

Correlation of MOOC Students’ Behavior Patterns and Their Satisfaction with the Quality of the Course

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Abstract—The article presents the results of the study on the patterns of behavior of massive open online courses (MOOCs) learners in the context of motives to the learning, set criteria of quality, and also the engagement rate. Within the research the data collected on learners enrolled in online courses of Tomsk State University on the online platforms Courcera, Lectorium and National Open Education Platform was classified and analyzed. It allowed us to define the students' patterns of behavior, to reveal the goals of learning on MOOC, social and demographic characteristics of the students, and also the quality criteria of the courses set by the students. As a result of data processing, a correlation between the above-mentioned parameters was found.

Keywords: *online learning, learning motivation, teaching, online course, learners, students, online learning support, automation of online course student support, virtual learning assistant, student behavior patterns, MOOCs*

I. INTRODUCTION

The agro-industrial complex (AIC) in general and the dairy One of the main problems in the field of online education is the low completion rate of courses, which is about 5% at average [1]. Researchers in the field of education note that completion is directly dependent on the learning engagement rate of learners, which is reflected in their behavior patterns [2, 3].

The study related to factors influencing on the engagement of learners with different learning behavior patterns contributes to the formation of an optimal model for MOOC learners support. In this regard, it is necessary to identify behavior patterns in the context of motives for learning, the socio-demographic characteristics of learners, MOOCs quality

criteria of learners. The correlation between the behavior patterns of learners and their satisfaction with the quality of MOOCs could also contribute to understanding the ways of influencing on the rate of engagement.

II. THE LITERATURE REVIEW AND THE METHODS OF THE STUDY

A. The literature review

The MOOC learners' engagement can be defined and measured differently, as well as its causing factors. The specialists note that the engagement of learners is defined by the criteria reflecting the level of the student's attention to the course's content. These criteria are based on the data of learners' behavior. Such criteria were offered in 2014 by 4 scientists: A. Anderson and J. Lescovic from Stanford University, and D. Huttenlocher and J. Kleinberg from Cornell University. They conducted the research on the engagement rate of MOOCs' learners and suggested their own engagement taxonomy [3]. Russian scientists, as usual, follow the offered criteria [16, 17]. The percentage of the watched video lectures and the completed assignments became the basic criteria used for the estimation of the engagement rate. Today, the given criteria are used for analytics in many universities around the world.

Based on the data analysis on user's behavior according to basic criteria, the scientists of Cornell and Stanford Universities defined the behavior patterns of MOOC learners. According to the engagement level in the learning process (from the highest to lowest), the following types were defined: All-rounders, Viewers, Solvers, Collectors, Bystanders [3]. Anderson, Lescovic, Huttenlocher and Kleinberg proved that

the learners' engagement is measurable and manifests itself behaviorally.

The scientists Wenzheng Feng, Jie Tang and Tracy Xiao Liu from Tsinghua University also contributed in the research on the engagement, having published the results of the research on the connection between the social and demographic characteristics of learners and their engagement rate. They identified the correlation between sex, age, educational background, course subjects and the learners' engagement rate [18]. The results of the Chinese scientists statistically prove the influence of variety of the factors on the engagement rate, which was mentioned in 2014 by Harvard and MIT scientists, who did the accent on the correlation of course's subject and behavior of the learners [4]. Rely on mentioned research, the student behavior characterized by various engagement rate has factors determining it. These factors can be studied and by affecting them we can modify the behavior of the MOOC learners in a preferred way.

Besides, the effect on the engagement of such factor as «the satisfaction of learners with the course» is considered as important in the international community [5]. The quality of the content plays an important role in the decision-making process about the beginning and continuation of study by the learners. According to these criteria, the quality can be evaluated subjectively, having connection with social and demographic characteristics of learners and depending on the behavior pattern.

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One more aspect influencing the engagement of learners is the organization of learning support, as today there is an urgent problem of self-regulation in online learning [19]. Many learners do not have certain competencies and soft skills, such as time management, ability to build their own educational trajectory, which are necessary for successful completion of the online courses [20]. In this regard, the role of the support by the course team is growing, as it helps to keep learners on the course and bring them to the end of study and certification [6].

To organize the support of online learning educators often build it on a base of electronic moderation model and tutor support model, applying the variety of different tools [7, 8]. Thus, the support tools have a certain evolution linked to the development of technologies. In 2010 forums, blogs and e-mail for support were mainly used [9]. In 2015 the support of learning in social networks started to be actively used [10]. In 2016 appeared precedents of supporting the learners in messengers and chats-bots [11]. Thus, support communication with learners becomes closer to the learners, getting into their personal digital space and competing the communication with friends and relatives [12, 13]. This issue is also interesting from the point of view of forecasting of the evolution of educational communication and search of methods of its optimization.

It is necessary to note that online learning, in particular in the format of MOOC allows us to accumulate enormous

volumes of data connected with the behavior of learners. The analysis of these data, in turn, allows us to correct the process of learning and to trace the result of changes. The use of educational analytics with the purpose of increasing the efficiency of educational process is one of the main trends of the last years both in Russian and in the world education [3, 21, 22] he individualization, personification, digitalization and other trends are directed, first of all, on the increase of the learners' engagement rate. The reason is its impact on complexity of the acquired knowledge and skills and, as a result, the influence on the quality of education [14, 15].

Thus, it can be assumed that the satisfaction of the course and its elements, as well as the requirements imposed by the learners on the quality of the course and its elements depends on the learning goals and affect the behavior patterns of MOOC students. This hypothesis is fundamental to this study.

B. The methods of the study

To conduct the study we applied the following research methods: questioning, data analysis, descriptive statistics, comparative analysis.

Within the present research, a survey of the learners of MOOCs of Tomsk State University was conducted in the period from 23rd September to 7th October 2019. The learners of the following three courses took part in the survey: "Russian language as a tool of successful communication" (the course is presented on the platforms: National Open Education Platform, Lectorium and Coursera in Russian language), "Psychodiagnostics" (the course is presented on Coursera in two variants: in Russian and in English), "Genius. Talent. Golden Mediocrity" (the course is presented on Coursera in English and on Lectorium in Russian). The general popularity (the total amount of learners on the given courses of the specified platforms from the launch dates till 07th October 2019) is 76 366 people, the number of the surveyed learners are 189 respondents (of them: 152 are learners from Russia, 37 are foreign learners). The confidence probability is 97 %; the confidence interval is 8 %.

Within the research the following objectives were set:

- 1) To reveal the behavior patterns of learners of TSU MOOCs.
- 2) To define profiles of learners of TSU MOOCs.
- 3) To reveal the learners' goals of study at TSU MOOCs.
- 4) To reveal the level of learners' satisfaction with the quality of TSU MOOCs as a whole and with separate elements (video lectures, assignments, additional materials, forums organization).
- 5) To reveal the criteria of quality the learners set for online courses as a whole and for their separate elements (video lectures, assignments, additional materials).
- 6) To reveal the differences between the goals of learning, the level of satisfaction with a course and its separate elements, and also between the criteria of quality for a course and its elements in the groups of learners with different behavior patterns.

III. RESULTS

A. The behavior patterns of learners of TSU MOOCs

Taking into account the influence of the course subject on the engagement rate, we took for research MOOCs from close fields related to the humanities (psychology and philology).

To classify the learners by behavior patterns, we used the taxonomy of engagement offered in 2014 [3]. Considering the different data format of the Russian and foreign online platforms, the analytics on learners' active actions was carried out in terms of only two parameters: views of the video lectures and completion of the assignments. According to the taxonomy the MOOC learners are subdivided into the following categories/patterns of behavior:

- 7) «All-rounders» (complete the majority of assignments, watch all video lectures);
- 8) «Viewers» (watch all video lectures but hardly ever complete assignments);
- 9) «Solvers» (complete assignment and hardly ever watch videos or don't watch them);
- 10) «Collectors» (watch some lectures and partially complete assignments, or don't complete them);
- 11) «Bystanders» (enroll on a course, but do not watch video lectures and do not complete any assignments).

In view of the low engagement rate of «Bystanders» and the lack of interest in educational communications, the learners of this category didn't participate in the survey. Thus, the research concerns the learners involved in the educational process with the following patterns: «All-rounders», «Viewers», «Collectors» and «Solvers». The learners were classified according to the answers to the questions on views of video lectures and completion of the course assignments. The ratio of respondents according to the behavior patterns is presented at the figure 1.

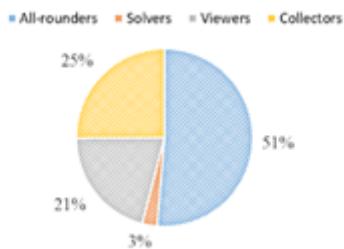


Fig. 1. The behavior patterns of engaged learners

Rely on the data on the behavior patterns, 51% of learners are classified as "All-rounders", 25% are "Collectors", "Viewers" are 21% of respondents and "Solvers" are 3% of learners.

Further, the social and demographic characteristics of learners, the goals of their learning, and also the satisfaction rate and quality criteria of the courses will be examined within the context of the revealed patterns.

B. The profiles of learners of TSU MOOCs

To determine the profiles of learners based on the social and demographic characteristics, the respondents were asked the questions concerning their sex, age, education, and occupation. Let us examine the basic results from the perspective of the behavior patterns.

On the average for all courses participating in the research, 80% of learners are female, 20% are male, but among "Collectors" other distribution of genders is observed in comparison with the learners with other patterns: 70% are women, 30% are men.

The greatest part among "All-rounders" are people aged 55-65. Their number is estimated at 25%. Moreover, "All-rounders" are the most widespread category among the group of people of the age 55-65 (other categories such as "Collectors", "Viewers" and "Solvers" contain less than 10% of the learners at this age).

The categories of learners aged 25-34 and 35-44 with all behavior patterns are approximately equal by the number of representatives (the difference is about 5%) and together they comprise the general body of all learners (50% on average). Thus, the given cumulative audiences are widely presented in the category of Viewers (63%) and to a smaller extent in the category of All-rounders (44%). Probably, it is connected to the goals of learning, the way of life and generational characteristics.

On an occupation level on the average 50 % of learners have full employment; it is actual for all patterns of behavior. The category of learners with partial employment composes from 20 to 30 percent of learners (least - among All-rounders, most of all - among Collectors). Schoolboys, pensioners and learners in aggregate on the average compose about a quarter of learners.

The behavior pattern according to the level of education corresponds to the data on the occupation. About half of the learners are people with higher education (Bachelor's degree and Master's degree), about a quarter are the learners with a PhD or who are post-graduate learners.

C. Learners' goals of study at TSU MOOCs

As part of the study, learners were asked an open question regarding the purpose of study. According to the results, the main motives for learning were identified (presented in descending order, according to the percentage of mentions by learners):

- 1) To acquire the knowledge on the subject – 49,7%;
- 2) Self-development – 31,5%;
- 3) Professional development – 12,2%;
- 4) Acquaintance with the format of online-learning/with the teaching technique - 3,3%;
- 5) To obtain a certificate – 2,8%;
- 6) To test oneself in the context of the subject – 0.6% .

Let us consider the main results of the identification of learning goals in the context of behavior patterns. “To acquire the knowledge on the subject” is the most frequent ground for “All-rounders”, “Collectors” and “Solvers” (it is true for a half of learners from the given categories) while for the “Viewers” category the ground of “self-development” was in the first place (true for 37% of learners of the given category). On average, about 30-40% of learners begin learning with a goal of “self-development” and this number of learners is true for all patterns of behavior. The goal of “professional development” is most often solved through the behavior pattern of a “Viewer” (21% of “Viewers” have the goal “professional development” while the learners with other patterns choose this motive in 9-14% of cases).

D. The level of learners' satisfaction with the quality of TSU MOOCs

To explore the level of the satisfaction with the quality of an online course as a whole and with its separate elements, the respondents were offered to estimate the video lectures, assignments, additional materials and the course as a whole. The results are presented below in the Table I.

TABLE I. SATISFACTION WITH THE MOOC'S QUALITY

The Subjects of Evaluation	Behavior Patterns			
	All-rounders	Viewers	Solvers	Collectors
Quality of the course				
yes	78	66	60	50
rather yes than no	17	32	40	43
rather no than yes	4	3	0	4
no	1	0	0	2
Quality of video lectures				
yes	70	53	40	48
rather yes than no	27	47	40	39
rather no than yes	2	0	0	7
no	1	0	20	7
Quality of assessments				
yes	70	45	20	46
rather yes than no	28	53	80	41
rather no than yes	1	0	0	7
no	1	3	0	7
Quality of additional materials				
yes	62	58	40	46
rather yes than no	30	26	60	35
rather no than yes	4	3	0	7
no	4	13	0	13
Quality of forum organization				
yes	33	21	20	26
rather yes than no	41	42	40	35
rather no than yes	10	11	0	15
no	16	26	40	24

The data shows the dependency of satisfaction with the quality of MOOCs on patterns of listener behavior. The answers “yes” and “rather yes than no” were considered as positive cumulatively, answers “no” and “rather no than yes” were considered as negative cumulatively.

The satisfaction with the courses is on the level from 93% to 100%; the least satisfaction with the course is shown by the representatives of the “Collectors” pattern, and the highest one by “All-rounders”. Possibly, in this case, the dissatisfaction with the course quality is the factor that leads to the formation of the “Collector” pattern.

The highest level of satisfaction with the quality of video lectures is also characteristic for “All-rounders” (97%), the least level (80%) have the “Solvers”. This, on the one hand, is caused by the difference in the goals of interaction with the content of the course by the given groups of learners, and on the other hand, there possibly is a connection with the satisfaction level.

The highest level of satisfaction with the quality of assignments is characteristic for “Solvers”; “Collectors” (87%) show the minimal level. The given aspect also indicates the connection of an insufficient level of satisfaction with the content and the lower engagement level.

According to the answers of learners, the organization of the learners’ communication on the forums is a weak part in the educational process of MOOC. The satisfaction with the given element is from 60% to 74%. “All-rounders”, having the high engagement level, watching all lectures and solving all assignments, are less interested in the external support and motivation to learning, being satisfied with the present format of the work on the forum. It causes the maximum level of satisfaction with the given element among other categories of learners. While about 40% of learners from the categories of “Viewers”, “Solvers” and “Collectors” are not satisfied with the organization of the work on forums and require another approach in comparison with the existing ones. It confirms the urgency of the research in the field of efficiency of student support models.

E. The criteria of quality the learners set for online courses

The MOOCs listeners' quality criteria was set by the listeners themselves through the answering the open questions of the survey. The answers were processed and generalized according to the similarity of the content. The results of processing the responses (10 the most widespread criteria of each category) presented below (Table II).

TABLE II. SATISFACTION WITH THE MOOC'S QUALITY

№	Criteria Subject			
	<i>Quality of the course</i>	<i>Quality of video lectures</i>	<i>Quality of assignments</i>	<i>Quality of additional materials</i>
1.	information is of interest, is thought-provoking	methodically correct design of the learning process	comprehensibility; clearness and correctness of instructions	reading format
2.	usefulness of the information, applicability to practical work	understandable way of presenting	learning something new through an assignment; skill formation applicable	wide coverage of the studied topic and the depth of formed knowledge
3.	a fascinating way of presenting	a fascinating way of presenting	is interesting, require thinking, efforts	availability
4.	understandable way of presenting	conciseness /brevity	relevance to video lectures and additional materials of the course	practicality (possibility to apply the material in practice)
5.	conciseness and completeness of the information	quality of video	relevance of the level of complexity to the level of readiness of the audience	conciseness
6.	urgency and reliability of the content	clear speech, good articulation, competent presenter's speech	wide coverage of the studied topic and the depth of formed knowledge	compliance with the course topic and plan
7.	competent and structured way of presenting the material	high-quality content (urgency, reliability, completeness)	conciseness (maximum effect for minimum time)	is interesting
8.	formation of new knowledge and skills during the learning	quality of sound	help to practice the material	connection with the main material of the course but not the duplication
9.	compliance with the course purposes, description and plan	visualization	compliance with the course topic and plan	completeness
10.	theory/practice balance	structured presentation	competence of the teacher who composed the assignment	novelty, urgency

Let us consider the quality criteria to MOOCs as a whole and to the courses elements (video lectures, assignments, additional materials) within the behavior patterns of learners.

For all the behavior patterns the following quality criteria are most often found: "the information is of interest, is thought-provoking"; "usefulness of the information, applicability to practical work"; "a fascinating, understandable, concise way of presenting"; "urgency and novelty of the content". "The competent and structured way of presenting the material" is important for "All-rounders" and "Viewers" as well as "the formation of new knowledge and skills during the learning". "The possibility to build individual educational trajectories" is important for "Solvers". The criteria "to gain independence/reach their goals" is crucial for "Collectors". In addition, the representatives of the given category of learners appreciate "a variety of forms of the content, the convenience of interaction with it".

The basic criteria of video lectures quality for learners are: "methodically competent construction of educational process"; "conciseness /brevity"; "fascination and availability of the presentation"; "clear speech, good articulation, competent presenter's speech"; "high-quality content (urgency, reliability, completeness)"; "quality of video"; "visualization". "The subtitles/texts/additional materials" are also important for "Viewers". "Solvers" appreciate "an abundance of examples". "Collectors" find important not only the quality of the video but also the sound.

The most widespread criteria for quality evaluation of assignments by all learners are: "the relevance to video lectures and additional materials of the course"; "comprehensibility"; "clearness and correctness of instructions"; "learning something new through an assignment"; "skill formation applicable in practical work"; "conciseness (maximum effect for minimum time)"; "are interesting, require thinking, efforts"; "relevance of the level of complexity to the level of readiness of the audience"; "help to practice the material". "All-rounders" also evaluate "the competence of the teacher who composed the assignment". "Viewers" consider "the possibility to express their opinion" and also "a creative approach" as important. "Solvers" value "a variety of forms of assessment". "Wide coverage of the studied topic and the depth of formed knowledge" are important for "Viewers" and "Collectors". "Solvers" and "Collectors" pay attention to "the urgency of assignments".

The basic criteria for the quality evaluation of additional materials of a course by the learners of all patterns are: "availability"; "wide coverage of the studied topic", "depth of formed knowledge"; "practicality (possibility to apply the material in practice)"; "interest"; "compliance with the course purposes and plan"; "reading format". "All-rounders" and "Viewers" also consider important such criteria as "completeness" and "the relevance to the basic materials of the course, but not duplication". "Viewers", "Solvers", and "Collectors" value "illustrativeness and visualization of the material". "Solvers" note as criteria "the scientific character", "reliability"; "novelty, urgency"; "a variety of formats"; "the contribution of the author to the selection of material".

F. The differences between the learners with different behavior patterns

The results of the study allow us to identify differences in learning objectives, level of satisfaction with the course and its elements, as well as in the quality criteria for the course and its elements, in groups of learners with different behavioral patterns.

“All-rounders” actively interacting with all the materials of the course are the least demanding audience of the courses and are more satisfied with its quality. Also, this category is characterized by the learners of more elder age who have a more complex and responsible approach to the learning process and set the goal of learning and knowledge acquisition.

The audience of “Viewers” is formed of the learners who enrolled with a goal of improvement of professional skill or self-education and not always have the purpose to obtain complex knowledge in the subject with the getting a corresponding certificate. Besides, even if the learners with the given pattern of behavior don’t complete the course, they note a high level of satisfaction with the course and note the achievement of the set goals of the learning.

The audience of “Solvers” has a goal to receive the certificate or acquire the practical skills formed through the assignments of the course. For the given category of learners, the support of the course team is important, as well as a variety of forms of material (not only video but also text files, additional materials). Special attention is given to practice-oriented courses and the presence of the system of formative assessment. A certificate without the formation of the corresponding skill is not interesting to this type of learners.

The younger audience demographically characterizes the category of “Collectors”. The need to “collect” the materials can be linked to the purpose of acquaintance to the format of online learning or teaching technique of a subject. Besides, the course materials can be used by the given category of learners as an auxiliary material for the organization of their own lessons in case if teachers are among this category. On the one hand, selective viewing of the course can completely satisfy the requirements of a part of the given category of learners. But, on the other hand, learners with this behavior pattern demonstrate smaller satisfaction with the quality of the course, than other categories of learners. In this connection, probably, the low engagement level of the given category of learners is a consequence of their dissatisfaction with the quality of the course. For example, one of the criteria of quality named by “Collectors” is an opportunity for self-determination and reaching of their own goals within the course. It is rather difficult to affect this factor and to adapt the content to the various demands of “Collectors”. Moreover, it does not guarantee the increase of the level of their engagement into the educational process, but it would positively affect the level of the satisfaction with the courses.

IV. CONCLUSION

Relying on the research data, we claim that the behavior of MOOCs’ learners, characterized by different engagement rate,

depends on the goals of learning, the satisfaction with the quality of the course, and also on social and demographic characteristics. But there is a debatable question: what is primary – the behavior of learners or the course content if it satisfies the needs and the criteria of quality set by the learners? To answer this question, we continue the research connected to the application of different models and tools for the support of MOOCs’ learners. Within the new research we try to identify the effect of learners support on their behavior patterns. Today, the research in the field of pedagogical design considering the design of a course on the basis of the data on the requirements and preferences of the learners are also urgent. The data presented in the given article can be used in research and applied in practice in the field of online learning.

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