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RESEARCH ARTICLE

Examining the role of sentence openers, role assignment scaffolds and self-determination in collaborative knowledge building

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Abstract
Scaffolds establish a cognitive connection with the students and what they want to express. Supporting the collaborative knowledge building process with scaffolds is crucial for the participation and continuity in the online discussions. In this research, where a quasi-experimental design is used, the contributions of the students in the online collaborative knowledge building process are examined in terms of role assignment, sentence opener scaffolds, and self-determination. 77 teacher candidates, who are registered to Computer II course, are assigned to 4 groups, in three of which scaffolds are used, and in the remaining one of which scaffolds are not used. The students contribute to the knowledge building process in the first group by using the sentence openers, in the second group by being assigned with roles, in the third group by both being assigned with roles, and using the sentence openers appertaining to the respective roles, and in the fourth group by not making use of any scaffold. Using content analysis and MANOVA, the research results reveal that using scaffolds, especially the combination of sentence openers and role assignment scaffolds encouraged higher cognitive levels of knowledge building. Significant differences with high effects were found between the groups for the dimensions of self-determination: self-awareness and perceived choice. The research points out some suggestions for future research.

Keywords Knowledge building · Online collaborative learning · Scaffolds · Role assignment · Sentence openers · Self-determination

Introduction

Various technologies have been developed in the recent years, which support new learning and teaching procedures in the educational process. Web 2.0 technologies among those give chance to the communication and interaction between the users. Some researchers indicate that, the students reshape the social nature of the knowledge, and thereby gain

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easy access to the information centers by way of making use of these technologies (Hickey et al. 2011). Following the introduction of Web 2.0 technologies in the educational process, the "community" concept has gained prominence (Cesareni et al. 2016). Attending a learning environment as a community means to activate, and contribute to the development of this learning environment. Learning environments, known as online collaborative learning environments and online learning communities, which go on developing throughout the educational process, have thereby been formed.

"Knowledge Building Community", having been developed by Scardamalia and Bereiter (1994, 2003, 2006, 2010) towards constructivist learning perspective, is one of these learning environments. In this model, collaborative cognitive responsibility is emphasized throughout the knowledge progression process among the learning communities. It is thereby intended to maintain continuity of the development of ideas. In this community, the participants add up, elaborate, and analyze the knowledge, and assume a collaborative cognitive responsibility, by virtue of which they are to know and improve not only their own responsibilities, but also those of the other members. In this model, the participants are encouraged to produce knowledge products by way of focusing on creating knowledge, rather than uttering it. These knowledge products are subject to the review of the community so as to be developed later on. These knowledge products are shared in the form of online messages over the knowledge building environments. The community thereupon assumes the responsibilities of developing the knowledge products by means of multiple resources, and to discuss over the shared ideas. Scardamalia (2002) has suggested 12 socio-cognitive and technological knowledge building principles so as to facilitate the development of the knowledge building communities, and to bring the ideas to the center of the class life. Scardamalia (2002) has indicated that, these ideas are interconnected, applying any one of them is to bring along another one of them, so that these principles operate together as a system.

The main purpose of the Knowledge Building Community is to realize, and maintain the continuity of the in-depth collaboration between the students. New knowledge shall thereby be built, and develop the community. Development of the community is realized by the active participation of the students in the respective learning process. However, maintaining active participation in the online collaborative learning environments is not easy as it seems. Besides, nowadays, web-based courses supported by such new-generation digital learning technologies as Web 2.0 require stronger active participation of the students (Cesareni et al. 2016). There are studies in the literature pointing to the existence of "lurker" participants, who read the message in the community, but do not post any message, in other words who anonymize themselves (de Waard et al. 2011; Mason 1994; Taylor 2002). According to Morris and Ogan (1996), the main risk in the students' participation to an online learning environment is that, they limit themselves with only reading the incoming messages without posting one to the online environment. Such students are weak in the discussion process, and passive in the collaboration process. These students have little contributions, consisting of simple expressions in the process of either creating, or building new knowledge. Not only they cast a cloud on the knowledge sharing process of the community in the discussion environment, but also the continuity of the discussion environment may therefore not be maintained. An online community may not last long if very few, or no message is shared therein. Even a well-designed discussion environment shall remain ineffective as long as the students neither assume any responsibility, nor play any active role in the knowledge building process. Strategies that shall not only encourage the active participation of the students, but also sustain such a participation should therefore be developed while designing an online course (Cesareni et al. 2016). Certain

scaffolds are applied for supporting, directing, and enriching the students' knowledge building processes, so as to maintain this expected active participation. In view of the literature, while these scaffolds appear as sentence openers in some of the studies, they may also appear as role assignments in some other studies. Intended use of both sorts of scaffolds is to structure, support, and enrich the knowledge building processes, to maintain an in depth collaboration among the students, and to cause the community members gain collaborative cognitive responsibility, which are expected to be realized in the course of the course. It is possible to come by current studies in the literature that reveal the different reflections of the various scaffolds to the educational process in the course of the knowledge building process (Ak 2016; Cesareni et al. 2016; De Wever et al. 2010; Gašević et al. 2015; Rienties et al. 2012). However, the studies within the literature are seen to focus on only one scaffold. It draws one's attention that, there is no study examining the contribution of both separate and combined use of scaffolds, which support, and bring activation in the knowledge building process.

Recent studies highlighted that the degree of students' self-determination, which can affect the type of course contributions detailed by students, has a strong impact on learning behaviour in online learning environments and online learner support (Ak 2016; Chen and Jang 2010; Chen et al. 2010; Giesbers et al. 2013; Rienties et al. 2009). The individuals should be aware of their needs and interests, their present strength and limitations to meet them, that is, they should have access to "self-awareness". Also, individuals should feel that they have "perceived choice" to choose among the available options in order to be aware of the needs of the situation in the decision-making phase. Therefore, the environmental conditions are influential on self-determination. Hence, feeling to be aware of their own wishes and right to choose in their behavior is shaped by self-determination (Deci and Ryan 2000; Ryan and Deci 2000; Sheldon et al. 1996). Recent research of Jang et al. (2010) on self-determination indicated that providing autonomy support, guidance and scaffold may positively influence student participation. According to Rienties et al. (2012) the degree of students' self-determination might explain why some learners contribute more to the knowledge building environment than others. Optimizing self-determination and scaffolding support in collaborative knowledge-building environments might have a major impact on the quality and the progress of the learning process. Also, it can be seen how scaffolds used in the collaborative knowledge building process are related to the self-determinations of students.

Research questions

Reviewing the literature reveals that there are researches that examine the knowledge building process and use various scaffolding types in this process. However, it can be seen from the suggestions of these studies that some of the questions mentioned below have not been answered yet and suggested to be investigated. In addition, there is also a lack of research using a combination of various scaffolds to support knowledge building. It is also emphasized that students' self-determination is important in the process of knowledge building and needs to be examined.

Rienties et al. (2012) re-designed an authentic CSCL environment supported by a more explicit scaffolding based on the principles of Problem-Based Learning and investigated its effect. As a result of their research, they stated that providing the balance between guidance and support to facilitate learning processes according to self-determination of students is a complex issue. Similarly, Ak (2016) examined the effects of technology-based

scaffolding (message labels and sentence openers) in an online asynchronous discussion process structured with problem-based learning strategy. The results generally showed that using technology-based scaffolding might be an effective way to enhance students' task-related learning activity. According to those researchers, however, there is a need for studies examining self-determination, which may affect the type of contributions elaborated by students. De Wever et al. (2010) focused on encouraging social knowledge building in e-discussions in their study and focused on the impact of the roles given to students in this process. The results showed that roles can be included at the beginning of the discussions and can be eliminated towards the end. Even students without a role in role-supported groups benefit from the introduction of roles. They suggested that a control condition of role versus no-role assignment could be useful to compare the impact for future researches. According to Cesareni et al. (2016), having a special role of students in a group can lead them to the exercise collective cognitive responsibility for collaborative knowledge building. Therefore, they investigated the relationship of role taking to participation in a blended course. They found that role takers were more likely to differentiate their contributions than non-role takers by suggesting more problems, synthesizing the discourse, reflecting on the process and the activity organization. According to the researchers, it is useful to understand how the existence of roles can change the dynamics of knowledge building. In future studies, the researchers suggested that whether role taking would bring benefits to the group knowledge building generally compared to those without roles and therefore, further research was needed to examine the role-taking perspective.

It is intended in this study to examine the contributions of four groups, which are either non-scaffolded, or make use of the scaffolds of sentence opener and role assignment in combination and separately, to the knowledge building process comprehensively in a quasi-experimental design. Self-determinations of these groups, which contribute to the knowledge building process, and make use of different scaffolds, are further examined hereunder. In this context, the current study focused on three main research questions:

- What are the differences in contributions of knowledge building process among discussion groups scaffolded with sentence openers, role assignment, combination of sentence openers & role assignment, non-scaffolded? Do high cognitive contributions differ among the groups in knowledge building process?
- What is the detailed analysis of the high cognitive contributing group?
- Are there any differences among the groups in terms of their self-determinations?

Background

Knowledge building in online collaborative learning environments

In the twenty-first century, throughout which the societies and economies have been shaped on the basis of knowledge, learning is seen to occupy a central position (ET, O. D. C. 2008; Pârgaru et al. 2009). In parallel to these developments we have been living through, students, too, have to possess the skills that may make them face various complex situations. Creating and building knowledge among these skills play a critical role. In the International Society for Technology in Education (ISTE) (2016) report, which emphasizes the skills and qualities required from the students in order to enable them to interact with the digital world, and to develop themselves, knowledge building is referred among the standards

determined for the students. In the ISTE report, the students are required to be Knowledge Constructor individuals. The students have to build knowledge critically, produce creative works, and organize various resources in order to bring about meaningful learning experiences not only for themselves, but also for the others. According to the report, the students have to be able to utilize effective research strategies in order to access the knowledge and digital resources for their intellectual or creative pursuits. Students have to be able to assess the accuracy, standpoint, reliability, and suitability of the knowledge, media, data, and such other resources. Students have to be able to organize knowledge from digital resources by making use of various tools and methods in order to create such unique works as e-portfolios, multimedia presentations, projects, reports, video displays that put forth meaningful connections or outcomes. Students have to be able to build knowledge by way of actively researching the actual issues and problems of the world, developing ideas and theories, and seeking after answers and solutions.

Educators find it critical to develop the students' skills of creativity, innovativeness, critical thinking, problem solving, communication, collaboration, etc. that are related with knowledge building in order to overcome the new challenges being encountered in the knowledge-based societies (Sun et al. 2010; Zhang and Sun 2011; Wu and Wang 2016). Knowledge building has come out in line with these needs (Scardamalia and Bereiter 1994; Scardamalia et al. 1989), and has been integrated with numerous technology-aided learning environments nowadays. What is emphasized with knowledge building is to point out the importance of expanding the limits of the collective creation of knowledge, and those of the knowledge itself within a community. Knowledge building involves an in depth perception, which requires collaborative inquiry, continuous elaboration of the ideas, establishing dialogue, and maintaining interaction over a certain subject. Throughout the knowledge building process, the students are told of what their communities should do to elaborate their ideas, and create knowledge, and students largely assume responsibility for their own learnings (Scardamalia 2002; Scardamalia and Bereiter 2006).

Sentence openers and role assignment scaffolds

Enabling the students to make use of scaffolds in online collaborative learning environments facilitates them in forming and discussing, arranging, organizing, and progressing their individual ideas (Law et al. 2011; Scardamalia and Bereiter 1994; Woo and Reeves 2007; Yücel and Usluel 2016). Sentence openers, which consist of short sentences, are utilized for making the student define and initiate his/her idea. They are, in this respect, described as the predetermined ways of initiating the contribution. It is indicated that, using sentence openers is an effective strategy, since they not only improve the quality of the discussion between the students, but also bring along more comprehensive and superior cognitive discourses (Ak 2016; Lazonder et al. 2003; Scheuer et al. 2013). Students may thereby assess their learnings throughout the discussion processes more positively. Role assignment is defined as one of the scaffolds that encourages the community members to play several written roles within an online discussion environment, and thereby makes them adopt the knowledge building process (Cesareni et al. 2016). Roles are the functions or responsibilities that direct the individual behaviour, and arrange the group interaction (Strijbos and Weinberger 2010). Role assignment is an effective approach that is intended for improving the content and structure of the knowledge, and the level and quality of discussion within the discussion environments. The productive interaction and the interdependence based on the speaking functions and collaboration throughout the discussion

process may thereby be enhanced (Wise et al. 2012). Role assignment gives hope towards the enhancement of the level of cognitive presence in the research communities (Gašević et al. 2015).

Methodology

Research design and participants

The study is based on a quasi-experimental design. It is participated by a total of 77 teacher candidates, 70 of whom are females, and 7 of whom are males. These students with an average age of 21 (SD: 3.222) ranging between 18 and 33 study at a university in Turkey. The same instructor gives course with similar content to this group consisting of 4 different classes, who are assigned to him/her readily. All students voluntarily participate in the knowledge building environment, which is carried out in the course process and this is considered as a part of the course, since their participation takes long period of the course. However, the students are told that, the main purpose of the process is to enrich their learning process by sharing.

Students may attend the knowledge building environment both face to face at the course time, and online as being independent from both time and space. Since it is hard to build knowledge within large groups, the students are divided randomly into 8 discussion groups consisting of 8–11 students according to the population of their classes so as to organize this process well, and to create an environment of knowledge building (Cesareni et al. 2016; Hmelo-Silver and Barrows 2008). Scaffolds (roles and sentence openers) are randomly assigned to each group. The instructions for the content of the scaffolds and their intended use are given in detail in the discussion environment. The student who does not take any scaffolds could be transferred to the unscaffolded group. When determining the roles, 1–3 students are asked to take a role randomly in each group. Students were free about how they can enact their roles. If the student declined a role, other student is asked to accept the role. Students who did not take any role could pass to different groups. No rotation was performed between the groups or role assignments. Students participated in eight discussion forums during 8 weeks. No significant group difference is found ($p > 0.05$) according to their genders, ages, and background information (basic computer skills—frequency, level, and experience of use); in other words, the characteristics of all groups resemble each other at the beginning of the course.

Course design and procedure

This study is carried out in the second semester of 2016–2017 within the scope of Computer II course. The content of the course involves the computer-aided educational process, based on the utilization of the multimedia applications in the learning process. Its content consists of the subjects namely Tutorials, Drills, Hypermedia, Simulations, Educational Games, Tools, and Open Ended Learning Environments. Students review relevant cases regarding one of the subjects from Turkey and Worldwide every week, and share these reviews in the knowledge building environment. Besides, each student learns a Web 2.0 tool within the scope of the respectively determined subject (i.e., Tutorials), and prepares an application in relation with his/her field of study by making use of this tool. While they use Powtoon for Tutorials, they use Kahoot for Drills, Wikispace for Hypermedia, as

well as ToonDoo and Storybird for Tools and Open Ended Learning Environments. While they create animated presentation via Powtoon, they create quiz and jumble via Kahoot, encyclopedia via Wikispace, cartoons via ToonDoo, and digital stories via Storybird. They carry out all the shares and reflections throughout this process in the knowledge building environment. The experimental process is shown in Fig. 1.

The students had no previous experience in course content and knowledge building process. That is why they make use of Modular-Object-Oriented-Dynamic-Learning-Environment (MOODLE), which is one of the Learning Management Systems (LMS), while they are informed of the course's content and the learning process for the first 2 weeks. Moodle's discussion platform was used in this study. The reasons why Moodle is preferred in this study are that, it is open-source, manages and utilizes the course and content easily, provides access free of charge, but above all, it facilitates the learning activities, allows monitoring, and carries out reporting. The groups other than the group not supported with scaffold are told of which scaffold (sentence openers (SO), role assignment (RA) and SO&RA) they are to use, and how they are to make use of that scaffold, in order to participate in the discussion environment. For the following 8 weeks, the inter-group knowledge building activities are carried out in Moodle discussion platform. The instructor taught the subjects (Tutorials, Drills, Hypermedia, Simulations, Educational Games, Tools and Open Ended Learning Environments) to all groups at the first hour of every week. However, the instructor does not interfere in the knowledge building discussions. In the period of 8 weeks, students bring in the domestic and foreign multimedia application examples, as well as the digital materials they created to the discussion platform. The course is completed, and the data are collected in the last 2 weeks.

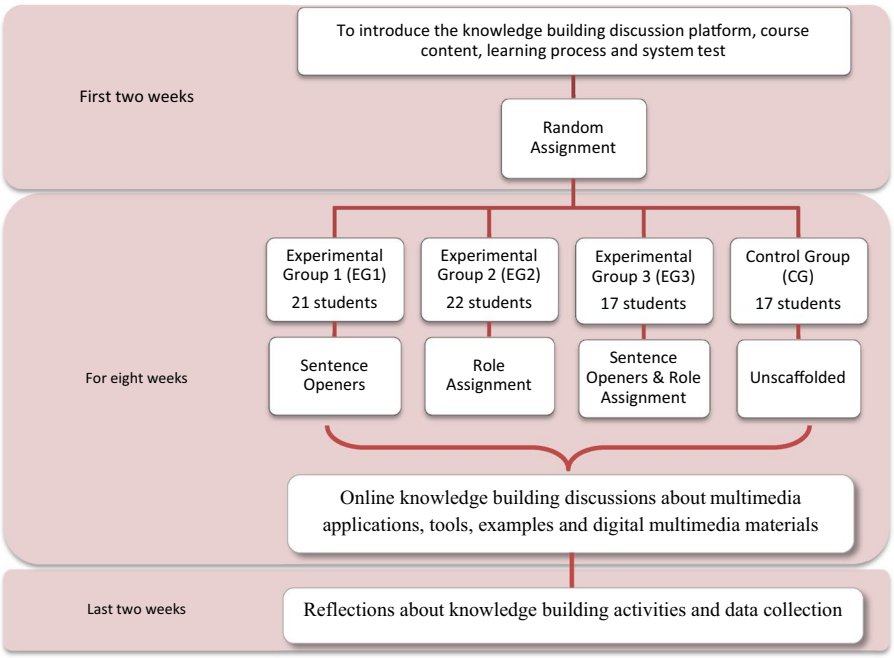

Fig. 1 Procedure of the experiment process

A knowledge building environment appertaining to each discussion group is created over Moodle every week regarding the relevant subject. While only the sentence openers are integrated in the discussion environment for EG1 group, and only information regarding the role of each member, and regarding the tasks of the roles is integrated for EG2 group, both the information regarding the role of each member, and regarding the tasks of the roles, as well as the sentence openers that may be used with the roles are integrated for EG3 group (Appendix 1). CG group is given only the detailed instruction. Besides, in the discussion environment, all groups are given detailed instructions regarding the relevant subjects to be discussed every week (Fig. 2). While the students are to seek also for examples worldwide, they are given search words in English as leads in each instruction.

In this study, a detailed literature review is carried out while determining sentence openers and roles to be adapted to the experimental process. When determining the sentence openers, attention is paid to be in accordance with the knowledge building approach, to be used in all roles with different kinds and meanings and to assist students in giving explanations, questioning, and argumentation (Chan 2001; Lazonder et al. 2003). Five roles are specifically designed to enable students to implement and configure knowledge building: Starter, Supporter, Moderator, Source Searcher & Theoretician, and Summariser. These roles are designed to create socio-cognitive conditions to scaffold collective cognitive responsibility in the process of knowledge building (Cesareni et al. 2016). While determining roles, it is tried to link with specific 12 socio-cognitive and technological knowledge building principles, which are inseparable from each other and work together as a whole in a community. Whichever sentence openers are suitable for which role was decided by reviewing the literature and sometimes a sentence opener could integrate with more than one role. In the first 2 weeks of the process, discussion is finalized by taking the suggestions of the students for sentence openers. Roles and sentence openers are listed in the Moodle discussion pages for each groups. The students started their discussions by writing the sentence openers they wanted. An example of the LMS logs of the EG3 group is shown in Fig. 3.

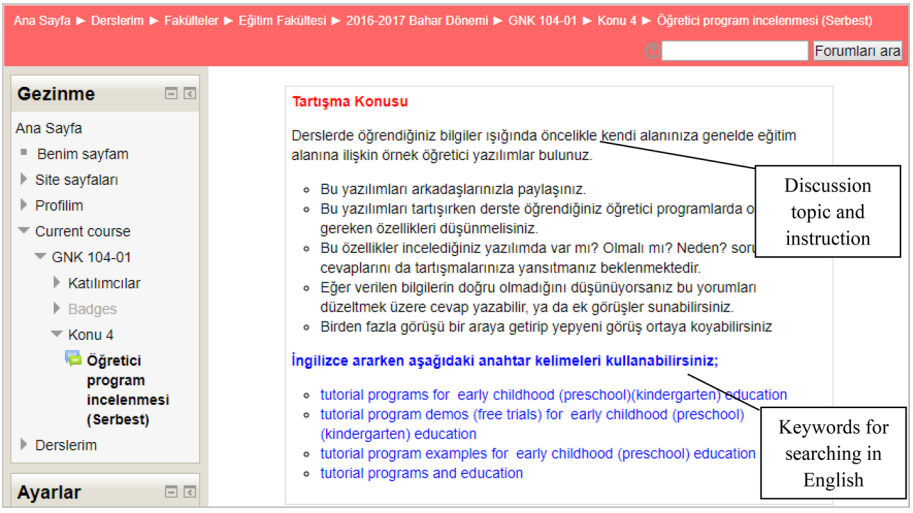

Fig. 2 The example of instruction

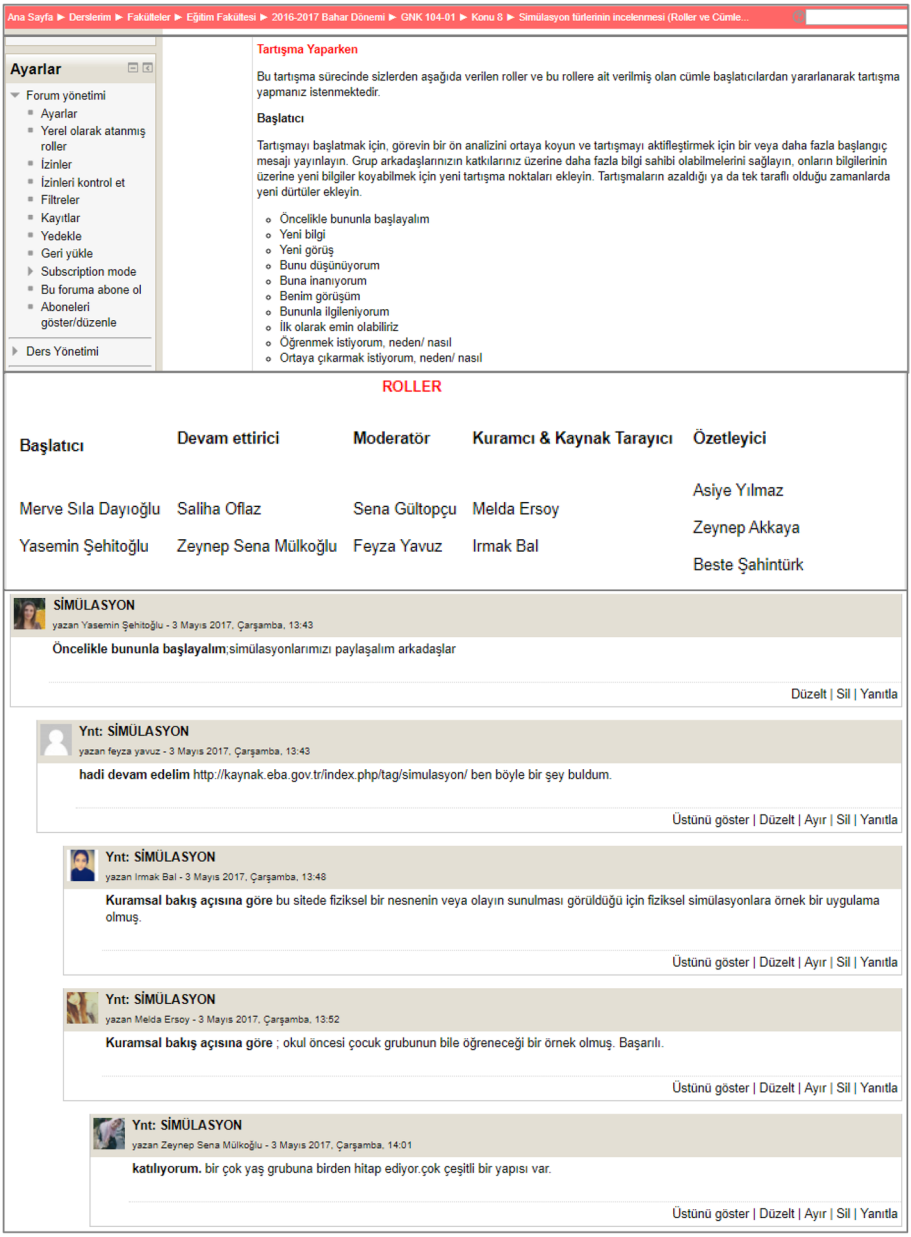

Fig. 3 An example of the LMS logs of the EG3 group

Data collection tools

Self-determination scale

Self-determination scale, which was adopted in Turkish by Kart and Güldü (2008), was

designed to assess individual differences of students for the tendency of people to function in their self-determined way. It is thus considered (1) to better understand their feelings and self-perceptions and (2) to feel a sense of choice according to their behavior. This scale consisting of 2 dimensions (5 items in the self-awareness, and 4 in the perceived choice) and 9 items was applied to 232 university students. The reliability coefficient (Cronbach Alpha-α) of the "self-awareness" and "perceived choice" subscales were 0.67 and 0.71 respectively. Self-determination scale was developed by Sheldon and Deci (1996) to assess individual differences in autonomous decision making. Participants were asked to determine the most accurate appearance according to them from pairs of expressions given on the scale. For example, against the expression "My emotions sometimes seem alien to me", the expression "My emotions always seem to belong to me" refers to the "*self-awareness*" dimension and the expression " I am free to do whatever I decide to do" against the expression "what I do is often not what I'd choose to do" refers to the "*perceived choice*" dimension. Participants made this determination based on a five-point likert-type scale ranging from "only A is completely correct" to "only B is completely correct". At the end, the total scores of self-determination and the scores of the two sub dimensions could be obtained. In many samples where the original scale was applied, the distribution of alpha values between 0.85 and 0.93 indicated that the scale had good internal reliability. In this study the Cronbach Alpha (α) was found 0.85 for self-determination, 0.75 for self- awareness dimension and *0.*81 for perceived choice dimension.

Content analysis of groups

The coding scheme developed by Veerman and Veldhuis-Diermanse (2001) is used in this study. According to Schellens and Valcke (2005), the coding scheme developed by Veerman and Veldhuis-Diermanse (2001) shows a clear relationship between collaborative activity types and knowledge building. It differentiates between task-related and non task-related communication and behavior. For this reason, they pointed out that this content analysis scheme is the most appropriate for students who are new in the knowledge building process. It is also considered as a proof of its validity as it is a scheme that has been used in previous studies (Ak 2016; Rienties et al. 2012; Schellens and Valcke 2005; Timmers et al. 2008; Zhu 2012). Their model's theoretical background is based on social constructivism and knowledge construction. Their scheme is divided into two message categories: non task-related (planning, technical, social and nonsense) and task-related messages (new facts, experience/opinion, theoretical ideas, explication and evaluation).

Content analysis was used to reveal evidence about learning details in knowledge building from the online discussion activities. The complete message has been selected as a unit of analysis so that encoders can agree consistently on the total number of coding units (Rourke et al. 2001; Schellens and Valcke 2005). At the end of 8 weeks there were a total of 4251 messages (Cronbach Alpha (α) = 0.833) from 77 students. Second expert coder coded approximately three quarters of the total messages to be randomly selected from all weeks and group discussions according to the coding scheme. Cohen's Kappa analysis was performed to measure the level of agreement between the two coders on the same data set for inter-rater reliability. Kappa coefficients were 0.76 for EG1, 0.78 for EG2, 0.82 for EG3 and 0.80 for CG. Cohen's Kappa has a value between − 1.0 and + 1.0. Kappa is close to + 1 means that the two coders agreed on the same data in a perfect and consistent manner (Wood 2007).

Statistical analyses

SPSS 18 was used for statistical analyses. Multivariate analysis of variance (MANOVA) was used to analyse the hypotheses, thus type I error (α) was controlled. Bonferroni's correction for multiple comparisons was applied and 0.0125 threshold was determined to be statistically significant. The distribution of data was checked for normality before proceeding to statistical analysis. Natural log ($\log_e$) transformation was used to deal with non-normality (Gašević et al. 2015; Keene 1995). Eta squared (η^2), the most commonly reported estimate of effect size for the ANOVA was used (i.e., 0.01-small, 0.06-medium and 0.14-large) (Cohen 1988; Green et al. 2000). Moreover, the presence of a moderate correlation between dependent variables showed that there is no problem of multicollinearity.

Results

Comparing contributions to knowledge building process

Firstly, the number of messages view and add, which may be a quantitative indicator of students' participation in Moodle, was examined. Students with the EG3 group (Role Assignment & Sentence Openers) were the most active in terms of message view (7040) and message add (1411). Students with the Supporter role were the most active in terms of message add (394) and Starter role were the second, Summariser role were the third, Moderator role were the fourth and Theoretician/Source searcher role were the fifth. Summariser role were the most active in terms of message view (1784).

According to content analysis, on avarage, EG1 group students contributed 4.08 (SD = 0.41), EG2 group students contributed 3.70 (SD = 0.50), EG3 group students contributed 4.48 (SD = 0.37), CG group students contributed 4.13 (SD = 0.59) messages during knowledge building process. While the average message contributions of the students seem to be similar, the contribution of the EG3 group seems to be highest.

Before the detailed analysis, the assumptions of MANOVA analysis were checked. The homogeneity of variance–covariance matrices assumption was not met based on the results of Box's test (Box's M = 374.95, F = 1.646, $p < 0.05$). The results of Levene's test of variance homogeneity were indicated that assumption was not met only in three of the nine categories ($p < 0.05$), while it was met in the other six categories. The results of Levene's test were found (F = 13.70, p = 0.000) for Nosense, (F = 4.24, p = 0.008) for Explication and (F = 17.72, p = 0.000) for Evaluation. Due to the absence of these assumptions, Pillai's trace is considered as the multivariate index. "If homogeneity of variance–covariance is violated and when working with unequal sample sizes, a more robust multivariate test statistics, Pillai's Trace in place of Wilk's lambda, can be selected when interpreting the multivariate results" (Mertler and Reinhart 2016, p:130; Tabachnick and Fidel 2012).

When examining in detail according to all categories of Veerman and Veldhuis-Diermanse (2001), MANOVA results indicated the evidence of significant differences among the groups (Pillai's trace = 1.459, F(36, 192) = 5.051, $p < 0.0125$) with the exception of planning category (C1). Although the CG group students posted more non-task-related messages, the difference among the groups seemed not to be very high. The students in EG2 group posted significantly fewer non-task-related messages

and the students in EG3 group posted significantly most task-related messages. The CG group posted the most non-task-related messages (Table 1). There was no significant difference among the groups in the planning category (C1) because the students made almost equal contributions in all categories. While students in the EG2 group contributed significantly fewer to the technical (C2) and social categories (C3) than other groups, CG students have contributed more to the nosense category (C4). EG3 students contributed significantly more in the new facts (C5), own experience (C6) explication (C8) and evaluation (C9) categories. Particularly in the C8 and C9 categories, it was seen that the EG3 students made significantly more contributions than all other groups. A significant difference was found among the groups in the theoretical ideas (C7) category and it was seen that the CG students had fewer contributions in this category than the EG1 and EG3 students. Considering the average in this category it was seen that EG3 is the most contributing group in this category. The results of univariate ANOVAs indicated significant differences with large effect sizes (eta-square) in task-related contributions to knowledge building process, especially in C8, C9 categories.

According to the Schellens and Valcke (2005), in the Veerman and Veldhuis-Diermanse (2001)'s model, it is seen that the groups with higher knowledge building activities have higher contributions in the *explication* (*C8*) and *evaluation* (*C9*) categories. According to Rienties et al. (2012), *theoretical ideas* (*C7*)*, explication* (*C8*) and *evaluation* (*C9*) categories can be specified as high cognitive messages. Thus, when examining higher cognitive processing messages (C7, C8 and C9 categories) on average, EG1 contributed 1.99 (SD = 0.51), EG2 contributed 1.73 (SD = 0.39), EG3 contributed 2.63 (SD = 0.59), CG contributed 1.42 (SD = 0.36) messages. Significant differences were found in the higher cognitive contributions among the groups. EG3 students had higher cognitive contributions more than EG1, EG2 and CG students, with a large effect size (eta-square, η^2). When examining students' basic cognitive processing messages (C5 and C6) on average EG3 contributed the most.

Detailed analysis of EG3 (scaffolded with sentence openers and role assignment) students' contributions

EG3 students were examined for their role-based participation because of their higher cognitive contribution (Table 2). As shown in Table 2, it is observed that the students in the starter role were most active in *planning* and *technical*. The students in the moderator role were most active in *social* and *nosense* categories. The students in the moderator role was shown the highest participation in non-task-related categories.

Students in the starter role were most active in *new facts and own experience* categories. Students in the theoretician/source searcher role most participated in *theoretical ideas* as expected and followed by summariser. Students in the supporter role most participated in *explication,* followed by theoretician/source searcher and summariser role students were most active in *evaluation* categories followed by supporter. The moderator was the least contributing role in the *explication* and *evaluation* categories. In task-related categories, while all roles were close together, the students in starter role were most participated, followed by supporter. So sentence openers (e.g. new information, to begin with, my opinion, I agree because, the reason is, for example) used by starters and supporters were also the most used.

Table 1 Contributions to knowledge building process per student

	EG1 (1)		EG2 (2)		EG3 (3)		CG (4)				
	M	SD	M	SD	M	SD	M	SD	F-value	*Post hoc tests*	η^2
Non-task-related	2.81	0.59	2.07	0.60	2.76	0.60	2.92	0.78	7.57*	2 < 1, 2 < 3, 2 < 4	0.237
Planning (C1)	0.93	0.76	0.85	1.02	1.41	0.97	0.95	0.84	1.44		0.056
Technical (C2)	1.24	0.60	0.62	0.55	1.45	0.72	1.93	0.94	11.73*	2 < 3, 2 < 4	0.325
Social (C3)	1.94	0.90	0.56	0.70	1.27	0.73	1.71	0.90	11.89*	2 < 1, 2 < 4	0.328
Nonsense (C4)	0.54	0.75	0.06	0.20	0.52	0.60	0.84	0.79	5.37*	4 > 2	0.181
Task-related	3.73	0.41	3.46	0.54	4.25	0.40	3.74	0.57	8.68*	3 > 1, 3 > 2	0.263
New facts (C5)	2.16	0.40	2.18	0.55	2.73	0.46	2.51	0.53	5.90*	3 > 1, 3 > 2	0.195
Own experience (C6)	3.16	0.61	2.75	0.77	3.57	0.58	3.13	0.88	4.23*	3 > 2	0.148
Theoretical ideas (C7)	1.30	0.73	0.83	0.60	1.40	0.95	0.53	0.67	5.53*	4 < 3, 4 < 1	0.185
Explication (C8)	0.51	0.70	0.56	0.59	1.57	0.73	0.15	0.34	16.99*	3 > 1, 3 > 2, 3 > 4	0.411
Evaluation (C9)	0.28	0.38	0.16	0.37	1.02	0.84	0.00	0.00	15.08*	3 > 1, 3 > 2, 3 > 4	0.383
Higher cognitive	1.99	0.51	1.73	0.39	2.63	0.59	1.42	0.36	21.17*	3 > 1, 3 > 2, 3 > 4	0.465

ANOVA *F*-test for EG1 ($n = 21$), EG2 ($n = 22$), EG3 ($n = 17$) and CG ($n = 17$)

CG control group, *EG1* experimental group 1, *EG2* experimental group 2, *EG3* experimental group 3

*Coefficient is significant at the 0.0125 level

Table 2 Contributions to knowledge building process with different roles in EG3

	Experimental Group 3 (EG3), Sentence Openers and Role Assignment														
	Starter			Supporter			Moderator			Theoretician/Source searcher			Summariser		
	n	M	SD	n	M	SD	n	M	SD	n	M	SD	n	M	SD
Non-task-related	4	3.22	0,23	4	2.76	0.45	3	3.29	0.46	3	2.01	0.26	3	2.35	0.50
Planning (C1)	4	2.46	0.27	4	1.04	0.40	3	2.11	1.06	3	0.23	0.40	3	1.00	0.53
Technical (C2)	4	1.86	0.38	4	1.43	1.11	3	1.81	0.82	3	1.13	0.46	3	0.92	0.40
Social (C3)	4	1.54	0.41	4	1.56	0.73	3	1.71	0.53	3	0.46	0.40	3	0.88	0.99
Nonsense (C4)	4	0.45	0.54	4	0.40	0.80	3	0.83	0.73	3	0.23	0.40	3	0.73	0.63
Task-related	4	4.46	0.28	4	4.37	0.73	3	3.99	0.04	3	4.16	0.40	3	4.16	0.03
New facts (C5)	4	3.31	0.35	4	2.48	0.41	3	2.70	0.19	3	2.19	0.11	3	2.83	0.06
Own experience (C6)	4	3.86	0.29	4	3.82	1.09	3	3.43	0.13	3	3.25	0.27	3	3.34	0.28
Theoretical ideas (C7)	4	1.24	0.46	4	0.62	0.46	3	1.19	1.04	3	2.79	0.87	3	1.46	0.71
Explication (C8)	4	1.59	0.42	4	2.18	0.60	3	0.73	0.63	3	1.83	0.86	3	1.29	0.56
Evaluation (C9)	4	0.75	0.66	4	1.07	0.52	3	0.37	0.63	3	0.96	1.12	3	2.00	0.82

Comparing students' self-determinations

The results of Box's test (Box's M = 8.437, F = 0.890, p > 0.05) was indicating that the assumption of homogeneity of covariance was satisfied. The results of Levene's test was not statistically meaningful for all the categories (p > 0.05). The results of Levene's test were found (F = 1.488, p = 0.225) for self-awareness, (F = 0.209, p = 0.890) for perceived choice. Therefore, Wilks' Lambda was used as the test statistic. The MANOVA showed a significant difference among groups for the self-determination of students (Wilks' Lambda = 0.784, F (6,144) = 3.100, p = 0.007, $\eta^2 = 0.114$). Univariate F tests showed significant differences with high effects (Cohen, 1988) between the groups for the dimensions of self-determination: self-awareness ($\eta^2 = 0.147$) and perceived choice ($\eta^2 = 0.177$) (Table 3). The self-determination of EG2 students was significantly lower than EG1 students. EG1 group had higher self-determination scores than the other groups. In other words, the self- awareness and perceived choice of students who used sentence opener scaffolds in the knowledge building process were higher. EG3 group students' self-determinations were found to be higher than EG2 and CG students.

Table 3 MANOVA results for students' self-determination in knowledge building process

	EG1 (1)		EG2 (2)		EG3 (3)		CG (4)				
	M	SD	M	SD	M	SD	M	SD	F-value	*Post hoc tests*	η^2
Self-awareness	21.6	2.75	17.8	3.91	20.0	4.02	18.8	4.12	4.21*	2 < 1	0.147
Perceived choice	17.4	2.89	13.8	3.25	15.8	2.94	15.8	3.05	5.22*	2 < 1	0.177

ANOVA F-test for EG1 (n = 21), EG2 (n = 22), EG3 (n = 17) and CG (n = 17)

CG control group, *EG1* experimental group 1, *EG2* experimental group 2, *EG3* experimental group 3

*Coefficient is significant at the 0.0125 level

Discussion

At the end of this study, participation in the knowledge building process seems to vary among the groups. It is further found that, making use of different scaffolds altogether and in a more detailed manner in the knowledge building process is found to have a significant influence particularly on the higher cognitive contribution (higher cognitive processing messages) of the students. In other words, using scaffolds especially the combination of sentence openers and role assignment scaffolds encourage higher cognitive levels of knowledge building. These students not only contribute to the knowledge building process with theoretical knowledge relevant to the context of the discussion, but also explain, interpret, explicate, and evaluate the available knowledge. It may be said that, the students in the knowledge building environment, which is not supported by scaffolds, have hardly any contribution to this process. Students making use of scaffolds are seen to make less non-task related contributions. The students (EG3) who make use of two particular scaffolds (sentence opener and role assignment) altogether are seen to make task-related contributions even more than those of the groups (EG1 and EG2) making use of the other scaffolds. It is further seen that, EG3 students' basic cognitive (processing) contributions (New Facts and Own Experience) are higher than those of the other groups. EG3 group is also found to be the group posting no-sense messages the least.

Upon review of LMS logs, EG3 group students are found to be the most active ones in adding and reading messages, and among them, those who are in the supporter role are found to be the most active ones in adding messages, and those who are in the summarizer role are found to be the most active ones in reading messages. EG3 group is also found to be contributing the most in the knowledge building environment. Significant differences are found between the groups in all categories, except planning. While the communications of the students in the knowledge building environment not supported by scaffold focus on more technical, or off-topic messaging, those in the knowledge building environment supported by scaffold focus on creating new information, putting forth individual experiences and theoretical knowledge, and on explicating and evaluating the available knowledge.

Upon detailed review of the contributions of EG3 group, which use the scaffolds of sentence openers and role assignment altogether, moderator is found to be most active in the non-task-related categories, and starter is found to be most active in the task-related categories. As it is expected, Theoretician/Source searcher is found to be most active in the theoretical ideas category, supporter in the explication category, and summarizer in the evaluation category. In this respect, supporter and summarizer are found to be the roles with the highest, and moderator to be the role with the lowest higher cognitive contribution in the knowledge building process. In view of the task definition of supporter, it is seen to be in charge with resuming the discussions by ways of giving examples, making descriptions, and with presenting causes and evidences. Explication is to enhance and elaborate any knowledge already indicated in the discussion (Veerman and Veldhuis-Diermanse 2001). In view of the task definition of summarizer, it is seen to be in charge with summarizing the solutions, indicating the different ideas and contradictions, explicating the knowledge more by way of logical and critical thinking, and with reasoning. Putting forth new and high-level of knowledge by way of unifying the discussion contents is also among its main tasks. Evaluation is to discuss the previous contributions firmly in line with the task definition with a critical point of view. Evaluation is more than "yes, it is a good idea", and generally involves the processes or motives of reasoning. It is evident that, there is a very close relation with the task definitions and functionality of these two roles. It may therefore

be said that, it would be a better approach to construct the knowledge building process by the role assignment scaffold. That is so, because the students may decide for the type of the contribution they would like to make in the knowledge building environment, approach this process by a more comprehensive manner, and be more reflective and elaborative by means of the scaffolds of sentence openers (Fujita and Teplovs 2010; Pifarre and Cobos 2010; Verdú and Sanuy 2014). However, when the role assignment scaffold is supported with a sentence opener being in relation with the task definition, such a combination is seen to have a significant effect on the task oriented and higher cognitive contribution.

Self-determination is an important variable that has an effect on the knowledge building, and therefore on the learning process of the students (Chen et al. 2010; Rienties et al. 2012). According to Vansteenkiste et al. (2006), self-determination may provide a quite helpful theoretical framework in order to understand the motivation in the context of education. That is so, because it is indicated that, social and environmental factors affect the motivation in self-determination. These factors are available in the active and collaborative learning with the group, in which social interaction, knowledge building and sharing particularly play a pivotal role. According to Serrano-Cámara et al. (2014), motivation is an important factor that affects a successful learning process particularly in the collaborative learning environments. The differences between the students' self-determinations may affect the type of the contributions that is elaborated by the students, as well as the sustainability and quality of the online discussion. That is why it is suggested to optimize the scaffolding in the knowledge building environments (Rienties et al. 2012). Benefiting from the scaffolds in order to facilitate the motivation in the knowledge building process may lead to positive outcomes. Hence a significant difference is attained among the groups in terms of self-determination within the scope of this research. This significant difference is between EG1 and EG2 groups, which make use of two different scaffolds. The self-determination of the group scaffolded with role assignment (EG2) was lower than the group scaffolded with sentence openers (EG1). There were two dimensions of students' self-determinations; self-awareness and perceived choice. Self-awareness and perceived choice of students scaffolded with sentence openers (EG1) and the follow-up EG3 students were found to be higher than the other groups. Significant differences between the self-determinations of the students in the groups may also affect their motivations. Low self-determinations of the students in group EG2 may be one of the reasons that their social interactions are found to be lower than those of the other groups as a result of the content analysis. While this result may cause positive outcomes for the task-related knowledge building process, it may also cause negative outcomes for the learning processes that require social interaction. The group that has the highest self-determinations is not found to be the one that makes use of both two scaffolds as a result of this research. However, it is evident that, self-determination is a variable that is influential on the collaborative knowledge building process. Especially in online learning environments, students have a great autonomous freedom and can decide their own learning paths. When students internalize the reasons for demonstrating a certain behavior, they become more self-determined (Legault et al. 2006). It is important to be motivated in this decision-making process. This indicates students' self-determination. According to Hänze et al. (2018), the self-determined behavior fosters intrinsic motivation. The knowledge building experience that supports students' experiences of both competence and autonomy should have a significant impact on the students' intrinsic motivation. According to Deci and Ryan (2000), not only students but also all people need supportive methods to improve their motivation. It is emphasized that students' self-determined and autonomous experiences such as knowledge building process have a strong impact on their learning behaviour (Rienties et al. 2012). In this context, the connection between the

students' self-determination degrees and the scaffolding used in the knowledge building process may explain why some students contribute more (Rienties et al. 2009).

Limitation, conclusions and future research

Findings of this research are limited by the sample group, and the number of the participant group may affect its generalizability. Besides, despite the discussion groups are created by random assignment in this study, and that the groups are found to possess similar characteristics, random assignment is out of question for the classes, since they are assigned to the instructor as being previously determined.

Quantity and quality are seen to be the two important criteria that have to be taken into consideration for facilitating the development of the ideas in a knowledge building community (Hong et al. 2016). Increasing the quantity of the ideas within a community is to bring along perpetual generation and diversification of ideas. Thus, the students in the community have to check out how to contribute to the ideas and how the ideas may be shared or changed, in order to increase their quantity. However, increasing the quality of ideas is to require the development and integration of the ideas by way of articulating them to one another, and giving details about them as well. The students in the community should therefore collaborate in order to deliver, clarify, or to elaborate their ideas (Hong and Sullivan 2009). Knowledge sharing is the key to this collaboration. Drawing the ideas together in the solution of a given problem, both quality and quantity has to be addressed jointly and closely. A progressive knowledge building process may thereby be realized. Although quantity is shown to be an indicator of the quality, rather than the increase in the quantity of the ideas, maintaining a perpetual improvement in the quality is what matters more for the group's knowledge building process (Hong et al. 2016). Upon review of the amount of the average message contribution in this research, EG3 group, which is supported by both two scaffolds, is found to be the most active group. CG group, which is not supported by any scaffold, is also found to be posting more messages in comparison to EG1 and EG2 groups. However, upon review of the messages in terms of content, the discussion process is found as not being detailed. It is seen that the content of the discussions consists of such messages "Hmm ok", "Thanks", "I agree with you", which not only keeps the discussions short, but also decrease their quality. Problems of sustainability, which is taken seriously in the knowledge building process (Zhang et al. 2015), are encountered in this group. It is concluded that, the groups, which make use of scaffolds either separately or jointly, generate more quality contents than those being generated by the group that does not make use of scaffolds. The groups that make use of scaffolds are found to eliminate such monotonous and off-topic discussion, focus on the subject matter, and attempt to question and evaluate the ideas. That is why although maintaining the group interaction and collaboration is still important for reinforcing the exchange and diversity of the ideas (Garrison et al. 2001), it may matter more to guide the students to the goal of development by way of elaboration and integration (Hong et al. 2016). However, this is a process, which is not as easy as it is thought to be realized and sustained, and that requires active participation (Cesareni et al. 2016). Scaffolds may support the students in the process of elaborating and integrating their ideas in terms of both quantity and quality (Tan et al. 2005). Hong et al. (2016) indicate that, encouraging the students to participate in the online activity more does not guarantee quality knowledge building. According to the researchers, in order to attain more efficient knowledge studies, the students have to develop ideas and do in-depth researches

continuously, and this requires more challenging idea integration activities. Lin and Chan (2018) put forth that, according to the research results, discourse groups of higher quality contain more problems, and ideas are constructed more consistently for the solution of the common problem.

21st century skills of today require going beyond the standpoint of the traditional learning. It is seen that, the knowledge building process lacks the meta-cognitive knowledge activities, and that the students are incapable of generating meta-cognitive ideas. That is so because in order to get the students involved in a meta-cognitive discussion process, the curriculum design should also have the flexibility to support this process. According to Zhou and Yang (2017), the students' collaborative knowledge buildings are affected from their learning motivations and meta-cognitions. The students who are able to confront real-life problems are to be able to advance their ideas to a higher level by way of producing, diversifying, elaborating, and integrating them perpetually. The students' self-determinations (their self-awareness and perceived choice) shall thereby increase, and their motivations shall be affected positively as well. According to Schellens et al. (2005), if the tasks being assigned to the students in the course of the knowledge building process to occur in the online discussion environments are to increase the students' senses of self-determination, this shall increase their motivations in the meantime. As the students' motivations increase, their knowledge buildings shall improve as well. That is why it is important to use such realistic problems that the students may correlate with their real life or work routines. Discussion topics have to allow the students ask explanation-seeking questions, and be applicable for open-ended inquiry for the sake of the development of the knowledge building process (Lai and Campbell 2018). The problem messages posted that start with questions are concluded with more active and quality discourses in the course of the collaborative knowledge building process (Khanlari et al. 2017). Besides, meta-cognitive shares may be realized more soundly not in a group that builds knowledge for the first time, but in a group that is experienced in that. This constitutes another limitation of this research. In this research, the discussion groups participate in the knowledge building process for the first time. A new knowledge building process, which is enriched with real life problems (i.e., performance of teaching profession), should be carried out with the same participant group within the scope of the next research. The increase in the quality of the meta-cognitive discourses should thereby be observed. A learning process, in which students are to arrange their own learning processes, build their individual knowledge, as well as meta-cognitive knowledge, and include the community in this process, shall be inevitable in the future. That is why knowledge building has to be integrated into different learning programs. Meta-cognition plays a critical role in enabling the students to develop their higher-order learning goals. Students' use of their meta-cognitive skills develops their collaborative knowledge buildings (Zhou and Yang 2017). Scaffolds assist this process as they establish a cognitive connection between the students and what they want to express. That is why it may be important to focus on new scaffolds that may support and facilitate the collaborative learning process, and enhance the dynamics of this process, and to integrate such scaffolds in the future researches.

Upon review of the groups that use scaffolds in terms of content, EG3 is seen to be the group that posts higher cognitive messages. In this respect, it may be indicated that, making joint use of both role assignment and sentence-opener scaffolds escalates the discussion in the course of the knowledge building process to the desired quality. EG2 group members, which make use of only the role assignment scaffold, are found to be having difficulty in initiating and resuming the discussion, and in expressing their ideas while enriching it. However, according to the results of Cesareni et al. (2016), this group is found to be

putting forth more problem sentences, supporting the messages with theoretical infrastructure, scanning the resources, attempting to do synthesizing and evaluation, tending towards diversifying their contributions, and avoiding off-topic speeches. On the other hand, members of this group assume the responsibilities that suit their own roles. For instance, in case an off-topic message is posted, the moderator is seen to raise a new question, and thereby drag the group back into the context of the subject. It is suggested that, this is the reason why EG2 group is the one that posts the least number of non-task related messages in this research. EG1 group, which uses only the sentence-opener scaffold, is seen to perform similar discussions, and have difficulty in diversifying these discussions. However, it is also noteworthy that, the members of this group express their ideas very clearly. For instance, it is even seen that, hardly any theoretical knowledge may be found in their discussions. This may be shown as the reason that, this group is ranked second after CG group in posting non-task related messages the most. It may be concluded out of the findings of this research that, making joint use of both scaffolds eliminates the foregoing critical deficiencies. It may therefore be suggested that, a knowledge building environment that is enriched by various scaffolds may assist the students in the learning process.

Determining the probable variables, that either affect the knowledge building process enriched by new scaffolds, or be affected by this process, may contribute to overcoming the encountered obstacles. For instance, the future researches may focus on "Community of Inquiry Framework (Garrison 2009)", which fortifies the cognitive independence, as well as the interdependency as a community, and aims to discern the online learning dynamics from a constructivist point of view based on collaboration. The group factor is important in the process of knowledge building. If the group dynamics is low in the discussion process, all members may be affected from this process negatively. Participation, even quality may decline consequently. It may therefore be helpful to look upon the use of the role assignment scaffold from the perspective of the research community (Gašević et al. 2015). Determining the students' senses of educational, social, and cognitive presence, and putting forth these components' relations with the scaffolds from this perspective may give support to the proper design of the online learning process both educationally and technologically, and to the students' role in this process. Examining the problems likely to occur in the knowledge building process, and grasping the students' and teachers' experiences in this respect may also play an important role not only in the proper structuring of this process, but also in keeping it active (Lin et al. 2014; Wang et al. 2017). For this reason, future studies may focus on measuring students' and teachers' experiences of knowledge building.

According to Wu and Wang (2016), the future researches should focus not only on the learning process, but also on the learning outputs for the sake of the progress of the knowledge building pedagogies. In this research, the self-determinations of the students are reviewed from the standpoint of groups, and a significant difference is found among the groups. Lin et al. (2017) conclude that, the knowledge building process develops the divergent thinking skills, and higher-level creative skills of the students, thereby enhancing the performances and creativities of the students. The future researches may examine how the knowledge building process may contribute to the knowledge and skills of the students from the standpoint of such new learning components as computational thinking, collaborative problem solving, critical thinking, (co)creative thinking, cognitive/meta-cognitive thinking.

The results of the literature, including this research, show that the use of the scaffolds contributes to support the knowledge building process and to increase the motivation of the students. As a result of this research, it has been shown that supporting the students with sentence openers and role assignment scaffolds has an important contribution to knowledge

building process at the higher cognitive level. However, it is clear that the learning environment supported by scaffolding is more successful than the unsupported. For this reason, it can be suggested that any learning subjects (i.e., English, Math, Science) supported by the knowledge building approach should be supported with at least one scaffold according to their aims and content. Actually, the self-determination of the group using the sentence openers was the highest in this study. Supporting the knowledge building process with scaffolds may affect both learning motivation and outcomes.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Appendix 1: Scaffolds

EG1: sentence openers

- To begin with
- New information
- New opinion
- Firstly, I think that
- Firstly, I believe that
- I am interested in
- We can first make sure
- Firstly, I would like to learn how/why
- Firstly, I would like to find out how/why
- I agree because
- That's right because
- I do not agree because
- My opinion
- My different opinion
- I need to understand
- It is important because
- I wrote about this because
- The reason is
- The details are
- For example
- The evidence is
- Would you please?
- Can we?
- Let's move on
- Please explain
- Please clarity
- Please elaborate
- Please indicate similarities
- Please indicate differences
- I would like to suggest that
- I have found some information

– According to source
– From a theoretical viewpoint
– From a empirical viewpoint
– According to theory
– A better theory
– This theory cannot explain
– Give information with the theoretical viewpoint
– I think that our ideas
– I think that our discussion process
– We have learned that
– We came up with the conclusion that
– From the discussion we can see that
– As a result
– To summarize
– A better summary
– Putting our knowledge together
– Integrating ideas together

EG2: role assignment

- Starter—starts the discussion first
- Supporter—resumes the discussion by way of either supporting, or not supporting the discussion
- Moderator—encourages the group to participate in the discussion, and directs it to logical sharing by means of the shares it makes
- Source Searcher & Theoretician—supports the discussion by means of theoretical knowledge and sources
- Summariser—summarizes the group discussions every week, puts forth new knowledge by way of integrating the contents, and integrates the knowledge

Starter

Put forth a pre-analysis of the task to start the discussion, and post one or more warm-up message(s) to activate the discussion. Keep your group-mates informed more about your contributions, and add new discussion points so as to add new knowledge up to their current knowledge. Add new triggers if the discussions either decline, or run one-sidedly.

Supporter

Resume the discussion by way of giving examples, making explanations, and presenting causes and proofs. Keep the discussion going by giving either positive, or negative feedbacks in response to the opinions of your mates. Direct your group mates towards dealing with the issue critically and logically by means of your both positive and negative supports.

Moderator

Monitor the discussions, and assist the group members in correlating their contributions. Ask critical questions so as to point to the similarities and divergences in the discussion

process, and encourage the members of the other group to display active participation in the discussion. Adjust the discussion process in order to coordinate and control the pace of the discussion. Approach equally to all members of the group. If the discussion does not go on efficiently, direct the discussion by way of assigning the other roles; such as requesting a new message from the starter for a new topic.

Theoretician and source searcher

Search for additional knowledge, and correlate it with the discussion. More specifically, you are expected to look through external sources, and move beyond the scope of the course sources. Take a quick look at the content of your source, and discuss why the source conforms to the theme of the discussion. Try to establish a clear connection between the discussion and the theory. Correlate all applicable theoretical concepts and knowledge with the ongoing discussion by way of citing the sources thereof. Correlate your theoretical input with the subject of the discussion clearly. You are recommended to seek for different courses, books, films, or practical examples other than the web sites. If you see the shares of the other group members lack any theoretical framework, tell them so. Ask from your group mates to comment about the sources from a theoretical or experimental standpoint, or over their past experiences.

Summariser

Keep track of all the posts of your mates throughout the discussion process. Present interim summaries at certain intervals of their posts. More specifically, present a general outlook of the discussions, summarize the solutions before the discussion ends, indicate diverging ideas, and provide interim solutions. Refrain from summarizing different subjects; however try to discern the contradictions. Formulate a final summary at the end of the discussion process. Ask from your other group mates to arrange their summaries, and thereby encourage them to collaborate. Add more explanation/reasoning by means of logical and critical thinking to the explanations/ideas put forth by your group mates. Put forth new and higher level of knowledge by way of integrating the contents of the discussions.

EG3: role assignment and sentence openers

Starter

- To begin with
- New information
- New opinion
- Firstly, I think that
- Firstly, I believe that
- I am interested in
- We can first make sure
- Firstly, I would like to learn how/why
- Firstly, I would like to find out how/why

Supporter

- I agree because
- That's right because
- I do not agree because
- My opinion
- My different opinion
- I need to understand
- It is important because
- I wrote about this because
- The reason is
- The details are
- For example
- The evidence is

Moderator

- Would you please?
- Can we?
- Let's move on
- Please explain
- Please clarity
- Please elaborate
- Please indicate similarities
- Please indicate differences
- I would like to suggest that

Source searcher and theoretician

- I have found some information
- According to source
- From a theoretical viewpoint
- From a empirical viewpoint
- According to theory
- A better theory
- This theory cannot explain
- Give information with the theoretical viewpoint

Summarizer

- I think that our ideas
- I think that our discussion process
- We have learned that
- We came up with the conclusion that
- From the discussion we can see that
- As a result
- To summarize
- A better summary

– Putting our knowledge together
– Integrating ideas together

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