Fostering Highly Engaged Knowledge Building Communities in Socioemotional and Sociocognitive Hybrid Learning Spaces

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Practitioner notes

What is already known about this topic

- Socioemotional facets of learning play an important role in sociocognitive development
- Stages of group development provide a relevant framework to examine socioemotional functioning of groups

What this paper adds

- A novel conception of hybrid spaces that foregrounds socioemotional and sociocognitive spaces across face-to-face and online settings
- A novel methodological approach to examine the co-development of socioemotional and sociocognitive spaces through a group developmental framework and chain analysis

Implications for practice and/or policy

- Teachers who want to foster technology-enhanced learning communities should be aware of stages of group development if they want to promote collective knowledge building
- Educational technologies that aim to support collaborative knowledge building goals should build in affordances to support socioemotional spaces

Abstract: With the aim of understanding sociocognitive and socioemotional hybridity in learning spaces, we examined a semester-long learning community where students were given the freedom to advance their epistemological and social agendas across face-to-face and online settings. We collected and analyzed 1,780 online notes written by students throughout the semester and coded them based on their sociocognitive or socioemotional values. We then examined the conversation chains that students engaged in vis-a-vis their developments as a group. In addition to showing how the group developmental stages served as a macro-level context for the socioemotional and sociocognitive spaces, the analysis highlighted how deep, rapid, community knowledge building conversations spontaneously emerged in relation to the timing of socioemotional developments. This study elucidates an important dimension of hybrid spaces, emphasizing the need to design activities to support both sociocognitive and socioemotional spaces in technology-enhanced learning communities.

Introduction

Contemporary learning scientists have been paying increasing attention to the way sociocognitive facets of learning are dynamically related to their socioemotional counterparts (Baker, Andriessen, & Järvelä, 2014; Slakmon & Schwarz, 2019). Exploring these two "spaces" together is important because, in practice, simply asking students to learn together does not guarantee a successful outcome (Barron, 2003). Moreover, with the blending of formal and informal learning in future learning spaces (Eberle, Hod, & Fischer, 2019), the hybridity of sociocognitive and socioemotional facets of learning has intensified. Better understanding the mutuality of these spaces is therefore vital to fostering the sustained growth of new and emerging technology-enhanced learning communities.

With this goal in mind, this paper explores a graduate course that was designed to foster a learning community by supporting both sociocognitive and socioemotional learning processes. In the rest of this paper, we elucidate the differences between these spaces to argue for a hybrid view that can promote significant learning. Next, we describe an educational design to foster the development of these types of hybrid spaces. We then report our findings from a three-part study that examined socioemotional and sociocognitive developments to shed light on how they are intertwined with one another. We conclude with conceptual and design implications.

Background

Hybrid spaces can mean many things, as there is a lack of clarity on many of the associated constructs. For example, Turnbull (2002) notes four different categories of spaces, including those that are discursive, cognitive, existential, and material. In this paper, we view "spaces" as more abstract and expansive versions as their frequent counterpart, "places", which typically relate to the location where lived experiences occur (Tuan, 1977). Hybrid spaces, therefore, refer two or more abstract and expansive educational goals that are combined and mixed to create a new type of discourse (Ellis & Goodyear, 2016).

There are both theoretical and practical issues underlying the interest in exploring the hybridity of sociocognitive and socioemotional spaces. The sociocultural turn in learning research laid the theoretical grounds to take broad views of learning (Herrenkohl & Mertl, 2010). From this perspective, the learning of individuals is viewed as their transforming participation into the practices and norms of a community (Rogoff, 1994; Sfard, 1998). The reciprocal processes involved in appropriating and contributing to the ongoing discourse of a community necessitates a view that is broader than ideas and knowledge alone, but encompasses students' identities and the socioemotional dynamics involved in negotiating community life (Lave & Wenger, 1991).

On a practical level, exploring the hybridity of sociocognitive and socioemotional spaces has been spurred by changing societal demands for collaboration in addition to the increasingly blurred lines between formal and informal learning facilitated by new technologies (Collins, 2017). The US Department of Education (2017), for example, argues that to remain competitive globally, schools today need to supplement cognitive learning with non-cognitive, socioemotional skills. These include learning how to successfully navigate relationships, problem solve collaboratively, develop self-regulatory functions, and concern for others.

Research exploring the relations between emotions and cognition is extensive, and the evidence that social and emotional learning can lead to greater academic success is impressive (Weissberg, Durlak, Domitrovich, & Gullotta, 2015; Wilson, Gottfredson, & Najaka, 2001). For it to be effective, students need to develop self-awareness, social cognizance, responsibility, self-management, and relationship skills. Environmental factors such as creating a supportive and safe

environment are vital, too. Social emotional learning should also be infused in the academic environment and not separate from it (Zins, Bloodworth, Weissberg, & Walberg, 2007). Despite the growing body of scholarship exploring these relations, empirical studies of this nature that relate to educational technologies and spaces and are framed from socioculturally-minded perspectives are needed.

Sociocognitive Spaces

Of particular interest in this paper is a model of technology-enhanced classroom learning communities, called knowledge building communities (KBCs). KBCs are founded on the sociocultural rationale that learners should participate in activities that are authentic to the types of knowledge practices that experts engage (Hod & Sagy, 2019; Scardamalia & Bereiter, 1994). As their name implies, they are idea-centered. This means that community members must take collective cognitive responsibility so that the knowledge building process can be sustained. The complexity of doing this is based on a set of principles, such as *developing epistemic agency* where students set long-term goals and monitor idea coherence, and *identifying real and authentic problems* that can be continually advanced (Zhang, Hong, Scardamalia, Teo, & Morley, 2011).

The Knowledge Forum (KF) was developed as a technological tool to support continual community knowledge advancements. Its key features involve students writing public notes that are organized into ever-deepening chains. These notes are purposefully colored to signify whether a user has read a particular note; once they do, the color of the note is changed from blue to red. Using the build-on function after reading a note, participants can add new ideas or explanations to the collective knowledge base. They are aided by customizable scaffolds representing idea relations, such as "an alternative explanation is…", to further deepen these chains. While there is value in orphaned notes that contribute new knowledge to the sociocognitive space, community discourse is embodied in the chains. This is captured in the idea of collective cognitive responsibility, which is based on the principles that participants must become aware of contributions, that contributions are complementary, and that engagement is distributed (Zhang, Scardamalia, Reeve & Messina, 2009).

In summary, by being idea-centered, KBCs have made valuable contributions to the understanding and practices involved in enacting rich, fluid sociocognitive spaces. Ever-deepening chains of notes written by community members embody some of the key principles of the knowledge advance criterion of KBCs.

Socioemotional Spaces

The sociocognitive emphasis of KBCs could easily lead to the dismissal of important socioemotional discourse that is essential for community vitality. Recognizing this problem, learning scientists have recently turned their attention to socioemotional spaces. Baker et al.'s (2014) book on affective processes when "learning together" was a significant step in this direction. Naykki, Järvelä, Kirschner and Jarvenoja's (2014) research on socioemotional regulation showed how interpersonal challenges and conflicts have the potential to be detrimental for effective collaboration if not supported properly. Slakmon and Schwarz (2019) created the online, Hot Discussion Platform to support deliberative emotional talk around controversial issues. The recent effort to get over the traditional bias among learning researchers to emphasize sociocognitive over socioemotional spaces offers exciting new directions for scholarship on educational technologies (Cress, Rosé, Law, Ludvigsen, 2019).

One of the ways that we can connect the sociocognitive dimensions of KBCs with the socioemotional dimensions is through research on groups. Group research has a long history of viewing the "task function" and "socioemotional function" of groups together (Brabender, 2010). Classroom-based KBCs are relevant to group research because, like any other collection of people with a common goal, KBCs are a specialized type of group. Evidence of this point comes from research on learning communities that have taken group developmental perspectives to elucidate their dynamics (see Hod & Ben-Zvi, 2015; Carabajal, LaPointe, & Gunawardena, 2003; McInnerney & Roberts, 2004).

Stage models of group development (see Table 1) typically assert that groups' socioemotional advancements progress through initial, transition, working, and final stages (Corey, Corey, & Corey, 2018). While groups may often regress or express multiple stages simultaneously, stage models are a useful way to frame the development of socioemotional spaces (Arrow, Poole, Henry, Wheelan, & Moreland, 2004). Successful groups—those that are able to move past the tension and mistrust characterizing the transition stage—enter into the working stage. One of the key characteristics of this stage has to do with achieving high levels of group cohesion—a sense of being connected or feeling a part of something larger (Marmarosh & Van Horn, 2010). Cohesion is important in group life so that the group can productively cope with the challenges, conflicts, and disagreements that naturally arise (Yalom & Leszcz, 2005). Conflicts or negative behaviors that are likely to surface during the life of the group do not necessarily indicate a lack of cohesion. The outcomes depend on the norms of the group and whether or not they have a commitment to work through the tough issues (Schmuck & Schmuck, 1975).

In summary, socioemotional spaces have been the subject of growing research in the learning sciences. Research on group developmental stages, and particularly their role in fostering cohesion, offers an extensive amount of knowledge that has yet to be applied to KBCs. This research applies these frameworks to examine the relations between sociocognitive and socioemotional spaces as new forms of hybrid learning emerge. Specifically, we ask (1) In what ways do participants express their advancing knowledge in sociocognitive spaces and their cohesion in socioemotional spaces in technology-enhanced learning communities? (2) How do these communities advance socioemotionally through stages of group development? (3) How are these group developments in socioemotional spaces related to the ever-deepening chains in sociocognitive spaces?

Methods

To answer these research questions, we carried out a case study of a technology-enhanced classroom learning community that was designed as a hybrid space. This approach is useful to untangle the complex learning processes involved in contextually-rich environments (Creswell, 2012). The setting of the research took place in a graduate course on "Learning Communities" in the Faculty of Education at the University of Haifa. Eighteen graduate students (15 female; 3 male) were enrolled in the course, led by a moderator and supported by a co-moderator. The course was designed to provide students with the experience of building knowledge in a learning community as they studied ideas about learning communities, thus fostering connections between experiential and theoretical knowledge. This approach was taken to situate students' knowledge-in-practice (Brown, Collins, & Duguid, 1989), in comparison with approaches where learning about pedagogical approaches remains disconnected from what students experience. Ultimately, the objective was for students to develop learning community practices as learners as well as deepen their understanding about the theory and design of learning communities.

The hybrid design of the course included a space that was oriented for sociocognitive developments, structured as a KBC, and a space emphasizing socioemotional issues, based on the theory and practice of person-centeredness (Cornelius-White & Harbaugh, 2010). The first half of face-to-face meetings were generally reserved for person-centered activities, such as non-directed discussions or structured activities aimed to build trust and explore the members' interpersonal relationships and the group's dynamics. Different person-centered activities, such as having students explore their interpersonal relations in the here-and-now, were carried out. The moderators held to the guiding principles of providing unconditional positive regard, empathic listening, and congruence (Rogers, 1969). With the exception of several special activities (e.g., reviewing the course contract at the start of the semester), these were carried out consistently throughout. The second half of face-to-face meetings focused on collective knowledge building on topics about learning communities that interested the participants. These included having the students build knowledge on topics that interested them, supported by opportunistic collaboration, guided by 12 knowledge building principles (Scardamalia, 2002). These sociocognitive and socioemotional spaces were given similar attention online, with activities on the KF designed to support these processes between the weekly face-to-face meetings (Figure 1).

Although the time during face-to-face meetings and the spaces on the KF were largely split based on personal/social and knowledge goals, there were many opportunities for interconnections to be made between these times and spaces, which were encouraged. For example, students were asked to write weekly personal reflective diaries, which were highly consequential in that they gave students an opportunity to freely write about their feelings and thoughts on the KF and receive feedback from others. In addition to writing open diary entries, several assignments asked students to reflect on what they know about the theory and practice of learning communities and discuss it in their personal diaries in relation to the here-and-now events in the community. We also note that both type of spaces provided students the opportunities to engage in interpersonal, small group, and whole community discussions. Underlying these design decisions were our interest in create a hybrid space that was authentic, i.e., allowed for participation like that in the real world. This provided the students them with different pathways to participate in ways that they felt most comfortable with.

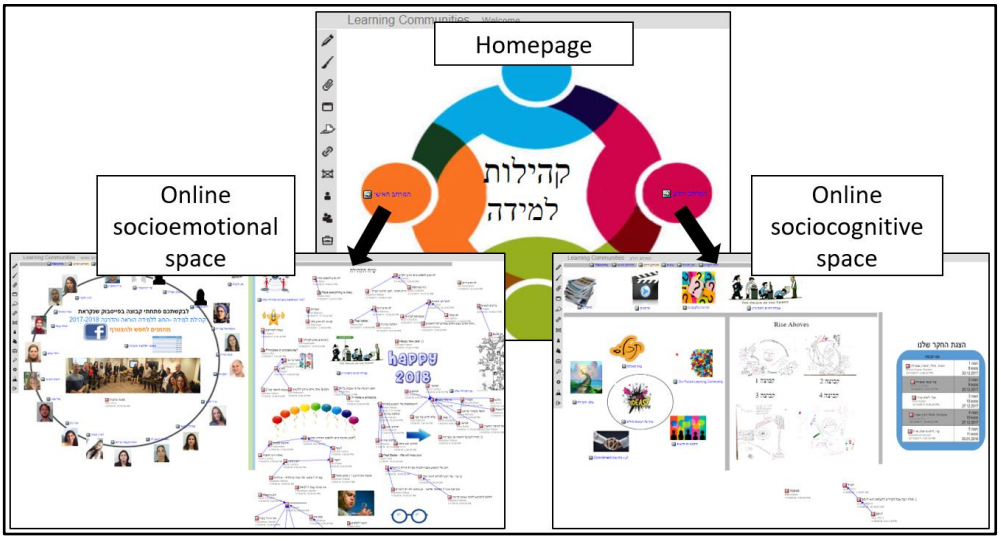

Figure 1. The KF divided into socioemotional and sociocognitive spaces

Data Collection and Analysis

We built a corpus of data from three main sources, collected retrospectively following approved ethical protocols. The main corpus included all notes and actions completed on the KF. This included students' online reflective diaries, particularly for the analysis of the socioemotional developments, and notes in the knowledge-oriented spaces to understand their sociocognitive developments. These data were supplemented by field notes from face-to-face meetings taken by the moderators, and physical and digital artifacts from course meetings.

To account for the sociocognitive and socioemotional expressions, we analyzed the complete corpus of 1,780 notes written on the KF. Using a constant-comparative method (Strauss, 1987), after collecting these notes we started analyzing them by applying codes that both described the actions as well as memos about what they could mean. Following application of codes and memos, we inductively organized the occurrences to refine operational definitions and values until the full corpus reached a point of saturation (roughly equivalent to grounded methods outlined by Charmaz, 2008). This entailed going back and forth between the definitions and values, particularly as we encountered new cases that did not fit the conceptualization existing at that time. At various stages throughout the process, two additional research assistants reviewed the codes and their interpretations to increase their reliability through intersubjective agreement.

We used an interpretive case study approach to identify and analyze the stages of group development of the KBC (Dooner et al., 2008; Purwanto, Zuiderwijk, & Janssen, 2018). The analysis process included outsider and insider vantage points in reference to criteria characterizing stages of group development (Table 1). The outsider vantage point involved analyzing the students' online reflective diary entries and both moderators' notes throughout the semester to find patterns in their writings based on a particular stage. The insider viewpoint included two course participants' interpretations of the stages vis-a-vis the data and their recollections. Only after consensus was reached between the outsider and insider viewpoints were stages identified (Schoenfeld, 2007).

Table 1. Criteria and operationalization for determining stage of group development (adapted from Corey et al., 2018)

Stage	Code	Theme	Expression (Statement or action)
Initial	I1	Getting acquainted, with the excitement of the beginning	Enthusiastic expressions of togetherness; Positive expressions about others that lack deep familiarity with the recipient
	I2	Risk-taking is relatively low, exploration is tentative, lack of openness	Lack of or limited participation in activities that require disclosure; Expressions that are laconic, or are said/written without care; Expressions that directly state a person's caution or inhibitions; Discussions that begin with an interpersonal focus that shift towards intellectualization
	I3	Looking for direction; Motivated out of compliance rather than self-direction	Lack of initiative to deepen interpersonal relationships; Explicit expressions of confusion or uncertainty about how to participate in the here-and-now

Transition	T1	Members test the moderator (or design) and other members	Expressions that explicitly address ongoing relationships in a general way, without calling out specific participants; Expressions that show skepticism towards the course design or the way activities are structured
	T2	Members struggle between wanting to play it safe and wanting to risk getting involved	Expressions that compare one's level of participation; Expressions that show beginnings or readiness to share more complex emotions; Contemplative expressions about personal or community hesitations
	T3	Control and power issues may emerge, or some members may experience conflict with others in the LC	Explicit expressions resisting participation; Criticisms towards others, oftentimes without directly stating the recipient
	T4	Members feel awkward or uncomfortable to discuss their interpersonal relationships in the here-and-now	Non-verbal gestures that display discomfort or unsettling feelings
Working	W1	High trust and cohesion	Expressions of closeness and inter-dependencies; Online discussions with involvement of at least half of the community members within several days; Strong emotional expressions.
	W2	Open communication and accurate expression of what is being experienced	Explicit expressions about one's feelings and what they evoke in others; sharing of difficult or complex feelings; explicit expressions about the community being open.
	W3	Free and direct interaction between participants	Initiation and sustenance of conversations without need for moderation; active discussions that include many members
	W4	Risk taking and personal revelation	Expressions about a person's private life
	W5	Feedback given and accepted non-defensively	Expressions seeking feedback from others about one's participation or identity
	W6	Confrontation is caring and respectful	Respectful and caring critiques about others or the community expressed
	W7	Participants feel supported	Open expressions from a participant that they were not making earlier
	W8	Members feel they can change	Expressions of change or transformation on the individual or community level
Final	F1	Sadness or anxiety about the separation	Fears, hopes, concerns expressed
	F2	Farewell gestures	Expressions that say goodbye or are other conventional ways to separate; Organizing sending off activities
	F3	Discussion about courses of action for the future	Expressions of a beginning or new horizon that come in the context of the end; Talk about some follow up meetings

F4	Evaluation or reflecting on the LC experience	Expressions in the past tense reflecting on the process that the community went through; expressions that explicitly note that a process is complete

To analyze how sociocognitive and socioemotional spaces co-developed throughout community life, we performed a chain analysis drawing on the first two parts of the analysis. We focused on chains instead of individual notes to assign meaningful values that represented community developments. Analyzing the notes in chains allowed us to take into consideration the degree to which the community members were talking to one another and building on each other's ideas, in addition to the quality of the notes. This gave the justified added value to notes that were in response to another note, in comparison with orphaned notes.

We operationalized the chains by creating a value system that helped untangle the community-level phenomena. Chain values were calculated by multiplying the quality or depth of notes in a particular chain (D), the rate (over how many days) at which a chain was written (R),[1, 2] and the number of people involved (W). A highly-valued chain would have notes that had high values on the sociocognitive or socioemotional scale, include many notes and participants, and was written in a short duration of time:

$$Chain\ value\ = \frac{(\Sigma note\ values\ in\ a\ chain)\ *\ number\ of\ different\ note\ authors\ in\ chain}{([Q3 - Q1\ day\ range]\ +\ 1)}$$

Figure 2. Calculation of total chain value

Findings

Sociocognitive and socioemotional expressions

In this section, the findings from the grounded analysis of notes on the KF are presented. Notes that had a sociocognitive or socioemotional dimension were assigned a 1 if they were *unelaborated*, a 2 if they were *elaborated*, and a 3 if they were *elaborated and reflective*. In total, 684 notes were coded as part of the sociocognitive space; 1,284 notes were coded as part of the socioemotional space. Table 1 summarizes the operational definitions that we derived.

Space	Operationalization
Socio-cognitive	Bringing in new resources; referencing and elaborating other knowledge-based notes; taking responsibility over the technical aspects of the space; deepening inquiry of the topic (based on external resources); connecting ideas about learning communities to the processes within the community; discussion and responsibility-talking about the knowledge building process
Socio-emotional	Desire to work together as a community; sharing of personal feelings about the group dynamics; reflecting on personal or private feelings about a person's participation or feelings within the community; sharing or reflecting about a person's personal life outside the community; expressions of empathy towards others; likeness and caring towards the community

[1] We multiplied the reciprocal value of the rate (i.e., put it in the denominator) to give a higher value to chains that were written over a fewer number of days.

[2] To determine the duration, we calculated the third quartile value minus the first quartile value (Q3-Q1) to remove outliers, then added one so that chains that were written on a single day would not result in a zero value.

Table 2. Summary of notes in the sociocognitive and socioemotional spaces

Socioemotional development through the stages

The central theme of the group's functioning had to do with their prior experience in the graduate program as a cohort. With the exception of Margaret and Tanya[3], who were new to the group, 16 of the 18 students studied most of their courses together during their first year. One required, introductory course (referred to herein as the "workshop") to the graduate program was based on exploring Jewish and Arab perspectives as part of the intractable regional conflict (Salomon, 2009) and their implications on education. The workshop was moderated by two outside facilitators, leading the group to discuss uncomfortable political topics embedded in the complex personal narratives of the students. The students described their experience in the workshop as loosely structured and causing deep emotional rifts within their cohort. Students explained that the workshop moderators did not bring closure to the group at its end. The workshop leaders took the perspective that as the group had another 18 months (three semesters) together, there would be many more opportunities for discussions to take place. Within this context, several rifts opened between the students, leading to some internal divisions and the general sentiment that the group was as functional as it could be and should just continue this way. With this history, the group entered into the learning community course at the start of their second year in the program. Table 3 provides a weekly summary with notable events that transpired.

Table 3. Weekly summary and notable events across stages of development

Week	Stage	Face-to-face Summary (with specific notable events bulleted)	Online Summary
1	Initial	Students were upbeat, describing themselves falsely as a learning community, holding back from sharing personal information and dealing with their group dynamics. ● First sharing activity ended uncharacteristically quickly	Students were positive, but brief and shallow in their online posts to one another.
2	Initial	N/A	Students were completing tasks without a genuine effort towards building collective understandings; There was a lack of deep, interpersonal engagement in reflective diaries
3	Initial-Transition	Signs of resistance and discomfort ● First group silence occurs	Complex emotions start to be expressed
4	Transition	Expression of confusion and loss of patience ● Two long group silences occur	Avoidance of talking about silence; confusion and resistance
5	Transition	Presentation about silence and first signs that the group wasn't talking about past issues from previous course ● An important discussion between the moderator and Margaret during a break about taking	Writing in the here-and-now with disclosures about self and beginning to raise issues about themselves and the group dynamics

[3] Pseudonyms

		responsibility	
6	Transition-Working	People who were quiet started talking ● Overt mentioning of group's history based in the workshop	Signs of increased openness and understanding about reflection, responsibility, and recognition that the group was changing
7	Working	New levels of intimacy and openness as the group had a discussion about participating and not participating. ● Sophia shared about her son ● Nora shared about her dog ● Sarah opened up to moderator during the break	Many posts in the here-and-now about participating and holding back in the learning community
8	Working	Tense, direct conversation about taking responsibility, feeling judged and being criticized in the community ● Margaret mentioned that she had criticism towards the group and the group openly discussed it	Many expressions of feelings that things were moving and that there was more openness and acceptance. ● Sarah more openly addressed issues from the past ● Paige realized that she shouldn't be the joker
9	Working	Discussion about taking responsibility, commitment and overtly addressing the group's past scars	Many students expressing that they felt a change. ● Nina and Amy put themselves in the center and a significant online conversation where everyone takes part
10	Working	Group expresses more positivity and optimism. ● Nora cries after reading what people write to her in paper activity ● Margaret gets a note saying that she isn't revealing enough about herself.	The group expresses a lot of cohesion, opening up, positive feelings towards the community. ● Jade puts herself in the center of the circle and posts her image. ● Large and very active discussion about the big ideas where everyone participated
11	Working	Many expressions about the importance of interpersonal relationships. ● Margaret shares about growing up and belonging to a kibbutz ● Zack shares about the difficulty of participating and his father-in-law.	Many expressions of personal change and openness
12	Working-Final	Community works together, and share ideas and feedback openly. ● Paige 's high engagement in the rise above activity	Many reflections about the entire community process, many expressions of empathy and care. ● Students self-organize the final activity and food
13	Final	Community engages positively and warmly in final community activities ● Frank organizes a community game based on	Community members write deep and meaningful final reflections ● Group self-organizes a Facebook

what everyone knows about each other • Sarah talks in final activity for the first time	group to stay connected

Several consequential moments helped the group reach high levels of cohesion. During the eighth face-to-face meeting, a conversation took place when both Margaret and Tanya expressed their disappointment with the group, claiming that people were not taking responsibility. This drew a sharp reaction from different members of the group, but appreciation of their feedback as newcomers. Most of the students in the group talked actively, including those that were typically silent, like Jade. In her case, after sharing her personal thoughts, many students in the group expressed how shocked they were that she finally talked publicly. Online expressions continued to show change:

Nina: Finally the community is moving

Bella: I'm glad that people finally felt open enough to talk about what they feel and I promise to make an effort and respond to more people. If someone was hurt in any way, I apologize.

During the ninth week, the moderator posted an image of glasses in the middle of the circle of students' portraits in the socioemotional space of the KF, and asked for any volunteers to drag their portraits to the center if they wanted to be the focus on personal discussion (Figure 3: left). Nina and Amy, two friends who had been relatively quiet throughout the semester, volunteered. In both of their personal views, deep discussions with many participants took place (Figure 3: right).

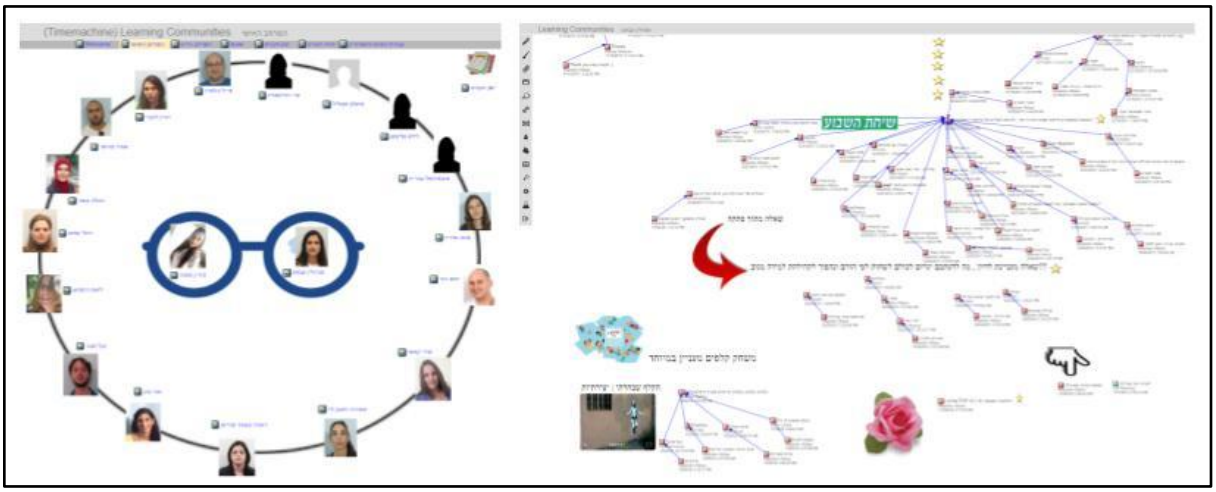

Figure 3 Glasses activity (left); Portion of Nina's personal view where intense community discussion took place (right)

Overall, the discussions on Nina and Amy's views were two of the deepest, most rapid, community-wide discussions that occurred over the semester. These were very visually distinct, as can be seen by their spider-like appearance. Many posts by the students expressed that a deepening of interpersonal relationships was taking place and that the group was now working.

One theme in the discussions touched on the history of the group from the workshop and how it influenced their current behaviors.

By the 10th meeting, the level of community cohesion was strong. During one activity, Nora began crying when she started to share her reflections with the community. She expressed how she sought to be a better version of herself, but didn't feel she was there yet. The feedback she received expressed that the others saw that this better version of herself was already present. Nora's crying was a very dramatic event for the group. This, as was later noted in many reflective diaries, generated strong feelings of cohesion and togetherness among the community members. Nora reflected about the event in an online post:

Nora: I suddenly felt flooded, in shock, surprised. I did not think this was the way I was being seen… I did not think this was the impression I was giving... When I got the feedback, everything flooded in me, all the emotions and the shock... until I felt the excitement in my throat and tears started coming out. I was very anxious about sharing and exposing myself, until it all came out.

By the end of the semester, the community was engaged in numerous activities that expressed their cohesion. For example, the students used the KF to self-organize a lunch for the final meeting as well as a closing activity whereby every person created a gift for another student and described how it represented an aspect of their identity. The discourse, both face-to-face and online, was dominated by reflections on the community process, moving from distrust to high engagement and cohesion.

Emma: I feel that at the beginning of the course there was no trust among the group members and the level of commitment was low... Towards the middle of the course there was a "breakout" in which more people were opened to express their opinions. At this stage, I felt that there was more commitment from the community. After that, I felt that "traffic jams were released" in the group, some past sediments between some of the members were solved, and that the level of trust among the members had increased. People who did not share and did not talk until then began to share and talk and I felt good about it. I felt that the community was doing something to people and I loved it.

Chain analysis of hybridity

We organized the 1,780 notes written throughout the semester into 530 conversational chains, ranging from single notes to the longest chain that included 39 notes. In total, the mean length of chains was 3.18 notes (SD=3.78), the frequency distribution of which can be seen in Figure 4. In total, the top 95 chains (17.82%), all of which were five notes or longer, accounted for 50% of the total number of notes written throughout the semester. The resultant distribution of chain values at the different lengths ranged from 1 through 556, with the top 25 socioemotional chains accounting for 50% of the total socioemotional value, and the top 12 sociocognitive chains accounting for 50% of the total sociocognitive value.

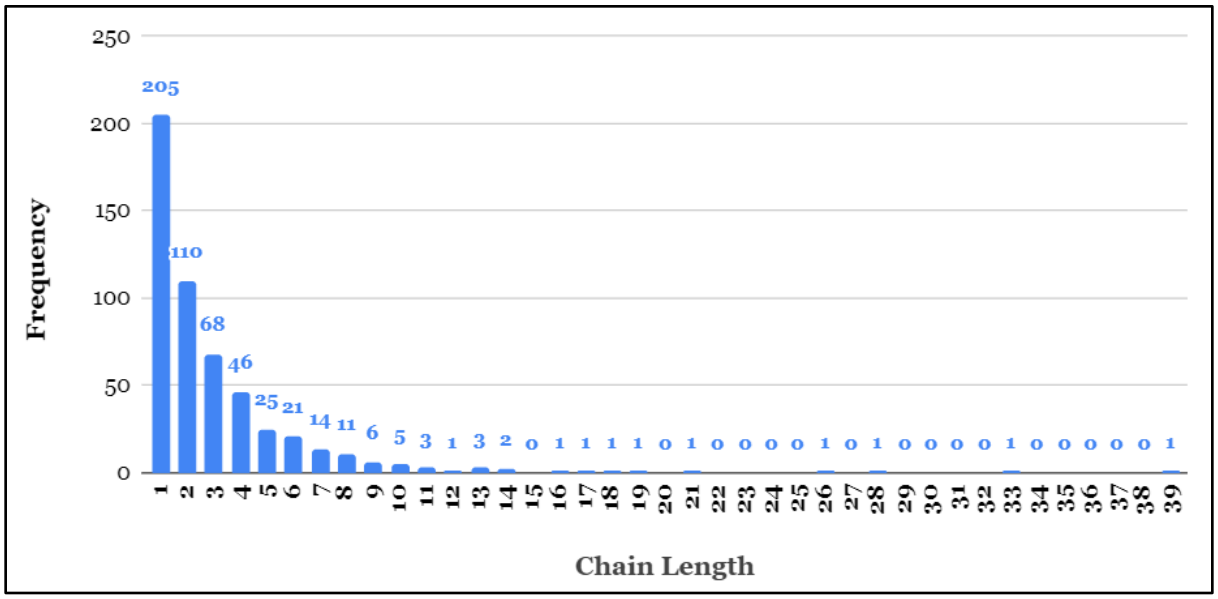

Figure 4. Frequency of Chain Length

Taking into consideration the importance of the deep, rapid, community-wide chains (herein referred to as "DRW chains"), we graphed all chains based on the median day that they were written. As Figure 5 shows, the DRW chains—both socioemotional and sociocognitive—occurred between weeks six and 11, consistent with our description of the community being in the working stage of group development during this period (Table 3). Most notably, the highest intensity chains occurred between the 10th and 11th face-to-face meeting, directly following the socioemotional breakthrough during the 10th face-to-face meeting.

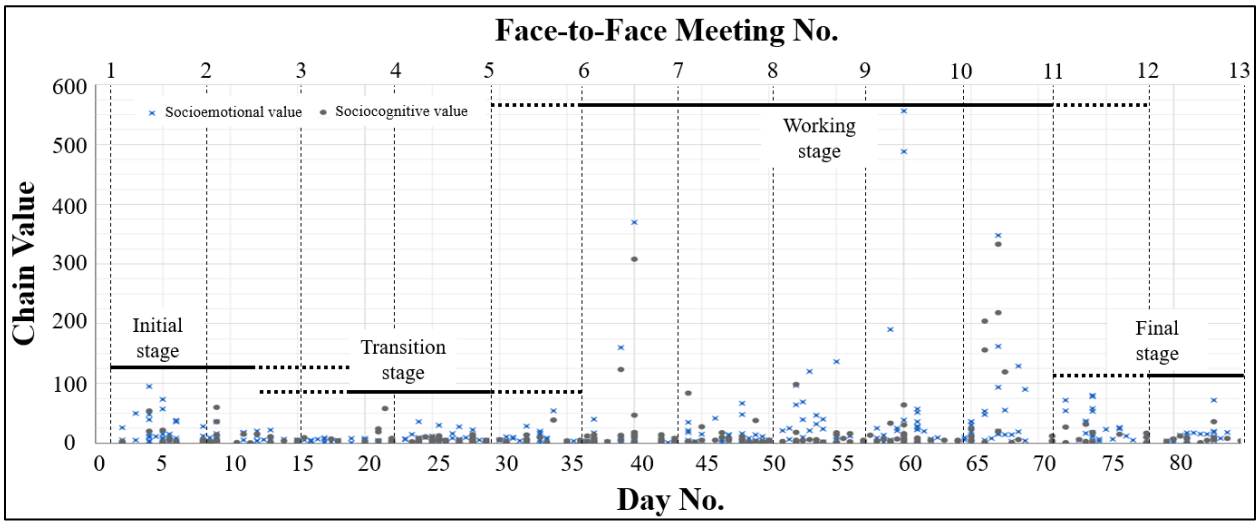

Figure 5. Chain values graphed by the median day they were written

Zooming in to this heightened period of community activity shed light on a visually distinct phenomenon that occurred on the KF. Specifically, the five highest socioemotional DRW chains occurred within a short timespan (median days 55, 59, 60, 60, 67, respectively) (Figure 6). Visually, these resembled the spider chains previously reported.

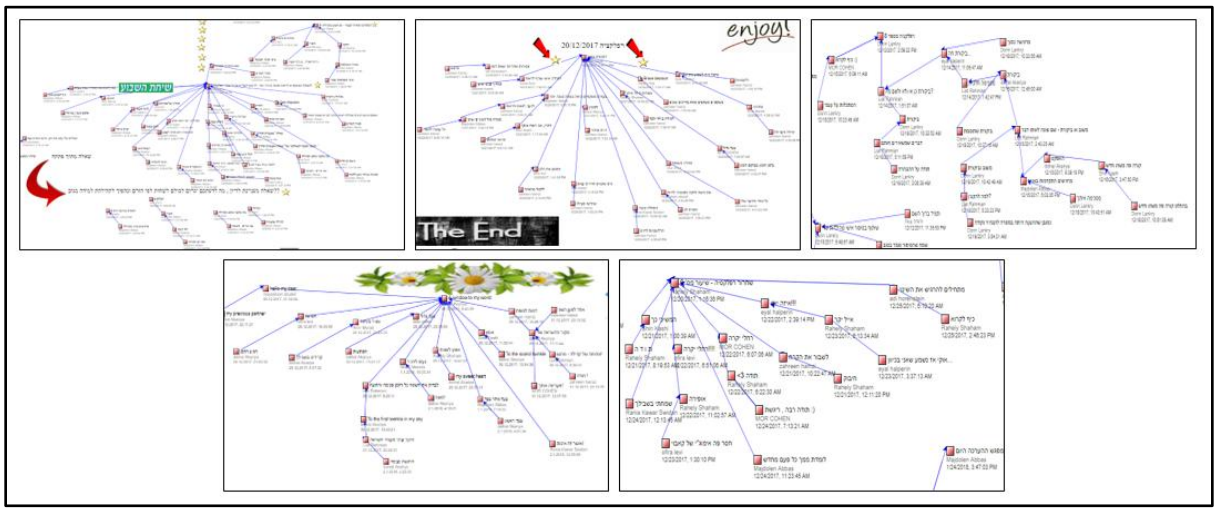

Figure 6. Spider-like visualization of DRW socioemotional chains

During that same period, a visually similar phenomenon took place in the sociocognitive dimension (median days 66, 66, 67, 67, 68, respectively). Specifically, the DRW chains that ensued dealt with the different ongoing inquiry lines (Figure 7). In comparison to the past, where every group worked primarily on their own questions, there was a great deal of cross-group building-on and interest from other groups, with an average of 9.8 participants per chain. These five were among the seven strongest sociocognitive chains that emerged throughout the entire semester (all of which occurred during the working stage).

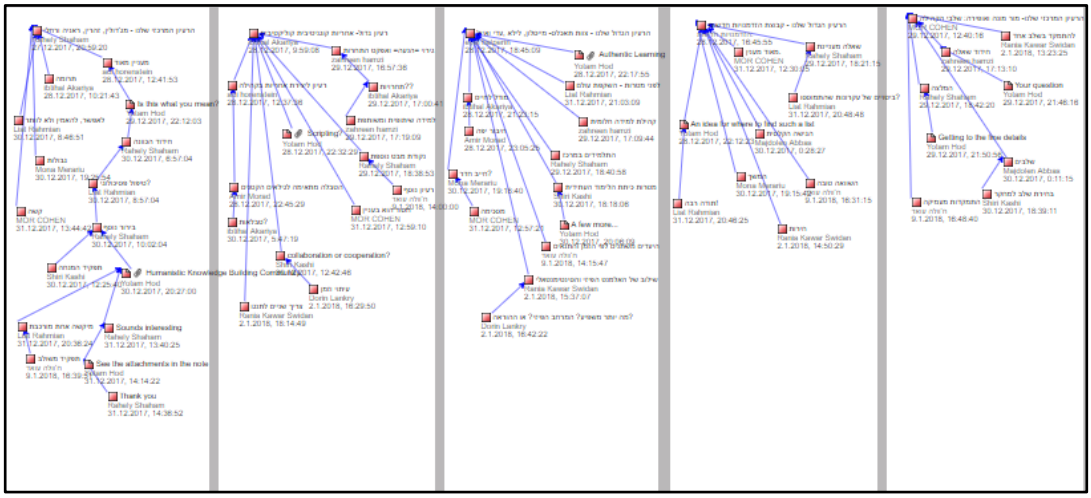

Figure 7. Five different sociocognitive DRW chains that emerged during week 10

Discussion

This study aimed to examine the intricate relationship between sociocognitive and socioemotional spaces in technology-enhanced learning communities. The study was broken into three parts. Part one resulted in operational criteria to determine the relative values of contributions on sociocognitive and socioemotional spaces. Part two showed how this particular KBC fit a typified pattern of growth, requiring a serious investment to support. This provided the macro-level

socioemotional context to understand the developments. The third part elucidated how the significant socioemotional developments over the stages were consequential for development of the sociocognitive space. The chain analysis, in particular, showed how the sociocognitive and socioemotional developments were inextricably related.

The key take away has to do with the DRW chains that emerged during the working stage. We use the metaphor of a garden, where after a great deal of sun, nutrients, and water, suddenly a new, colorful flower emerges that attracts all the visitors' attention. The DRW chains are this flower; they represent serious knowledge advancements that engaged all members of the community learning from one another and discussing their ideas actively and deeply. Reaching such a pinnacle is not easy and most likely will not occur at the start of any community. Research shows that achieving deep discourse involves varied, principled efforts. Many of these principles have been articulated and are widely known, such as on knowledge building (e.g., Zhang et al., 2011). But, the principles in KBCs that are largely undertheorized and have only been gaining attention in recent years are those involved in fostering the socioemotional space of communities. The findings of this paper advance the conversation on KBCs in this direction (Hod, Basil-Shachar, & Sagy, 2018)

Stages of Knowledge Building Community Development

Our analysis of the developmental stages showed how the macro-level socioemotional context was consequential for the sociocognitive space. At the start of the semester, most members of the community conveyed a verbal message that they already felt comfortable with and loved by everyone. Very quickly, there were signs that began to reflect a less harmonious picture of the community. This description revealed some complex group processes mainly based on historical events. As the community was asked to reflect on themselves, it became clear that many students were content engaging in moderate levels of knowledge building. The macro-level context whereby the group slowly confronted its past and transitioned into a highly functioning community takes on a clearer form when viewed through the model of developmental stages.

Examining group phenomena from this perspective has very practical implications. One of these is that instead of running away from conflicts, as is often the case in both research and practice, it is important to explore and investigate them (Slakmon & Schwarz, 2019). Moving in this direction is often counter-intuitive, but vital to reach high levels of cohesiveness. This research serves as a case study for this type of activity. Instead of accepting the group's notion that they were a community at first — a term used so, commonly today as if by "linguistic fiat" (Grossman, Wineburg, & Woolworth, 2001, p. 5)—the group was challenged to explore their interpersonal relationships in the here-and-now and, in so doing, deepened their collectively-held meanings of and participation in their learning community.

One important question that this finding raises has to do with idiosyncrasy of our research setting given the unusual background of this particular community. Specifically, the ratio of socioemotional to sociocognitive notes was roughly 2:1, and one may legitimately wonder if this is tied to the history of the group (in the workshop) and/or to the two new members of the community (Margaret and Tanya). We cannot be entirely sure of the underlying reasons for the outsized number of socioemotional notes. Still, we note that it is common for a group who already has a shared history to be asked, at some point in their functioning, to organize as a learning community. A great deal of formal schooling includes relatively static groups and in so far that a single course in a program is designed as a learning community, the situation is similar to ours. Furthermore, even in cases where groups come together for the first time, their socioemotional

functioning will develop due to interpersonal issues that arise, and so these need to be attended to. The interpersonal issues that we saw, such as vying for control or feeling unsafe and criticized, are typical for groups (Corey, Corey, & Corey, 2018). Therefore, we would expect there always to be a significant component of socioemotional activity when groups are asked to reflect on themselves as a community. Whatever the situation may be, the number and quality of notes is not fixed. In our study, we believe that the high levels of socioemotional notes spurred higher levels of sociocognitive functioning. If the group had not worked through their socioemotional issues by going through the stages of development, our evidence (particularly from the chain analysis) suggests they their knowledge building would not have been so deep.

Chain analysis

To bring together the sociocognitive and socioemotional categories in relation to the stages of community development, we performed an analysis of the conversational chains. Analysis of these chains began was informed by the spider-like visualizations that the stages of community development indicated had great significance within the community. Our findings showed a correspondence between the sociocognitive and socioemotional spaces in that both appeared intertwined throughout the four stages, but equally fluctuated as the group developed from one stage to the next. Furthermore, we can see a slight delay in the onset of the sociocognitive dimension, particularly in reaching high levels, which suggests that their high levels of functioning are predicated on highly functional socioemotional spaces.

The delay in sociocognitive development may be one of the main reasons that socioemotional spaces are often considered as infrastructure for their cognitive counterpart (e.g. Bielaczyc, 2009). Considering the socioemotional space to be infrastructure is akin to considering it as a road which cars (the sociocognitive space) drive on. This infrastructure metaphor has been useful when we prioritize one over the other, as is often the case in formal education. However, in the context of contemporary needs where socioemotional skills are seen as co-dependent and equally important as their sociocognitive counterpart, considering this mutuality in a hybrid space is a more useful metaphor.

Conclusion

This study sheds light on a relatively undertheorized, but growing interest in research on educational technologies. It addresses an important gap in the literature on KBCs, which have been designed to foster sociocognitive spaces without considering the important mediating role of socioemotional spaces. Though the sociocognitive and socioemotional dimensions of learning have long been theorized as being inseparable, it is important for research on technology-enhanced learning to examine their hybridity to get a more complete understanding of community functioning. Theoretically, this research shows how macro-level socioemotional variables, captured by stages of group development, mediate sociocognitive developments. The practical implications of this research can help designers of hybrid spaces support the complex, interwoven goals of their community.

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Statements on open data, ethics and conflict of interest

A request to access the detailed coding procedures and data samples can be directed to the authors. There are no conflicts of interest involved in this study. We received approval from the relevant institutional ethics committee and strictly following their guidelines.

References

Arrow, H., Poole, M., Henry, K., Wheelan, S. & Moreland, R. (2004). Time, change and development: Temporal perspective on groups. *Small Group Research*, *35*(1), 73-105.

Baker, B., Andriessen, M. & Järvelä, J. (Eds.) (2014). *Affective Learning Together: Social and Emotional Dimensions of Collaborative Learning.* Routledge.

Barron, B. (2003). When smart groups fail. *The Journal of the Learning Sciences*, *12*(3), 307-359.

Bielaczyc, K. (2009). Designing social infrastructure: Critical issues in creating learning environments with technology. *Journal of the Learning Sciences*, *15*(3), 301-329.

Brabender, V. (2010). Group development. In R. K. Conyne (Ed.), *Oxford handbook of group counseling* (pp. 182-204). Oxford, UK: Oxford University Press.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, *18*(1), 32-42.Carabajal, K., LaPointe, D., & Gunawardena, C. N. (2003). Group development in online learning communities. In M. G. Moore, & W. G. Anderson (Eds.), *Handbook of distance education* (pp. 217-234). Mahwah, NJ: Lawrence Erlbaum Associates.

Charmaz, K. (2008). Grounded theory as an emergent method. In S. N. Hesse-Biber, & P. Leavy (Eds.), *Handbook of emergent methods* (pp. 155-172). New York: The Guilford Press.

Collins, A. (2017). *What's Worth Teaching? Rethinking Curriculum in the Age of Technology.* New York, NY: Teachers College Press.

Corey, M. S., Corey, G., & Corey, C (2018). *Groups: process and practice* (10th Ed.). Belmont, CA: Brooks/Cole Publishing Company.

Cornelius-White, J. H., & Harbaugh, A. P. (2010). *Learner-centered instruction: Building relationships for student success.* Thousand Oaks, CA: Sage publications.

Cress, U., Rosé, C. P., Law, N., Ludvigsen, S. (2019). Investigating the complexity of computer-supported collaborative learning in action. *International Journal of Computer-Supported Collaborative Learning*, *14*(2), 137-142.

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th edition). Boston, MA: Pearson Education.

Dooner, A. M., Mandzuk, D., & Clifton, R. A. (2008). Stages of collaboration and the realities of professional learning communities. *Teaching and Teacher Education*, *24*(3), 564-574.

Eberle, J., Hod, Y., & Fischer, F. (2019). Future learning spaces for learning communities: Perspectives from the learning sciences. *British Journal of Educational Technologies*, *50*(5), 2071-2074.

Ellis, R. A., & Goodyear, P. (2016). Models of learning space: Integrating research on space, place and learning in higher education. *Review of Education*, *4*, 149–191.

Grossman, P., Wineburg, S., & Woolworth, S. (2001). Toward a theory of teacher community. *The Teachers College Record*, *103*(6), 942–1012.

Herrenkohl, L. R., & Mertl, V. (2010). *How students come to be, know, and do: A case for a broad view of learning*. Cambridge University Press.

Hod, Y., & Ben-Zvi, D. (2015). Students negotiating and designing their collaborative learning norms: A group developmental perspective in learning communities. *Interactive Learning Environments*, *23*(5), 578-594.

Hod, Y., Basil-Shachar, J., & Sagy, O. (2018). The role of productive social failure in fostering creative collaboration: A grounded study exploring a classroom learning community. *Thinking Skills and Creativity*, *30*, 145-159.

Hod, Y., & Sagy, O. (2019). Conceptualizing the designs of authentic computer-supported collaborative learning environments in schools. *International Journal of Computer Supported Collaborative Learning*, *14*(2), 143-164.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, UK: Cambridge University Press.

Marmarosh, C. L., & Van Horn, S. M. (2010). Cohesion in counselling and psychotherapy groups. In R. K. Conyne (Ed.). *The Oxford Handbook of Group Counseling* (pp. 137-163) Oxford, UK: Oxford University Press.

McInnerney, J. M., & Roberts, T. S. (2004). Online learning: Social interaction and the creation of a sense of community. *Educational Technology & Society*, *7*(3), 73-81.

Näykki, P., Järvelä, S., Kirschner, P. A., & Järvenoja, H. (2014). Socio-emotional conflict in collaborative learning—A process-oriented case study in a higher education context. *International Journal of Educational Research*, *68*, 1-14.

Purwanto, A., Zuiderwijk, A., & Janssen, M. (2018). Group development stages in open government data engagement initiatives: A comparative case studies analysis. *In International Conference on Electronic Government* (pp. 48-59). Springer, Cham.

Rogers, C. R. (1969). *Freedom to Learn*. Columbus, OH: Charles Merrill Publishing Company.

Rogoff, B. (1994). Developing understanding of the idea of communities of learners. *Mind, culture, and activity*, *1*(4), 209-229.

Salomon, G. (2009). Peace education: Its nature, nurture and the challenges it faces. In *Handbook on building cultures of peace* (pp. 107-121). New York, NY: Springer

Scardamalia, M. (2002). Collective cognitive responsibility for the advancement of knowledge. In B. Smith (Ed.), *Liberal education in a knowledge society* (pp. 67–98). Chicago IL: Open Court.

Scardamalia, M., & Bereiter, C. (1994). Computer support for knowledge-building communities. *Journal of the Learning Sciences*, *3*(3), 265-283.

Schmuck, R. A., & Schmuck, P. A. (1975). *Group processes in the classroom (Second edition).* Iowa: USA: Brown Company Publishers.

Schoenfeld, A. H. (2007). Method. In F. K. Lester (Ed.), *Second Handbook of Research on Mathematics Teaching and Learning* (pp. 69-107). Charlotte, NC: Information Age Publishing.

Sfard, A. (1998). On two metaphors for learning and the dangers of choosing just one. *Educational Researcher*, *27*(2), 4-13.

Slakmon, B., & Schwarz, B. B. (2019). Deliberative emotional talk. *International Journal of Computer-Supported Collaborative Learning*, *14*(2), 185-217.

Strauss, A. (1987). *Qualitative analysis for social scientists.* Cambridge, UK: Cambridge University Press.Tuan, Y.-F. (1977) *Space and place: The perspective of experience.* Minneapolis, MN: University of Minnesota Press.

Turnbull, D. (2002) Performance and narrative, bodies and movement in the construction of places and objects, spaces and knowledge, *Theory, Culture & Society*, *19*, 125–143.

U.S. Department of Education (2017). *Reimagining the Role of Technology in Education: National education technology plan update.* Washington, D.C., Office of Educational Technology.

Weissberg, R. P., Durlak, J. A., Domitrovich, C. E., & Gullotta, T. P. (Eds.). (2015). Social and emotional learning: Past, present, and future. In J. A. Durlak, C. E. Domitrovich, R. P. Weissberg, & T. P. Gullotta (Eds.), *Handbook of social and emotional learning: Research and practice* (p. 3–19). The Guilford Press.

Wilson, D. B., Gottfredson, D. C., & Najaka, S. S. (2001). School-based prevention of problem behaviors: A meta-analysis. *Journal of Quantitative Criminology*, *17*, 247–272.

Yalom, I. D., & Leszcz, M. (2005). *The theory and practice of group psychotherapy* (5th Ed.). New York, NY: Basic Books.

Zhang, J., Hong, H. Y., Scardamalia, M., Teo, C. L., & Morley, E. A. (2011). Sustaining knowledge building as a principle-based innovation at an elementary school. *The Journal of the Learning Sciences*, *20*(2), 262-307.

Zhang, J., Scardamalia, M., Reeve, R., & Messina, R. (2009). Designs for collective cognitive responsibility in knowledge-building communities. *The Journal of the Learning Sciences*, *18*(1), 7-44.

Zins, J. E., Bloodworth, M. R., Weissberg, R. P., & Walberg, H. J. (2007). The scientific base linking social and emotional learning to school success. *Journal of educational and psychological consultation*, *17*(2-3), 191-210.