds, the students can become better aware of the hypothetical nature of the ideal world as an analytic tool used to understand the real world.

New question in the wrong answer: analysis of a science lesson

In an actual lesson, most of the students' wrong answers are not the ones like in the above case, whose existence and implications are known publicly beforehand. The teacher must, on the spot, grasp a student's unique question in the student's unique wrong answer. Let us examine a concrete science lesson regarding the re-crystallization of ammonium chloride. This concerns a fifth grade class at Nagano elementary school attached to the Faculty of Education of Shinshu University, taught by Ken'ichiro Seki (Nagano elementary school attached to the Faculty of Education, Shinshu University, 2010). As this lesson appeared in Miyazaki (2020), only the outline of the lesson is given here.

The students watched a movie in which a bottle of liquid ammonium chloride was immersed in cool water, after which white crystals emerged one after another in a transparent solution, and they conducted an experiment to reproduce this phenomenon. After the experiment, one group reported that when they put the bottle in cool water, the quantity of undissolved crystals of ammonium chloride at the bottom of the bottle appeared larger. Hideta commented that this means that the undissolved crystals at the bottom of the bottle were simply larger. The teacher confirmed Hideta's idea by asking whether he thought that the undissolved crystal expanded and the transparent part of the solution made no contribution to the expansion of the crystal. Hideta acknowledged the teacher's question, adding that the transparent liquid in the bottle was mostly water, although a small amount of ammonium chloride was likely dissolved in it. Another student, Taka, argued against Hideta, saying that ammonium chloride was necessarily present in the upper, transparent part of the bottle, while Hideta counter-argued that the upper layer was not salty in the case of the saline solution from a previous experiment.

Hideta's answer was wrong, and Taka's was correct. Nevertheless, Hideta's answer was understandable as it was based on his own experience with a saline solution. While the majority, including Taka, asked why the crystal at the bottom of the container expanded, Hideta's question instead was something like why the crystal at the bottom of the container expanded when there was insufficient ammonium chloride in the transparent part of the solution.

The teacher could not grasp Hideta's question fully. Nevertheless, he discovered in Hideta's response something that was correct in its way. On reflection, the teacher considered Hideta not to be wrong, mobilizing all his previous experience to think in the way that he did, while his conclusion was not factual. The teacher recognized Hideta's unique way of exploring nature. Thus, the teacher did not contradict Hideta. He provided a schematic drawing of the molecules of the solution to the students and

asked them to think of the inner state of the solution. In discussing this, a new experiment was proposed to boil down the transparent part of the solution to identify whether there was ammonium chloride. The experiment was conducted, and the existence of ammonium chloride was confirmed.

Here, Hideta's answer was literally a wrong response to the question, as understood by most students and the teacher. However, Hideta's experience with a saline solution led him to think that there was insufficient ammonium chloride in the transparent part of the solution to crystallize. Thus, he posed a different question than the rest of the students, for which his answer was correct. The teacher could not grasp his answer fully but did not deny his idea. With the assistance of the teacher, the other students came to share Hideta's question on the quantity of ammonium chloride in the transparent part of the solution and explored it collaboratively in an experiment. Hideta's new question in his seemingly wrong answer advanced all students' understanding.

Answer as the course of each one's understanding process

Thanks to Hideta's unique idea, which differed from that of the majority and helped the class develop a novel experiment, the class reached the conclusion that the crystal at the bottom of the bottle includes precipitated ammonium chloride from the liquid. Given this, should the intellectual process of this lesson be characterized as a dialectical one, in which different views are integrated into one, as the deliberative argumentative pedagogy argues? The class record, taken by the teacher, has no detailed record showing each student's response, but it seems not unnatural to suppose that no one, including Hideta, opposed the conclusion publicly. I analyze the lesson flow under that supposition.

Did all students' ideas become the same, integrated one? My answer is no. Even though the students' thoughts appeared to be the same from the distance, each of them was unique if we take into account the full process of answering. After the first experiment, the majority of students, like Taka, thought that crystal at the bottom of the container expanded due to the crystallized ammonium chloride from the transparent part of the solution, implicitly supposing that there was enough ammonium chloride in this part of the solution. They then met Hideta's view and were with the facts of the previous saline experiment, which they may have forgotten about. Thus, they must have implicitly encountered Hideta's question regarding why the crystal on the bottom of the container expanded when there was not enough ammonium chloride in the transparent part of the solution. In response to this, Hiro, another student, said the following.

> Hiro: Though it was not salty before stirring, it became salty everywhere after we stirred it. Well, I was confused.

Hideta's view undermined Hiro's confidence in his own thinking. We cannot know what Hiro ultimately thought after the second experiment, as no explicit description was provided regarding the final phase of the lesson in the teacher's record. It is probably that he would have returned to his initial answer before encountering Hideta's view. Even so, Hiro's understanding in the final phase would have become different from the one he had held because it would have evolved through the fluctuation caused by the encounter with Hideta's view. His thought might ultimately have been strengthened due to this fluctuation. Some students might have not fluctuated in encountering Hideta's view, so their final understanding must have been the same as Hiro's on a surface level. However, as they had not experienced the process of fluctuation and re-establishment, their understanding would necessarily have differed from Hiro's.

Hideta would also have understood that there was sufficient ammonium chloride in the transparent solution that crystallized on the bottom of the container from the final experiment. More specifically, he likely understood the following: there is certainly sufficient ammonium chloride in the transparent solution to crystallize on the bottom of the container, although I had thought it was not enough from my previous

experience of the saline experiment. In other words, his understanding must have evolved from re-examining his own experience. Thus, he did not scrap the old idea and replace it with a new one but developed the new idea from a re-examination of what he had thought.

Hideta, Hiro and others, thus, might have arrived at the same answer. However, they could only have done so through different routes. Although their understanding can be summarized in the same words, that the ammonium chloride in the transparent solution crystallized, the content of their understanding could reflect a unique course of understanding, even though this would not be in their power to express in language. For example, it can be that one who experienced fluctuation of her/his own understanding finally had more robust understanding than one who did not experience. The students' intellectual processes should not be considered dialectical, as understood by the deliberative argumentative pedagogy. Instead, it is dialogic, in that each student evolved her/his unique understanding differently from the others in encountering with others' ideas.

Different questions in the seemingly same understanding: analysis of another science lesson

Let us examine an episode in another science lesson where students seem to provide the same, correct answer to one question, although their own questions and answers are unique and different from each other if their processes of understanding are taken into consideration. This lesson took place in a third-grade class taught by Kazuyasu Azegami (elementary school teacher at the time of the lesson, currently at Shinshu University) in 1990 at Tamagawa Elementary school, Chino, Nagano, Japan (Azegami, 1990).[2]

The topic of the lesson was a bamboo air pressure gun. This is a toy involving a barrel and a plunger. Two balls of paper are put into both ends of the barrel, the plunger pushes one ball, and the ball at the other end is shot out by air pressure. The lesson unit consists of twelve classes. In the seventh lesson and afterward, the students discussed why the paper ball flew out based on their own individual exploration from the previous two lessons. At the beginning of the seventh lesson, the teacher asked Aki to present her view. Aki indicated that a paper ball flew when two wet balls were placed at the ends of the barrel but did not when only one paper ball was placed at the front end of the barrel. There were two possible reasons for this, and she was wondering which one was correct. It could be that the paper ball at the front end flew out because the plunger and the paper ball at the rear end worked together on the paper ball at the front end. The other possibility was that there was air in the barrel between two balls, and the paper ball at the front flew due to the power of the air. Her friend Sayaka took the latter view, and Aki was not sure if the ball could fly due to the power of the air alone as the air was spongy.

Then, Kazu spoke.

> Kazu: Sayaka said that there was air (in the barrel). I checked it and found out there really was. Aki said that she could not understand why the ball flew as the air is spongy. I think that air is here (in the barrel), and as you push it (the plunger) hard and it collides with the rear ball, the air becomes narrow (sic), and (the front ball) flies due to its' (the air's) force.

After speaking, Kazu conducted the experiment to confirm the existence of air in the barrel. He put the bamboo gun in the water tank and shot it to see if air emerged from the barrel. He tried three times unsuccessfully and succeeded in the fourth trial. Then Masa spoke:

[2] The following analysis is based on the materials that Azegami prepared for presentation and the video record of the class.

Masa: I checked too as Kazu did, using a different method, whether there is air in the barrel, and there was.

Masa also demonstrated his experiment, in which a film of soap was placed at the front end of the barrel in place of the front ball to see whether it would bubble when the plunger was pushed in.

The teacher asked the class whether they accepted that there was air in the barrel, and many students answered yes. However, Asa raised her hand, and the teacher asked her to speak after checking whether she wanted to speak about this topic or another one. Asa told the class about the experiment that she performed in the previous lesson.

Asa: I put the barrel (of the bamboo gun) in a plastic bag, put the balls in the gun and sealed (the bag) with tape, and fired (the gun). The bag expanded, so there must be air in the barrel.

After this, the class moved on to discussing the students' thoughts regarding whether the ball flew out for other reasons than due to the air in the barrel.

Kazu, Masa, and Asa each presented an experiment to explore Aki's question. Presenting and conducting the experiment in the classroom can be characterized as pursuing the question in two senses. First, posing the question is asking nature about some natural phenomenon. The result of an experiment can be thought as the answer that nature provides to the experiment. Second, more important from a dialogic pedagogical perspective, presenting and conducting the experiment in a classroom means asking the question of other students and the teacher. The experimenter asks the class this question: "I am exploring nature in this way—what do you think?" It is needless to say, that questioning in this paper refers to the second one.

What questions did the three children ask? Broadly speaking, they were raising one and the same question: is air in the barrel? They used different methods, however. To specify the method in the experiment is to develop the question in a specific form.

- Kazu: Does air come out of the barrel as a bubble if there is air in the barrel and if the bamboo gun is shot underwater?
- Masa: Does a film of soap put on the front end of the barrel bubble up if there is air in the barrel and if the gun is shot?
- Asa: Does a plastic bag in which the bamboo gun is placed expand if there is air in the barrel and if the gun is shot in the bag?

The students' understandings from these experiments are, broadly speaking, the same: there is air in the barrel. At a closer look, however, their understandings are clearly somewhat different, corresponding to the differences in their questions. We can describe their understandings schematically, as follows.

- Kazu: There is air in the barrel that becomes a bubble underwater.
- Masa: There is air in the barrel that pushes out a film of soap at the front end of the barrel.
- Asa: There is air in the barrel that can expand a plastic bag in which the gun is placed.

They did not just propose their experiments independently. Masa at least realized the similarities and differences between his experiment and Kazu's. Masa noted this explicitly, stating that his experiment was the same as Kazu's, asking whether there was air in the barrel, but using a different method. Kazu, who performed the experiment first, connected his experiment to those of the other two. At the end of the seventh lesson, the teacher asked whether there was something in the lesson that the students understood well. To answer the question, Kazu referred to the experiments of Masa and Asa, saying, "Experiments with the soap and the plastic bag. They made me understand." Though he did not say what exactly he had understood, it is likely the fact that there is air in the barrel. He must have understood it somehow before he saw these two experiments by Masa and Asa, as he showed his own experiment first. Still, his understanding of the fact that there is air in the barrel must have advanced by addressing basically the same but a little bit different question.

It is not accidental that these students posed similar questions in this class. The attitudes of the students were noted by the teacher, who shows a unique view of the experiment and the process of understanding. Azegami reported thinking, even in childhood, that his understanding of something cannot really be his own unless he confirms it with the experiment that he himself performs (K. Azegami, personal communication, July 27, 2021). For Azegami, the experiment is not a device to make a final decision on which hypothesis is correct after possible hypotheses are formulated, like experiments in the Hypothesis-experiment-class pedagogy (Itakura, 2019). For him, to do an experiment is to ask a question about some phenomenon, exploring it from some direction and developing a novel understanding. Thus, encountering others' ideas of experiment in the class can lead to an improved understanding of the phenomenon by learning how others can explore them. Therefore, he encouraged and helped students to think of and conduct their own experiments. This attitude is clearly shown in his interaction with Asa in class. Before Asa spoke, many students appeared to agree, perhaps not on the cause of the ball's flight but on the fact that there was air in the barrel. Thus, it did not seem necessary to do an additional experiment to show this. However, the teacher allowed Asa to describe her experiment after confirming that she would talk about an experiment to show that there is air in the barrel. This episode should not be understood to show how the teacher respects her right to speak in general but instead respects her desire to show her unique understanding to the class.

The uniqueness of each person's understanding produces differences in questions

Personal history of understanding

Finally, let me clarify why new questions continuously emerge in an exchange of questions and answers. In the section "Bakhtin's view on questioning," I noted that Bakhtin suggested that this is because of the difference between each person's chronotopes. This answer is too broad and general, and it does not explain how a difference in the chronotopes results in the emergence of a new question. In this section, I present a view on learning developed in the cognitive sciences to explain this process: *constructivism*.

This view is particularly important for the study of misconception and the development of the concept (diSessa, 2006; Inagaki & Hatano, 2002; Smith et al., 1994). The basic tenet of this view is that all learning involves the interpretation of phenomena, situations, and events, including classroom instruction, through the perspective of the learner's existing knowledge (Smith et al., 1994, p. 116). This view rejects the tabula rasa conception of learning, in which new information is acquired by being written on the mind as onto a blank slate. Additionally, new information cannot simply replace old information. So, confrontation with an old idea is not enough for a new idea to be acquired and understood. If new knowledge is to be acquired and understood, it should be connected somehow to an existing knowledge base.

The knowledge base of each person is the product of her/his encounter with and experience of phenomena, situations, and events. This includes not only directly perceived experiences that are not mediated by the other persons but also those that are mediated by the other persons and symbols, as is typically the case in education. Each person's knowledge base is always changing and is renewed in the encounter with new phenomena, situations, and events in life. As a result, each person's knowledge base is unique to that person. It constitutes the accumulation of each person's experience in her/his life history and is different for each person. Here, I call each person's unique knowledge base *the personal history of understanding*, emphasizing the characteristic that it is continually changing throughout that person's history.

The uniqueness of each person's knowledge base is not focused in the research tradition of the misconception and conceptual development. Instead, these studies investigate the structure of knowledge (diSessa, 1988, 2008; Vosniadou, 2007). However, a novel research area has been emerging that is near to my research interest in the uniqueness of each person's knowledge base. These studies focus on *epistemic heterogeneity* or the differences in knowledge base among people from different communities. For example, Bang and colleagues (Bang et al., 2015; Barajas-López & Bang, 2018; Medin & Bang, 2014) have been studying indigenous ways of knowing among the native peoples of the United States and around the world. Likewise, Rosebery et al. (2010) investigated how students come to understand the concepts of thermodynamics, such as heat and heat transfer, examining how scientific concepts and the everyday experiences relate to their understanding. In this work, they focused on students' different everyday experience based on their original communities.

As noted in the section "Bakhtin's view on questioning", differences between communities and their cultures were discussed by Bakhtin (1986). It is unnecessary to emphasize, however, that these differences are only a part of the source of individuals' uniqueness. The research interests of researchers working on epistemic heterogeneity thus seem somewhat limited.

Questioning and the personal history of understanding

How does the personal history of understanding function in asking a question? This paper characterized questioning as presenting a problem/an issue. Something becomes a problem/an issue when that something is not understood, so presenting a problem/an issue or questioning is the act of coming to know and/or to understand something that is unknown and/or not understood. Naturally, questioning on a topic relates to the questioner's own history of the understanding of the topic. Because someone's personal history of understanding reflects what and how that person has understood things in life, it must influence what and how the topic or the meaning of a question about the topic is understood.

What about the case where person A asks a question of person B? A's question is understood by A, based on A's personal understanding. B, on the other hand, must understand the meaning of the question before answering it, and B does so based on B's personal history of understanding. The personal histories of understanding of A and B are unique to each person and different from each other. In consequence, the question that B understands is different from the question that A intended. Thus, a new question emerges in B, and B does not answer the question A intended, but the one B has understood, causing B's answer to deviate from A's question.

Tsukamoto's lesson on the poem *Haru* described above is a good example of this. He asked his students: this (Chouchou) is counted as *ippiki*. What do you think it is? Tsukamoto's intention was to ask how the word is read aloud. However, many students understood the question as follows: what is *tefutefu*, something that can pass a strait. Consequently, these students provided an answer that was wrong with reference to Tsukamoto's intended question.

What is the difference between the personal history of Tsukamoto's understanding and the personal histories of each student's understanding? Although all we can do is speculate, the reasoning might go something like the following. Their understandings might differ not only with respect to the content of the poem but also with respect to the procedure of understanding the text in general. For Tsukamoto as a teacher, it might seem natural to check the pronunciation of words first and then interpret the meaning of the sentence. However, it might be natural for students to begin reading by interpreting the meaning of a sentence, even if there are some words with uncertain pronunciations.

The differences between Tsukamoto's question and the students' question can also be characterized as follows. Both Tsukamoto and the students refer to the word *tefutefu* as their topic. However, the two sides interpret the topic differently based on their own personal histories of understanding, so their questions differ from each other. The structure of the questioning in cases from science education shown above is easily describable in this way. Some situations are not well understood by the participants in them. These can be called *problematic situations*, following Dewey (1938). It is the situation in which a problem/an issue is discovered. However, the participants do not share a question, even if they focus on the same problematic situation. Participants interpret a problematic situation based on their own personal history of understanding and try to understand it in their own way. In other words, each one poses a unique question for the situation.

In Seki's lesson, for example, the problematic situation was to determine why the quantity of undissolved crystals of ammonium chloride at the bottom of the bottle appeared larger. Hideta, who answered differently from other students, recalled and compared the result of the saline solution previously examined. Based on his personal history of understanding, he interpreted this situation differently from other students and produced a question that was different from theirs, asking why the quantity of undissolved crystals of ammonium chloride at the bottom of the bottle appeared larger if the ammonium chloride in the upper, transparent part of the bottle is thin and not dense enough to make the crystal at the bottom larger.

Let me return to Bakhtin's view, presented in the section "Bakhtin's view on questioning." The chronotope, in Bakhtin's conception, at least one component of it, refers to the way of understanding the world. Therefore, differences in the personal histories of understanding would be components of differences between individuals' chronotopes. This section shows that the cultural differences that Bakhtin discusses using the concept of mutual outsideness in *Response to a question from the Novy Mir editorial board* (Bakhtin, 1986) are the object of research as the epistemological heterogeneity caused by differences between communities. It is also noted that heterogeneity based on differences between communities are only a part of the difference of people's personal histories of understanding. Bakhtin's idea of outsideness is caused not only by cultural differences but also by each person's individual differences so that the personal history of understanding is at least a component that causes people's mutual outsideness.

Concluding remarks

This paper examined the differences between the Bakhtinian dialogic view and the pedagogical thought based on it, on the one hand, and the theories of argumentation and the pedagogical thought based on them, on the other, by focusing on the characteristics of questioning for both of them. The theories of argumentation insisted that one question should be shared among the participants for an argument to develop. The Bakhtinian view is that a question is not shared by the participants, and a new question emerges continuously in an answer to the previous question. For Bakhtin, exchanges that stick to one and the same question are monologic.

New questions emerge in dialogue because those who participate in it have unique knowledge bases that are the product of the accumulation of their unique life experiences. This paper termed this knowledge base – the personal history of understanding. Because of the uniqueness of the person's personal history of understanding, each participant in the dialogue understands the same topic or the same problematic situation differently and so produces different questions unique to each.

When a student's answer to a teacher's or other students' questions seems to be wrong or felt strange in the lesson context, this may be the result of a new question implied in the answer that is unique to that student. Likewise, when the same idea seems to be presented by different students, it may be that each student has a unique question, approaching the same idea from different directions. The lesson becomes dialogic as the teacher notices the new question and presents it to the class.

That is, it becomes dialogic because the participants of the lesson understand that seemingly different, wrong, or strange ideas are actually reasonable, having equal rights vis-à-vis the truth to other ideas, when the questions in these seemingly wrong or strange ideas are discovered. By finding a new question in her/his seemingly different, wrong, or strange answer, the student can explore it further and develop her/his understanding. Students who recognize the new question in the other's seemingly different, wrong, or strange answer can investigate this new question and become aware of their own questions and develop them further. In this way, each student can develop his or her own understanding based on the personal history of understanding by exploring her/his unique question.

In science and mathematics, there seem to be only one correct answer to any question. However, this paper showed that even in the field of science education, supposedly incorrect answers can still be correct for the question hidden in the answer. It also showed that, where participants' thoughts seemed to converge finally into one, each one still possesses a different answer corresponding a different question, indicating each one's different path to the final idea.

This paper does not insist that theories of argumentation are without value. On the contrary, they are effective means to organize the methods for participants to reach one consensus, such as at a conference. However, education is not for consensus building but for individuals to develop their own understandings based on each one's personal history. The participants might reach consensus on a topic in a lesson, but the consensus itself is not important. What is important is each student's path to this consensus or the individual exploration that builds understanding. This exploration, which is unique to each person, is her/his questioning. Encountering others in dialogue makes it possible to become aware of one's unique questions. Unfortunately, theories of argumentation ignore individual people's uniqueness of understanding, so necessary in pedagogy, theories that should support unique individual paths to new questions and new answers.

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