Journal of Humanistic Mathematics

Volume 13 | Issue 1 January 2023

Teaching Mathematics After COVID: A Conversation not a Discussion

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Synopsis

Inspired by Brent Davis' conceptualization of listening and conversation in his book *Teaching Mathematics: Toward a Sound Alternative*, we propose how we as a mathematics education community may move forward by continuing in the conversation that emerged from COVID. We encourage all involved to listen rather than assume a discussion-oriented stance. Using an enactivist lens, we look at the pandemic learning space, give an overview of the education conversation that emerged in Ontario, and offer a way to rethink Mathematics Education within the frame of a conversation. We believe that if mathematics education is to engage learners in a meaningful way, sustaining the progress made in mathematics education, all stakeholders should embrace the changing context of our network within the environment and interact through listening.

Most countries have been progressively lifting COVID-19 restrictions and it seems we are returning to "normal". However, the maskless faces should never mask the reality that mathematics education pre-COVID has changed and is constantly changing. Brent Davis' work does much to acknowledge the changing nature of mathematics education.

More than two decades ago, in his book, *Teaching Mathematics: Toward a Sound Alternative* [2], Davis used listening as a frame to propose teaching mathematics as an engaging conversation. Davis' approach differs from the

traditional way of teaching mathematics as procedures and rules, which gives the false impression that mathematics is removed from human experiences. Davis encouraged mathematics educators to consider the emergent nature of a conversation which depends on the context and the people involved when thinking about mathematics teaching. The flow of the conversation is not necessarily planned: how it develops is dependent on the members listening skills, which includes observing non-verbal clues. The conversation becomes real in action. A conversation merges individual subjectivity, bringing with it shared understanding, even if points of view differ. Thus, due to the holistic nature of a conversation, there is no separation between individuals or between individuals and their environment; all are necessary pieces for the conversation to progress. Davis contrasts a conversation with a discussion, in which listening does not inform its development. He believes that the focus of a discussion is promoting individual subjectivity as the emphasis is on maintaining one's point of view.

When teachers take a conversational approach to teaching mathematics, the atmosphere of the classroom is non-threatening, dispelling doubt and fear. In such a scenario, teachers are not knowledge keepers because students are also enveloped in process of creating the mathematics. This is not to say that teachers do not plan. However, the interaction in the classroom unfolds the creativity of students and teachers. Teachers set the tone of the classroom by encouraging listening. The creativity of everyone is appreciated such that an observer is unable to tease apart different voices: all voices, including the environment, become a part of a coherent whole from which the mathematics emerges [11]. Thus, the chasms and walls between teacher-students and environment-participants are removed.

Davis' work [2], together with contributions from many other mathematics education researchers and educators [1, 4], has changed the way many see mathematics. Still, there is much work to be done as the negative perception — "that of a static, formal, hierarchical, and truthful body of knowledge" [2, page 57] — still lingers in mathematics education. Therefore, we need to continue the positive work. Unfortunate as COVID-19 has been, it can help us learn to approaching mathematics education as a conversation rather than a discussion.

Teaching mathematics with the constraints and inconsistencies of this pandemic compelled mathematics stakeholders (policy-makers, administrators, teachers, students, software developers, etc.) to listen to each other, to make

adjustments according to an emerging conversation. During the pandemic, all stakeholders had to accept and embrace the changing context of our collective situation and engage in the conversation that emerged to facilitate teaching and learning as best as possible. Using Davis' conceptualization of listening and conversation [2], we propose how we as a mathematics education community may move forward by continuing the conversation that emerged from COVID. We encourage all involved to listen rather than assume a discussion-oriented stance.

In the following sections, we look at the pandemic learning space, give an overview of the educational conversation that emerged in Ontario, and offer a way to rethink mathematics education within the frame of a conversation.

The Pandemic Learning Space

The harsh grip of COVID-19 thrust us into a space of immediacy and inconsistency. Try as we may, the space could not be defined by "fixness" or constancy: we had to promptly rethink mathematics education in an attempt to preserve the integrity of teaching and learning. Teachers, parents and students, and other stakeholders had to reconsider methods and resources. We tried to hold on to a stable ground during COVID, but the space naturally provoked dizziness, confusion, frustration, anxiety, and fear. Many countries underwent several lockdowns to curb the spread of COVID-19 and mental health awareness increased. Face-to-face learning periodically stopped in some places in favor of remote/online education. Even without lockdowns, people had to be absent from work or school: they were frequently absent when they experienced at least one COVID-related symptom, which would otherwise be dismissed as a passing bug. Within this state of uncertainty and whirlwind of emotions, mathematics stakeholders faced many setbacks. Yet, we were challenged to act. The unfortunate circumstances of the pandemic propelled mathematics stakeholders of all levels to rethink mathematics teaching and learning in ways that they may not have considered.

The Educational Conversation in the Pandemic: The Ontario Case

During the COVID- 19, a conversation emerged in the pandemic learning space among the mathematics stakeholders in Ontario. The learning context triggered actions from stakeholders, which in turn affected how the learning context was perceived.

At the onset of the first lockdown in Ontario, turning to remote (at home) teaching and learning was a quick alternative. However, given the suddenness of the adjustment, this was not well-organized, even with the launch of the first phase of an accompanying new Learn at Home portal, an online resource to support families in assisting students with their learning [6]. As a government initiative, the first phase focused on supplying students with content for learning, but educators, parents, students, and other stakeholders had challenges participating in a smooth learning process. For example, some students could not access appropriate devices, which led to inequality concerns; and some families could not afford the internet. Challenges were mitigated as best as possible by school boards and government intervention.

By March 31, 2020, with a month lockdown extension, the second phase of Learn at Home seemed to capture earlier challenges. It outlined expectations for the education community, including guidelines to reconnect students with school staff, recommended contact hours to restabilize teacher-led learning, approaches to supply students with devices, alternate means of student-teacher connectivity, and support for teachers and graduating students. Additionally, in the second phase, a solution-oriented COVID-19 working group was announced to support students [7].

By June 19, 2020, the Ministry of Education, equipped with information on how educational stakeholders adjusted to the pandemic, published a comprehensive web document, Approach to Reopening Schools for the 2020-2021 School Year, an operational guide for resuming teaching and learning during COVID-19. In addition to face-to-face learning, boards were required to have two alternate modes of operation to implement according to the state of the pandemic: a modified school routine with alternate days or alternate weeks to put students in smaller cohorts, and at-home learning (online where possible) delivery. Also, school boards were required to extend arrangements so that all students had access to remote learning and all educators received training to appropriately manipulate Learning Management Systems (LMS) [5]. The June 19 document was amended by the Guide to Reopening Ontario's Schools, a working document that the Ministry was committed to regularly re-evaluating and updating according to public health guidelines [3].

Face-to-face learning was able to resume in Ontario for the new school year in September 2020. In addition to strict physical distancing requirements, tighter guidelines were given for remote learning, such as an established

minimum expectation for synchronous learning. Therefore, by the second provincial-wide lockdown in January 2021, school boards could default to synchronous and asynchronous remote learning, and by September 2021, students were back to face-face learning with an online option.

Rethinking Mathematics Teaching Post-Pandemic: A Proposition

The back-and-forth between the learning environment and education stakeholders during the COVID-19 crisis in Ontario is an excellent example of how an emerging conversation through listening takes place. At each moment, stakeholders had to listen, not passively, but actively, by engaging with the environment to get a deeper understanding of the conversation at hand to respond meaningfully. In responding to the current state of the pandemic situation, governmental action (decisions) could not be isolated and subjective as with a discussion. The conversation emerged based on interaction of the whole body of stakeholders with the learning environment.

Following this example, as we go forward, mathematics education stakeholders should engage in the conversation that emerged from the pandemic by listening, with the goal of promoting mathematics as a phenomenon that arises from human experiences. Davis [2] wants all voices in mathematics classrooms to be included to remove the gulf between teachers and students so that no student is disengaged or left behind. Similarly, within the larger network of educational stakeholders, all voices are relevant in attending and engaging students in mathematics learning that allows the experiences of learners to be heard in classrooms so as to dissociate the negative perception and emotions attached to mathematics.

For mathematics education stakeholders to engage in a conversation, we must recognize that mathematics education emerges in the same way a conversation does: from the actions of all stakeholders, the interactions between them, and the interactions between stakeholders and their environment. The diversity and interaction between them create products and processes that shape and enhance mathematics education. If we acknowledge that the network of stakeholders is immersed in their environment and that both (environment and network) are changing constantly through mutual encounters [10], we would be more sensitive to the context in which we operate and be more willing to make changes, as was the case during the pandemic in Ontario. With this understanding, teachers would be aware that students, parents,

other stakeholders, and the teaching and learning workspace (including the real world) are as much a part of mathematics as the "mathematics" they seek to teach. Then, teaching mathematics as a procedural subject would have no place in classrooms when practice, research, parents voices, and student achievement consistently demonstrate that a meaning-making approach to teaching mathematics supports student interest and industry needs [1, 8]. Moreover, curriculum developers would more readily update the curriculum to reflect the changing trends in society. It would not take decades to upgrade mathematics curriculums to reflect computational thinking and coding when mathematics practice and research, for decades, indicate the relevance of technology in mathematics [8].

In addition, as we go forward, educators, parents, teachers and students, and other stakeholders can learn from this pandemic that each teaching and learning workspace/environment is different. Each workspace articulates and is typically composed of artifacts such as boards, chart papers, breakout rooms, and chats [9]. Also, each space offers unique signs or signals such as students' mathematics productions and ideas. Therefore, as we contribute to mathematics education in whatever capacity, we should not simply perceive the features within one setting as we do another. For example, from this pandemic, educators should recognize that features within online settings do not necessarily correspond to features in a face-to-face learning environment. Thus, they should allow for new opportunities and mathematics meaning to emerge in accordance with the shared learning space (whether face-to-face, online, or outdoor). For instance, a breakout room in a virtual learning setting affords mathematics learning differently from a breakout room in a physical environment. Educators can only maximize the uniqueness of each learning space as they listen and make meaning from the broader context of the ongoing conversation as was done in the pandemic.

In general, what has the pandemic taught us? It has proven to us (albeit forcefully) that we are embedded in our environment, such that we are changed by it as we change it. Thus, moving forward after this pandemic, if mathematics education stakeholders try to remain mentally fixed as we were for a long time, with a procedural approach [1], there will be a breach in the system. Learners, who are our primary responsibility, will not appreciate mathematics for its creativity and beauty [1]. Educators and parents will be more frustrated as they seek to find ways to support learners. The work of researchers, policymakers, and administrators will be futile.

Only when mathematics education stakeholders are open to listening, with the understanding that we operated in a dynamic and complex education system can we engage learners in a meaningful way to sustain the progress made in mathematics education. Davis' work [2] expresses that, and COVID-19 was a vivid reminder of the same. Let us not return to "normal".

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