Impact of an Instructor's Personalized Email Intervention on Completion Rates in a Massive Open Online Course (MOOC)

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Abstract: Although Massive Open Online Courses (MOOCs) are increasing in popularity, they have been subject to criticism due to the high dropout rate. This study examined the impact of an instructor's personalized email intervention on the rate of completion of a nine week course, which included seven weekly quizzes, and the rate of completion of the final exam. The participants, who took an Israeli noncredit academic MOOC on negotiation management, were randomly assigned to two groups. Treatment group participants (N = 576) who did not complete the weekly quiz received a tailored reminder by email from their instructor encouraging them to complete the quiz and offering them assistance in order to deal with the past week's contents. The control group (N = 608) that did not complete the weekly quiz did not get any emails from the instructor. The impact of the intervention was measured in three different ways: the immediate-impact, the delayed-impact and a cumulative impact. The increase in quiz completion within a week after the instructor's email was defined as an immediate-impact. The increase in the completion of the next quiz was defined as a delayed impact. The increase in the final exam completion rates was defined as a cumulative impact. The results show that the weekly intervention had an immediate impact as well as a cumulative impact on the final exam completion rate. The results suggest that an instructor's acknowledgement and interest might increase learners' commitment to learning in a MOOC. This study aimed to gain insight into learners' propensity to stay active in a MOOC and to increase completion rates. Findings of this study can be useful to MOOC designers and instructors to design and facilitate more effective MOOCs for learners by using email interventions to prevent students from dropping out of courses.

Keywords: MOOC, massive open online course, email intervention, dropout rate, completion rate, online learning

1. Introduction and literature review

Since 2011 to the end of 2020, more than 180 million students were enrolled in more than 16,000 Massive Open Online Courses (MOOCs) carried out by about 950 universities all over the globe (Dhawal, 2020), allowing participants to earn microcredentials, academic degrees and/or professional development and skills (Barak, Watted and Haick, 2016; Breslow et al., 2013; Evans et al., 2016). These courses are delivered by well-established MOOC platforms, such as Coursera and Udacity (USA), edX (USA), XuetangX (China), Future Learn (UK), and Swayam (India). In Israel, a digital platform named Campus IL (https://campus.gov.il/en/about/) was established by the Ministry of Social Equality, enabling free MOOCs based on the edX platform.

It seems that MOOCs are gradually becoming an integral part of the learning process, especially in higher education settings (Schuwer et al., 2015; Soffer and Cohen, 2015). These courses provide high-quality content and allow students to experience diverse learning practices online that enhance their learning experience (Cho and Byun, 2017; Mohamed et al., 2015). However, there are drawbacks, such as a large number of dropouts, inability to validate the learner's identity, barriers to learners' satisfaction, and difficulties in studying complicated subject matters, e.g., engineering and sophisticated quantitative materials (Dalipi et al., 2018; Rabin et al., 2020; Schuwer et al., 2015).

The dropout rates of MOOCs are high. For example, for certificate courses, the completion rate is in the range of 2%–10% (Reich, 2014). In another study, the completion rates of 221 MOOCs varied from 0.7% to 52.1%, with a median value of 12.6% (Jordan, 2015). Indeed it has been found that more than half (52%) of the students who registered never entered the courses at all (Reich and Ruipérez-Valiente, 2019). Typically, there is a steep decline in participation throughout the course (Edinburgh Group, 2013).

There are several reasons for dropping out of MOOCs, some of which are related to the learners and some to different aspects of design and marketing. Learner-related reasons are most often a lack of motivation, lack of

time, and lack of ability or background (Alario-Hoyos et al., 2017; Chaw and Tang, 2019; Cisel, 2018; Lee and Choi, 2011; Rabin et al., 2020). The reasons related to the MOOC drop outs often involve the way the MOOC was designed, lack of interaction, and other hidden costs (Dalipi, Imran and Kastrati, 2018; Hone and El Said, 2016; Lee and Martin, 2017; Padilla Rodriguez and Armellini, 2015).

In a survey study exploring factors that influence retention in a MOOC, Hone and Said (2016), found that the course content was a significant predictor of MOOC retention. Interaction with the instructor of the MOOC was also found to be a significant predictor of course retention. Interactions, particularly between the instructors and students, were found to be a significant factor determining student engagement and thereby the completion rate (Hew, 2015). One of the primary means of interaction in MOOCs relies on discussion forums (Baxter and Haycock, 2014; Chen et al., 2019), and there have been different attempts to increase participation and involvement in forums (Kizilcec et al., 2014). In some cases, the availability of the instructor's or course staff member's email address for assisting in specific problems (e.g., code debugging) (Kizilcec et al., 2014) increased students' motivation. In an article describing a case study of a MOOC on user experience (UX) design involving group projects, effective communication was found to be essential for building trust among students and having a substantial impact on reducing dropout. However, several participants reported that they experienced a high degree of stress caused by constant communication with the teams (Cheng et al., 2019).

In another study focusing on learners who wanted to complete the course but experienced challenges in solving the exercises, the course developers created adaptive automatic just-in-time interventions encouraging students to ask for help if they needed it. The approach was evaluated in over 5,000 active students in a MOOC course via a survey, and the metrics were gathered alongside it. The results showed that the intervention increased the callouts for help by up to 66% and lowered the dwelling time until initiating action (Teusner et al., 2018). However, intervention studies have not always yielded positive results. For example, Borrella, Caballero-Cabllero and Ponce-Cueto, (2019) reported an intervention at MIT that consisted of sending tailored encouragement emails to learners at risk of dropping out. In this work, the researchers tried to address psychological attributes (lack of motivation) through an intervention that encourages learners to complete an important course activity at one specific moment (halfway through the course before the mid-term exam). The statistical analysis of the results demonstrated that the email intervention had no effect on reducing the dropout rate associated with the mid-term exam. The findings of this study can be explained by the fact that the intervention setup should be more frequent and not at a single point in time during the course.

In the present paper, we used a quantitative study with an experimental design method to examine the impact of the instructor's tailored encouragement emails on the rate of completion of seven weekly quizzes and the rate of completion of the final exam during the nine weeks of the course. There is empirical evidence that an effective intervention research methodology, like the one we chose for the current research, can reduce the dropout rate in MOOCs (Borrella et al., 2019). Although the use of a reminder email is not a new method for instructors, in the present study, the context in which the emails were sent is unique, e.g., after the due date for the quiz had passed. The concept of sending individual emails each week to students who did not complete the weekly quiz with an offer of assistance is rooted in the teaching presence (TP) element in the community of inquiry (CoI) framework of learning processes in online educational environments (Garrison et al., 2000). Part of TP includes facilitation of learning and direct instruction in the online space (Garrison and Anderson, 2003). These tailored encouragement emails, delivered outside of the course's environment, can be viewed as part of the facilitation of learning and direct instruction. Moreover, they can be viewed as part of a method for the humanization of MOOCs, where faculty actively engage learners to communicate throughout an entire course (Evans, Kensington-Miller and Novak., 2021; Kilgore and Lowenthal, 2015), sending an individual email not generated as an automated reminder. From a behavioral economics and psychology point of view, we can view this intervention as a "nudge". Thaler and Sunstein (2008) have suggested that a nudge is an effective way to influence social or individuals' decisions or behavior by slightly altering the choice architecture in which decisions are made. In our context, the notion of "choice architecture" is the equivalent of using or not using the instructor's intervention. We can consider this influence as a nudge, as it does not limit the choice set or make other alternatives appreciably more costly (Hausman and Welch, 2010).

2. Purpose of the research and research questions

The goal of this study was to examine the impact of the instructor's tailored emails on the completion rate in weekly quizzes and the final exam. The immediate-impact corresponds to the increase in the quiz completion in

the week after the instructor's email was sent (Figure 1A). Students from the treatment group who did not complete a specific quiz a week after it was opened received an email regarding their lack of participation and an offer of assistance. The students from the control group did not receive such an email. A week later, we tested whether the students completed the quiz. The immediate-impact effect was measured by comparing the sum of differences between the students' completion rate after one week and after two weeks for all seven quizzes between the control and experiment groups.

The delayed impact was defined as the effect on the following quiz completion (Figure 1B). For example, after receiving an email regarding their lack of performance on quiz number one, the student completed quiz number two. Thus, the effect of the delayed impact was tested by comparing the sum of students who completed quiz number two after one week for all seven quizzes between control and experiment groups. To explore the cumulative impact on the final exam completion rate, we compared the rate of completion of the final exam between control and experiments groups. Figure 1 illustrates the immediate-impact, delayed impact, and cumulative impact on final exam completion rate. The specific measures will be further explained in the findings section.

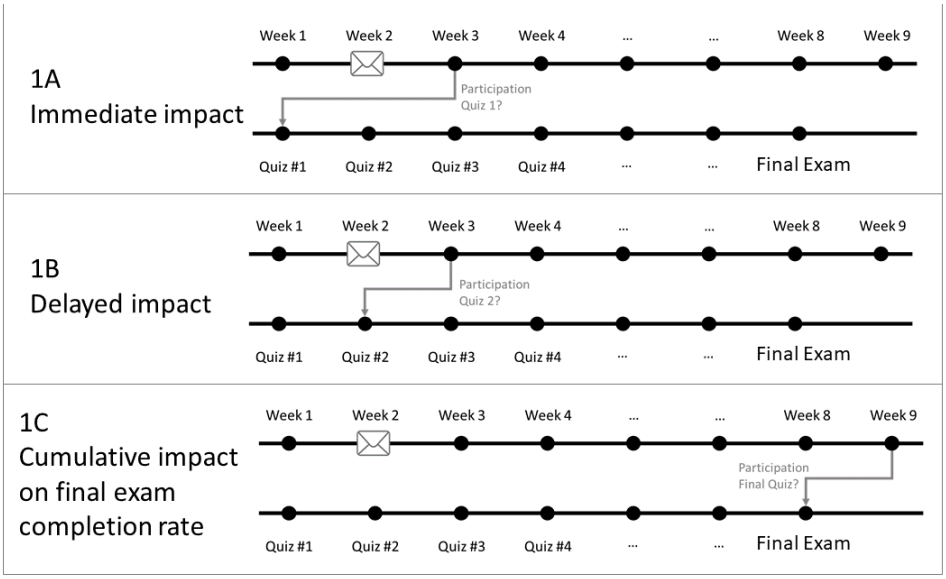

Figure 1A–C: An example of a certain intervention and the three types of impact: (1A) immediate impact, (2A) delayed impact, and (1C) cumulative impact on final exam completion rate.

Three research questions guided the process of this research:

1. What is the immediate impact of the instructor's email intervention on the quiz completion rate?
2. What is the delayed impact of the instructor's email intervention on the quiz completion rate?
3. What is the cumulative impact of the instructor's email intervention on the final exam completion rate?

3. Methodology

3.1 The research environment: MOOC *negotiation management*

The production of the MOOC *Negotiation Management* was part of the Israeli National Project for Digital Learning named CAMPUS. The goal of CAMPUS is to promote general, academic, and professional education in Israel in order to reduce social gaps and accelerate economic growth (https://campus.gov.il/en/about/). The course aimed to impart knowledge and skills in negotiation, understand complex negotiation processes, and allow learners to build a "personal toolbox" that will allow them to negotiate optimally (https://campus.gov.il/course/course-v1-hitacd_hit_361negotiation). In general, negotiating is an important skill that is relevant to each person's personal and professional life. The ability to understand the process, isolate its components, manage it, and lead to a successful integrative solution can provide a real advantage to managers and employees in changing human and digital environments (Kopolovich, 2020). Course topics include the following: conflicts, interests, and negotiations; conflict management styles; addressing objections in negotiations; negotiation strategies and tactics; culture and negotiations; body language and negotiation.

The course offers weekly video clips, readings, quizzes, and discussions. The videos included a series of narrative scenes that are kind of "mini-cases" that the instructors analyze. The mini-cases consist of a series of episodes played with four actors, presenting daily situations in their natural environment (e.g., home and/or work). The integration of video content stems from the insight that it is difficult to focus attention over time on a lecture type "talking head" format (Fyfield et al., 2019; Guo, Kim and Rubin, 2014). The use of mini-cases is based on cognitive flexibility theory, which advocates the creation of a learning process involving repetitive transitions, "crisscrossing a landscape", mini-cases, and relevant conceptual knowledge (Spiro and Jehng, 1990).

The MOOC includes eight modular learning units, mostly in Hebrew. Each unit stands on its own and is linked to other units, thereby producing a synergy of knowledge and process. At the end of each unit, participants are required to complete a quiz testing the level of knowledge and understanding of the content being studied.

The MOOC is offered in two modes. The first mode is as a free instructor-led MOOC. The second mode is a blended academic course at Holon Institute of Technology (HIT) in Israel that combines three to five face-to-face meetings. The course was first presented in winter 2018. To date, there have been three rounds of the free MOOC and fifteen rounds of the academic session. Approximately 13,500 participants, mainly from Israel but also from 25 other countries, have registered in both modes of the course.

3.2 Participants, data collection and data coding

One thousand one hundred eighty-four participants registered for the free instructor-led *Negotiation Management* MOOC in the winter semester of 2018. Upon enrollment, the participants filled out a personal demographic information survey. Of the respondents, 51% were female, while 49% were male.. The average age was 41 (SD = 16). The majority (71%) said that they held a higher education degree (BA, MA, PhD), while 29% held a high school education or lower.

The participants were randomly assigned to a treatment group and a control group (therefore, according to the binomial distribution, the group size is not equal). Examining the differences in the demographic characteristics of the two groups yielded no significant differences; that is, both groups were identical in their personal background characteristics (see Table 1 below).

Table 1: Personal background characteristics of participants by groups

	All	Treatment group	Control group
N	1,184	576	608
Mean age in years (SD)	41 (16)	41(16)	42 (15)
Male	49%	50%	47%
Female	51%	50%	53%
Higher education degree	71%	69%	74%
High school education or lower	29%	31%	26%

As outlined above, each week a different learning unit was opened, which included a quiz to evaluate students' level of understanding. Students of the treatment group who did not take the weekly quiz after one week received an email from the instructor: *"We have noticed that you have not begun to answer the quiz following lesson No. 1 (*for example*). If you need any assistance, we are here to help you. Yours sincerely, Orna and the course team*."

The control group students, who did not complete the weekly quiz, did not receive such an email. The impact of this intervention was measured in three different ways: the immediate-impact, the delayed-impact and the cumulative impact on the final exam completion rate. The increase in quiz completion within a week after the instructor's email was defined as an immediate-impact. The increase in the completion of the following week's quiz was defined as a delayed impact. The completion data for each quiz and completion of the final exam were derived from the online log file. The data collection was held between November 2018 and December 2018.

The data were coded for each quiz as follows: "0" for no participation and "1" for completion. Participation was documented over two cycles: a week after the quiz had been opened for students, Cycle 1 ("C_1"), and two weeks after the quiz has been opened for students, Cycle 2 ("C_2").

The study received full ethical approval from our host institution, the Holon Institute of Technology, Israel.

4. Findings

4.1 Immediate impact results

In order to explore the immediate impact of the instructor's intervention, we examined the completion rate in Cycle 1 and Cycle 2 for each quiz. This rate was compared between control and treatment groups. As shown in Figure 2 and Figure 3, the completion rate in C_2 was higher than in C_1. In addition, the results indicate that the difference in the students' completion between cycles, meaning $C_2 - C_1$, in the treatment group was higher and that completion in C_2 decreased over time for the control and treatment group.

In order to quantify the immediate impact of the instructor's intervention, we calculated the sum of differences between the students' completion rate in Cycle 1 and Cycle 2 for all seven quizzes.

$$TDC = \sum_{i=1}^{7} C_2 t_i - C_1 t_i$$

Where $C_1 t_1$ indicates the completion rate in Cycle 1 for quiz 1; $C_2 t_1$ indicates the completion rate in Cycle 2 for quiz 1, and the total difference between cycles (TDC) is the sum of differences between the rate of completion in the two quiz cycles (Cycle 1 and Cycle 2). When the delta value for a specific quiz (e.g., quiz 1) is 0, there is no difference in participation between Cycle 1 and 2. It may indicate that the student did not complete the quiz in any of the cycles or completed the quiz in Cycle 1 and therefore had the same result in Cycle 2. When the delta value for a specific quiz value is above 0, participation in Cycle 2 was coded as one and was coded as 0 in Cycle 1. As TDC is a quantitative variable, we can examine the differences in the average of TDC, meaning the total differences between cycles divided by number of participants between the control and treatment group. In order to examine the immediate impact, an independent sample t-test was conducted, using TDC as the dependent variable and the group (treatment vs. control) as an independent variable.

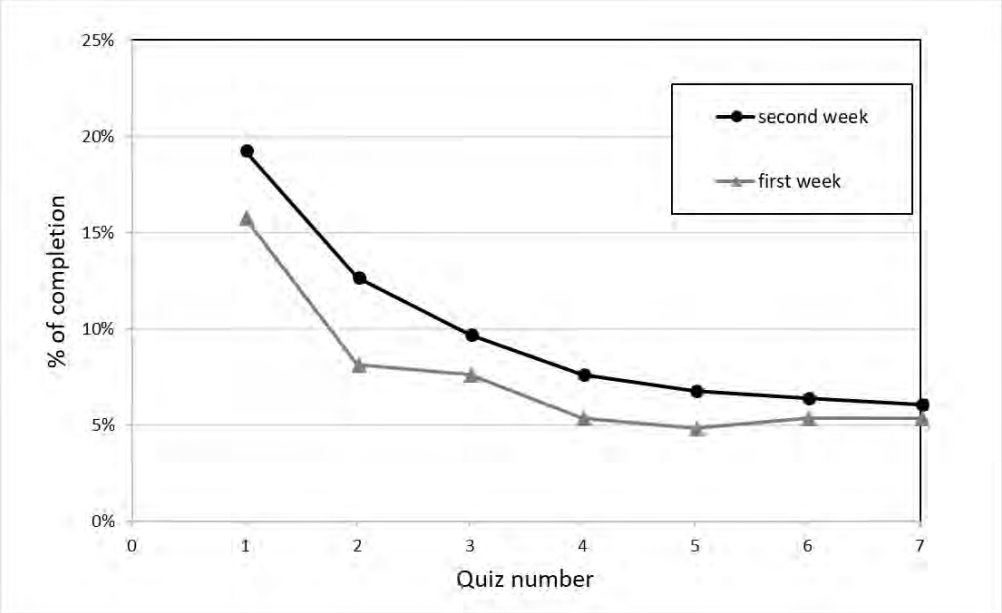

Figure 2: Percentages of completion in $C_2$and C_1 for each quiz—control group

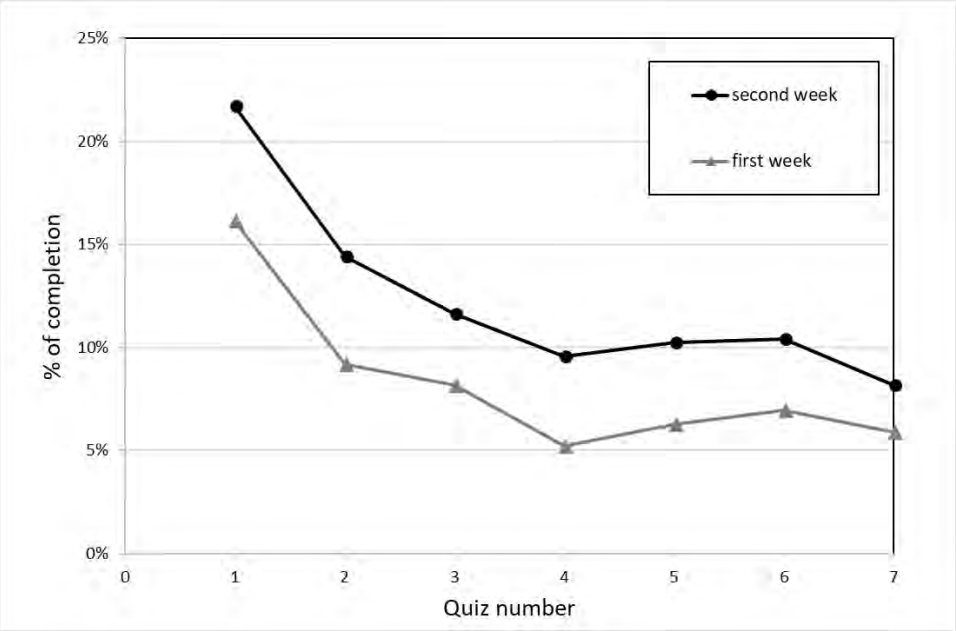

Figure 3: Percentages of completion $C_2$and C_1 for each quiz—treatment group

The results of the independent sample t-test showed a significant difference in the average of TDC between the control group (M = 0.151, SD = 0.513) and treatment group (M = 0.283, SD = 0.772), t(993) = -3.435*, p-value < 0.01.* The average TDC for the treatment group (0.283) was higher than the average TDC for the control group (0.151), which means that the instruction's intervention had a statistically significant effect, as seen in Table 2.

Table 2: Number of completions in each quiz cycle

		Control	Treatment
Total		608	576
Quiz 1	*Cycle 1*	91	93
	Cycle 2	111	125
Diff		20	32
Quiz 2	*Cycle 1*	47	53
	Cycle 2	73	83
Diff		26	30
Quiz 3	*Cycle 1*	44	47
	Cycle 2	56	67
Diff		12	20
Quiz 4	*Cycle 1*	31	30
	Cycle 2	44	55
Diff		13	25
Quiz 5	*Cycle 1*	28	36
	Cycle 2	39	59
Diff		11	23
Quiz 6	*Cycle 1*	31	40
	Cycle 2	37	60
Diff		6	20
Quiz 7	*Cycle 1*	31	34
	Cycle 2	35	47
Diff		4	13
Sum TDC		92	163
Average TDC		0.151	0.283

4.2 Delayed Impact

In order to examine the delayed impact, we tested the percentages of completion in C_1 for each particular quiz and compared it between the control and treatment groups. We argue that higher completion in C_1 in the treatment group in comparison to the control group may indicate a delayed impact of the intervention, meaning that students have developed an independent behavior without relying on the instructor's nudge. Based on a

chi-square analysis, there was no significant difference between the control and treatment groups for any of the quizzes (*p-value > 0.1* for all the quizzes).

Figure 4 shows the completion in C_1 for each quiz for the control and treatment groups.

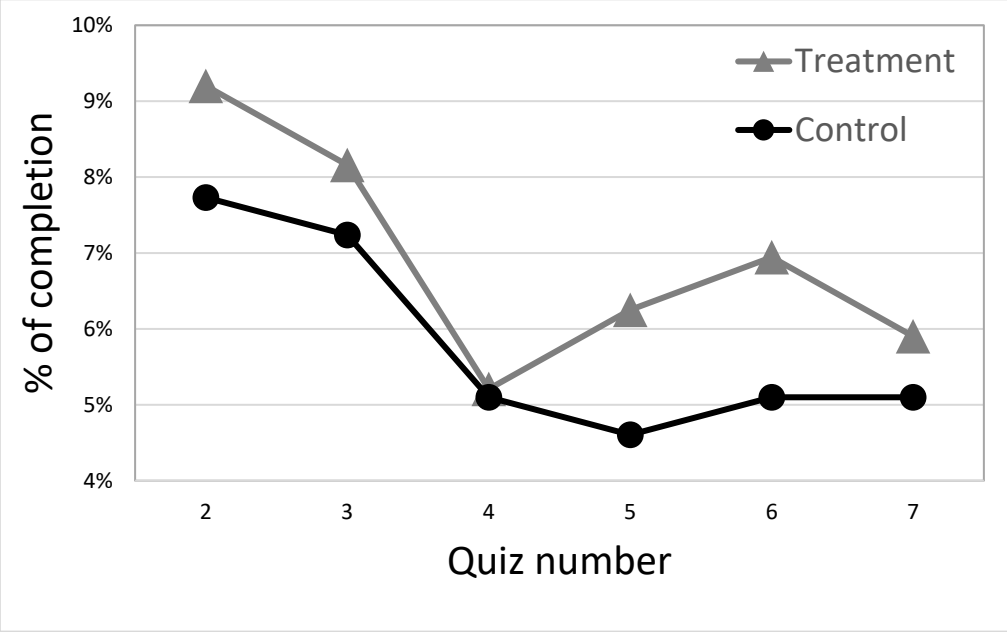

Figure 4: Percentage of completion in C_1 for all quizzes—control and treatment groups

In order to quantify the cumulative completion in C_1 during all of the quizzes, we calculated the sum of students' participation in C_1 for quizzes no. 2-7. Quiz No. 1 was not included as independent behavior could have developed following the first experience only.

$$SC_1 = \sum_{i=2}^{7} C_1 t_i$$

Where SC_1 indicates the total completion in Cycle 1 for all six quizzes. In order to examine the difference between the average SC_1 for the control and treatment groups, an independent sample t-test was conducted (using SC_1 as the dependent variable and the group, treatment vs. control, as an independent variable).

The results of the independent sample t-test showed that the SC_1 for the treatment group (M = 0.417, SD = 1.226) was higher than the SC_1 for the control group (M = 0.349, SD = 1.161). However, no significant difference was found t(1182) = -0.980*, p-value = 0.327.* Figure 5 shows the average SC_1 for both groups.

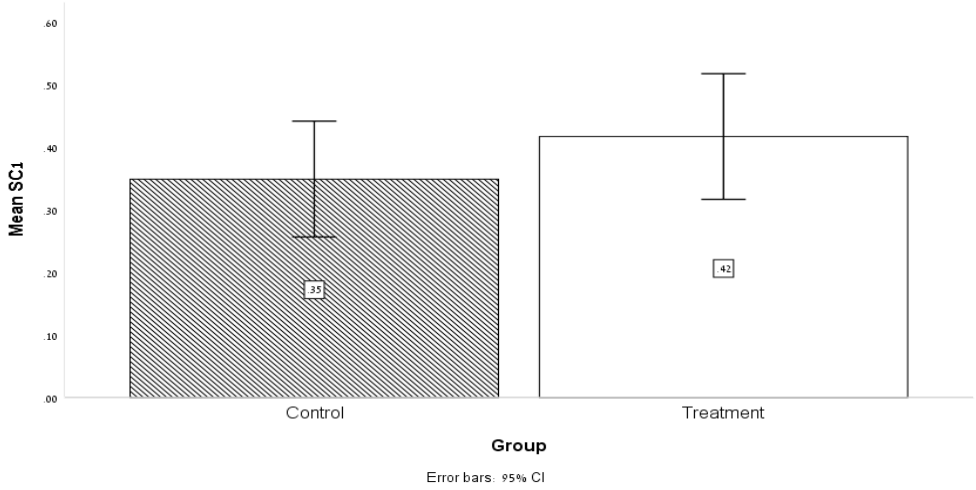

Figure 5: Average SC_1 for control and treatment groups

4.3 Cumulative impact of final exam completion rate

The cumulative impact on the completion rate of the final exam was determined through the completion of the final exam.. The final exam participation percentage for students in the control group, as shown in Figure 6, was 4.1%, and the percentage of completion for those in the treatment group was 7.5%.

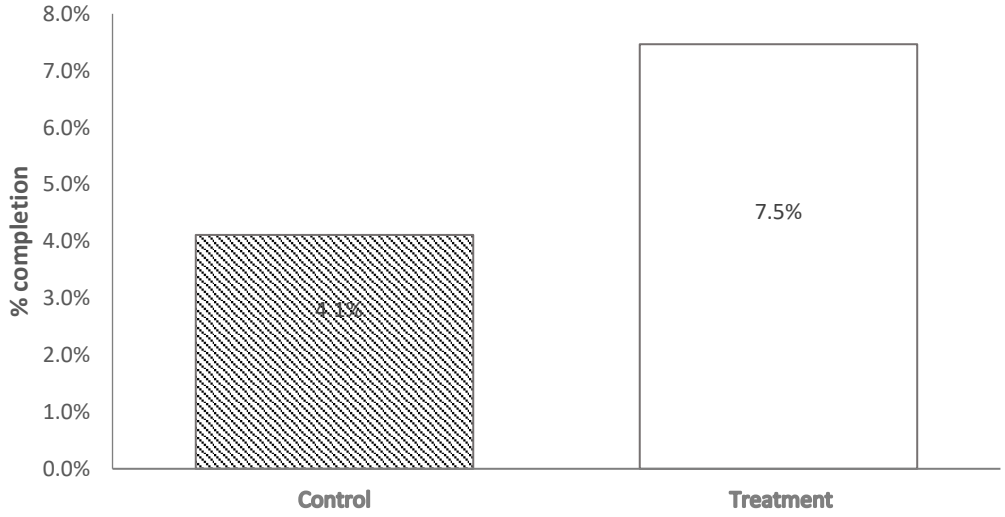

Figure 6: Percentage of completion in the final exam: control vs. treatment

5. Discussion

The increase in demand for MOOCs over time requires not only creating more high-quality courses but also supporting the learners' mental and pedagogical needs. In most MOOCs, there is little or no tutoring to help learners (Min and Jingyan, 2017).

In the current study, we examined the impact of a tailored instructor's email intervention on the rate of completion in seven weekly quizzes and the rate of completion of the final exam during the nine weeks of a MOOC. We compared the results to a control group that did not receive an email from the instructor. This nudge effect was examined for the immediate impact, delayed impact, and the cumulative impact on the final exam completion rate. In the study, we used nonparticipation in a weekly quiz as an indicator of future dropout or the need for support. Therefore, an email from the instructor was sent to these learners every time they did not participate.

The results show that weekly intervention had an immediate impact as well as a cumulative impact on final exam completion rates. One might argue that a 3.4% effect size (see Figure 6, Impact of final exam completion rate result) is not that impressive. We would suggest that with popular courses, in which thousands of students enroll, such an effect is, indeed, quite meaningful. For instance, it means that our modest “nudge” intervention might affect the progress of 680 students in a course with an accumulative enrollment of 20,000 students. These results suggest that an instructor's acknowledgement and interest might increase learners' commitment to learning in a MOOC. The findings of the present study are in line with Teusner, Hille and Staubitzs (2018) study, which highlighted the role of the instructor as a source of assistance as part of the TP element (Garrison and Anderson, 2003) where the faculty actively engage learners throughout an entire course (Kilgore and Lowenthal, 2015). We did not find a significant difference for the delayed impact measurement between the control and treatment groups, indicating that the effect of the instructor's email intervention was limited in its impact and did not impact the next quiz. A limited time effect of the intervention can provide a partial explanation. When students in the treatment group received the email, it motivated them to take an action only for the specific quiz. By the time the following quiz was due, the effect of the email had already dissipated. Moreover, perhaps the students in the treatment group got used to receiving a reminder about the quiz and therefore did not bother to take the quiz in the first week upon receipt, knowing they would receive the reminder and then be able to take it (i.e., have enough time for it). Completion rate in the treatment group is probably higher due to the cumulative effect of the instructor's intervention. An alternative explanation might be that eventually the students in the treatment group invested more in the course and therefore participated in more quizzes.

Therefore, it was a "pity" for them not to take the exam, or their motivation to take the final exam was higher in order to complete the course and prove to themselves that they had completed the course successfully.

We would like to suggest that the instructor's seemingly minor intervention, namely noticing that a student did not participate in a course activity, and gently offering support, might have created what the psychoanalyst Winnicott (1982) referred to as a "holding environment". This is supported by the small number (2 participants) that requested additional assistance, which was technical assistance.

Winnicott's concept of a "holding" is related to the nurturing quality of infant-mother relationships. This concept was extended to organizational and educational settings (Ghosh et al., 2013; Kahn, 2001). It suggests that when a learner/worker experiences suitable holding by a leader/instructor/parent, they will dare to take risks and inquire about new territories: "The quality of such holding (i.e., the sense in which it engenders basic trust in one's surrounding) determines the extent to which the person can become a genuine, creative individual" (Van Buskirk and McGrath, 1999, p. 808). In context of our MOOC, it might suggest that the instructor's gentle gesture toward the learner might have provoked a sense of belonging, defused a sense of anonymity, and increased a sense of security and trust.

Despite the encouraging findings, more research with further rounds of the same course and additional courses will present an increasingly robust picture of the effects of an instructor's interventions on the completion rates of MOOCs. Also, while there are many factors that have contributed to the completion rate, we only looked at completion in quizzes and the final exam. In future research, we recommend that other course components, like video clips, readings, and participation in the discussions, be examined to broaden our understanding.

We believe that this study provides insight into learners' propensity to stay active in a MOOC. We hope that future MOOC designers and facilitators will experiment with similar interventions in an attempt to increase completion rates.

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