JYX JYVÄSKYLÄN YLIOPISTO UNIVERSITY OF JYVÄSKYLÄ

This is a self-archived version of an original article. This version may differ from the original in pagination and typographic details.

Author(s): Lainema, Kirsi; Syynimaa, Kirsi; Lainema, Timo; Hämäläinen, Raija

Title: Organizing for collaboration in simulation-based environments : an affordance perspective

Year: 2023

Version: Published version

Copyright: © 2021 The Author(s). Published with license by Taylor & Francis Group, LLC.

Rights: CC BY 4.0

Rights url: https://creativecommons.org/licenses/by/4.0/

Please cite the original version:

Lainema, K., Syynimaa, K., Lainema, T., & Hämäläinen, R. (2023). Organizing for collaboration in simulation-based environments : an affordance perspective. Journal of Research on Technology in Education, 55(2), 307-323. https://doi.org/10.1080/15391523.2021.1962451

Journal of Research on Technology in Education

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/ujrt20

Organizing for collaboration in simulation-based environments: An affordance perspective

Kirsi Lainema, Kirsi Syynimaa, Timo Lainema & Raija Hämäläinen

To cite this article: Kirsi Lainema, Kirsi Syynimaa, Timo Lainema & Raija Hämäläinen (2021): Organizing for collaboration in simulation-based environments: An affordance perspective, Journal of Research on Technology in Education, DOI: 10.1080/15391523.2021.1962451

To link to this article: https://doi.org/10.1080/15391523.2021.1962451

© 2021 The Author(s). Published with license by Taylor & Francis Group, LLC.

Published online: 25 Oct 2021.

Submit your article to this journal

View related articles

View Crossmark data

Full Terms & Conditions of access and use can be found at
https://www.tandfonline.com/action/journalInformation?journalCode=ujrt20

JOURNAL OF RESEARCH ON TECHNOLOGY IN EDUCATION
https://doi.org/10.1080/15391523.2021.1962451

Routledge
Taylor & Francis Group

OPEN ACCESS Check for updates

Organizing for collaboration in simulation-based environments: An affordance perspective

Kirsi Lainema[a], Kirsi Syynimaa[a,b], Timo Lainema[b] and Raija Hämäläinen[a]

[a]University of Jyväskylä, Jyväskylä, Finland; [b]University of Turku, Turku, Finland

ABSTRACT

Extant research has identified the significance of technological affordances in computer-supported learning environments. However, until recently, there is scarcely empirical research on affordances for organizing collaboration in these learning environments. To address this gap, this study empirically examines affordances for organizing collaboration in a simulation-based learning environment. We focus, in particular on understanding how the organizing affordances of the learning environment are perceived and employed by the learners during a simulation-based learning task. The study was executed among 177 undergraduate higher education (HE) business students from 10 universities in Belgium, China, Estonia, New Zealand, the USA, Austria, and Finland. The data were obtained from the students' reflective essays, and analyzed with a qualitative content analytical approach. The results of our analyses yield in four types of organizing affordances: (1) organizing the division of work, (2) managing information and resources, (3) managing tasks, and (4) strategizing. Each type of organizing affordance was required in the joint learning task. The study offers an advanced understanding of affordances for organizing and of their use/nonuse in simulation-based learning environments. The findings of this study have theoretical and empirical implications and can contribute to both the development of pedagogic and educational practices as well as the design of learning tasks and environments.

ARTICLE HISTORY
Received 18 November 2020
Revised 30 June 2021
Accepted 2 July 2021

KEYWORDS
Affordances; organizing; collaboration; simulation-based learning; CSCL

The global pandemic caused by COVID-19 has put societies and citizens in an unprecedented situation involving social distancing and lockdown. For the first time in history, universities in many regions have been mandated to ban attendance to their premises, and to implement digital learning solutions on a large scale. Teachers and students alike have taken a giant leap technologically, pedagogically and socially. Consequently, the need for computer-supported and simulation-based learning environments that foster collaborative learning has amplified.

Hence, research on computer-supported collaborative learning (CSCL) has gained momentum (Stahl & Hakkarainen, 2020). Collaborative learning continues to be one of the most popular research topics in the field of computers in education (Chen et al., 2020). At the same time, the use of simulation-based learning environments, a specific type of CSCL has increased (Oksanen et al., 2018). Correspondingly, an abundance of research has been carried to create learning environments that cater for a more accessible, immersive and authentic learning experience (e.g., Ke et al., 2020; Lin et al., 2020). An important stream of research in this context focuses on affordances.

The term "affordance" was first coined by Gibson (1979), who used it to refer to the functional properties that determine the possible utility of an object or an environment. Later, various authors expanded the concept, emphasizing different aspects and considering usability in addition

CONTACT Kirsi Lainema kirsi.lainema@utu.fi Department of Management and Entrepreneurship, University of Turku, FI-20014 TURUN YLIOPISTO, Finland.
© 2021 The Author(s). Published with license by Taylor & Francis Group, LLC.
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

to utility (e.g., Kirschner et al., 2004; Park & Song, 2015). Further elaborations of the concept addressed whether affordances are intended (i.e., embedded in the environment) or emergent (i.e., emerging through learners' interactions with the environment), whether affordances are functional or nonfunctional, and whether they are potential or actual (see Stendal et al., 2016). The concept of affordance has been employed in a variety of meanings and it has found application in Education (Berthelsen & Tannert, 2020; Churchill & Churchill, 2008; Kirschner et al., 2004; Park & Song, 2015; Wang et al., 2020) and Information Systems and studies of technology (Chatterjee et al., 2020; Majchrzak & Markus, 2012). Furthermore, affordances have been examined in Communication and Social Media Studies (Meredith, 2017; Rice et al., 2017; Saebø et al., 2020) and in Management and Organization studies (Baralou & Tsoukas, 2015; McCord & Franetovic, 2014).

Simulation-based learning environments, similarly to CSCL in general, ground on collaboration of groups of learners that work in computer-supported contexts to accomplish joint tasks. In studies of CSCL The technological aspects have received extensive attention, and studies of technological affordances are abundant (Meredith, 2017; Suthers, 2006). In addition, various studies have explored the socio-interactional and educational affordances (Jeong & Hmelo-Silver, 2016; Lee et al., 2020; Park & Song, 2015) and learning materials (Berthelsen & Tannert, 2020) in CSCL. Previous research has examined how groups of students organize their interaction to achieve their shared goals (e.g., Perit Çakır et al., 2009). Other studies point out to the importance of organizing how learners collaboratively assume responsibility for their teamwork (Hernández-Sellés et al., 2019). How organizing for collaboration takes place in CSCL and how the learning environment may or may not support collaboration have, however largely remained unexplored particularly from the students' view. Consequently, there is scarcely empirical research on how organizing is afforded in CSCL environments, such as simulation-based environments. This is surprising considering the centrality of organizing in all collective action, such as innovation, for example (Dougherty, 2017). Furthermore, collaboration has until recently, not been addressed from the perspective of how it is organized by the learners themselves. This study sets out to investigate how organizing affordances are perceived and employed by the learners during a simulation-based learning task.

Joint activity in CSCL environments requires that the learners use technologies in methodical ways to ensure that their actions are intelligible to each other, and to sustain their joint work (Hernández-Sellés et al., 2019; Perit Çakır et al., 2009). Simulation-based environments often lie between scripting specific organizational roles for participants (Heinonen et al., 2020) and organizing space and starting points for spontaneous collaboration (Strijbos & Weinberger, 2010) Particularly in spontaneous contexts, organizing for collaboration is elementary to the cohesion of the collaborative team and the effectiveness of learning.

Candy (1991) notes that the learners' ability to contribute to the learning task depends on the possibilities the environment offers for them. Therefore, the affordance perspective is particularly suitable for examining how groups of learners spontaneously organize for collaboration in simulation-based learning environments. The affordance perspective allows for examining the coordinated action of learners (Berthelsen & Tannert, 2020). This study makes a timely contribution by adopting an affordance perspective to investigating how groups of learners organize for collaboration in a simulation-based learning environment. Thus far, most studies have focused on listing and reporting affordances without considering how they are perceived and put into use by learners (e.g., Berthelsen & Tannert, 2020).

The rapid global deployment of distant learning due to COVID-19 pandemic has revealed shortages in learning technologies and infrastructures as well as in the competencies of both teaching staff and the students in HE (Crawford et al., 2020; Marinoni et al., 2020). Students in vulnerable economic, psychological and social situations have been affected most severely by the lockdown (Aristovnik et al., 2020). How the application of distant learning and different learning technologies during confinement has contributed to or hindered learning results is yet unknown (Gonzalez et al., 2020). Consequently, now more than ever there is a need for

research-based knowledge on the preconditions for effective computer-supported learning, and particularly on the premises for successful collaborative learning.

In its part, the current study aims at generating timely and much needed knowledge of aspects that promote collaboration in CSCL environments. In this study, empirical data is collected in an authentic context and analyzed to illuminate the learners' view on affordances in a simulation-based learning environment. The two interrelated research questions of this study are *What kinds of organizing affordances do students perceive when collaborating in a simulation-based learning environment* and *How are these affordances employed (or not) in their joint learning task?*

Organizing simulation-based learning: An affordance perspective

Simulation-based learning environments as a type of CSCL environments provide learning communities shared spaces for creating, visualizing, organizing, sharing and advancing knowledge (Stahl & Hakkarainen, 2020, p. 11). They contain the main elements of CSCL: they ground on collaboration of groups of learners in computer-supported contexts. Simulation-based educational games allow for solving authentic, real-life problems, and exercising skills and competencies that may be hard to learn in a classroom context (Lainema, 2004). Learners collaboratively pursue to address a learning problem in a dynamically changing context (Suthers, 2006). Simulation-based environments illustrate dynamic and complex systems, and allow to collaboratively learn and rehearse safe and risk-free decision-making in contexts such as business, logistics, healthcare, and environmental planning (Köhler et al., 2013; O'Regan et al., 2016; Sterman, 2011)

The starting point for learning in simulation-based learning environments is the learners' commitment to collaborative action to accomplish a joint goal. According to Lehtinen et al. (1999), collaborative learning involves multiple learners working toward a shared learning goal. Hämäläinen and Vähäsantanen (2011) state that collaboration is typically described based on certain types of (a) shared learning processes, such as knowledge building (Scardamalia & Bereiter, 1994) or shared knowledge construction (Arvaja et al., 2008), and/or (b) shared learning activities, such as argumentation (Andriessen, 2006) or explanation (Sandoval, 2003). Learning in CSCL and simulation-based environments are affected by the quality of these shared processes and activities. In this study, the term "collaboration" refers to the activities of learners pursuing a shared goal. In this process, the learners may divide tasks, but they eventually achieve a joint accomplishment.

When students collaborate in the simulation-based learning environment without the clear leadership or management hierarchies, they need to quickly advance ideas and generate and make decisions to collaborate successfully (Lee et al., 2020). How this collaboration is organized becomes therefore a topic of great importance. The study of Hernández-Sellés et al. (2019) reveals that organizing for collaboration played a central role in how learners took responsibility for their teamwork. The students also perceived that the time allocated to organizing the group work was to some extent compensated by the learning that they acquired (Hernández-Sellés et al., 2019). Organizing for collaboration can, thus be regarded as key activity in simulation-based learning. Consequently, how the learning environment affords for organizing and how the students employ these affordances in their collaboration become issues of great interest.

Studies on affordances related to organizing have until to date predominantly focused, for example on organizational changes, processes, and developments (McCord & Franetovic, 2014; Strong et al., 2014). In addition, organizations as collections of actors or sites and contexts for studies on affordances (e.g., Chatterjee et al., 2020; Ellison et al., 2015) have been probed. Furthermore, some studies have examined affordances as organizational resources (e.g., Rice et al., 2017; Strong et al., 2014).

Some studies have probed into organizing collaboration from the affordance perspective. Perit Çakır et al. (2009) found that interactional organizing facilitated joint problem-solving, and allowed learners to invoke and operate with multiple realizations of their mathematical artifacts. The chat posts and drawing inscriptions were identified as affordances for understanding.

Zammuto et al. (2007), in turn, studied the enterprise resource planning systems to capture the organizing character of affordances. In their study, the organizing affordances of an enterprise resource planning system referred to possibilities for visualizing all work processes afforded by implementation of the system. The implementation of enterprise resource planning systems lead to different outcomes in different organizations.

Saebø et al. (2020) study on collective action in a political movement identified the following organizing affordances: adapting rules and processes, making decisions collectively, circulating information, crossing boundaries, (de)structuring the community, acting ubiquitously, engaging in delimiting actions, connecting members, and triggering actions. The authors suggest that the affordances for organizing collective action are combinations of various affordances. These studies feature affordances for organizing in different contexts, and illuminate joint problem-solving and interaction in relation to organizing. However, the way in which these affordances provide the potential for organizing collective action in practice remains inexplicit.

Organizing can be perceived as the assembling of available resources to attain order, structure, and organizational objectives. In the context of this study, organizational objectives correspond to the team task. Affordances are action potentials that are best phrased using action verbs or gerunds, such as "share knowledge" or "information sharing," and can be regarded as the acts or behaviors afforded by the environment and perceived by the learners (Majchrzak & Markus, 2012; Michaels & Carello, 1981). Fayard and Weeks (2014) further stress that the action orientation emblematic of the concept of affordances needs to be preserved in the treatment of the concept. Consequently, organizing affordances can be defined as action potentials for assembling the available resources to attain order and structure and to accomplish the team task. This rendering is in line with our aim of investigating how teams of students perceive and employ (or not) affordances for organizing collaboration in a simulation environment. Furthermore, the affordance perspective is well suited for examining the coordinated actions of groups of people (i.e., learners) working to pursue a common goal (Strong et al., 2014).

Affordances from the learners' perspective

Analysis of the applicability and usefulness of a learning technology requires evaluation of how the affordances of the technology respond to learners' needs (Antonenko et al., 2017). To look beyond the functionality of the learning system, we adopt a more comprehensive view of affordances that includes the learners' perspective, and consider some of the preconditions related to affordances from the learners' view.

First, affordances are relational in the sense that they have a meaning to the learner for a specific learning task (Antonenko et al., 2017). An affordance must be perceivable and meaningful so that it can be used, and it must support or anticipate an action in which the learner wants and needs to engage (Kirschner et al., 2004; Wang et al., 2020). Nevertheless, Margolis et al. (2006) point out that designers of learning environments often fail to link the users' needs with the affordances of the learning technology. Instead, emphasis has been on what can be designed instead of what should be designed considering the learners' needs (Reeves & Reeves, 2015).

Second, despite their relevance for the learning task, some affordances may not be employed. Affordances, thus, represent the potential for action to achieve an immediate concrete outcome rather than a prescription for doing so (Bygstad et al., 2016; Strong et al., 2014). How and if affordances are employed or not is, however not primarily a design issue (Stendal et al., 2016). Instead, the social and collaborative aspects may have greater importance, and therefore more attention needs to be paid to examining how participants of social groups actually employ technologies (Leonardi, 2013).

Third, the learner must have the necessary cultural knowledge to perceive the action potential of the environment and its elements. Thus, in order to perceive the action potential of

something, the user first needs to learn to use it (Dohn, 2009). This is a particularly pertinent aspect in international learning contexts that may accommodate students from diverse economic, social, disciplinary and educational backgrounds.

Finally, the learner must have the necessary capacity and skills to take advantage of the affordances. These include skills for using computers and diverse computer software and applications, collaboration skills (especially skills for online collaboration), language skills (English as a lingua franca), and knowledge of appropriate business concepts. Thus, more attention needs to paid to the learners' diversity when designing CSCL (Jeong & Hmelo-Silver, 2016). The recent rapid deployment of computer-supported distant learning solutions worldwide further emphasizes this aspect (see e.g., Crawford et al., 2020; Marinoni et al., 2020).

In sum, various aspects potentially affect how—and whether—affordances can be perceived and utilized, which stresses the pertinence of generating new research-based knowledge on affordances from the learners' perspective.

Methods

The learning environment and the learning task

The study was conducted on an online course with undergraduate students in business programs ($N = 177$) at 10 universities in Belgium, China, Estonia, New Zealand, USA, Austria (2 universities), and Finland (3). These students represent 38 different nationalities, the most common of which are Finnish (52 students), New Zealander (52), Austrian (29), Belgian (15), and Chinese (14).

During the course, students played the business simulation game in randomly assigned teams of 10–13 members, and 18 teams in total. The simulation game took place on two days separated by two weeks. Both simulation days lasted for 14 hours, which allowed the teams to work in shifts through various time zones. Working in shifts was natural due to the geographical dispersion of the participants. It was recommended that each team have at least 3–4 team members online at all times.

The task was to manage the operations of a manufacturing company in a clock-driven business simulation game. Each team procured raw materials for manufacturing, organized production, and managed warehousing, sales, and deliveries. The business simulation game could be accessed by each student with their own computers from the location of their choice using a remote access software (RealVNC). The user interface is displayed in Figure 1.

The participants were instructed to join the business simulation game from a peaceful location with a stable Internet connection. Thus, the physical context was, for example a space at home or the university or a nook at the library. The digital context comprised the business simulation game and various communication, information storage and planning applications at the students' disposal.

It was recommended (but not mandated) that the students communicate using Skype's Voice over Internet Protocol (VoIP). Moreover, students could choose to employ various other applications, such as Skype chat, Adobe Connect (video meeting software), text messaging, and email. In addition, Google Docs was available for communication and information storage. Excel charts, Word documents, and Doodle polls were used to structure information, make plans, and divide tasks and responsibilities.

Figure 2 illustrates how teams of students connected to the simulation game via Internet, shared the view to their simulation company on their computer screens and communicated via Skype.

Before the simulation exercise, the students got information about the available and recommended software and applications as well as about the simulation content, preliminary readings, and assignments on the course website. Each team received a list of team members and their email addresses to initiate contact. The teams were free to decide how they would organize their

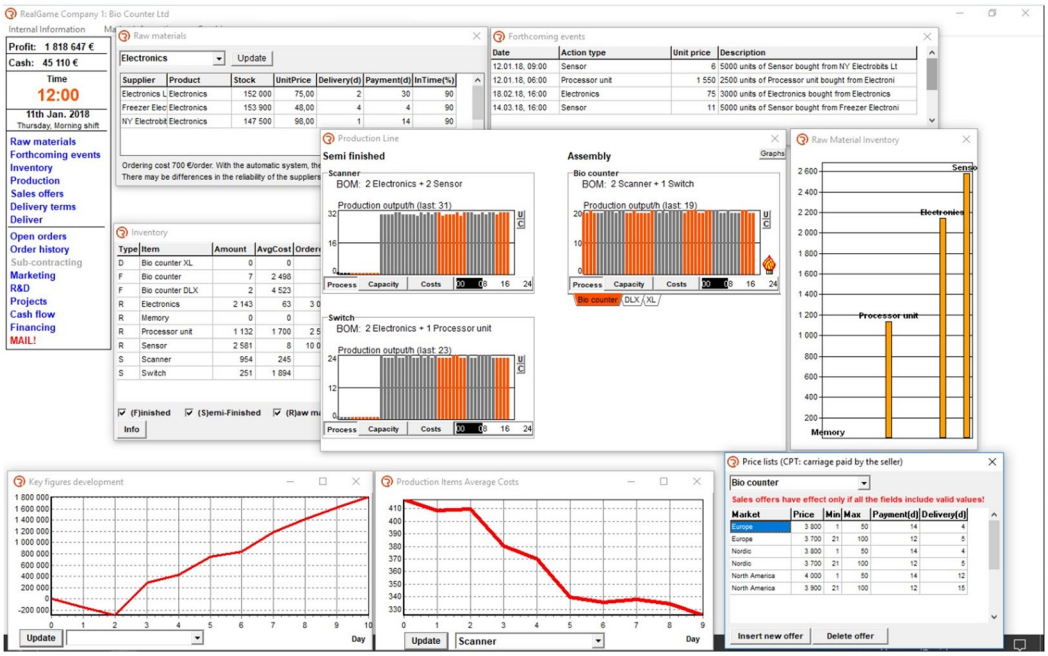

Figure 1. User interface of the simulation game.

Figure 2. Virtual setting of the simulation game: students remotely connected to the simulation are looking at the same view on their computer screens while engaged in a synchronous discussion using VoIP.

teamwork and which software solutions they would use for organizing their teamwork and for communicating.

The learning aims of the course were loosely set to support the main goal of the course: to highlight the interrelated nature of business operations and to provide the students an authentic experience of international business communication. The real-time-operated simulation game was clock-driven, which meant that all actions in the game were immediately updated and shown on the computer screen. The real-time operated nature of the simulation game required continuous decision-making and synchronous collaboration. All team members saw the same screen depicting their simulated company, and had access to making decisions in the game by moving the mouse, clicking, and inserting numbers and text in the decision-making fields.

Data collection

Data collection was based on convenience sampling meaning that the study was conducted among students taking part in an online business simulation course led by one of the authors. Students were tasked with writing two reflective essays in English (a minimum of two pages). The first was to be written directly after the first gaming session, and the second was to be written after the final gaming session. In this paper, we focus on the first essays to tap into the immediate process of organizing for collaboration.

The essay assignment after the first simulation session prompted the students to reflect on their simulation experiences regarding teamwork, team organization, roles, conflicts, challenges, well-functioning aspects, virtual collaboration, and other incidents worth mentioning. As the second essays focused on describing decisions taken in the simulation game, it was purposeful to restrict the analysis only to the first essays.

In total, 177 students returned essays after the first simulation session, which comprise the data for this paper. Most students wrote lengthy descriptions of their gaming experience. While doing so, they explained how their team got organized and how they collaborated as a team. The entire data set amounted to 447 pages. Signed informed consent forms were requested from all participants.

Analysis

We adopted the qualitative approach of content analysis (see e.g., Patton, 2015), a research method suitable for making inferences about textual material (Krippendorff, 2004) and the investigation of simulation-based learning settings. Following the analytical process suggested by Elo and Kyngäs (2008), two of the researchers conducted manual analyses of the students' reflective essays, to acquire a comprehensive view of the organizational affordances perceived by the students when collaborating in the simulation-based learning environment. Furthermore, the systematic application of content analysis revealed how affordances were employed (or not) to accomplish the collaborative task. In order to ensure the rigor of the analytical process, subsequent techniques were employed: (1) data were collected across different nationalities, (2) investigator triangulation i.e., two researchers engaged in the analysis process, and (3) and fertile data descriptions of the participants were incorporated to support the findings.

The iterative and progressive analytical process was carried out by the first author in close collaboration with the second author. The analysis consisted of three main phases: *preparation, organizing*, and *reporting* (Elo & Kyngäs, 2008). First, the preparation phase involved careful close readings of the data in multiple iterative rounds. The data analysis began with an inductive data-driven coding approach that allowed for novel insights related to the research questions to emerge from the data. Two of the researchers conducted initial rounds of the analyses independently by first reading all individual essays and highlighting all potentially meaningful information. This allowed for arresting the extensive variety of standpoints. After that, the essays were combined into batches including all writings for each team. After this phase, the authors chose the unit of analysis in light of the research questions. The analysis thus focused on how the students' descriptions of how their team got organized and was engaged in the team task (i.e., managing their simulation company). Second, during the organizing phase the progressive analytical process proceeded with a theory-driven coding approach in which the researchers' insights were constantly mirrored against literature. This procedure provided us with means to scrutinize the data based on the emerging categories.

Our analysis was guided by Michaels and Carello (1981) description of affordances as acts or behaviors perceived by the learners and afforded by the environment. Organizing affordances are, thus action potentials for fostering team organization and the task accomplishment. Perceiving the affordance (the action potential) did not automatically lead to taking advantage of it, as is shown in the data analysis. Therefore, both the affordances that were perceived and taken

advantage of as well as the affordances that were perceived but not employed are laid out in the data illustration section. The adopted approach aligns with our research aim. Thus, our analysis focused on capturing all standpoints about how the students reported their actions and interactions in the learning environment and with each other. These were then summed up and categorized into different types of action potentials. The categorization was first independently conducted by two of the researchers and then cross-checked for higher validity. The analysis yielded four main categories of organizing affordances: organizing immediate and short-term activities, managing information and resources, managing tasks and medium-term activities, and strategizing for the long term. After this, eight subcategories were identified to underpin and highlight the various aspects of data. This analysis resulted in a versatile outlook on the dynamics and interrelatedness of the action potentials for organizing collaboration.

Finally, in the reporting phase, in order to create a persuasive report of the overall findings, the analytic characterizations of the relevant data extracts were consolidated to expose essential insights in the context of the existing study. In our analysis, we gauged into the action potentials of the simulation-based collaborative learning environment from the learners' perspective by analyzing their own perceptions of their organizing for collaboration in the learning environment.

Findings

Four main categories of organizing affordances were identified from the data set of 177 student essays: (1) organizing the division of work, (2) managing information and resources, (3) managing tasks, and (4) strategizing. Eight subcategories were aligned within these larger categories. Table 1 illustrates the organizing affordances perceived by the learners in the learning environment.

Table 1 presents the key findings of this paper, summarizes the identified organizing affordances, and illustrates with the help of data extracts how the affordances were perceived and employed by the participants. Furthermore, the data extracts on the right-hand side column illustrate how affordances were perceived but not employed by the students.

The identified eight organizing affordances are presented in the same chronological order as the students described them in their reflective essays. The order follows the logic of the simulation game starting from the first things to organize and proceeding toward the next tasks to handle. Therefore, the identified affordances are grouped according to their sequential progress.

Organizing the division of work

Organizing shifts, roles and tasks (subcategory 1.1) were key activities for coordinating who does what and when. They were crucial for running and balancing the simulation company's supply chain. Bonneau and Bourdeau (2019) found that establishing roles and responsibilities adhered to the first tasks in simulation-based collaboration. Kirschner et al. (2004) noted, in turn, that assigning functional roles positively affected team interaction and collaborative learning. Our findings corroborate these results. Utilizing the affordances for organizing the shifts, tasks and roles allowed the teams to coordinate their activities better. On the other hand, teams that did not utilize these affordances suffered from a lack of coordination, leading to unbalanced actions and mismanagement of key tasks.

In a similar vein, purposefully managed *handovers between shifts and team members* (subcategory 1.2) allowed the teams to share updates of key events and actions in the simulation and to create an action plan for the following shifts. Well-managed handovers enabled to continue the team task with minimal interruption and ensured that the team could concentrate on its task. On the other hand, not employing this affordance led to various kinds of problems, such as lack of clarity about next actions, delays in responding to events that unfold in the simulation, and frustration among team members.

Furthermore, some students pointed out that poor organization of team tasks and shifts led to poor handovers. Students in teams with poor organization of tasks, shifts, and handovers

reported difficulties in responding to game events in a purposeful and timely manner. This important finding confirms that individual elements in the broader learning task are interdependent and influence each other.

Managing information and resources

Gathering, processing, and disseminating information (subcategory 2.1) relates to key affordances, particularly in collaborative problem-solving tasks. Information is an essential resource for

Table 1. Organizing affordances.

Organizational affordance	Example of how affordance was perceived and employed	Example of how affordance was not perceived and/or employed
1. Organizing the division of work		
1.1 Organizing shifts, roles and tasks	We initially had early contact through email in which we had some discussion regarding our plans for the simulation. After this we created a Facebook group as this is an easier method for such a large group to keep in touch rather than email. We used a polling option where each member could select a particular job title and the shift they wanted to work. (—) The jobs titles included sales and deliveries manager, inventory and purchases manager and a head of shift manager where each position had specific roles. (Team 7)	Not distributing the tasks also led to some errors; we sometimes jumped between the different tasks and ended up not ordering enough raw materials in the end, ultimately causing a downtime in production, delayed or canceled deliveries. (Team 17)
1.2 Handovers between shifts and team members	I am very proud of the handover part of the simulation; there was about an hour of overlap between team members, which enabled us to show the others how we dealt with tasks, what the different functions are for (—). (Team 4)	A weakness in our team was for sure the handing over of the shifts. Although some shifts were overlapping so one shift could explain to the other shift what was going on and explain the strategy, etc. I don't think that it was a big success and so it came that every new shift had a "hard" time to see what was going on and what the plan was. (—). (Team 18)
2. Managing information and resources		
2.1 Gathering, processing, and disseminating information	Team 8 was an extremely effective in terms of game outcome, we ended up winning the simulation overall. Working as a team we were very effective with the knowledge obtained from previous shifts being passed on to the next to enable smooth as possible transitions between the shifts. Constantly there was chat amongst all shifts before, during and after. These chats helped with the development of ideas, solutions to problems, and general information that would benefit the team, this made our team prosperous as it was constantly being improved. (Team 8)	On the other hand, the person who should inform me about the development in the first hours of the game did not do a good job on it. (Team 15) Someone should be in charge of providing information, for that we had not assigned anyone. Many decisions were not made on rational basis, more like we felt it to be right. (—) Maybe the problem was in lack of economic knowledge. (Team 12)
2.2 Securing and re-arranging resources	Our production manager handled very well the overview on material required. He kept the inventory managers, for instance me, up to date on what we need and I entered into negotiates with the other teams. (Team 13)	The simulation was roughly said six hours of semi-organized chaos. No one took the initiative to make our profit better during the time I was online. (—). (Team 11)

(*Continued*)

Table 1 Continued.

3. Managing tasks		
3.1 Managing one's own task	As we were working in groups of three, each had their own task. These tasks are Sales and Deliveries, Production Process and Inventory and Raw Material Purchases. But although each had its own task, we always we tried to help others when our task need less attention. (Team 2)	(—) one team mate did not reply to the duty roster and was not online for the whole day and another teammate who was in the duty roster for the last shift suddenly did not appear and was not online for the whole day as well. (Team 10)
3.2 Offering help and ensuring that all areas are covered	Another interesting issue was that almost every member was online at least for a short time outside their shift to ask about the situation and offering help. This showed clearly that everybody in the team identified with it and wanted the best outcome for the company. (Team 3)	
3.3 Pointing out critical areas, suggesting actions, and giving orders	We had front and back office functions, performed in such way that there were few people buying, selling and producing; and then there were others in Skype at the same time, giving ideas or suggestions for improvement. (Team 5)	(—) We had one member frantically trying to control everything without giving clear, concise instructions on how to help. This team member made decisions alone (—). As a team, we didn't get together and support this type of leadership and I and other teammates sat by idly thoroughly confused and useless. (Team 16)
4. Strategizing		
4.1 Strategy-making	(—) we had a small discussion via email about what strategy we should follow during the game. (—) Our strategy regarding procurement was to engage in long term business relationships with sub producers (—). (Team 8)	(—) one main weak point of my group and my company was that we didn't thought about an overall strategy at all. After the first people left the game we tried to follow our own strategy and after our shift the next people started a new strategy. (Team 18)

learning activities, and managing it is particularly important in team tasks. Bonneau and Bourdeau (2019) found that in distributed teams involved in computer-supported collaboration a significant amount of time needs to be dedicated to exchanging information. Employing affordances for processing and disseminating information helped teams stay engaged in the team task and make more justified decisions. Teams that paid less or no attention to managing the information flow suffered from incorrect, missing, or untimely information and were unclear about what to do next. Students in teams that experienced problems with information dissemination brought up that they suffered from "lack of economic knowledge," referring to a lack of adequate business and finance knowledge and concepts, as shown by the student comment in Table 1.

In addition, poor English language skills made some teams dependent on chats for team communication instead of a VoIP solution, which is a linguistically more challenging medium. One student described this as follows: *"Another aspect (—) was the language barrier which for sure was frustrating to our Asian colleagues. They tried to participate, but it was impossible for us to understand what they were trying to tell us. A solution would be to use the chat to write down statements and suggestions."* Thus, our analyses indicate that the choice of communication technologies had an impact on which organizational affordances the team could employ during collaboration. This observation stresses the importance of possessing adequate skills and capacity to perceive and take advantage of the affordance (Dohn, 2009; Kirschner et al., 2004).

Many students acknowledged the international context of the simulation game, and found it exciting to work with people representing different nationalities and cultural backgrounds. As pointed out by one student: *"The session was a good experience in a way that it prepares students*

like me for the future international group work. It takes in consideration of different time zones in different countries, different cultures, different personalities and analyzing skills of people." For some other students, in turn, *"accents were the only reminder that I was interacting with someone from a different country to mine." Securing and re-arranging resources* (subcategory 2.2) were closely linked to managing information flows in the simulation game. Much of the teams' organizational work in the game was related to ensuring the availability and timely delivery of resources. Successful utilization of this affordance benefited the team task, whereas neglecting it led to "semi-organized chaos," as phrased by one student. Here again, the lack of necessary skills and capacity led to uncoordinated teamwork and poor management of the team task.

Managing tasks

Managing one's own task (subcategory 3.1) entailed assuming responsibility for their designated tasks in the game. How each team member took care of their responsibilities had a direct impact on how the team task proceeded. When team members managed their tasks well, the team atmosphere was positive, and the confidence of all team members enhanced. Failing to manage one's tasks brought about not only practical difficulties and poor team performance in the game but also had a deteriorating effect on the mood and morale of the team.

Managing the team task beyond one's specific area involved *offering help and overseeing to ensure that all areas are covered* (subcategory 3.2). More experienced team members could stay online after their shift to ensure that those on the next shift proceeded with their tasks. This way, team members could be proactive and anticipate future events in the game. It is worth pointing out that this is the only affordance in the learning environment utilized by all teams. We consider this a very important observation. Despite the underutilization of many of the organizing affordances available in the learning environment, all teams engaged in team processes that involved offering help to teammates. In our view, this suggests that even if teams struggled with other aspects in the game, the team members were mindful of the overall team task.

Pointing out critical areas, suggesting action, and giving orders (subcategory 3.3) meant that the focus shifted from immediate tasks to anticipating activities that could actualize in the medium term. This involved assigning leadership within the team. Teams were self-organizing in the sense that the game facilitators did not assign a leader. Hence, the team members selected the leadership roles. The simulation-based collaborative environment in the present study afforded various types of leadership contributions, from solitary management of the game to participatory and distributed leadership. The analysis of the reflective essays suggests that collaborative, engaging, and encouraging leadership behavior was most suitable for this type of collaborative learning task.

Strategizing

Strategy-making (subcategory 4.1) involved making action plans, analyzing their outcomes, comparing the team's performance to that of the other teams, and making conclusions based on these analyses. This was a continuous, long-term process whereby the unfolding events gradually revealed whether the strategy was working or whether it needed adjusting. Teams that engaged in strategy-making were able to learn about their decisions, whereas teams that repeatedly changed strategy or had no strategic guidelines were forced into a reactive approach. The less strategic teams became frustrated with the unpredictability of game events and had fewer opportunities to learn from their decisions.

Our observations corroborate the findings of previous research, highlighting that the actualization of strategic initiatives is elementary to the success of the organization (i.e., team) (Balogun & Johnson, 2004; Lê & Jarzabkowski, 2015). The long-term positive effect of strategy-making

was that the teams learned from their past decisions and actions and grew more confident in their future decision-making. Being able to understand causalities between decisions and their outcomes, and to learn from them were also the ultimate aims of the simulation game.

Now that we have summarized the findings of this study, the following section will discuss them.

Discussion

This study illustrates organizing affordances that students perceive in a simulation-based environment, and how these affordances are employed (or not) in their collaborative task from the learners' point of view. The most important results of the study are the four main affordance categories, which contain eight sub-categories of affordances for organizing. The four groups are organizing the division of work, managing information and resources, managing tasks, and strategizing. Each type of affordance was required in the collaborative learning task. *Organizing the division of work* entailed deciding who does what and when. *Managing information and resources* related to the assembly and dissemination of information and arrangement of resources in the game. *Managing tasks* in the game included the practical management of one's own tasks as well as tending to the other decision-making areas in the game. *Strategizing* was related to the analysis and planning of long-term actions in the game.

The results indicate that affordances for organizing represent key resources for collaboration in simulation-based learning environments. While earlier research has stressed the importance of technological affordances, this study highlights that the execution of a learning task in a simulation environment is highly dependent on affordances for organizing.

The identification and categorization of organizing affordances have both theoretical and methodological implications, and provide insights for educators and developers. Researchers can employ this study as an exemplar for investigating how learners use learning technologies and how these technologies enable or constrain collaborative activities in simulations. A more developed understanding of the role of organizing and related affordances helps educators to support students' collaboration in simulation-based learning environments. The insights gained through the findings of this study benefit educators both in pre-scaffolded as well as in spontaneously organizing collaborative learning assignments.

For the developers of simulation-based learning environments the affordance perspective is helpful in that it allows looking beyond the features of particular technologies and tools, and developing learning environments that encourage and support organizing for collaboration (see Gibbs et al., 2017).

A second key finding is that while teams shared the technological environment, they perceived and employed the organizing affordances in different ways. Perceiving an affordance did not necessarily prompt team members to take advantage of it. Thus, although affordances can be seen as preconditions for an activity, they do not imply that a specific activity will occur (Greeno, 1994). Our study points out that this may, at least partly depend on the learners' level of knowledge and skills. Lack of skills was recognized as a factor that prevented the learners from taking advantage of some of the identified affordances. For example, teams with a lack of adequate business knowledge and insufficient language skills suffered from problems related to information dissemination.

These findings are consistent with those of Orlikowski (1992), who stresses flexibility in technology use. Orlikowski notes that when people use a technology, they interpret, appropriate and manipulate it in different ways, and are influenced by various individual and social factors, not only technology. Furthermore, the abilities of users, the materiality of the technology, and the context of technology use are all potentially dynamic. Thus, the materiality of technology influences, but does not determine its possibilities for users.

Other elements influencing the use or nonuse of affordances relate to team roles and dynamics. On the one hand, the clarity of roles and tasks contributed to more organized collaboration,

as team members could anticipate what to do and when. On the other hand, teams with adjustable roles were able to divide tasks according to the unfolding events of the game. Thus, our findings point out that explicit, but flexible and compatible, organization of tasks is beneficial for executing the collaborative task.

Collaborative team dynamics reflected as joint ownership of the mutual learning task. Kirschner et al. (2004) refer to positive interdependence, which means that the group together assumes responsibility for the collaborative learning task. Social cohesion and a strong sense of belonging to the group are key in this respect. Teams with more proficient organization and fluent team collaboration reported more examples of giving and receiving help from teammates. From our perspective, this signals higher commitment and accountability for the collaborative task. Interestingly, many of the teams that failed to employ some of the organizing affordances also acknowledged their potential usefulness and advantages for collaboration.

Our study also reveals that different affordances were closely linked and intertwining. Teams that had abundant interaction employed a greater variety of affordances for organizing. Our findings align with those of Saebø et al. (2020), who found that affordances for organizing collective action consisted of combinations of various affordances.

The interrelatedness of affordances was also evident in the fact that a team's inability to employ some affordances would prevent them from using other affordances. For example, teams that were not able to organize tasks, shifts, and handovers were also not able to employ affordances for managing one's own tasks or managing contact with collaborative teams (as shown in sections 1.1 and 1.2). This failure also led to difficulties in responding to the game events in a purposeful and timely manner. This is a vital aspect that warrants more attention, particularly among educators and developers of learning environments.

The findings of this paper should be considered in the light of the following limitations. First, our analysis focused on the affordances for organizing in the first phase of the simulation game. Limiting the analysis to the first batch of reflective essays helped to narrow the scope of the study and to accommodate the resource limitations regarding the management of the research data. However, it ruled out the possibility of tracing how teams developed their collaboration and whether teams started to employ new affordances in their next gaming session. Consequently, this study did not investigate the actual influence of organizational affordances on the entire collaborative learning process. Despite this limitation, our detailed analysis adds to our understanding of the first-phase experiences of simulation-based collaboration as well as the discovery of organizing affordances by providing a pioneering analytical framework. Second, our study did not compare teams, and hence the learning processes of different teams cannot be contrasted. Third, while it focuses on affordances for organizing, our analysis did not explore group-level interaction. This decision was made to enable a sharper focus on organizing and yielded a more thorough understanding of how teams perceive and employ (or not) organizational affordances in simulation-based collaborative learning.

Conclusions and implications

Recently, much research has been dedicated to investigating how learning environments can provide for more accessible and comprehensive learning experiences. Previous research has found that organizing for collaboration is highly significant to the effectiveness of collaborative learning and for facilitating long-term learning (Hernández-Sellés et al., 2019). Despite its centrality, collaboration has until recently, not been addressed from the perspective of how it is organized by the learners themselves. Thus, there is lack of empirical studies that examine how students self-organize for collaboration in simulation-based learning environments. Furthermore, empirical studies on affordances remain scarce (Berthelsen & Tannert, 2020). The current study represents a warranted and novel endeavor to investigate affordances for organizing collaboration in light of robust and versatile empirical data. The sample size of the data (177) as well as the representativeness of the nationalities (38) and universities (10) are prominent to any study

investigating collaboration in computer-supported learning environments. Consequently, the data provide for a solid outlook on what kinds of affordances for organizing are perceived and employed (or not) by the learners when collaborating in a simulation-based learning environment.

Following the traditions inherent to qualitative research, we abstain from making strong claims about generalizability. Yet, we find that the results of this study help to highlight, illustrate and suggest explanations for phenomena in similar settings, and contribute to the development of theory by demonstrating the salience of affordances for organizing in simulation-based learning environments. The findings, thus, provide a more dynamic view of affordances in simulation-based learning and serve as a theoretical framework for identifying affordances perceived essential for collaboration. Furthermore, the findings regarding the design and development of CSCL imply that when appropriating learning technologies, it is necessary to consider their affordances, not only for technical execution of the learning task but also to ensure that interaction and organizing are sufficiently and explicitly afforded. The learning environment needs to fulfill the learning intentions of the learner and not only invite, but also guide the learner to employ the learning environment (Kirschner et al., 2004).

Thus, we find that a more comprehensive understanding of organizing affordances in CSCL and simulation-based environments benefits the learners both in their immediate learning task and in all collaborations in the learning environment. This new knowledge will also inform the designers of learning environments to create affordance-rich learning environments, and help facilitators to better support learners in their collaborative tasks.

Results of this study pinpoint potential future avenues for research and design of simulation-based learning environments. The study suggests that simulation-based learning environments should entail complementary communication technologies to ensure that learners may create combinations that best suit their needs in the collaborative learning task. Another noteworthy implication of this study is that both asynchronous and synchronous communication modes are required in organizing and collaboration in CSCL. Future studies can further improve our understanding of the role different modes of communication to collaboration in CSCL.

As simulation-based learning environments, such as business games ground on the principles of student-centered, authentic, social, and interactive learning, the tutor's role is facilitative. Currently, however there are scarcely empirical studies explicating instruction and pedagogy in CSCL and simulation-based learning environments. In the future, more empirical research is needed to establish how and when the tutor can best support collaboration in simulation-based environments and other CSCL contexts.

The global pandemic caused by COVID-19 has revealed the vulnerability of educational infrastructures, the frailty of learning technologies and the shortcomings in digital pedagogy across all educational levels around the world. The negative effects of the lockdown have most severely affected students in developing countries as well as students with economical, psychological and social vulnerabilities. These effects may have durable consequences to individuals and societies. Now more than ever there is a pressing need for pedagogically sound CSCL environments with global outreach that enable collaboration across nations and between HE institutes. Simulation-based learning environments feature as feasible contexts in this pursuit. Hopefully, the learnings from the COVID-19 crisis serve as an opportunity to take forward research and expertise in the field of CSCL.

Conflicts of interest

We have no conflicts of interest to disclose.

Notes on contributors

Kirsi Lainema's (PhD (Econ)) research focuses on interaction, organising, collaboration and learning in face-to-face and digital working and learning contexts. Lainema's research covers topics and contexts such as managerial meetings, municipal government, networked businesses, strategic practices, hospitals and digital learning

environments. Currently, Lainema works in RealGame Business Training, and she focuses particularly on business development, service design and developing research-based digital pedagogy.

Kirsi Syynimaa (M.Ed.) is a Research Funding Advisor in the Research and Innovation Services at the University of Jyväskylä. She has extensive experience of working with 15 national and international projects in the field of technology-enhanced teaching and learning at the University of Jyväskylä, since 2004. Syynimaa is currently doing her PhD on students' views on technology-enhanced collaborative learning in higher education.

Timo Lainema holds a PhD (Econ) in Turku School of Economics, University of Turku, Finland, with an emphasis on Information Management. His research interests include learning through simulation gaming, conceptual change, knowledge sharing in virtual working contexts, and dynamic decision making in time intensive environments. He holds an Adjunct Professorship in Education in University of Turku, and in Information Research and Interactive Media in University of Tampere. Presently he is CEO in RealGame Business Training, a company specializing in virtual business simulation learning environments for universities and businesses.

Raija Hämäläinen, a Full Professor, works in the field of technology-enhanced learning at the Center for Research for Learning and Teaching at the University of Jyväskylä, Finland. Hämäläinen's research interests include collaboration and creativity at technology-enhanced learning settings, workplace learning and teacher-student interaction. Hämäläinen has been the principal investigator/leader of several research projects, and she has designed a long-term research line that focuses on designing and investigating new learning environments for future educational efforts. Hämäläinen's recent publications include articles in Computers & Education, the British Journal of Educational Technology, The Internet, and Higher Education.

Funding

This research has been supported by The Finnish Work Environment Fund, grant number 190154 Well@DigiWork, and The Academy of Finland, grant number 318095, the Multidisciplinary Research on Learning and Technology profile ll of University of Jyväskylä (JYU).

ORCID

Raija Hämäläinen http://orcid.org/0000-0002-3248-9619
Kirsi Lainema http://orcid.org/0000-0003-3621-8696
Kirsi Syynimaa http://orcid.org/0000-0001-9365-0894

References

Andriessen, J. (2006). Collaboration in computer conferencing. In A. M. O'Donnell, C. E. Hmelo-Silver, & G. Erkens (Eds.), *Collaborative learning, reasoning, and technology* (pp. 197–231). Routledge.

Antonenko, P. D., Dawson, K., & Sahay, S. (2017). A framework for aligning needs, abilities and affordances to inform design and practice of educational technologies. *British Journal of Educational Technology*, *48*(4), 916–927. https://doi.org/10.1111/bjet.12466

Aristovnik, A., Keržič, D., Ravšelj, D., Tomaževič, N., & Umek, L. (2020). Impacts of the COVID-19 pandemic on life of higher education students: A global perspective. *Sustainability*, *12*(20), 8438. https://doi.org/10.3390/su12208438

Arvaja, M., Häkkinen, P., & Kankaanranta, M. (2008). Collaborative learning and computer-supported collaborative learning environments. In *International handbook of information technology in primary and secondary education* (pp. 267–279). Springer.

Balogun, J., & Johnson, G. (2004). Organizational restructuring and middle manager sensemaking. *Academy of Management Journal*, *47*((4)), 523–549.

Baralou, E., & Tsoukas, H. (2015). How is new organizational knowledge created in a virtual context? An ethnographic study. *Organization Studies*, *36*(5), 593–620. https://doi.org/10.1177/0170840614556918

Berthelsen, U. D., & Tannert, M. (2020). Utilizing the affordances of digital learning materials. Contribution to a special issue Danish as L1 in a learning materials perspective, edited by J. Bremholm, S. S. Fougt, & B. Buch. *L1-Educational Studies in Language and Literature*, *20*, 1–23. https://doi.org/10.17239/L1ESLL-2020.20.02.03

Bonneau, C., & Bourdeau, S. (2019). Computer-supported collaboration: simulation-based training using LEGO®. *Educational Technology Research and Development*, *67*(6), 1507–1527. https://doi.org/10.1007/s11423-019-09689-w

Bygstad, B., Munkvold, B. E., & Volkoff, O. (2016). Identifying generative mechanisms through affordances: A framework for critical realist data analysis. *Journal of Information Technology*, *31*(1), 83–96. https://doi.org/10.1057/jit.2015.13

Candy, P. C. (1991). *Self-direction for lifelong learning. A comprehensive guide to theory and practice*. Jossey-Bass.
Chatterjee, S., Moody, G., Lowry, P. B., Chakraborty, S., & Hardin, A. (2020). Information Technology and organizational innovation: Harmonious information technology affordance and courage-based actualization. *The Journal of Strategic Information Systems*, *29*(1), 101596. https://doi.org/10.1016/j.jsis.2020.101596
Chen, X., Zou, D., Cheng, G., & Xie, H. (2020). Detecting latent topics and trends in educational technologies over four decades using structural topic modeling: A retrospective of all volumes of computer & education. *Computers & Education*, *151*, 103855. https://doi.org/10.1016/j.compedu.2020.103855
Churchill, D., & Churchill, N. (2008). Educational affordances of PDAs: A study of a teacher's exploration of this technology. *Computers & Education*, *50*(4), 1439–1450. https://doi.org/10.1016/j.compedu.2007.01.002
Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Burton, R., & Lam, S. (2020). COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching*, *3*(1), 1–20.
Dohn, N. B. (2009). Affordances revisited: Articulating a Merleau-Pontian view. *International Journal of Computer-Supported Collaborative Learning*, *4*(2), 151–170.
Dougherty, D. (2017). Organizing for innovation in complex innovation systems. *Innovation*, *19*(1), 11–15. https://doi.org/10.1080/14479338.2016.1245109
Ellison, N. B., Gibbs, J. L., & Weber, M. S. (2015). The use of enterprise social network sites for knowledge sharing in distributed organizations: The role of organizational affordances. *American Behavioral Scientist*, *59*(1), 103–123. https://doi.org/10.1177/0002764214540510
Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, *62*(1), 107–115. https://doi.org/10.1111/j.1365-2648.2007.04569.x
Fayard, A. L., & Weeks, J. (2014). Affordances for practice. *Information and Organization*, *24*(4), 236–249. https://doi.org/10.1016/j.infoandorg.2014.10.001
Gibbs, J. L., Sivunen, A., & Boyraz, M. (2017). Investigating the impacts of team type and design on virtual team processes. *Human Resource Management Review*, *27*(4), 590–603. https://doi.org/10.1016/j.hrmr.2016.12.006
Gibson, J. J. (1979). *The ecological approach to visual perception*. Houghton Mifflin.
Gonzalez, T., De La Rubia, M. A., Hincz, K. P., Comas-Lopez, M., Subirats, L., Fort, S., & Sacha, G. M. (2020). Influence of COVID-19 confinement on students' performance in higher education. *PLoS One*, *15*(10), e0239490. https://doi.org/10.1371/journal.pone.0239490
Greeno, J. G. (1994). Gibson's affordances. *Psychological Review*, *101*(2), 336–342. https://doi.org/10.1037/0033-295x.101.2.336
Heinonen, K., De Grez, N., Hämäläinen, R., De Wever, B., & van der Meijs, S. (2020). Scripting as a pedagogical method to guide collaborative writing: University students' reflections. *Research and Practice in Technology Enhanced Learning*, *15*(1), 1–20. https://doi.org/10.1186/s41039-020-00131-x
Hernández-Sellés, N., Muñoz-Carril, P. C., & González-Sanmamed, M. (2019). Computer-supported collaborative learning: An analysis of the relationship between interaction, emotional support and online collaborative tools. *Computers & Education*, *138*, 1–12. https://doi.org/10.1016/j.compedu.2019.04.012
Hämäläinen, R., & Vähäsantanen, K. (2011). Theoretical and pedagogical perspectives on orchestrating creativity and collaborative learning. *Educational Research Review*, *6*(3), 169–184. https://doi.org/10.1016/j.edurev.2011.08.001
Jeong, H., & Hmelo-Silver, C. E. (2016). Seven affordances of computer-supported collaborative learning: How to support collaborative learning? How can technologies help?*Educational Psychologist*, *51*(2), 247–265. https://doi.org/10.1080/00461520.2016.1158654
Ke, F., Pachman, M., & Dai, Z. (2020). Investigating educational affordances of virtual reality for simulation-based teaching training with graduate teaching assistants. *Journal of Computing in Higher Education*, (32), 607–627. https://doi.org/10.1007/s12528-020-09249-9
Kirschner, P. A., Strijbos, J.-W., Kreijns, K., & Beers, P. J. (2004). Designing electronic collaborative learning environments. *Educational Technology Research and Development*, *52*(3), 47–66. https://doi.org/10.1007/BF02504675
Köhler, T., Fischlmayr, I., Lainema, T., & Saarinen, E. (2013). Bringing the world into our classrooms: The benefits of engaging students in an international business simulation. In C. Wanker & P. Blessinger (Eds.), *Increasing student engagement and retention using classroom technologies: Classroom response systems and mediated discourse technologies. Cutting-edge technologies in higher education* (Vol. *6E*, pp. 163–198). Emerald Group Publishing Limited.
Krippendorff, K. (2004). *Content analysis. An introduction to its methodology* (2nd ed.). Sage Publications.
Lainema, T. (2004). Redesigning the traditional business gaming process: Aiming to capture business process authenticity. *Journal of Information Technology Education Research*, *3*(1), 35–52.
Lê, J. K., & Jarzabkowski, P. A. (2015). The role of task and process conflict in strategizing. *British Journal of Management*, *26*(3), 439–462.
Lee, T., Pham, K., Crosby, A., & Peterson, J. F. (2020). Digital collaboration in design education: How online collaborative software changes the practices and places of learning. *Pedagogy, Culture & Society*, *29*(2), 1–15.
Lehtinen, E., Hakkarainen, K., Lipponen, L., Rahikainen, M., & Muukkonen, H. (1999). Computer supported collaborative learning: A review. *The JHGI Giesbers Reports on Education*, *10*, 1999.
Leonardi, P. M. (2013). When does technology use enable network change in organizations? A comparative study of feature use and shared affordances. *MIS Quarterly*, *37*(3), 749–775. https://doi.org/10.25300/MISQ/2013/37.3.04

Lin, P. C., Hou, H. T., & Chang, K. E. (2020). The development of a collaborative problem solving environment that integrates a scaffolding mind tool and simulation-based learning: An analysis of learners' performance and their cognitive process in discussion. *Interactive Learning Environments* .https://doi.org/10.1080/10494820.2020.1719163

Majchrzak, A., & Markus, M. L. (2012). Technology affordances and constraints in management information systems (MIS). In E. Kessler (Ed.), *Encyclopedia of management theory*. Sage Publications.

Margolis, J. L., Nussbaum, M., Rodriguez, P., & Rosas, R. (2006). Methodology for evaluating a novel education technology: A case study of handheld video games in Chile. *Computers & Education*, *46*(2), 174–191. https://doi.org/10.1016/j.compedu.2004.07.007

Marinoni, G., Van't Land, H., & Jensen, T. (2020). *The impact of Covid-19 on higher education around the world*. IAU Global Survey Report.

McCord, A., & Franetovic, M. (2014). Toward a model of organization development: Values-based orientation, collaborative engagement, and affordance-based adoption of digital professional productivity systems. *Organization Development Journal*, *32*(4), 37–52.

Meredith, J. (2017). Analysing technological affordances of online interactions using conversation analysis. *Journal of Pragmatics*, *115*, 42–55. https://doi.org/10.1016/j.pragma.2017.03.001

Michaels, C. F., & Carello, C. (1981). *Direct perception*. Prentice Hall.

Oksanen, K., Lainema, T., & Hämäläinen, R. (2018). Learning from social collaboration: A paradigm shift in evaluating game-based learning. In *Gamification in education: Breakthroughs in research and practice* (pp. 500–524). IGI Global.

O'Regan, S., Molloy, E., Watterson, L., & Nestel, D. (2016). Observer roles that optimise learning in healthcare simulation education: A systematic review. *Advances in Simulation*, *1*(1), 1–10. https://doi.org/10.1186/s41077-015-0004-8

Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization Science*, *3*(3), 398–427. https://doi.org/10.1287/orsc.3.3.398

Park, H., & Song, H. D. (2015). Make e-learning effortless! Impact of a redesigned user interface on usability through the application of an affordance design approach. *Journal of Educational Technology & Society*, *18*(3), 185.

Patton, M. Q. (2015). *Qualitative methods & evaluation methods* (4th ed.). Sage Publications.

Perit Çakır, M., Zemel, A., & Stahl, G. (2009). The joint organization of interaction within a multimodal CSCL medium. *International Journal of Computer-Supported Collaborative Learning*, *4*(2), 115–149. https://doi.org/10.1007/s11412-009-9061-0

Reeves, T. C., & Reeves, P. M. (2015). Educational technology research in a VUCA world. *Educational Technology*, *55*(2), 26–30.

Rice, R. E., Evans, S. K., Pearce, K. E., Sivunen, A., Vitak, J., & Treem, J. W. (2017). Organizational media affordances: Operationalization and associations with media use. *Journal of Communication*, *67*(1), 106–130. https://doi.org/10.1111/jcom.12273

Saebø, Ø., Federici, T., & Braccini, A. M. (2020). Combining social media affordances for organising collective action. *Information Systems Journal*, *30*(4), 699–732. https://doi.org/10.1111/isj.12280

Sandoval, W. A. (2003). Conceptual and epistemic aspects of students' scientific explanations. *Journal of the Learning Sciences*, *12*(1), 5–51. https://doi.org/10.1207/S15327809JLS1201_2

Scardamalia, M., & Bereiter, C. (1994). Computer support for knowledge-building communities. *Journal of the Learning Sciences*, *3*(3), 265–283. https://doi.org/10.1207/s15327809jls0303_3

Stahl, G., & Hakkarainen, K. (2020). *Theories of CSCL. International handbook of computer-supported collaborative learning*. Springer.

Stendal, K., Thapa, D., & Lanamäki, A. (2016, January). Analyzing the concept of affordances in information systems. In *2016 49th Hawaii International Conference on System Sciences (HICSS)* (pp. 5270–5277). IEEE.

Sterman, J. D. (2011). Communicating climate change risks in a skeptical world. *Climatic Change*, *108*(4), 811–826. https://doi.org/10.1007/s10584-011-0189-3

Strijbos, J. W., & Weinberger, A. (2010). Emerging and scripted roles in computer supported collaborative learning. *Computers in Human Behavior*, *26*(4), 491–494.

Strong, D. M., Johnson, S. A., Tulu, B., Trudel, J., Volkoff, O., Pelletier, L. R., Bar-On, I., & Garber, L. (2014). A theory of organization-EHR affordance actualization. *Journal of the Association for Information Systems*, *15*(2), 53–85. https://doi.org/10.17705/1jais.00353

Suthers, D. D. (2006). Technology affordances for intersubjective meaning making: A research agenda for CSCL. *International Journal of Computer-Supported Collaborative Learning*, *1*(3), 315–337. https://doi.org/10.1007/s11412-006-9660-y

Wang, C., Fang, T., & Gu, Y. (2020). Learning performance and behavioral patterns of online collaborative learning: Impact of cognitive load and affordances of different multimedia. *Computers & Education*, *143*, 103683. https://doi.org/10.1016/j.compedu.2019.103683

Zammuto, R. F., Griffith, T. L., Majchrzak, A., Dougherty, D. J., & Faraj, S. (2007). Information technology and the changing fabric of organization. *Organization Science*, *18*(5), 749–762. https://doi.org/10.1287/orsc.1070.0307