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Fostering students' participation in creating educational content through crowdsourcing

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ABSTRACT

This paper proposes and evaluates a model of crowdsourcing in microlearning that includes the balancing of collaborative learning and crowdsourcing mechanisms. The goal of the research is to implement a learner-centered approach through crowdsourced content creation and to improve the process and outcomes of learning. Crowdsourced content creation was accomplished through a collaborative project within a higher education institution. Micro-courses in the form of short video lessons were created by students and published on the Coursmos platform and a certain group of students attended these micro-courses. The evaluation was carried out at the Faculty of Organizational Sciences, the University of Belgrade on a sample of 71 students who created micro-courses and 74 students who attended these micro-courses. The results show that the developed model provides simple communication and collaboration among students, high level of their self-organization and satisfaction, efficient management of crowdsourcing network and collaborative knowledge building.

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KEYWORDS
Crowdsourcing; microlearning; micro-courses; collaborative learning

1. Introduction

New e-learning environment offers different opportunities for collaboration and knowledge creation (McAndrew & Johnston, 2012). Collaborative learning connects students, professors, learning resources and activities into the student-centered environment which promotes participation and collaboration (Theng & Mai, 2013). Student participation and engagement are now positioned as main characteristics of high quality teaching and learning (Ashwin & McVitty, 2015).

Building a student-centered, participatory and interactive educational environment can be based on the crowdsourcing concept by combining students' collective intelligence and crowdsourcing mechanisms (Heusler & Spann, 2014). Crowdsourcing in learning (crowdlearning) refers to "learning through real-case projects with the participation of several students (crowd)" (Llorente, Morant, & Garrigos-Simon, 2015). Crowdsourcing in an academic context, compared to a business and social context, often has the characteristics of closed access to participation, smaller crowd size and non-monetary rewarding (Hedges & Dunn, 2017). Participation in crowdsourcing projects in education can be limited to students, educators, researchers, public, etc., or some combination of these (Solemon, Ariffin, Din, & Anwar, 2013). These projects are often realized within smaller groups, since large groups are usually not appropriate for learner-centered approaches (Hills, 2015). The

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reward for crowdsourcing participants in education is the knowledge they acquire by performing the tasks (Good & Su, 2013).

Crowdsourcing offers new approaches to: education, organization of educational system, design of study programs and syllabuses, creation of educational materials, organization of scientific research work, stimulation of students' creativity, etc. (Bogdanović, Labus, Simić, Ratković-Živanović, & Milinović, 2015; Ochoa & Sprock, 2011; Tarasowa, Khalili, Auer, & Unbehauen, 2013). Therefore, many universities in the world use it for different purposes (Skaržauskaitė, 2012).

Although crowdsourcing has a great potential in education, there is a lack of general understanding of the concept (Hosseini, Phalp, Taylor, & Ali, 2014) and researches related to understanding different activities used in crowdsourcing applications (Pedersen et al., 2013). The key challenge of crowdsourcing in learning is managing activities related to crowdsourcing mechanisms and collaborative learning. Therefore, the main goal of this paper is to design and evaluate an efficient and comprehensive approach that would encourage students to participate in crowdsourcing educational activities. We developed and implemented a model of crowdsourcing in microlearning. Microlearning is realized through crowdsourcing creation of micro-courses in smaller groups of students. Micro-courses were published on a platform accessible to the public and a certain group of students attended and peer-assessed the micro-courses (Anderson, 2011). Integration of crowdsourcing and microlearning has the potential to strengthen the participatory roles of students. The results of evaluation have shown the potential for the further use of the presented model.

2. Theoretical background

In an academic environment, crowdsourcing could be used for enhancing existing processes of education (Heusler & Spann, 2014). Crowdsourcing can be integrated into courses where students solve specific problems and reach solutions collaboratively (McAndrew & Johnston, 2012). Some tasks require a significant degree of collaboration among participants, while in others there may be the absence or low intensity of collaboration (Pedersen et al., 2013). Therefore, there are various approaches to crowdsourcing in education, including collaborative projects, creation of open educational resources, peer assessment, problem-based learning, etc. (Anderson, 2011). Although concepts of crowdsourcing in education and collaborative learning have a lot of similarities, the key features that distinguish crowdsourcing in education are: building a clear organizational structure with the key managerial role of crowdsourcer, required usage of online platforms and specification of the form of solution of a crowdsourcing task. In the context of crowdsourcing, collaborative work and students' collective intelligence are used to build collaborative knowledge, while crowdsourcing mechanisms enhance and support these activities (Heusler & Spann, 2014).

2.1. Crowdsourcing collaborative knowledge building

The theoretical foundations for building crowdsourcing collaborative knowledge can be derived from social constructivism (Anderson, 2011). The constructivist learning environment emphasizes the importance of activities of collaborative problem-solving that support the process of knowledge building (Theng & Mai, 2013). Collaborative knowledge building refers to externalization of individual knowledge from cognitive system into social system and it is accomplished with processes of external assimilation and accommodation (Kimmerle, Moskaliuk, & Cress, 2011). Collaborative environments imply small groups of students working together and solving problems with the purpose of learning (Cheung & Vogel, 2013).

In crowdsourcing collaborative environment with the student as producer model, students can be involved in identifying and explaining content, as well as in creating new content (Hills, 2015). Crowdsourcing collaborative knowledge building in higher education can be accomplished through collaborative creation of wikis (Wheeler, Yeomans, & Wheeler, 2008), asynchronous discussion groups (Schrire, 2006), online collaboration tools (Chu & Kennedy, 2011), creation of micro-courses (Zahirović

Suhonjić, Labus, & Despotović-Zrakić, 2016), etc. Collaborative learning through the collaborative creation of educational content enables students to generate, edit and synthesize knowledge (Wheeler et al., 2008). Individuals from the crowd contribute to collaborative knowledge building with their knowledge, ideas, solutions, etc. These contributions can be specific objective contributions or subjective content and they are at the end either aggregated or filtered (Prpić, Shukla, Keitzmann, & McCarthy, 2015). Aggregation of contributions can be accomplished through an integrated or selective approach (Geiger, Seedorf, Schulze, Nickerson, & Schader, 2011). All contributions obtained from the crowd should be verified with the verification mechanisms (Hosseini et al., 2014).

2.2. Crowdsourcing mechanisms

For the success of crowdsourcing collaborative projects, it is necessary to design an adequate structure and organization of collaboration and effectively manage crowdsourcing mechanisms (Pisano & Verganti, 2008). Hosseini et al. (2014) classify these mechanisms into: crowd-related, crowdsourcer-related, task-related and platform-related. Pedersen et al. (2013) point out the governance mechanisms such as incentive mechanisms, task break-down and task integration mechanisms, feedback mechanisms, etc. Enrollment mechanisms refer to providing the crowd with the opportunity to participate in the crowdsourcing platform or task (Hosseini et al., 2014) and this can be accomplished through open call, call limited to a specific community or a combination of both (Estelles-Arolas & Gonzalez-Ladron-de-Guevara, 2012). Mechanisms for managing collaborative network can be democratic or hierarchical (Pisano & Verganti, 2008). Estelles-Arolas and Gonzalez-Ladron-de-Guevara (2012) emphasize the importance of the mechanisms for determining the optimal size and composition of a group that solves the crowdsourcing task.

Among crowdsourcing mechanisms, the motivation or incentives that drive the crowd are especially important. For crowdsourcing in education, the most important are the following incentives: personal, social and compensation incentives. Personal incentives arise from an individual (self-esteem, fun, personal interest, self-realization, altruism) (Pan & Blevis, 2011) and from a task (learning and acquiring skills) (Hosseini et al., 2014; Pan & Blevis, 2011; Pedersen et al., 2013). Social incentives relate to recognition among participants, public recognition from colleagues or teachers (Hosseini et al., 2014), social relationships, social status in the community, and respect for others (Pan & Blevis, 2011). Compensation incentives come from crowdsourcer and they refer to higher grades, number of points, etc. (Allahbakhsh et al., 2013; Hosseini et al., 2014).

3. Development of the model of crowdsourcing in microlearning

The model of crowdsourcing in microlearning is structurally and functionally in accordance with the Input-Process-Output model (Pedersen et al., 2013). The model is presented in Figure 1. Between the task of crowdsourcing creation of micro-courses and the outcomes of crowdsourcing process there are two key functional layers: collaborative learning and crowdsourcing mechanisms, which are connected by technology.

The task involves the crowdsourcing creation of micro-courses as open educational resources. Collaborative learning is carried out through group creation of micro-courses. During the creation of micro-courses, students transfer their knowledge into information understandable to other members of the group, and this is accomplished by activities of external assimilation and accommodation (Cress & Kimmerle, 2008). External assimilation refers to adding initial content or simply adding new content to the existing content of the micro-course, without changing the basic message or the structure of the artifact, while external accommodation involves editing and reorganization of the content (Kimmerle, Moskaliuk, Harrer, & Cress, 2010). By creating the final content of the micro-course, the construction of explicit collaborative knowledge is accomplished.

Crowdsourcing mechanisms refer to the following components: behavior of entities, tactics for encouraging participation and hierarchy in the work of the crowd. Entities refer to individuals,

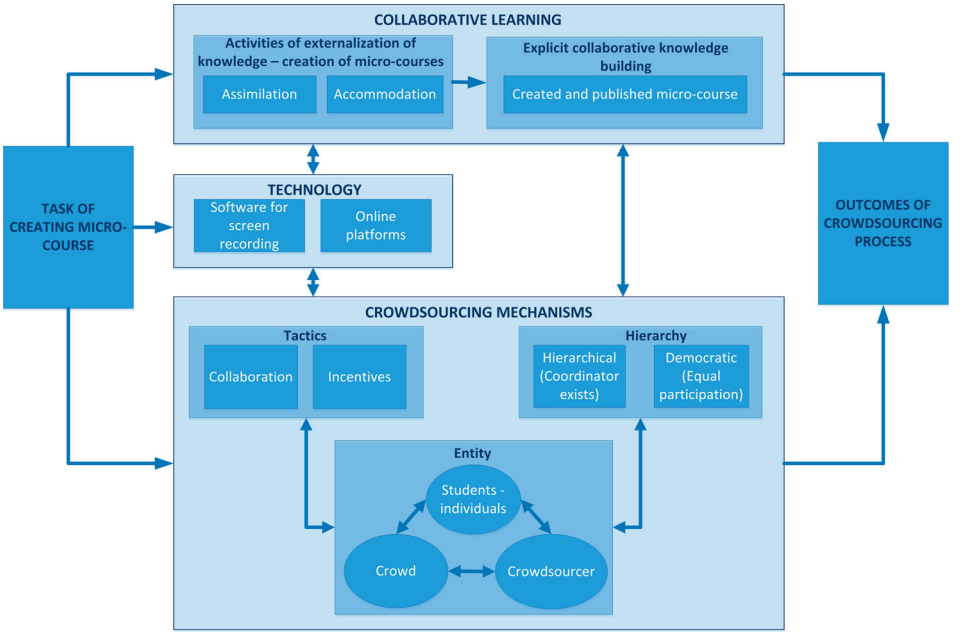

Figure 1. Model of crowdsourcing in microlearning.

crowd, and crowdsourcer (Pedersen et al., 2013). Managing the crowdsourcing (collaborative) network is a special task of crowdsourcer and it involves defining tactics and hierarchy in the work of the crowd. Tactics refer to a combination of different crowdsourcing mechanisms aimed at achieving collaboration (task description, student registration, group formation, task assignment, work control, etc.) and incentives for encouraging individuals to participate (Deci, Koestner, & Ryab, 2001; Tranquillini, Daniel, Kucherbaev, & Casati, 2015). Hierarchy in the work of the crowd implies hierarchical and democratic management of a group (Pisano & Verganti, 2008).

The technological aspect of the model of crowdsourcing in microlearning relates to harnessing different technologies, such as screen recording software (e.g. Camtasia, CamStudio, Ezvid), as well as platforms of open educational resources.

The outcomes of crowdsourcing process of micro-courses creation can be factual and perceptual (Pedersen et al., 2013). Factual outcomes can be measured by the number of completed and published micro-courses, evaluation of the quality of micro-courses by teachers and students, time needed to complete the task, etc. Perceptual outcomes are based on students' perception of satisfaction, confirmation, learning outcomes under the influence of externalized activities, etc.

4. Research methodology

4.1. Research aims and questions

The objective of the empirical research is the evaluation of the model of crowdsourcing in microlearning. Crowdsourcing is realized within small groups because students have sufficient level of knowledge which enables them to complete the task (Hosseini et al., 2014), and because it allows them to externalize their knowledge and to build explicit collaborative knowledge (Cress & Kimmerle, 2008). The basic research questions are:

(1) What are the key features of crowdsourcing mechanisms, collaborative learning and outcomes of the crowdsourcing creation of micro-courses? This requires investigation into the basic

characteristics of the members of the crowd, relationship between group members and crowdsourcer, mechanisms of tactics and hierarchy, collaborative knowledge building with external assimilation and accommodation, and outcomes of the crowdsourcing process.

(2) What are the key relations and interdependencies between the components of crowdsourcing mechanisms, collaborative learning and outcomes? In order to provide answers to this question it is necessary to investigate the relations between different variables, including: satisfaction, incentives, understandability of administrative support of crowdsourcer, grades on micro-courses quality, and students' gender and learning orientation.

4.2. Participants

The participants in the project were students as individuals, groups of third-year undergraduate students (crowd), project team of five members (crowdsourcer) and teachers (supervisor). The final number of the participating students who created micro-courses was 123. The groups consisted of two or three students (one student individually created micro-course). Among all the students who created micro-courses, 71 of them or 57.7% made the convenience sample. There were 28 male (39.4%) and 43 female (60.6%) students. The total number of students who attended micro-courses was 146. The sample of students who attended and evaluated micro-courses was 74 or 50.7%. There were 24 male (32.4%) and 50 female (67.6%) students who attended micro-courses.

4.3. Context

The project for micro-courses creation and evaluation through crowdsourcing was implemented within the e-learning course E-business at the Faculty of Organizational Sciences, University of Belgrade in the 2015/2016 academic year.

4.4. Procedure

The procedure of the project implementation is presented by the activity diagram in Figure 2.

The supervisor formed the project team that had the following tasks: to identify the potential topics of micro-courses, publish them, organize the procedure of students' applications, help students, review completed micro-courses and publish them on the Coursmos platform for

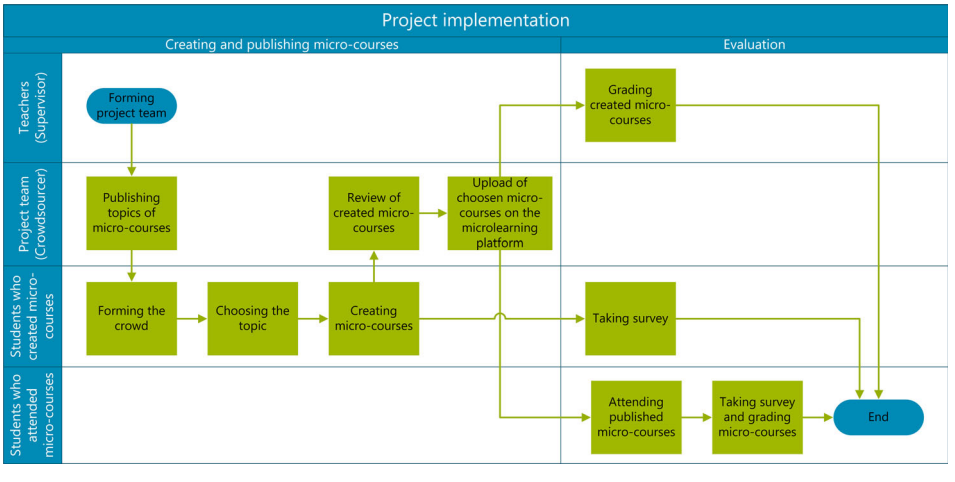

Figure 2. Activity diagram.

microlearning. The students were informed that they can participate voluntarily in the creation of the micro-courses. Their participation was rewarded with bonus points for the final exam. They could work individually or in self-organized groups. Each group had to choose a topic and then create a 5–7 min long micro-course. The topics were related to web technologies, Wordpress, MatLab, SuiteCRM, Microsoft Office, etc. The micro-courses were created by using the screen recording software and published on the Coursmos platform. Three course teachers were asked to grade the educational and technical quality of each published micro-course. The students voluntarily applied for attending the published micro-courses and they were also rewarded with bonus points for the final exam.

4.5. Variables and indicators

The variables of interest for this research refer to components of the layers of the model of crowdsourcing in microlearning. Each of the components is presented by the unobservable variable with the identified indicators, which is given in Table 1.

4.6. Data and methods of analysis

The data was collected via two surveys: one for the students who created micro-courses and one for the students who attended micro-courses. The quality of micro-courses was also graded by teachers. Different measuring scales were used for measuring the variables of the model. 5-point Likert-type scale [1-strongly disagree to 5-strongly agree] was used for measuring the attitudes of students who created micro-courses towards: incentives, satisfaction and understandability of administrative support of crowdsourcer. Students' claims regarding the individual attributes of incentives for learning and acquiring skills referred to encouraging or enhancing different attributes by participating in the creation of micro-courses. For the social and compensation incentives, the claims referred to the intensity of the significance of the incentive impact on participation while creating micro-courses. The general grades for the quality of created micro-courses given by the students who attended micro-courses were measured on a scale [1-worst grade to 5-best grade]. The teachers graded the quality of published micro-courses on a scale [5-worst grade to 10-best grade]. Other questions

Table 1. Variables of different components of the model of crowdsourcing in microlearning.

Component	Unobservable variable	Indicators
Crowdsourcing mechanisms		
Entity (Allahbakhsh et al., 2013; Cullina, Conboy, & Morgan, 2015; Hosseini et al., 2014; Pedersen et al., 2013)	Crowd	Group size, students' average work time, gender, structure based on learning orientation.
	Relationship with crowdsourcer	Understandability of administrative support of crowdsourcer, demands for help.
Tactic (Estelles-Arolas & Gonzalez-Ladron-de-Guevara, 2012; Hosseini et al.,2014; Pan & Blevis, 2011; Pedersen et al., 2013; Zahirović Suhonjić et al., 2016)	Incentives	Students' attitudes towards incentives.
Hierarchy (Pan & Blevis, 2011; Pisano & Verganti, 2008)	Democratic work of the group	Students' attitudes towards democratic work of the group, equality in giving ideas and creating micro-course.
	Role of the leader/ coordinator	Formal acceptance of the group coordinator, accepting the team leader.
Collaborative learning		
Collaborative knowledge building (Cress & Kimmerle, 2008; Kimmerle et al., 2011)	External assimilation	Adding content, interventions.
	External accommodation	Editing and synthetizing final content of micro-course, interventions.
Outcomes of crowdsourcing in microlearning		
Outcome (Cullina et al., 2015; Pedersen et al., 2013).	Results of the crowdsourcing process	Number of completed and published micro-courses, average time to complete the task, grades on micro-courses quality, students' satisfaction, grades of the students who attended micro-courses.

were dichotomous (yes/no) (e.g. adding content, demands for help) and questions stating the frequency (e.g. group size, interventions). Additional data was collected including: gender and preferences related to individual/collaborative learning in general (moderator variables).

An internal consistency was found of the measuring scales in both surveys. Cronbach's Alpha value of the used measuring scale for incentives, satisfaction and understandability of administrative support of crowdsourcer was 0.879, while for the scale with grades on different criteria for students who attended micro-courses it was 0.809. Moreover, every question in Cronbach's Alpha if Item Deleted for both instruments is higher than 0.773.

For the analysis of the results we used descriptive, correlation, Chi-square and T statistics.

5. Analysis of results

5.1. Analysis of crowdsourcing mechanisms

The analysis of crowdsourcing mechanisms refers to the characteristics of entity (behavior of the group members and their relationship with crowdsourcer) and the characteristics of mechanisms of tactics and hierarchy.

The basic characteristics of the members of the crowd are:

- Average size of the group that created micro-courses is 2.67 members.
- Average time per student for creation of micro-courses is 3.83 h with the standard deviation of 2.79.
- Cross tabulation analysis of variables: gender and orientation towards collaborative/individual learning shows that 50% of male and 79.1% of female students prefer collaborative rather than individual learning. The Chi-square test of independence (with Yates' Correction for Continuity) shows a significant relationship between students' gender and their orientation towards collaborative/individual learning, $\chi^2(1,n = 71) = 5.28$, $p = 0.02$. Phi coefficient is 0.304 and it demonstrates the medium relationship between these variables (Pallant, 2010).
- Regarding the relationship between group members and crowdsourcer the results are the following:
  - Only 4 (5.6%) students asked for help from crowdsourcer.
  - The mean value for understandability of the administrative support of crowdsourcer is 4.06 while the standard deviation is 0.97.

The mechanisms of tactics refer to encouraging students to participate (Pedersen et al., 2013). This is accomplished via four different types of incentives presented in Table 2.

Table 2. Incentives as mechanisms of tactics in creating of micro-courses.

Attribute	Mean	Std. Deviation
Incentives for learning		
Adjustment to learning orientation	3.92	1.02
Preferring collaborative, compared to individual, creation of micro-courses	3.97	1.29
Stimulation of creativity	4.00	1.03
Stimulation for making an effort at the course	3.73	0.96
Incentives for acquiring skills		
Advancing social and communication skills	3.82	1.20
Advancing skills for solving concrete tasks	3.76	1.15
Advancing teamwork skills	4.03	1.22
Advancing science-research skills	3.54	1.21
Social incentives		
Recognition by colleagues compared to the number of points	3.30	1.29
Compensation incentives		
Bonus points	3.17	1.35

Table 3. Mechanisms of hierarchy.

	Frequencies	
Mechanisms of hierarchy	Yes	No
Formal acceptance of the group coordinator	24	46
Accepting team leader	29	41
Directing other group members	29	41
Equality in giving ideas and creating micro-course	65	5

Compensation and social incentives have a significantly lower mean in relation to personal incentives for learning and acquiring skills. Bonus points have got the lowest mean and the highest standard deviation. What follows is recognition by colleagues as a less notable incentive of creating micro-courses. The most significant incentive for acquiring skills is advancing teamwork skills, while the most significant incentive for learning is stimulation of creativity.

Regarding the mechanisms of hierarchy in the work of the crowd (Table 3), the majority of the groups did not have coordinator/leader (58.6%). Democratic way of working is supported by 92.9% of students. Hierarchical way of working is characterized by accepting a formally determined coordinator (34.3%) and leader (41.4%). Coordinator/leader involvement was important in directing other group members (41.4%). Among the students who support the democratic approach to the creation of micro-courses, 44.6% of them accepted a coordinator/leader who directs the work of other participants.

5.2. Analysis of crowdsourcing collaborative learning

The analysis of crowdsourcing collaborative learning refers to the results of collaborative knowledge building.

Collaborative knowledge building occurs through external assimilation and external accommodation and their attributes are given in Table 4. Adding content into students' individual work by other group members occurred in 45.7% lessons, while adding content into work of other group members by individual student occurred in 51.4% lessons. The role of coordinator/leader was not very important for external accommodation (12.9% cases), while their involvement in synthetizing the final content of micro-course is present in the work of 39.9% students.

Frequencies of interventions for external assimilation are given in Table 5. The average number of interventions of other group members is 1.34 with the standard deviation 2.32, while the average number of interventions of individual students into work of other group members is 1.64 with the standard deviation 2.35.

5.3. Analysis of the outcomes of crowdsourcing process

The outcomes of the crowdsourcing process are analyzed based on the number of published micro-courses, time needed to create micro-courses and teachers' and students' grades on quality of micro-courses.

Table 4. Collaborative knowledge building.

	Frequencies	
Attribute	Yes	No
External assimilation		
Adding content by other group members	32	38
Adding content to the work of other group members	36	34
External accommodation		
Editing and correcting by coordinator	9	61
Synthetizing micro-course by coordinator	23	47

Table 5. Interventions.

	Frequencies of interventions				
Attribute	1	2	3	4	>5
Adding content by other group members	6	14	6	2	4
Adding content to the work of other group members	8	11	7	2	8

In two week period 46 micro-courses were created, among which 44 were published on the Coursmos platform. The average time to complete the task of creating micro-course per group is 10.23 h. The teachers graded published micro-courses based on two criteria: educational quality (Figure 3(a)) and technical quality (Figure 3(b)).

The average grade for educational quality of micro-courses is 9.43 with the standard deviation 0.73. Technical quality is lower graded, with the average grade 8.14 and the standard deviation 1.13. The reasons for lower grades for technical quality were mostly low resolution or low sound quality.

The mean for participation-related satisfaction is 4.31 and the standard deviation is 0.89. Considering the measured attributes of all the components, satisfaction related to the creation of micro-course has the highest mean and the lowest standard deviation.

Students who attended micro-courses graded them based on different criteria and means and standard deviations are presented in Table 6.

All the grades on micro-courses based on the criteria in Table 6 have the above average value. The created micro-courses are best graded by the criterion understandability, followed by the criteria usefulness and ease of use. The lowest graded criteria are adapted to the needs of students in relation to the level of knowledge and innovation.

5.4. Analysis of relations between variables of the model of crowdsourcing in microlearning

The Pearson's correlation coefficient at the 0.01 level demonstrated the following (Pallant, 2010):

- Between satisfaction on the one hand and incentives for learning and acquiring skills on the other hand, there is a statistically significant positive strong (higher than 0.5) or moderate (0.3–0.49) correlation. Satisfaction is not in correlation with compensation and social incentives.
- Between satisfaction and understandability of administrative support of crowdsourcer there is a moderate positive correlation.
- Between understandability of administrative support of crowdsourcer on the one hand and incentives on the other hand, there is a statistically significant strong or moderate positive correlation. A

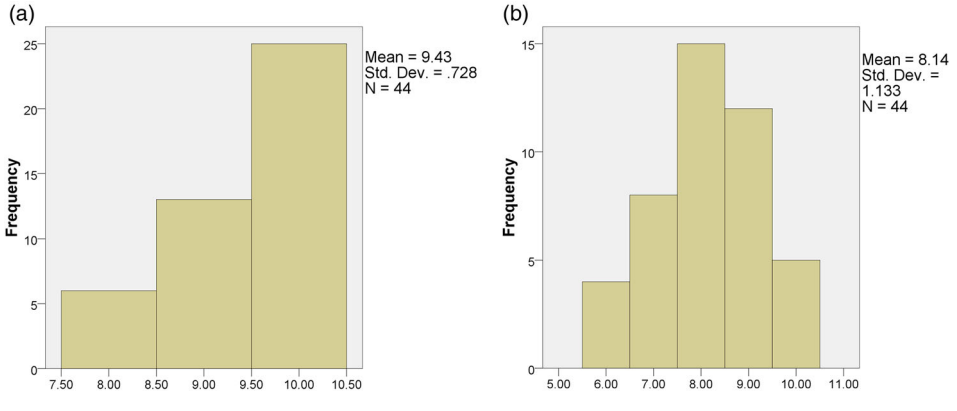

Figure 3. Teachers' grades on a) educational quality of the micro-courses, and b) technical quality of the micro-courses.

Table 6. Students' grades on micro-courses.

Criteria	Mean	Std. deviation
Ease of use	4.38	0.79
Innovation	3.88	0.92
Usefulness	4.38	0.75
Understandability	4.45	0.64
Adapted to the needs of students in relation to the level of knowledge	3.72	1.15
Time needed to learn micro-course content	3.96	0.91
The quality of learning	3.97	0.92
Improvement of skills	4.09	0.80
Stimulation for the courses at the Department of E-business as a whole	4.09	0.85
Enjoyment	4.07	0.87

moderate correlation was found with the variable recognition by colleagues. There is no correlation with compensation incentive.

- There is a moderate correlation between grades on educational and technical quality of micro-courses.
- There is no correlation between grades of micro-courses on the one hand, and incentives, satisfaction and administrative support of crowdsourcer, on the other hand.

Independent T-Test was used to compare the results of students' attitudes related to the influence of moderator variables of the members of the crowd (gender (G) and orientation towards collaborative/individual learning (C/I)) on incentives (Table 7). Effect size is interpreted as small (S), medium (M) and large (L).

According to all *p*-values in Table 7 which are less than 0.05, it can be concluded that there are significant differences in the following matters:

- Between female and male students regarding the attitudes towards the following six attributes: adjustment to learning orientation, preferring collaborative compared to individual, creation of micro-courses, advancing social and communication skills, advancing skills for solving concrete tasks, advancing teamwork skills and bonus points. The effect size based on eta-squared for these attributes is in the range from medium to large.
- Between students who prefer individual or collaborative learning regarding the attitudes towards the following attributes (with effect size): preferring collaborative, compared to individual, creation of micro-courses (medium to large), stimulation of creativity (medium to large),

Table 7. T-Test results.

	G		C/I	
Attribute	*p*	Effect size (eta)	*p*	Effect size (eta)
Incentives for learning				
Adjustment to learning orientation	**0.01**	M-L (0.09)	0.14	S-M (0.03)
Preferring collaborative, compared to individual, creation of micro-courses	**0.02**	M-L (0.08)	**0.02**	M-L (0.08)
Stimulation of creativity	0.35	S (0.01)	**0.03**	M-L (0.07)
Stimulation for making an effort at the course	0.10	S-M (0.04)	0.45	S (0.01)
Incentives for acquiring skills				
Advancing social and communication skills	**0.01**	M-L (0.10)	**0.00**	L (0.16)
Advancing skills for solving concrete tasks	**0.03**	M-L (0.07)	0.15	S-M (0.03)
Advancing teamwork skills	**0.01**	M-L (0.11)	0.07	S-M (0.05)
Advancing science-research skills	0.32	S (0.01)	**0.05**	S-M (0.05)
Social incentives				
Recognition by colleagues compared to the number of points	0.96	M (0.00)	0.08	M-S (0.04)
Compensation incentives				
Bonus points	**0.02**	S-V (0.07)	0.20	M-S (0.02)

advancing social and communication skills (large), and advancing science-research skills (small to medium).

There are significant differences regarding the attribute satisfaction related to participation between female and male students ($p = 0.04$, eta = 0.06 medium).

Additional analysis of profiles of students' attitudes of male/female population and students who prefer individual/collaborative learning shows that mean values of:

- Assessment of attitudes of the female population is higher than that of the male population for all the attributes of incentives and satisfaction.
- Assessment of attitudes of students who prefer collaborative learning is higher for all attributes of incentives, satisfaction and administrative support of crowdsourcer, compared to students who prefer individual learning.

6. Discussion

In this research it was confirmed that collaborative projects, crowdsourcing and micro-courses represent a suitable framework for encouraging students to participate in the creation of educational content. Implementation and evaluation of the model of crowdsourcing in microlearning in academic environment enable balancing the layers of crowdsourcing mechanisms and collaborative learning, as well as using the collective intelligence of students for creating and expanding knowledge. The results confirmed that students could successfully create educational content (Tarasowa et al., 2013). It was also confirmed that crowdsourcing can be combined with learning in order to improve learning and performance of individuals (Dontcheva, Morris, Brandt, & Gerber, 2014). Similar examples of a successful creation of crowdsourced content by students can be found in the works of Hills (2015) and Skaržauskaitė (2012). The advantages of this approach are simple implementation and the fact that it does not require financial investments since it uses the existing resources.

The research results indicate the validity of the model of crowdsourcing in microlearning and the procedure for implementation of the project. Throughout the process, students showed high competence for collaboration (Theng & Mai, 2013), high degree of self-organization, and low need for interventions of crowdsourcer.

Good planning of crowdsourcing projects and understanding of the use of administrative and technical support by students, have been confirmed as important factors for the realization of the project as a whole. A low number of demands for help from crowdsourcer confirm this.

Personal incentives for learning and acquiring skills in the creation of micro-courses have stronger intensity compared to social and compensation incentives, which is in accordance with the findings in the work of Hosseini et al. (2014). Mechanisms of students' incentives through bonus points and recognition by other students are the lowest graded aspects of creating micro-courses.

Students prefer democratic way of working in groups. However, there are a significant number of students who support the role of coordinator/leader in directing the work of the group, which implies the possibility of a hybrid approach to managing crowd hierarchy.

During the collaborative creation of micro-courses, external assimilation is more present than external accommodation. Since the participants are students, adding content is a simpler process than correcting and synthesizing knowledge. Based on perception of achievement it was found that externalized knowledge expands individual knowledge of students (Cress & Kimmerle, 2008), especially in segments of improving skills and stimulating creativity.

The effectiveness of metrics for perceptual outcomes defined by satisfaction of students has been confirmed (Pedersen et al., 2013). Satisfaction related to participation represents the most significant attribute of creating micro-courses (Theng & Mai, 2013). High level of satisfaction of students confirms the acceptance of this kind of participation (Kapp, 2009). The established correlation between

satisfaction and incentives for learning and acquiring skills can be an important determinant for planning and implementation of crowdsourcing projects in education.

The analysis of time needed for creating micro-course provides implications for better curriculum planning and the structure of grading. This is specially related to the objective determination of students' points during micro-course creation.

Teachers' satisfaction with the educational quality of micro-courses suggests that students can be engaged in creating educational content even more (Allahbakhsh et al., 2013). However, additional training regarding the technical aspects of content creating would be beneficial. Evaluation of created micro-courses by students showed that the most important criteria are understandability, ease of use, and usefulness. This can serve as a guideline for students' creation of educational content.

It is confirmed that female students and students who prefer collaborative learning give more importance to crowdsourcing projects than male students and students who prefer individual learning. This indicates the possibility to identify the mechanisms for managing the work of individuals in groups based on their gender. Our results are supported by findings in (Baneshi, Dehghan Tezerjani, & Mokhtapour, 2014; Tarhini, Hone, Liu, & Tarhini, 2016) and generalized in the context of crowdsourcing.

The model has certain limitations and disadvantages of the study: the platform does not offer a high level of informational support, implemented model is not directly related to the learning management system, evaluation was conducted according to the results obtained through closed crowdsourcing and survey, precise and objective metrics were not developed enough, there are limitations related to convenience sampling, and the number of indicators for external assimilation and accommodation is small.

7. Conclusion

This paper presents a new approach to fostering students' participation in creating educational content in higher education. The approach integrates the advantages of microlearning, crowdsourcing and collaborative learning. The proposed approach is student-centered, since it puts students in the role of knowledge creators. The experimental part of the study showed that students are more satisfied and motivated for learning when they participate in creating the teaching materials. Furthermore, the presented approach confirmed readiness of students for collaboration, production of good quality content and high level of self-organization. The model can be used by researches and practitioners to strengthen students' participation and to evaluate the efficiency of different types of e-learning. Future directions of our work include testing the proposed model in creating other forms of educational content and extending the model with the characteristics of individual learning.

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