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Finding valuable direction for teaching and learning in campus-integrated Medical Massive Open Online Courses

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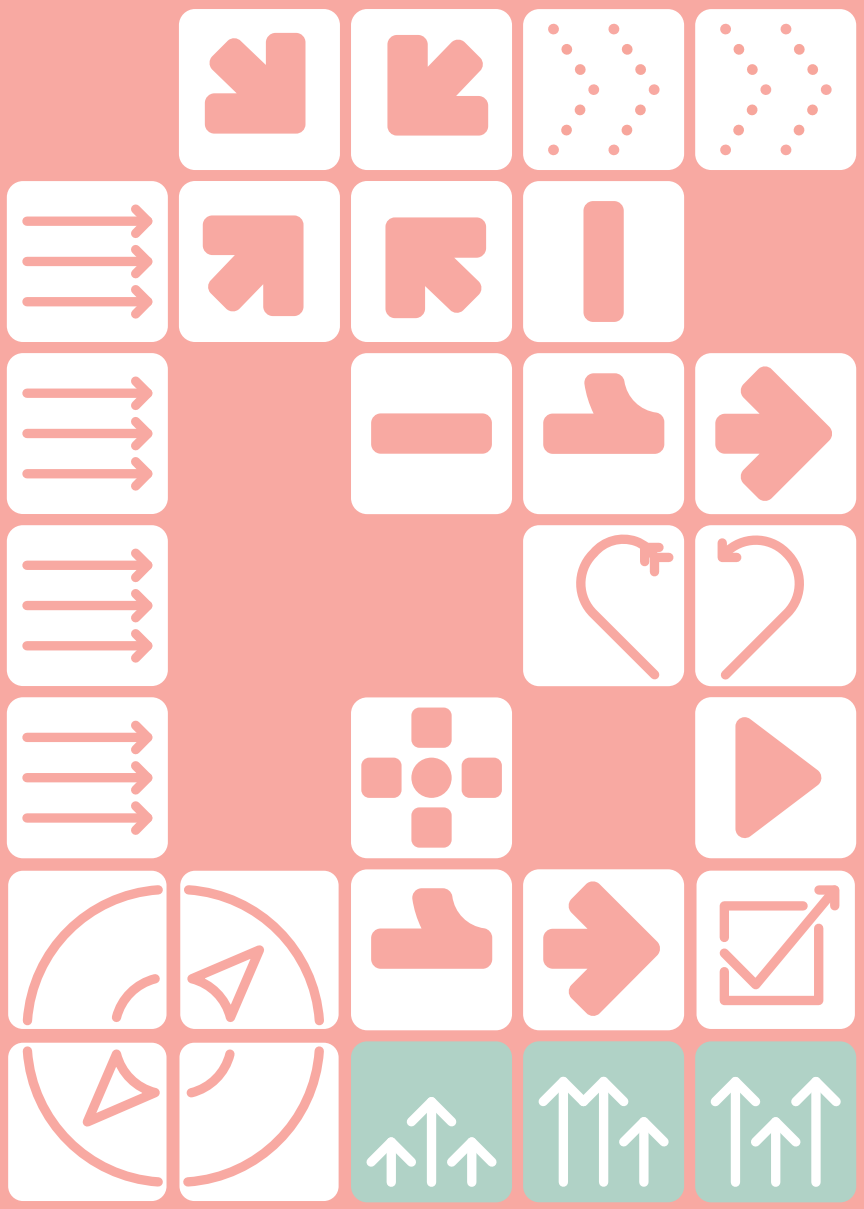
CHAPTER 7



Students Learning in MOOC Integration Designs are Self-Determined Learners, Grade Hunters or Teacher Trusters

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Submitted

Abstract

Integration of Massive Open Online Courses (MOOCs) in campus education is rising, in many different forms. In search for optimal integration designs, motivation to learn needs to be considered as it is related to academic achievement and wellbeing among others, and as motivation to learn in informal MOOC learning could be very different to integrated formal MOOC learning. In this study motivation profiles of undergraduate students that learn in three different MOOC integration designs were explored, as was the distribution of profiles among integration designs. Finally, factors that underpin motivation were compared between integration designs. Six motivation profiles were recovered through a twostep cluster analysis: Self-determined learners and highly self-determined learners, grade hunters, and teacher trusters who are moderately, highly or extremely trusting. Proportions of motivation profiles differed significantly between MOOC integration designs, and MOOC integration designs satisfied and frustrated psychological needs significantly different. Future MOOC integration research should enlighten effects of design choices related to degree of obligation and online versus face-to-face ratio. Future MOOC integration practice should aim to monitor motivation and enhance autonomous motivation in obligatory designs specifically.

Introduction

When first introduced, Massive Open Online Courses (MOOCs) were said to be a disruptive innovation that would be able to change the higher education model (Al-Imarah & Shields, 2019; Flynn, 2013). Many universities that created MOOCs have also integrated these courses into their regular campus teaching (Bozkurt, 2021; de Jong et al., 2019). This has many advantages for both teachers and students (Hendriks et al., 2020a; Hendriks et al., 2019). In fact, several institutions are now connected to exchange initiatives to offer students MOOCs from other institutions (Leiden University Website, 2019b). In this respect, MOOCs are indeed changing the higher education model as many different forms of MOOC integration designs are being experimented with worldwide.

MOOC integration designs can be characterised by decisions about '1) level of education, 2) degree of obligation, 3) ratio of online versus face-to-face teaching, 4) replacing or adding MOOC content to formal courses and 5) level of contact with other online learners in the MOOC' as described in Hendriks et al. (2020b). In many case studies, specific approaches to integration have been described (Fair et al., 2017; Mabuan & Ebron, 2018) as have facilitators and barriers for learning (Bralić & Divjak, 2018). Some studies have compared multiple ways of integrating MOOCs, finding that in blended designs student outcomes are equal or improved compared to fully online or traditional face-to-face designs (Cornelius et al., 2019; Larionova et al., 2018). Studies that investigate multiple integration designs are scarce however, while this offers an approach to distinguish what works when.

In finding optimal integration designs, relevant input variables and outcome measures are manifold. Motivation to learn is highly influential for learning and has been studied in depth in informal MOOC settings (Alemayehu & Chen, 2021; Bozkurt, 2021), but not in integration settings, which can be characterized as mainly formal learning (Hendriks et al., 2020b). The important difference between informal and formal MOOC learning is that formal learning implies that external factors also influence motivation to learn, such as grades or expectations from others. As one of the choices in MOOC integration designs regards the degree of obligation to participate in the MOOC, we foresee that design choices could influence motivation to learn and the related outcome measures considerably. The current study aims to contribute to insights on how students' motivation in existing integration settings can be characterized. This characterization will 1) help to understand the effects that MOOC integration can have on motivation to learn in them, 2) offer direction for future intervention studies with integrated MOOCs, and 3) inform efforts to offer more effective and personalized learning experiences with integrated MOOCs.

Overview of the literature

Motivation for learning in informal MOOCs

Over the last few years motivation for learning in MOOCs has been a focal point in MOOC research (Bozkurt, 2021; Zhu et al., 2018), as it has such influence on engagement (Badali et al., 2022; Lai, 2021). Furthermore, it is closely related to self-regulated learning which is essential for learning in MOOCs (Alemayehu & Chen, 2021). Many studies focused on what motivates students to participate in a MOOC or to complete a MOOC (Badali et al., 2022). In this regard Kizilcec et al. (2017) developed the Online Learning Enrolment Intentions scale with thirteen different intentions to enrol in informal MOOCs, including most of the reasons for enrolment found in other studies (Huang & Hew, 2017; Loizzo et al., 2017). In 2019 Luik et al. developed the 'Factors Influencing Enrolment in MOOCs scale'. Reported reasons for participation include 1) interest in a topic, 2) relevance to job, 3) school or academic research, 4) personal growth, 5) career change, 6) fun and challenge, 7) to meet new people, 8) to experience an online course, 9) to earn a certificate, 10) prestige of the university or professor teaching, 11) taking the course with friends or colleagues, and 12) to improve English skills (Luik et al., 2019).

As MOOCs matured, data from many studies showed that MOOC completion is often very low. This prompted researchers to investigate why this happened (Pursel et al., 2016; Zheng et al., 2015), what reasons for persisting to learn in a MOOC (Alemayehu & Chen, 2021; Rizvi et al., 2022) and completion exist (Tang & Chaw, 2019; Zhang et al., 2019), and to discuss the definition of successful learning in MOOCs. The new lens to define successful MOOC learning is based on the notion that informal MOOC learners are often self-directed, meaning they decide their own learning objectives, and when these have been met, completion of the MOOC is unnecessary (Loizzo et al., 2017; Rabin, 2021). Successful informal MOOC learning is thus more defined by learner satisfaction and personal goal attainment than completion, and MOOC platforms have accommodated to this new standard by asking learners for their personal goals when enrolling in a MOOC, and learning analytics are being employed to offer personalized experiences (Rabin, 2021).

While completion is not any longer the sole desired outcome, studies on completion did show that positive motivation was related to positive engagement (Xiong et al., 2015), participation and to the inclination to complete a MOOC (Luik & Lepp, 2021; Tang & Chaw, 2019). In addition, research has been directed to discovering how motivation to learn in a MOOC influences other variables such as retention, self-regulated learning and academic achievement (Zhu et al., 2018). Through a systematic literature review Badali et al. (2022) found that need-based academic motives including intrinsic goal motivation were most important for retention directly and indirectly via self-regulation, performance and engagement among others. In addition, several studies found that intrinsic motivation specifically played an important role and related to better self-regulated Learning (Littlejohn

et al., 2016), performance (de Barba et al., 2016; Moore & Wang, 2021), and participation (Barak et al., 2016; Romero-Frías et al., 2020), which in turn related to completion. Finally attention has been directed at promoting motivation through design measures, although MOOC course design specifically has been understudied (Alemayehu & Chen, 2021; Zhu et al., 2018).

Motivation for learning of university affiliated MOOC learners

Although motivation significantly influences MOOC learning and MOOCs are being integrated in campus learning, only little attention has been dedicated to motivation of university affiliated MOOC learners specifically. Semenova (2020) found that for university affiliated MOOC learners taking the course out of interest and to earn a certificate both positively related to earning a MOOC certificate, and that amotivation negatively related to it. However in this study, the MOOCs had not been integrated into the formal curriculum. Watted and Barak (2018) compared motivation of two groups of MOOC completers: general informally learning participants and university affiliated students. The university students were mostly motivated by earning a certificate and general interest, and the general learners were mostly motivated by general interest and (improving) professional competence. For the university students, a negative relationship was found for the two motivations, students who were highly intrinsically motivated were less extrinsically motivated and vice versa. Finally, Formanek et al. (2018) compared motivation of informal astronomy MOOC learners with motivation of their university students in a similar introductory astronomy course in university and found that the university participants had significantly lower intrinsic motivation, self-efficacy, and self-determination. University learners scored higher on social motivation, grade motivation, and career motivation however.

Theoretical lens: Self-determination Theory

Intrinsic motivation, characterized as important for MOOC participation and completion, is an extreme on the motivation continuum described by Self-determination theory and is related to enjoyment and interest (Ryan & Deci, 2000). It belongs to the act of doing something without external reward or punishment. On the other extreme, amotivation exists, constituting a lack of motivation. In the middle are several forms of extrinsic motivation, which encompass that one is motivated for external reasons. These forms are controlled, introjected, identified and integrated regulation of motivation, which in this order are increasingly more close to personal norms and values and thus intrinsic motivation (Ryan & Deci, 2000). Intrinsic and extrinsic motivation can also be divided differently, into autonomous motivation and controlled motivation, the first including intrinsic motivation and internalized and identified forms of extrinsic motivation, and the second consisting of external and introjected forms of extrinsic motivation (ten Cate et al., 2011). This categorization is important in formal learning contexts as formal learning is rarely purely intrinsically motivated. Often learning in school or university is extrinsically motivated,

however through identification or internalisation of the learning goals, students can feel autonomously motivated. Autonomous motivation has been thoroughly researched in educational contexts and is related to well-being, enjoyment, deep learning strategies and academic achievement (Reeve et al., 2008; Ryan & Deci, 2000).

A meaningful distinction also exists between quantity and quality of motivation (Ryan & Deci, 2000). Quantity of motivation is the sum of autonomous and controlled motivation, quality of motivation can be calculated as autonomous motivation minus controlled motivation. Motivation can be high, however when it is only or highly externally regulated, or controlled, it is considered low quality motivation as the subtraction will result in a low or even negative score (Vansteenkiste et al., 2009). High quality, mostly autonomous motivation is internally regulated to a greater extent, and it is positively associated with deep learning strategies, academic achievement, well-being and enjoyment (Reeve et al., 2008; Ryan & Deci, 2000). In line with this, Vansteenkiste et al. (2009) have found that high quality motivation in students is related to higher academic achievement and Self-Regulated Learning. Thus, high quality motivation, e.g. high autonomous motivation and low controlled motivation, is desired. Furthermore, according to self-determination theory there is a psychological need for feelings of autonomy, competence and relatedness to others in order to be autonomously motivated. In educational settings, these feelings may be satisfied or frustrated. In this way, instructional designs such as MOOC integration designs can influence the amount of autonomous motivation a student experiences, consequently influencing the quality of motivation (Reeve et al., 2008; Vanasupa et al., 2010).

Motivation profiles

When designing for MOOC integration, learning can also be personalised by adjusting pedagogy and online environment according to the motivation of students, to help personal performance (Hegarty, 2011). Grasping the shape of the motivation students feel for learning is therefore essential. This is no easy feat however, as students in online or blended environments are often heterogeneous in their motivation and can have multiple motivations (Vanslambrouck et al., 2018). Profiling can facilitate the design process as it provides a holistic model of learners, offering a tool for informing and justifying MOOC designs (Li & Xiao, 2022). Previously, motivation profiles of university students learning face-to-face, online, or blended have been discerned, describing clusters of students with high quality, high quantity, low quality and low quantity motivation (Vanslambrouck et al., 2018; Vansteenkiste et al., 2009). Motivation profiles of informal MOOC learners have also been determined, resulting in clusters of opportunity motivated, over-motivated, success motivated and interest motivated students (Luik & Lepp, 2021). Profiles of university students formally learning in MOOCs have not been described. To support integrated MOOC learning, motivation profiles could be used to tailor, for example, assessment (Wei et al., 2021). Moreover, targeting students with low quality motivation seems desirable especially, as students with highly controlled motivation tend to engage less with online course materials (Lai, 2021).

Design of informal MOOC learning has been adjusted according to research findings about motivation to learn in them, however research on motivation to learn in formally integrated MOOCs is lacking. Based on our information, no studies have been conducted to characterise or compare motivation of students in multiple integrated MOOC settings. Knowledge of motivation among students in specific MOOC integration designs, and levels of satisfaction and frustration of the underlying psychological needs is necessary to inform future research and practice of MOOC integration.

This study aims to gain insight into the presence of specific motivation profiles and their foundation in different MOOC integration designs, and possible improvements. Moreover, this study reveals motivation to learn in integrated MOOCs based on students' authentic learning experiences, which might indicate potential inconsistencies or agreements between motivation theories and MOOC integration practices to consider.

The research questions of this study are:

1. What are motivation profiles of (bio)medical students in three different MOOC integration designs?
2. Do the three MOOC integration designs differ in students' motivation profiles?
3. How are psychological needs of students satisfied or frustrated in different MOOC integration designs?

Material and methods

Research design

A cross-sectional research design was employed. The variety of motivation profiles was discerned to answer RQ1. To answer RQ2, we calculated the significance of dispersion of motivation profiles over MOOC integration designs. To answer RQ3, we compared scores for psychological need satisfaction and frustration between MOOC integration designs.

Context description and participant selection

The study was conducted at Leiden University Medical Center (LUMC) in the Netherlands. Prospective participants studied MOOC-content between May 2019 and March 2020, before the COVID-19 pandemic spread to the Netherlands. Three MOOC integration designs for undergraduate students using a MOOC on Clinical kidney, pancreas and Islet transplantation (de Jong et al., 2021) were selected for this study and all enrolled students were invited for participation, as previously described and depicted in (Hendriks et al., 2020b). In Figure 1 the MOOC integration designs, the MOOC teaching mode profile and the final teaching mode profiles of the integration designs are summarised.

Integration design	Level of education	Degree of obligation	Online-F2F ratio	Replacement or addition	Contact with other MOOC learners
A (LOTS)	Undergraduate	Compulsory MOOC component in a voluntary course	4 weeks – 3.5 days	Addition	Full access
B (MOD)	Undergraduate	Compulsory MOOC component in a compulsory course	1 week – 7 weeks	Replacement	Separate, private version of the MOOC
C (Hons)	Undergraduate	Voluntary MOOC component in a voluntary course	4 weeks – none	New course	Full access

MOOC FACT SHEET: Clinical Kidney, Pancreas, and Islet Transplantation

Offered by	Leiden University Medical Center
Platform	Coursera
Level	Intermediate
Time to complete	Approx. 15 hours
Language	English
Rating	4.8 of 5 (205 votes)

4 modules of one week

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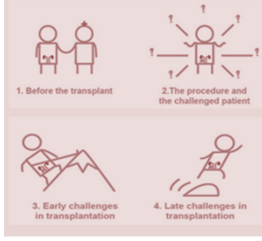

Teaching mode profile	#
Instruction	
Digital text or textbook	28
Independent activities related to content	1
Video of instructor talking to camera	49
PPT slides	24
Illustrations or simulations	12
Links to external online resources	214
Prompts to use external links	✓
Interaction	
Discussion boards for asking questions	✓
Discussion board answering questions prompted	✓
Discussion boards for discussing course materials	✓
Prompts to respond to peers	✓
Discussion board prompt to introduce oneself	✓
Assessment	
Multiple Choice Questions	98
Open ended question peer reviewed	2
Open ended question with long answer	5
Multifunctional	
Virtual patient cases	32
Games	1

Final integrated teaching mode profile

A: - all of the MOOC
- 9 lectures
- 6 workshops
- 1 patient demo
- 1 group assignment
- 3 social activities

B: - part of the MOOC
- 26 lectures
- 8 question hours
- 3 patient demos
- 3 seminars
- 2 working groups
- 2 assignments
- 1 formative exam
- 1 summative exam

C: - all of the MOOC
- 1 written assignment

Figure 1. MOOC teaching mode profile and MOOC integration designs.

Integration design A includes completion of a MOOC prior to enrolling in the 3.5-day undergraduate "Leiden Oxford Transplantation Summer School" (LOTS), running every July, except in 2020 due to COVID19 restrictions. Enrolment in this LOTS program is voluntary and student admission is based on an application letter. However, once admitted to the program, completion of the MOOC is a prerequisite for admission to the face-to-face meeting. Students sign up for the MOOC individually and learn with other global MOOC learners. About 20 students take the LOTS program each year.

Integration design B is a compulsory 8-week second year course called "Mechanisms of Disease". At the end of the course a full week of lectures has been replaced by a set of MOOC activities. The entire cohort of about 300 students enrols in a single separate iteration of the MOOC, so there is no connection to MOOC learners outside the cohort.

Integration design C is an elective for undergraduates enrolled in the Leiden University Honours Program (Ommering et al., 2018). The Honours program is designed for students who desire more challenge in their studies. All students in this integrated design must complete the MOOC at any time during their first or second year of undergraduate studies

and must submit additional written assignments. Students will not have face-to-face interactions with other students as this is an individual online course. Between 14 to 18 students participate in this integrated design each year.

Data collection

Email addresses were accumulated through coordinators of the integrated MOOC design courses. The first author contacted students via email to inform them about the study when they enrolled for the selected courses, before commencing the MOOC part. She had no educational role in relation to the students in these cohorts. Furthermore, a notification was placed on the Learning Management System. Students received a document with further information about the study, aspects of their participation and a form regarding informed consent (Appendix G). After finalising the MOOC element of each course, students were approached in person after an exam, or before or after a workgroup or lecture for integration designs A and B, and online for integration design C. They received the information and informed consent again, followed by the questionnaire. All written questionnaires were digitised, and the digital files were checked for mistakes in input.

Measures and materials

To answer our research questions two primary outcome measures were selected: motivation and psychological need satisfaction and psychological need frustration. Instruments were adapted to learning in MOOCs, tested in think-aloud sessions in three iterations with a different student and combined in a questionnaire.

- *Motivation.* The Learning Self-Regulation Questionnaire (Black & Deci, 2000) is comprised of 12 items and constructed to measure autonomous and controlled motivation on a 7 point Likert-scale. Reported Cronbach's α's are 0.80 for autonomous and 0.75 for controlled motivation.
- *Psychological Need Satisfaction and Frustration*. The Basic Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015) is comprised of 24 items on a 5 point Likert-scale. It yields scores for satisfaction and frustration of the psychological needs autonomy, competence and relatedness. The reported Cronbach's α's are between 0.71 and 0.88 for subscales.

Factor analyses and reliability tests

To ascertain the internal validity and reliability of the two instruments, exploratory factor analyses (EFA) were performed using a principal component analysis with an oblique rotation with minimization method, and Cronbach's α were calculated. Factor loading significance was determined according to the sample size thresholds described by Hair (2009).

- *Motivation to learn.* EFA revealed 3 factors in our study instead of the 2 factors predicted by the instrument description. The factors were 1) autonomous motivation, students being motivated to learn in a MOOC because they find it interesting or they want to learn; 2) instructor trusting motivation, students being motivated to learn in a MOOC because they trust their instructor to guide them and to know what's best; and 3) positive image motivation, students being motivated to learn in a MOOC because they want to be perceived positively. Combined the factors explained 61% of the variance. Cronbach's α scores of .836, .705 and .634 were obtained, respectively. The items and factor loadings can be found in Appendix J.

The motivating factors could not all be categorized as strictly autonomous or controlled. However, the recovered factors of instructor trusting motivation and positive image motivation seem similar to motivation factors described in previous informal MOOC research (Luik et al., 2019), and they resonate with findings from a previous qualitative study in this group of students, where we found that "trust in the teacher" is a major driver for learning strategies (Hendriks et al., *submitted*). Furthermore, wanting to be perceived positively certainly fits in the competitive context of (bio)medicine where people want and need to distinguish themselves to secure desired further study or employment positions (Bram et al., 2020; Hill et al., 2018).

- *Psychological need satisfaction and frustration.* The final two principal component analyses with oblique rotation with minimization methods revealed that for psychological need satisfaction, relatedness and autonomy partly loaded together, and that for psychological need frustration, competence and relatedness loaded together, resulting in the following factors: 1) relatedness-autonomy satisfaction, 2) competence satisfaction, autonomy satisfaction, 4) autonomy frustration, and 5) competence-relatedness frustration. The factors of psychological need satisfaction combined explained 60% of the variance, and the factors of psychological need frustration combined explained 51% of the variance. Cronbach's α scores of .819, .794, .456, .836 and .798 were obtained, respectively. As a score of .456 is unacceptable, factor 3: autonomy satisfaction was left out of further analyses. The items and factor loadings can be found in Appendix K.

Analyses

For RQ1, cluster analysis consisted of Ward's hierarchical clustering followed by K-means clustering to form the clusters, a double split cross validation to discern the stability of the cluster solution, and finally a multivariate analysis of variance (MANOVA) to discern to what extent the constituting motivation dimensions contributed to the cluster solution.

Prior to cluster analysis normal distributions were tested and means were calculated for autonomous, teacher trusting and positive image motivation based on the maximum number of items or maximum minus one with a minimum of two, for each scale. This means that autonomous motivation was calculated based on a minimum of five out of six items for each participant. This was followed by finding and discarding multivariate and univariate outliers as these can disturb cluster formation. In total data from ten participants was excluded from further analysis due to missing data (n=6), multivariate outliers (n=1) and univariate outliers (n=2).

Ward's hierarchical clustering was performed forming 2 to 10 clusters, yielding nine different cluster solutions. Sums of squares between groups and within groups for each cluster solution were used to calculate the Variance Ration Criterion (Caliński & Harabasz, 1974) to discern the optimal cluster solution. This is calculated as the optimal ratio between the variance explained by the cluster solution, compared to the total variance (or variance between the clusters), the number of clusters (criterion of parsimony) and the number of units to be clustered. The optimal number of clusters of K=6 was obtained, as can be seen in Appendix L. For the optimal cluster solution, Ward's cluster seeds were recorded to base the non-hierarchical K-means clustering upon. This yielded a final cluster solution and final K-means cluster seeds.

The double split cross validation (Vansteenkiste et al., 2009) was performed by randomly splitting the sample in two and following the cluster-forming steps described above. This yielded final cluster solutions and final K-means cluster seeds for group A and group B. K-means cluster seeds from group A were used to base K-means clustering of group B upon and vice versa. The orders of clusters formed for A and B were then matched to the likeness of the order of the original final cluster solution by hand, so that the K-means cluster seeds of each cluster were similar to each other across the original, group A and group B. Finally Cohen's kappa's were calculated to discern reliability between the original cluster solution and A and B, which informed us of the stability of the cluster solution. The double split cross validation yielded a Cohen's Kappa of .547 for stability of the cluster solution.

For the cluster solution to be acceptable, a minimum of 50% variance should be explained by the constituting motivation factors (Kusurkar et al., 2013; Vansteenkiste et al., 2009). In a MANOVA constituting dimensions of the clusters were added as dependent variables. This was to discern to what extent each type of motivation contributed to the cluster solution. The constituting dimensions included the three forms of motivation found in the factor analysis, and based on literature, quantity of motivation, and quality of motivation A and B. As instructor trusting motivation can consist of both autonomous and controlled forms of regulation, two types of quality of motivation were calculated. Quality of motivation A was calculated as Autonomous motivation and Instructor trusting motivation combined,

minus Positive image motivation. Quality of motivation B was calculated as Autonomous motivation minus Instructor trusting motivation and Positive image motivation. Covariates were not included in the calculation as any difference in age or gender could be important for the composition of the clusters and thus controlling for these covariates was undesirable. As can be seen in Appendix M, constituting dimensions explained 55% of variance or more.

A Chi-squared test was performed to investigate if specific integration designs were associated with specific motivational profiles for RQ2, and a second MANOVA was conducted to discern if student's psychological needs were satisfied and frustrated differently between the different MOOC integration designs for RQ3. This was followed by post-hoc tests.

All analyses were carried out in IBM SPSS statistics 25, except for the Variance Ration Criterion calculations, which were completed in Microsoft Excel.

Ethical considerations

This study was approved by the Educational Research Review Board (ERRB) of the LUMC. It was conducted according to the Dutch General Data Protection Regulation (AVG). Data was anonymized and participants had the right and option to audit the way their data was stored. Participants signed an informed consent form and were aware they were able to withdraw at any moment without consequence. Participants were not offered compensation for partaking, nor were they disadvantaged in any way.

Results

A total of 272 participants filled out the questionnaire, 19 (95%), 240 (67%) and 13 (48%) joined from integration design A, B and C, respectively. Mean age was 19.69 (stdev.= 1.416, data missing from 13 students) and 66,9% were female versus 29,4% male (data missing from 10 students). For Integration design B only students from Leiden University (n=260) participated, for integration design A and C students from eight other universities in Europe and Asia (n=12) also participated.

Typology of student motivation for formal MOOC learning

In Table 1 and Figure 2, we have summarized the six motivation types based on the three underlying motivation dimensions. The K-means clustering algorithm revealed six types of motivation profiles: learners that are 1) Highly self-determined, who are regulated mostly by their autonomous motivation, 9,9% (n=26); 2) Self-determined, who are regulated by their autonomous motivation similarly, but with more emphasis on the other forms of motivation, 14,4% (n=38); 3) Grade hunting or CV building, who are regulated by all three types of motivation, with the highest amount of positive image motivation of all clusters, 23,6% (n=62); 4) Moderately trusting, who are regulated mostly by their autonomous motivation

and instructor trusting motivation, but who have a moderate quantity of motivation, 13,7% (n=36); 5) Highly trusting, who also are regulated mostly by their autonomous motivation and instructor trusting motivation, but who have a high quantity of motivation, 24,7% (n=65); and 6) Extremely trusting, who are regulated mostly by their autonomous motivation and instructor trusting motivation, but who have an extreme quantity of motivation, 13,7% (n=36).

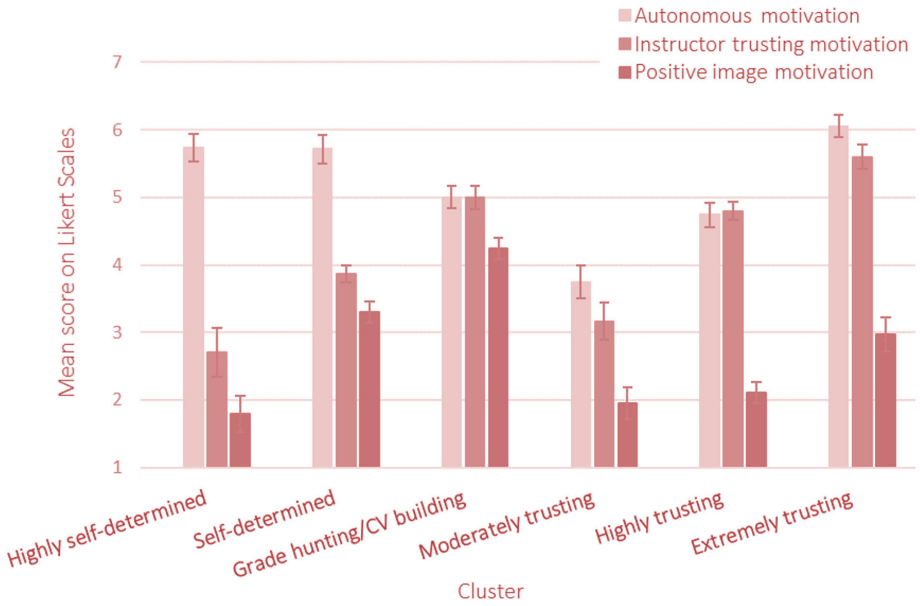

Figure 2. Motivation profiles composed of distinct combinations of the three motivation types, including 95% confidence intervals.

Table 1. The six extracted clusters with mean scores and standard deviations of the constituting dimensions.

	Highly self-directed	Self-directed	Grade Hunters	Moderately trusting	Highly trusting	Extremely trusting
	n = 26 (9,9%)	n = 38 (14,4%)	n = 62 (23,6%)	n = 36 (13,7%)	n = 65 (24,7%)	n = 36 (13,7%)
Constituting dimension						
Autonomous motivation	$5{,}73_a$ (0,51)	$5{,}72_a$ (0,64)	$5{,}00_b$ (0,65)	$3{,}74_c$ (0,71)	$4{,}74_b$ (0,72)	$6{,}06_a$ (0,47)
Instructor trusting motivation	$2{,}70_a$ (0,89)	$3{,}87_b$ (0,38)	$5{,}00_c$ (0,68)	$3{,}17_a$ (0,81)	$4{,}80_c$ (0,55)	$5{,}60_d$ (0,54)
Positive image motivation	$1{,}79_a$ (0,65)	$3{,}30_b$ (0,47)	$4{,}24_c$ (0,60)	$1{,}95_a$ (0,69)	$2{,}11_a$ (0,64)	$2{,}97_b$ (0,73)

Note. Cluster means are significantly different if they have different a, b, c and d subscripts.

Relationship between integration designs and motivation profiles

In Table 2 and Figure 3, we have summarized the counts, expected counts and proportions of the six motivation types per MOOC integration design. All profiles were present in integration design B, with the majority of students (57%) moderately, highly or extremely trusting, a quarter grade hunting or CV building and a minority (18%) was (highly) self-determined. In integration design A only the Highly trusting profile was missing, and 75% of the students had a Self-determined motivation profile, of whom the minority was Highly self-determined. Finally, in integration design C the moderately and extremely trusting profiles were not present and over three quarters of students had a Self-determined motivation profile, of whom the majority was Highly self-determined.

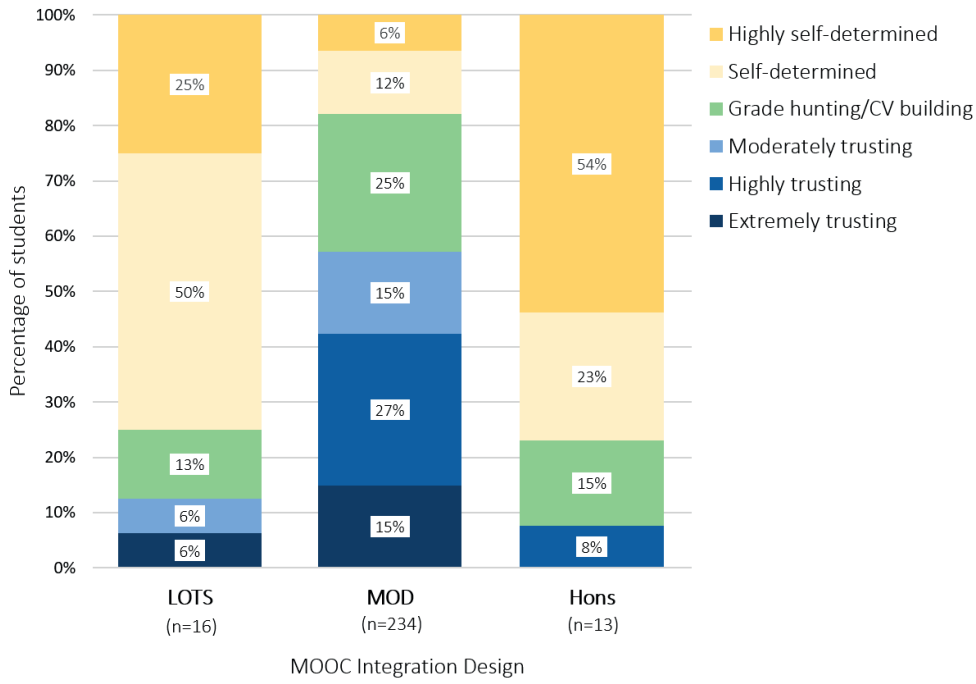

Figure 3. Proportions of students with each motivation profile in three MOOC integration designs.

A chi-square test of independence was performed to examine the association between MOOC integration design and motivation profile. A cross tabulation of counts and expected counts for students in MOOC integration design and profiles can be found in Table 2. The relation between these variables was significant, X^2 (10, N = 263) = 50.17 (Likelihood ratio), $p < .000$. Cramer's V was calculated as 66.7% of the expected counts was less than 5. This resulted in an effect size of 0.340, signifying a weak to medium association between MOOC integration design and motivation profile.

Table 2. Counts and expected counts of students with a specific motivation profile in each MOOC integration design.

		Integration design			Total
		LOTS	MOD	Hons	
Highly self-determined	Count	4	15	7	26
	Expected Count	1,6	23,1	1,3	26
Self-determined	Count	8	27	3	38
	Expected Count	2,3	33,8	1,9	38
Grade hunters / CV builders	Count	2	58	2	62
	Expected Count	3,8	55,2	3,1	62
Moderately trusting	Count	1	35	0	36
	Expected Count	2,2	32	1,8	36
Highly trusting	Count	0	64	1	65
	Expected Count	4	57,8	3,2	65
Extremely trusting	Count	1	35	0	36
	Expected Count	2,2	32	1,8	36
Total	Count	16	234	13	263
	Expected Count	16	234	13	263

Relationship between integration designs and students' needs satisfaction and frustration

In Table 3 we have summarized mean scores and standard deviations of psychological need satisfaction and frustration for the three MOOC integration designs. To examine the differences in psychological need satisfaction and psychological need frustration between MOOC integration designs a MANOVA was performed. the Wilks's lambda was significant, $F(8,496) = 6,215$, $p < .001$; Wilks' $\Lambda = .826$, partial $\eta 2 = .091$, indicating that significant differences were found between MOOC integration designs for psychological need satisfaction and/or frustration.

Tukey's honestly significant difference post hoc test revealed that Relatedness-autonomy satisfaction scores were statistically significantly lower in integration design B (2,41 ± 0,68) versus A (2,86 ± 0,76, $p = .025$) and C (2,96 ± 0,45, $p = .012$), and that competence satisfaction scores were statistically significantly lower in integration design B (3,53 ± 0,57) versus A (3,97 ± 0,56, $p = .008$) and C (4,21 ± 0,45, $p < .001$). Relatedness-competence frustration scores were statistically significantly higher in integration design B (1,98 ± 0,59) versus A (1,54 ± 0,40, $p = .010$) and C (1,52 ± 0,42, $p = .014$), and autonomy frustration scores were also statistically significantly higher in integration design B (2,95 ± 0,77) versus C (2,19 ± 0,63, $p = .002$) but not A (2,52 ± 0,86). Scores from integration design A and C did not statistically differ significantly for any of the psychological needs. Overall, MOD students scored lower on psychological need satisfaction and higher on psychological need frustration than LOTS and Hons students.

Table 3. Mean scores and standard deviations of psychological need satisfaction and frustration for the three MOOC integration designs.

	LOTS	MOD	Hons
	n = 16 (6,3%)	**n = 225 (88,6%)**	**n = 13 (5,1%)**
Satisfaction of			
Relatedness-autonomy	$2{,}86_b$ (0,76)	$2{,}41_a$ (0,68)	$2{,}96_b$ (0,45)
Competence	$3{,}97_b$ (0,56)	$3{,}53_a$ (0,57)	$4{,}21_b$ (0,45)
Frustration of			
Relatedness-competence	$1{,}54_b$ (0,40)	$1{,}98_a$ (0,59)	$1{,}52_b$ (0,42)
Autonomy	$2{,}52_{a,b}$ (0,86)	$2{,}95_a$ (0,77)	$2{,}19_b$ (0,63)

Note. MOOC integration design means are significantly different if they have different a and b subscripts.

Discussion

In this study we found six distinct motivation profiles based on three forms of motivation: Self-determined learners and highly self-determined learners, grade hunters, and teacher trusters who are moderately, highly or extremely trusting. We also found proportions of motivation profiles to differ significantly between MOOC integration designs, and that MOOC integration designs satisfy and frustrate psychological needs significantly different.

Motivation in integrated MOOC learning versus informal MOOC learning

We found similar motivation factors as previous MOOC research (Kizilcec et al., 2017; Luik et al., 2019) while using a different instrument, however our findings deviate from prior findings in several ways. First, we did not find the same diversity in motivation factors for learning in a MOOC as for example Kizilcec et al. (2017) or Luik et al. (2018). It is possible that more motivation factors might have surfaced with a different instrument. Second, though our motivation factors are similar to some of the factors that informal MOOC learner profiles were based upon (Luik & Lepp, 2021), the profiles are not. Specifically, our factor autonomous motivation could be linked to Luik and Lepp's *interest in the course,* and positive image motivation could be linked to Luik and Lepp's *usefulness related to certification* and *social influence* based on similarity in items for these scales. However, the cluster solutions are not similar: the profile with the lowest score for *interest in the course* from Luik & Lepp (2021) had a mean 7-point Likert scale score of 5.7 while in our profiles five out of six profiles have mean 7-point Likert scale scores for autonomous motivation of 5.73 or lower. Similarly, we found one cluster to peak (mean score 4.24) in positive image motivation, while Luik & Lepp (2021) found one profile to dip (mean score 4.1) in *usefulness related to certification* and *social influence*. Finally, Kizilcec et al. (2017) found that in 57% of the informal MOOCs they investigated, learners said to be motivated by a prestigious university or professor to join the course. From their study it was unclear however to what extent this factor played a role. We have found instructor trusting motivation to play a major role in cluster

formation in integrated MOOCs, with some profiles emphasizing the role of the instructor in motivation in relation to other factors. Thus, motivation in integrated MOOC learning and informal MOOC learning seems to be measurable with similar factors, however previous and current results show that factor scores and learner motivation profiles differ between informal and formal MOOC learning. Specifically, in integrated MOOC learning, autonomous motivation seems lower, positive image motivation seems more condensed to one profile, and instructor trusting motivation seems more prevalent. This is in line with earlier findings regarding intrinsic motivation and motivation to earn a certificate in university affiliated students in MOOCs (Formanek et al., 2018; Watted & Barak, 2018).

Motivation profiles in different integrated MOOC learning designs

Within integrated MOOC learning, we found motivation to learn to be context dependent as well. Different MOOC integration designs related to different psychological need satisfaction and frustration and also to different (proportions of) motivation profiles per design. Predictably the two designs that were less obligatory, A and C, had substantially larger proportions of self-determined learners and better scores for psychological need satisfaction and psychological need frustration. The difference between design A and C in the amount of highly self-determined learners could stem from the fact that in design C the MOOC was voluntary in an extracurricular program and A was compulsory in an extracurricular program. In addition, as these courses were for credit but extracurricular, we are not surprised to see CV-builders are also similarly present in design A and C. The most deviant design in terms of MOOC integration choices, design B, is also the most deviant in proportions of present profiles. Notably, many students in this obligatory MOOC design are teacher trusters, with varying quantity of motivation. We believe, informed by a qualitative study in the same cohort (Hendriks et al., *submitted*), that students in this case acquiesce to what is expected of them. They do not study in the course out of interest per se, but will have to complete it to progress in their studies and thus they revert to being 'led' by the teacher, 'who probably knows best'. This trust in the teacher also fits Vygotsky's *Zone of Proximal Development* where the teacher is the designated 'more knowledgeable other' (Vygotsky, 1978). In addition, it resonates with the *Social Cognitive Path to Self-Regulatory Skills* as postulated by Zimmerman and Kitsantas (2005), describing a gradual transference of self-regulated learning skills and agency from the teacher to the learner. Our sample consists of undergraduate students only, however we found differences in the amount of teacher trusters between designs. Our current study cannot explain this difference, however we see possible explanations in two directions: 1) individual differences in self-regulated learning skills and learner maturity exist, and more advanced students self-select in voluntary MOOC integration designs; and 2) the design in which a MOOC is offered scaffolds a specific role for the teacher and the student. We expect both factors to play a role.

Psychological need satisfaction and frustration in different integrated MOOC learning designs

Design B differed significantly from design A and C for psychological need satisfaction and frustration. Self-selection might play a major role here. Specifically, higher scores for competence satisfaction and lower scores for relatedness-competence frustration in design A and C, might be explained by self-selection. Students that feel competent and or have high self-efficacy to learn in MOOCs, might be more prone to seeking voluntary extracurricular study credit in that form. Similarly, to us, it seems only logical that autonomy frustration scores increase in more obligatory designs. If this self-selection effect is indeed in place, specifically obligatory designs are in need of competence and autonomy support. Another important factor in psychological need satisfaction might be the emphasis that is placed on the MOOC in the larger MOOC integration design. Our analyses revealed that items from relatedness and autonomy satisfaction loaded together and that students in design B scored significantly lower on this factor. Looking at the items for this factor (see Appendix K), we believe they might portray a feeling of 'belonging to or fitting into the online course', instead of relatedness or belonging to other people in the course or having autonomous choices per se. In this regard, we believe the difference in online/f2f ratio might play a role, as in integration design B the MOOC is only a small portion of an extensive face to face course. Peacock et al. (2020) described that for a sense of belonging to an online course, engagement, the culture of learning and support are important themes. In our study, especially design B might not have had enough time or emphasis on the MOOC to develop real engagement or an online learning culture.

Future research, practical implications and limitations

While we found significant differences in motivation profiles between integration designs, in this study we can only speculate as to why these differences occur. In researching what works when in MOOC integration, many contextual variables are present, including the topic or discipline of the MOOC, the choices in the integration design and the instructional design or teaching mode profile of the final blend, to name a few. In this study we investigated three already existing MOOC integration designs with the same MOOC, and so our designs do not differ in topic or discipline, but they do on various other variables. The next step is to compare integration designs that differ on only one variable at a time. Informed by our findings, we also propose to investigate the role of the degree of obligation in MOOC integration designs, as it may lead to scaffolded student and teacher roles or self-selection of students. Finally, as we aimed to measure motivation in terms of autonomous and controlled motivation as previous studies in formal education, but found factors that resemble motivation previously described for MOOC learning, optimal instrumentation for measuring motivation in integrated MOOC settings should be studied.

The desired motivation profile is that of the highly self-determined student, as previously it has been shown that high quality motivation is related to better academic achievement

and high autonomous motivation is related to better learning strategies, well-being and enjoyment (Ryan & Deci, 2000). Our study showed that in MOOC integration designs similar to A and C, not much support may be needed. However in courses similar to integration design B, psychological need satisfaction and frustration could be improved. In this regard, it is advisable to monitor motivation when integrating a MOOC obligatorily and take precautions to support motivation beforehand. This can be done by integrating MOOCs that are already designed with improving motivation in mind, for example with game elements and personalised designs (Saputro et al., 2019), earning badges for completed assignments (Ortega-Arranz et al., 2019), improved content, accessibility and interactivity (Deshpande & Chukhlomin, 2017), and specific support for self-regulated learning skills (McCann et al., 2015). In addition support of feelings of autonomy, relatedness and competence in the final MOOC integration design can be realised through relatively small interventions (Reeve et al., 2008).

Two limitations need to be mentioned. First, generalisability to other MOOC integration designs and contexts needs to be examined as our findings are, per design of the study, highly context specific. Second, in this study participation rates of 95%, 67% and 48% were obtained for integration designs A, B and C, respectively. As the 'missing' data in this study could be missing due to low motivation, which is the measured construct in this study, we gather data is missing possibly not at random. As a group of students might in fact not have responded because of low motivation, we have to take into account a possible representation bias. This could mean our results present a slightly more positive view on motivation to learn in integrated MOOCs than it in reality is. Mean scores for motivation factors could thus be lower, or an extra very low motivation profile could be missing. Especially for integration design C it could mean that the proportion of self-determined learners is in fact smaller than we have found. As we did find a lower quantity motivation profile among the 'Teacher trusters' we do believe the findings are representative and implications are highly valuable for future research and practice.

Conclusions

In integrated MOOC learning students are motivated by autonomous motivation, trust in their instructor and the image others have of them. From these factors six different motivation profiles presented: highly self-determined students, self-determined students, grade hunters or CV builder, and moderately, highly and extremely trusting students. Motivation factors in integrated MOOC learning are similar to motivation factors in informal MOOC learning, however motivation profiles are not. Finally, motivation to learn in integrated MOOCs is dependent of the MOOC integration design, and most likely supported by psychological need satisfaction and frustration. This study is the first to characterise motivation to learn in formally integrated MOOCs, and the first to compare integration designs based on motivation.