RESEARCH ARTICLE

What are the key themes associated with the positive learning experience in MOOCs? An empirical investigation of learners' ratings and reviews

Ruiqi Deng[1]* and Pierre Benckendorff[2]

*Correspondence:
r.deng@hznu.edu.cn
[1] Department of Educational Technology, School of Education, Hangzhou Normal University, Hangzhou, China
Full list of author information is available at the end of the article

Abstract

Past MOOC research has tended to focus on learning outcomes valued in traditional higher education settings, such as achievement and retention. This study recognises that student ratings are an important alternative outcome measure in MOOCs. This paper adopted a semiautomatic text mining approach to collect and analyse 8475 ratings and reviews submitted for 1794 MOOCs. The analysis revealed six important themes that contributed to positive ratings: 'learning', 'understanding', 'interesting', 'videos', 'recommend', and 'questions'. The paper then investigated the characteristics of each identified theme based on the proximity of themes, distribution of concepts within themes, and important connections. Based on research findings, the paper presents the following propositions to assist educators and providers to enhance the learning experience in MOOCs: (1) provide *realistic* learning contexts and instructional conditions in MOOCs to facilitate the acquisition of knowledge that transfers more readily to *real-world* practices; (2) carefully design the instructional conditions so that some *mental challenge and stimulation* is required for learners to achieve a full understanding of the content, rather than making MOOCs too simple or effortless to complete; (3) design the *course content, materials, and communications* to generate interest; (4) allocate *sufficient* resources to create *high-quality* video lectures; (5) employ video lectures to elicit *positive emotions* from MOOC learners and simplify *complex, difficult concepts*; and (6) incorporate discussion boards in MOOCs and invest in human and digital resources to address learners' *queries*.

Keywords: Massive open online courses (MOOCs), Learning experience, Student ratings, Student reviews, Perceived quality of instruction, Text mining

Introduction

The disruptive potential of MOOCs has generated increasing scholarly interest in MOOC learning outcomes, particularly learners' academic performance (Meek, Blakemore, & Marks, 2016; Phan, McNeil, & Robin, 2016) and completion (Engle, Mankoff, & Carbrey, 2015; Hone & El Said, 2016). While academic performance and completion are important measures of learning outcomes in traditional higher education

institutions (HEI) settings (Entwistle, 2018), it could be argued that these outcome measures are less relevant to the MOOC teaching and learning context. MOOC learners display a combination of intrinsic, extrinsic, and social motivations when registering for a MOOC (Deng, Benckendorff, & Gannaway, 2017, 2019). Only a small percentage of enrolled learners intend to complete a MOOC and earn a certificate of accomplishment (Evans & Baker, 2016). The majority of MOOC learners are not motivated by educational advancement, such as gaining entry to a postsecondary degree programme (Stich & Reeves, 2017). They tend to be more concerned with achieving personal learning goals than academic achievement (Jung, Kim, Yoon, Park, & Oakley, 2019). Furthermore, learner engagement in MOOCs represents a relatively simple structure when compared with engagement in traditional, credit-bearing university courses (Deng, Benckendorff, & Gannaway, 2020a). These differences draw attention to other measures for evaluating the performance of MOOCs.

Student ratings, or students' perceived quality of instruction, have been employed by HEIs for decades to provide feedback to enhance the quality of teaching, help students to make enrolment decisions, and facilitate administrative evaluations for promotion and tenure decisions (Cohen, 1980). Similarly, student ratings of MOOCs provide feedback to construct or revamp a MOOC, help prospective learners to select courses for study, and assist university leaders and managers to make investment decisions about future MOOC production. Despite its importance, limited effort has been devoted to analysing and interpreting student ratings and accompanying written feedback on MOOCs. This apparent knowledge gap provides the impetus for the current study. An empirical investigation of student ratings and reviews will contribute to an improved understanding of the study experience in MOOCs. This study limits the scope to the positive study experience and seeks to achieve two research objectives. First, this study aims to identify the *key themes* contributing positive learning experiences in MOOCs. Second, the study aims to explore the *characteristics* of each identified theme.

Literature review

The role of students in constructing positive learning experience

From a 'students-as-customers' perspective, Higher Education (HE) services are viewed as commodities which are purchased and consumed by students, and students expect HEIs to provide superior service across the student lifecycle (Bunce, Baird, & Jones, 2017). While supporters of such an approach claim that students are beneficiaries and end users of the experiential service offered by HEIs, opponents contend that this approach contradicts to the notion of professionalism (Olssen & Peters, 2005) and leads to lower academic standards (Hassel & Lourey, 2005; Johnson, 2003). Despite the polarised debate, empirical research reveals that university students often see themselves as customers when it comes to student feedback and classroom study, but do not expect to be treated as customers in terms of curriculum design, rigour, classroom behaviour, and graduation (Riina & Petri, 2015).

A more recent paradigm in HE is to view students as 'co-creators' (Bovill, Cook-Sather, & Felten, 2011), 'co-producers' (McCulloch, 2009), or 'partners' (Bovill, 2020) in constructing positive educational experiences. Under the partnership model, the purpose of student feedback and evaluation is gradually shifting away from rewarding

and punishing academics to improving teaching practices (Golding & Adam, 2016) and establishing and recalibrating benchmarks for quality teaching and learning (Chen & Hoshower, 2003; Clayson & Haley, 2005). Student ratings have long been recognised as a useful benchmark for evaluating the performance of HEIs at both the subject/unit level (Stewart, Speldewinde, & Ford, 2018; Walker & Palmer, 2011) and the programme/institution level (Betz, Klingensmith, & Menne, 1970; Landrum, Hood, & McAdams, 2001). The scope of discussion in this article is limited to student ratings at the subject level. This is because traditional educational attributes such as campus climate and physical infrastructure are irrelevant to the MOOC context. This study endorses the 'students-as-cocreators' perspective and recognises learners' voices in constructing positive MOOC study experiences. This perspective implies that student ratings and reviews are valuable sources that can be used to improve the quality of learning experience in MOOCs.

Higher education student ratings and reviews

There is little consensus about how student rating scales are best conceptualised and constructed in the HE context. A review of student rating instruments shows that some HE researchers have treated student ratings as a multidimensional concept (Harnash-Glezer & Meyer, 1991; Hendry, 1983; Krehbiel, McClure, & Pratsini, 1997). Adopting a multi-attribute model, scales are divided into a range of distinct characteristics and assessed using Likert-type or rating scales. Some researchers have attempted to simplify student ratings by adopting a more holistic approach. In these studies, a student rating is defined as the overall perception of the student experience, and the multidimensionality of the construct is ignored in the measurement process (Han, Kiatkawsin, Kim, & Hong, 2018; Zafra-Gómez, Román-Martínez, & Gómez-Miranda, 2015). This simplification provides a fast and frugal way to obtain student feedback, especially when student ratings are not the sole focus of a research study (e.g. Alves & Raposo, 2007; Denson, Loveday, & Dalton, 2010).

Some researchers argue that the single measure fails to acknowledge the multiple attributes of a learning experience and varying degrees of student perceptions about each individual attribute (Elliott & Shin, 2002). Others have shown that the unidimensional evaluation approach can be as informative as the multidimensional method. This is because some dimensions are more central and account for a substantial amount of the variance in student ratings, while the more peripheral dimensions only play a marginal role (Apodaca & Grad, 2005; Cashin & Downey, 1992). Higher student ratings are often associated with good teaching skills (Ginns, Prosser, & Barrie, 2007), sufficient support and advise (Richardson, Slater, & Wilson, 2007), appropriate assessment and workload (James & Casidy, 2018), clear goals, standards, and evaluation criteria (Mikulić, Dužević, & Baković, 2015), and the development of higher order cognitive capabilities (Lizzio, Wilson, & Simons, 2002).

Student rating can be affected by a variety of personal and environmental factors. Examples of personal characteristics and attributes that affect student rating are age (Spooren, 2010), ethnicity (Worthington, 2002), gender (Nasser-Abu Alhija & Fresko, 2018), personal interest (Nasser & Hagtvet, 2006), and attitude towards evaluation (Carlozzi, 2018). At the same time, student rating can be influenced by configurations of the teaching environment, such as course delivery mode (Beran & Violato, 2005), class size

(Gannaway, Green, & Mertova, 2018), and teaching experience of the instructor (Berbegal-Mirabent, Mas-Machuca, & Marimon, 2018). Certain student-based and teaching context-based factors, such as academic discipline (Berbegal-Mirabent et al., 2018; Nasser-Abu Alhija & Fresko, 2018) and the instructor's gender (Berbegal-Mirabent et al., 2018; MacNell, Driscoll, & Hunt, 2015), are not related to criteria of good teaching and often beyond the control of the instructor and the HEI. These factors will contaminate and bias the finding if they are not controlled for (Bedggood & Donovan, 2012). While some scholars attempt to control for these extraneous factors (Denson et al., 2010), critics contend that there are numerous factors which will affect student rating and it is not clear what factors should be considered meaningful indicators or biasing factors (Spooren, Brockx, & Mortelmans, 2013). Given these potential limitations, it is important to consider adopting other forms of student evaluation.

Qualitative responses are often collected alongside quantitative scales to assist with the interpretation of student ratings. However, text-based, free-form student reviews can be viewed as a useful evaluation technique on its own. This is because qualitative feedback supports the development of learner identities and encourages students to become co-producers of knowledge (Erikson, Erikson, & Punzi, 2016), provides insight into teaching and learning issues that are not normally captured by quantitative methods (Stupans, McGuren, & Babey, 2016), and elicits a richer, learner-centred perspective of the student experience (Steyn, Davies, & Sambo, 2019). Research shows that student reviews are positively correlated with quantitative ratings data (Alhija & Fresko, 2009; Braskamp, Ory, & Pieper, 1981; Burdsal & Harrison, 2008; Ory, Braskamp, & Pieper, 1980). To gain a full understanding of learners' experience, it is critical that student reviews are systematically analysed and interpreted in conjunction with student ratings data, sometimes with the aid of software tools (e.g. Grebennikov & Shah, 2013).

MOOC student ratings and reviews

Student ratings are presented and used in different ways in MOOC research. MOOC research on student ratings can be divided into three categories. The first category includes descriptive studies that explore MOOC learners' attitudes towards one or more course components. Studies in this category adopt a quantitative approach and conduct descriptive analyses (e.g. mean, standard deviation). For example, Khalil and Ebner (2013) reported that 65% of MOOC learners were satisfied with online interaction. Yousef, Wahid, Chatti, Schroeder, and Wosnitza (2015) found that learners were highly satisfied with the peer assessment module in a MOOC. Studies in this category are sometimes presented in form of case studies and contain qualitative insights that complement quantitative results (e.g. Gutiérrez-Santiuste, Gámiz-Sánchez, & Gutiérrez-Pérez, 2015; Moskal, Thompson, & Futch, 2015). These studies tend to have a narrow focus and rarely investigate the relationship between student ratings and other teaching and learning factors. Nevertheless, these early studies collectively create a snapshot of MOOC learners' satisfaction with course design features and provide ideas and inspiration for subsequent MOOC research.

The second category treats student ratings as a mediating or outcome variable. Studies in this category are quantitative in nature and apply multivariate data analysis to determine the relationship between student ratings and other learning-related variables. For instance,

Joo, So, and Kim (2018) revealed that higher MOOC ratings had a positive influence on learners' continuance intention to use MOOCs, and that MOOC ratings can be predicted by perceived ease of use and perceived usefulness. These studies tend to have a relatively small sample size and typically focus on individual MOOCs. Therefore, caution should be exercised when generalising findings from these studies to broader learner profiles and MOOC settings. Scholars may need to verify research findings from these studies in alternative teaching and learning environments.

The third category of research adopts qualitative approaches to explore student rating in MOOCs. Compared with MOOC studies in the other two categories, very few scholars have taken a qualitative approach to analysing and interpreting MOOC learners' ratings and reviews. An exception is a case study of three highly ranked MOOCs, which identified five factors that were important for promoting learner engagement in MOOCs: problem-centric learning, instructor accessibility, active learning, peer interaction, and resources (Hew, 2015). Despite its usefulness, the case study focused exclusively on engagement and explored factors that can potentially contribute to learner engagement in MOOCs. There is a scope for researchers to move beyond 'learner engagement' and identify additional themes associated with positive learning experiences in MOOCs. In addition, past research almost exclusively focused on a few hand-picked, highly rated MOOCs. There is scope to incorporate a broader spectrum of MOOCs and a higher volume of review data to enhance transferability of research findings.

Research opportunities

A long history of research in traditional HE settings has established that student ratings provide a valuable data source for optimising the teaching and learning environment for university students (Cohen, 1980). Student ratings and reviews are potentially important information sources for assisting MOOC learners to make enrollment decisions, instructors to revamp MOOCs, university leaders and managers to make investment decisions about the production of future MOOCs, and for helping researchers to better understand what makes MOOCs successful.

Many quantitative analyses of student ratings have tended to adopt a convenience sampling method and have focussed on individual MOOCs or single learner cohorts. These studies are often bounded by specific teaching contexts and may not be generalisable to the broader MOOC setting. On the other hand, qualitative studies are often constrained by the small number of cases analysed and the potential bias of coders and investigators. The current study aims to overcome these limitations by employing a semiautomated text mining solution and evaluating MOOC learners' positive ratings and reviews for 1,794 MOOCs. This study is guided by two important research questions: (1) what are the *key themes* contributing to positive learning experiences in MOOCs, and (2) what are the *characteristics* of each identified key theme? For the purpose of clarity, key themes are defined as themes that most frequently occur in MOOC reviews, and theme characteristics are conceptualised to comprise the theme scope, key connections within the theme, and relationships with other themes.

Research method

Data collection

MOOC ratings and reviews were collected from a third-party review site—Class Central. This website allows MOOC learners to rate courses they have taken and to read other learners' ratings and reviews. The rating system on Class Central has five categories, anchoring from one star to five stars. MOOC learners are requested to provide written comments when they rate a MOOC, and the comments must be at least 20 words long.

A third-party website was selected over independent MOOC platforms (e.g. Coursera, edX) for three important reasons. First, not all leading MOOC platforms have a review system. Users of FutureLearn and edX, for example, are unable to leave a review because these MOOC platforms do not provide such affordances. Second, the use of different rating systems makes it difficult to compare ratings across MOOCs. The adoption of a five-point rating system on Coursera means that MOOC participants have options to leave neutral responses. In contrast, Open2Study employs a four-point rating system, which means indicating a neutral position is not possible. Third, a third-party website aggregates MOOCs from multiple platforms. The course catalogue of Class Central shows diversity in difficulty, duration, field of study, syllabus, and instructional approaches. Ratings and reviews collected from this website would provide a more diverse range of opinions than a single, independent MOOC platform.

The authors created a programme in Octoparse, a data extraction tool, to randomly collect MOOC learners' ratings and reviews from Class Central. The data extraction tool helped to transform raw Hypertext Markup Language (HTML) into structured data. Kozinets (2009) indicates that collecting existing data from the Internet does not strictly qualify as human subjects, and informed consent is required only when interventions occur. In this study, all data collected were already publicly available online. No interventions were applied during the data collection process. Therefore, ethics approval was not required. The metadata were stored in an Excel worksheet, documenting the information such as MOOC name, provider (e.g. Edinburgh, Duke), platform (e.g. FutureLearn, Coursera), language of instruction, personal rating (1 to 5), and text-based review. A total of 17,612 entries were collected from learners who participated in 2717 courses delivered by 506 HEIs and organisations. The pool of entries was inspected, and duplicate entries and entries that are not meaningful were deleted. Only entries meeting the predetermined criteria (Table 1) were retained.

The selected entries were edited to a standard format in Microsoft Word for further processing. The final text document used for data analysis contains 8475 reviews from individuals who participated in 1794 MOOCs delivered by 382 HEIs and organisations across more than 20 platforms. In the text document, the shortest entry contains 47 characters, and the longest entry contained 12,316 characters. The average length of the selected entries was 389 characters. The total number of characters analysed in this study was 2,745,543. More information about the selected entries is displayed in Table 2.

Table 1 Selection criteria for entries

	Selection criteria	Rationale
Cost	Free	The 'open' nature of MOOCs implies that the course materials should be freely available to the public
Discipline or field of study	All inclusive	This study is set to investigate positive learning experiences in MOOCs of all disciplines and fields of study
Rating of the learner	4 stars and above	This study defines positive learning experiences as 4 stars and above on a five-star scale
Language of the learner feedback	English	Leximancer cannot process texts in certain languages (e.g. Japanese). The entries written in languages other than English account for about 5% of all entries
Date	Published online from 2013 to 2019	Both old and new entries are useful for understanding the positive learning experience in MOOCs

Table 2 Information about the selected entries

|	Frequency	Percentage
MOOC discipline or field of study		
Art and design	377	4.4
Business and management	898	10.6
Computer science	1398	16.5
Data science and mathematics	750	8.8
Education	250	2.9
Engineering	455	5.4
Health science	736	8.7
Humanities	1264	14.9
Professional development	600	7.1
Science	895	10.6
Social science	852	10.1
Language of instruction		
English	8058	95.1
Non-English	417	4.9
MOOC platform		
Coursera	3836	45.3
edX	1778	21.0
FutureLearn	1349	15.9
Other MOOC platforms	1512	17.8
Learner's MOOC completion status		
Learners who had completed the MOOC	7424	87.6
Learners who were taking the MOOC	1051	12.4
Learner's rating of MOOCs		
4 stars	1696	20.0
5 stars	6779	80.0

Data analysis tool

The authors employed Leximancer Desktop 4.5 to explore and analyse the cleaned data. Leximancer is a data-mining tool which extracts key concepts from collections of textual documents based on the frequency of occurrence of concepts and

co-occurrence use, thereby providing impartial opinions on open codes (e.g. themes, categories) and avoiding coder bias (Harwood, Gapp, & Stewart, 2015). Leximancer is widely acknowledged as a useful tool for data mining and has been previously applied to technology-enhanced learning research (e.g. Rodrigues, Almeida, Figueiredo, & Lopes, 2019). In Leximancer, concepts are defined as 'collections of correlated words that encompass a central theme' (Leximancer, 2018, p. 65). The extracted information is then visually displayed on an interactive thematic map. The map allows researchers to inspect the conceptual structure of a body of text, to examine the relationship between key concepts, and to explore the association between key concepts and original texts (Leximancer, 2018).

On the thematic map, concepts that co-occur frequently within the text tend to settle near one another and are clustered into themes. Themes are shown as coloured circles, with the most important theme appearing in warm colours such as red and beige. These latent themes are important topics extracted from learners' reviews and carry the same meaning with the word 'themes' in Research Question 1. Therefore, each theme retrieved in Leximancer was inspected and interpreted in detail. The size of a concept dot reflects the connectivity of the concept. The larger the concept dot, the more frequent the concept co-occurred with every other concept on the map. When inspecting the thematic map, four components representing clues for interpretation can help researchers gain new insights: colour of themes, density of concepts within each theme, proximity of concepts and themes, and paths between concepts (Caspersz & Olaru, 2014). These four aspects were given priority in the interpretation of findings. Indicative quotes from MOOC participants were extracted from each theme to enrich the study results.

Processing model

In this study, there are four steps for defining and building a processing model to generate a final project output for analysis (Fig. 1). The Step 1 was to upload the selected entries to Leximancer. An unsupervised machine learning approach was applied to allow

Fig. 1 Steps for defining and building a processing model
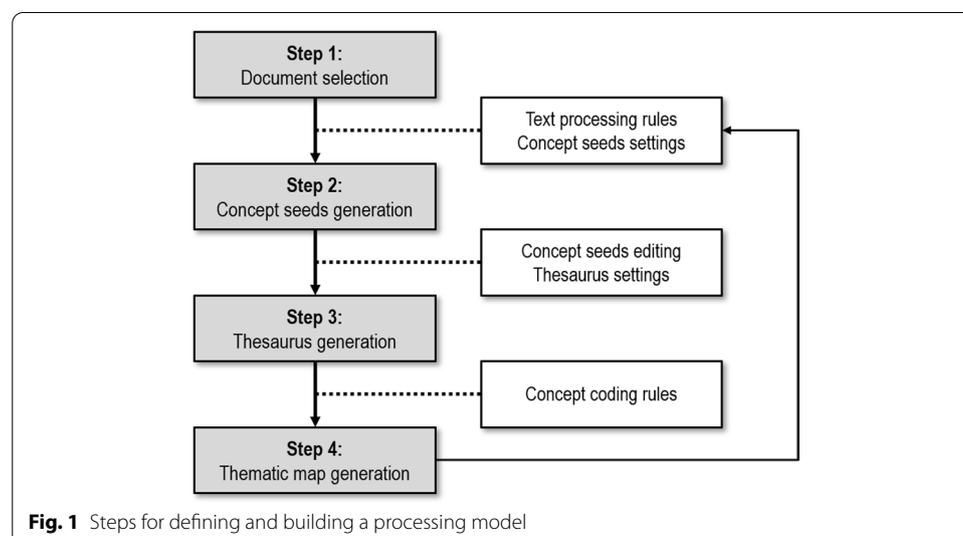
key concepts and themes naturally emerge from the data. In other words, the authors instructed Leximancer to automatically identify concept seeds instead of manually providing seed terms. In spite of this, text processing rules and concept seed settings were manually adjusted to produce more relevant and meaningful results. The authors adopted two-sentence text blocks as coding units and paragraphs as context units. The authors also removed seed terms with weak semantic information (e.g. by, thus) from the text data. This configuration was to ensure that high-frequency, low-semantic words would not impact the seed selection and the subsequent machine learning of thesaurus concepts. The authors set the percentage of name-like concepts below 10%, because this study aims discover general concepts rather than specific terms, such as the name of a professor. The authors then proceeded to generate concept seeds.

After a list of concept seeds was extracted by Leximancer (Step 2), the authors inspected the results and made further adjustments to the seeds. As some of the seeds were similar to each other (e.g. topic and topics), the authors modified these seeds by merging two or more similar concepts together (Appendix A). For example, the concept 'professor' now represented two seed terms 'professor' and 'teacher' comprising the initial thesaurus for this concept. In addition, the authors removed three name-like concepts (e.g. Python) that are linked to specific academic disciplines or fields of study. The authors proceeded to generate a thesaurus of terms associated with each concept identified in this phase.

After the thesaurus generation was completed (Step 3), the authors proceeded to configure concepts for displaying on the thematic map. Upon close inspection, all the available concepts are meaningful and interpretable. Therefore, no concepts were suppressed during this process. Leximancer then tagged each text block with the names of the concepts that it contains. The relationships between the surviving concepts were quantified and represented in the thematic map (Step 4). The authors adopted an iterative process of inspecting the results and modifying the processing model, until a meaningful, stable thematic map was produced. At the same time, Leximancer also produced detailed logs for each concept. These logs displayed actual text excerpts with relevant concepts highlighted. These logs provided valuable information that guided the authors through the text. However, Leximancer only provides a starting point to the analysis of a large amount of text data and cannot replace researchers' judgement, inference, and interpretation (Haynes et al., 2019).

Data analysis

Leximancer was used to uncover important structures, clusters, and patterns in the textual data. The analysis was then interpreted to provide more meaningful insights. Key findings are presented based on the investigation of (1) the proximity of themes, (2) distribution of concepts within themes, and (3) important connections.

The proximity of themes was investigated by visually inspecting the distance between themes on the thematic map. If two themes were spatially close on the map and overlapped with each other (e.g. 'video' and 'interesting'), they would be considered to have a close relationship. If two themes were apart from each other and did not overlap (e.g. 'questions' and 'recommend'), their relationship would be considered as relatively weak.

The distribution of concepts within themes was investigated by inspecting (1) the distance between concepts on the thematic map and (2) text co-occurrence counts of a concept with every other concept within the same theme. This analysis identified the scope and nature of each theme. Leximancer generated a synopsis for each theme containing illustrative examples. Two illustrative examples of excerpts for each theme were incorporated into the presentation of results to help readers better understand each theme.

Research studies adopting Leximancer for text mining normally report the proximity of themes and distribution of concepts within themes (e.g. Penela & Serrasqueiro, 2019). However, in this paper important connections were also explored to provide further insights. Important connections were identified as pairs of concepts that (1) have a high likelihood of co-occurrence (equal or greater than 10%), (2) show close distance on the thematic map, and (3) provide insight into the positive learning experience. If a connection between two concepts did not meet one of these criteria, it was not considered as an important connection. The 10% cut-off point was determined by the researchers upon the inspection of the likelihood occurrence gaps for the concepts in all six themes. A generous cut-off point would yield too many results. Stringent criteria would yield too few pairs of concepts, leaving the researchers little room for interpretation. Table 3 provided examples explaining why some pairs were not qualified as important connections.

To identify important connections, the co-occurrence likelihood data generated by Leximancer were inspected and pairs of concepts showing a low likelihood of co-occurrence ($<10\%$) were eliminated. Following this, the thematic map was then visually inspected and pairs of concepts that were not close on the thematic map were disregarded. Finally, logs containing text excerpts with pairs of concepts were reviewed to identify eight important connections that provided insight into the positive learning experience in MOOCs. To improve the transparency of the study, all the entries selected for data analysis will be deposited on the journal publisher's website

Table 3 Examples of pairs of concepts not qualified as important connections

Pairs of concepts	Criteria		
	High likelihood of co-occurrence ($\geq 10\%$)	Close distance on the thematic map	Provide insight into the positive learning experience
'interesting', 'makes'	Yes, high likelihood (18%)	No, not close	Yes. Although this pair of concepts is a common expression (e.g. 'makes economics interesting', 'makes this course so interesting'), the reasons that make a topic or course interesting is relevant to the content of this study
'interesting', 'useful'	Yes, high likelihood (16%)	Yes, close	No. This pair of concepts is often combined to provide general, positive course evaluation (e.g. 'a very useful and interesting course', 'really interesting and I know that it will be really useful for me in the future')
'interesting', 'excellent'	No, low likelihood (.9%)	No, not close	No. This pair of concepts is often combined to provide general, positive course evaluation (e.g. 'an excellent and very interesting course', 'the lectures are excellent, informative and interesting')

as a supplementary file for download and inspection. The following section presents the results. The implications of these results are discussed in a separate section.

Results

The analysis of the text data yielded 67 concepts. Appendix B provides insights into the connectivity of these concepts and displays the text co-occurrence counts of each concept with every other concept. The 67 concepts are represented by grey nodes and are grouped into six important themes: 'learning', 'understanding', 'interesting', 'videos', 'recommend', and 'questions' (Fig. 2). Each theme has a cluster of concepts that some have commonality, which can be observed from their proximity on the thematic map. The authors examined each theme in greater detail in the rest of this section.

The latent themes with the highest importance and number of hits are displayed in Table 4. Hits represent the number of text segments in the document associated with a theme and the importance of a theme relative to all other themes. The importance of a theme in the text segments is also indicated by the colour of the circles (Fig. 2). The analysis indicates that 'learning', 'understanding', 'interesting', and 'videos' are relatively more important themes, and 'recommend' and 'questions' are less important ones.

Fig. 2 Thematic map

Table 4 Themes in the order of importance

Theme	Significance	Hits	Coloured circle
Learning	1	8004	Red
Understanding	2	7720	Beige
Interesting	3	6553	Dark green
Videos	4	6259	Blue
Recommend	5	5660	Light green
Questions	6	1264	Purple

'Learning' was identified as the most important theme, affirming that MOOCs are designed to enable and facilitate learning. This theme was mostly associated with concepts that describe the characteristics of knowledge learned in MOOCs (e.g. 'basic', 'life'). The proximity of 'learning' to the theme 'recommend' indicates that individuals who reported the accumulation of knowledge in a MOOC were likely to recommend the MOOC. The excerpts below provide two illustrative examples related to this theme:

> 'This course gave me a new experience. I had a great time taking it: learning the language formally from the basics and using the simple basics to build on something fun - the projects - they are games I used to play in childhood!'
> 'I highly recommend this course…It was fun, it was not time-consuming, yet I still feel as though I **learned** a lot that will be applicable to my life.'

There are two important connections within the 'learning' theme that merit attention: 'learning-basic' and 'learning-life'. The first connection is the *learning-basic* path. The likelihood of 'learning' being linked to 'basic' was 24%. This connection indicates that MOOCs afforded people the opportunity to learn and revisit *basic knowledge*. Specifically, learners who left positive reviews reported that MOOCs had helped them gain the fundamental knowledge in a new subject area: 'Where I didn't know a word of Spanish before, I was conversing with my colleagues from Mexico after three months of the class!'.

Learners also reported that MOOCs refreshed the basic knowledge learned previously: 'I'm a pretty bad cook and took it for inspiration in learning to cook but I also found myself interested in relearning some basic chemistry that faded from my memory long ago.' MOOCs that teach fundamental knowledge were not only useful to beginners but also advanced learners and experienced practitioners: 'Although I consider myself as an experienced developer, I learned a lot of basic stuff I didn't know and I didn't learn at school'.

The second connection is the *learning-life* path. The likelihood of co-occurrence between 'learning' and 'life' is 20%. This connection highlights the importance of reinforcing the relationship between MOOC content and everyday *life*. Learners who gave positive reviews indicated that the MOOCs they were studying were designed in a way that showed direct and immediate relevance to daily life. For example: 'The instructors have done a laudable job of teaching how to integrate learning into your everyday life, and the importance of doing so', and 'The course drew on examples from real life and provided a basis to apply it in real life'.

Learners also reported positive impacts from studying MOOCs. For example: 'This course…reduced the amount of stress I was experiencing and confirmed that I should include some form of mindful meditation in my daily life', and 'It helped me in my personal, family, and work life to become a more centred person and more capable of thoroughly caring for my patients'.

The second important theme is 'understanding'. The theme 'understanding' contains two layers of meaning: (a) *instructors* made the course content easier to understand (e.g. 'understand', 'concepts), and (b) *learners* made efforts to understand the complex, difficult course content (e.g. 'time', 'week'). Two illustrative examples of excerpts connected to this theme are shown below:

> *'The book which he provides for free is very useful to* **understand** *the concepts. Along with the assignments by Coursera, I also in parallel solved the problem sets from the book which led to a better* **understanding**.'
> *'Great course. Was a little more difficult than I was expecting. Had to re-watch videos multiple times to* **understand** *certain concepts.'*

Two important connections within this theme, 'understand-concepts' and 'time-week', are explained in greater detail below. The first connection was the *understand-concepts* path. The likelihood of co-occurrence between 'understand' and 'concepts' was 22%. Learners highlighted how MOOC instructors have made the course content *easier to understand*. Examples of the strategies employed by MOOC instructors included 'explaining concepts in reasonable length articles', 'explaining concepts with visual aids', 'revisiting concepts repeatedly throughout the course', 'providing real-world examples', 'providing additional examples and sample responses', and 'constantly being tested on concepts'.

The second prominent connection within the theme 'understanding' was the *time-week* path. The likelihood of co-occurrence between 'time' and 'week' was 17%. This connection shows the importance of investing *plenty of time* when studying MOOCs: 'I spent closer to 18 weeks completing, but I took notes, reviewed before starting each section, and spent extra time on any quiz question that was difficult'.

However, the connection 'time-week' should not just be taken literally. This connection emphasises the importance of investing mental effort in MOOCs to understand more complex, difficult course content. Examples of strategies used by learners included 're-watching videos multiple times', 'pausing videos frequently to take longhand notes', 'going back to the resources', and 'working with difficult concepts often'. The following excerpt illustrates this point: 'I spent a lot of time each week of the course…the amount of time I spent on a course also includes taking my own notes, making them digitally available online, doing revision to be sure I understood everything, looking up and learning about formulas and the why behind them, etc.'.

The third important theme was 'interesting'. This theme was associated with concepts indicating positive affective responses towards a MOOC (e.g. 'interesting', 'engaging') and the sources of these responses (e.g. 'professor', 'content'). The proximity of 'interesting' to the theme 'recommend' suggests that learners were likely to recommend a MOOC to other people if they perceived the MOOC to be interesting. Two illustrative examples of excerpts relevant to this theme are displayed below:

'I enjoyed everything about this class. The professor made the subject **fun** *to learn with wit and humor and always brought up* **interesting** *case studies.'*

'I enjoyed taking this class and looked forward to completing the exercises at the end of each chapter. I thought Dr. Chuck was a great teacher, and I found his personality really **fun** *and engagingly silly, which I personally enjoy.'*

The *interesting-professor* path within this theme is an important connection. The likelihood of co-occurrence between 'interesting' and 'professor' is 14%. This connection illustrates how *instructors* made a MOOC more *interesting*. Learners who left positive reviews highlighted the central role instructors played in making MOOCs interesting: 'The teacher was very thorough in his explanations and made many good analogies and was really pleasant to listen to. He really made the course a lot more fun to follow than I had originally expected'.

Learners commented that MOOCs were entertaining because instructors designed the course content and materials to be interesting. Course content and materials frequently mentioned by participants include but are not limited to 'choice of topics', 'examples', 'case studies', 'lecture videos', 'dialogues between the professor and students in the videos', 'assignments', 'games', and 'supplementary information and links'.

In addition, learners responded positively to communication styles and techniques adopted by MOOC instructors to add interest to the content using expressions such as 'humorous', 'energetic', 'enthusiastic', and 'passionate'. The following excerpts illustrate how the use of humour made MOOCs interesting: 'Professor Bates's occasional humour really helps liven up the dull, and sometimes dry material', and 'His quirky sense of humour and his abstractionist drawings often made me chuckle and refreshed my attention'.

'Videos' were identified as a fourth important theme. This theme incorporates concepts that describe the quality of video lectures (e.g. 'clear', 'easy') and course components relevant to video lectures (e.g. 'reading', 'examples'). The proximity of the 'videos' theme to 'understanding', 'interesting', and 'questions' suggests that videos played an important role in helping learners understand difficult concepts, making MOOCs interesting, and addressing learners' questions. Two illustrative examples of excerpts relevant to this theme are shown below:

'Absolutely amazing course. The teachers are clear and easy to understand, the **videos** *are high quality and contain great (and very useful) visual material to supplement the content.'*

'I appreciate the "flipped learning" style of the course, especially as the lecture **videos** *are well filmed and content is explained clearly.'*

Within this theme, the *videos-reading* path stood out as an important connection. The relative distance between videos and reading was close and the likelihood of 'reading' being linked to 'videos' is 31%. This connection shows that *video lectures* and *reading materials* were valuable resources and often complemented each other to create a positive learning experience in MOOCs: 'It progressively gets more difficult but allowed a lot of reading and watching videos around the subject which creates a sense of becoming an expert at it', and 'There is no fluff here. Every video and each reading add something of interest and value to the topics'.

Learners commented on how videos complemented and clarified the reading materials, and vice versa. Some learners also commented that the videos provided a useful summary of the reading materials: 'The lectures are a re-cap of the readings, so serve as a kind of curation and reminder and helped to cement the learning', and 'I frequently felt lost when reading the articles, but the videos helped to some degree.'

The fifth important theme was 'recommend'. This theme incorporates concepts indicating that learners would recommend a MOOC to other people (e.g. 'recommend', 'courses'). The agglomeration of concepts in the 'recommend' theme was lower than for 'learning', 'understanding', 'interest', and 'videos', indicating that 'recommend' was less complex and multifaceted than the four previously discussed themes. Two illustrative examples of excerpts related to this theme are shown below:

> *'Great course and great teacher! I didn't know there were so many distinct perspectives on justice and the good life. I highly* **recommend** *it!'*
> *'The course is well structured; the videos are very good. I can really* **recommend** *this course.'*

An important connection within this theme was the *'recommend-anyone'* path. The proximity of these two concepts and the 30% likelihood of co-occurrence indicate a strong relationship in the text document. This connection explains *why* learners recommended a MOOC. Learners who recommended a MOOC often described their overall learning experiences as 'good', 'great', 'excellent', 'outstanding', and 'perfect'.

Learners also provided specific, detailed reasons when recommending a MOOC. Some learners recommended a MOOC because the MOOC was 'educational', 'informative' and 'insightful'. This type of recommendation often came from the learners who reported that they had accumulated new knowledge, mastered new skills, or gained new perspectives: 'This course is very insightful...I practically learned to manage myself, set goals and follow them...I recommend every smart person to take it.'

Other learners who recommended a MOOC because the MOOC was well-organised, or the selection of topics and materials in the MOOC is appropriate in scope. These learners described MOOCs as 'structured', 'well-constructed', 'well-put together', 'comprehensive', and 'wide-ranging'. The following excerpt illustrates this point: 'This course was really well-structured, with theory immediately supported by examples and personal witness reports. It tackled broad ideas with understandable examples drawn from world-wide situations...Without doubt the best MOOC, possibly the best course I have ever done.'

In addition, some learners recommended a MOOC because communities in the MOOC were described as 'supportive' and 'helpful': 'Discussion groups were helpful and supportive with interaction between students and lecturers... I thoroughly enjoyed this course and would recommend it to anyone interested in permaculture.' Another learner wrote: 'I was greatly aided by the comments section in the course where you could bounce ideas off each other. I was honoured to exchange ideas with other much more experienced and helpful online students which made the whole experience really uplifting. I highly recommend this course to the layman and professional alike.'

The sixth theme was labelled 'questions'. This theme incorporated a concept that indicates getting answers to questions (i.e. 'questions'). The agglomeration of concepts in

'questions' is lower compared to the previously discussed themes, indicating that 'questions' represents a relatively simple structure. Two illustrative examples of excerpts pertinent to this theme are provided below:

> 'The course is tough, but the instructor explains everything very clearly, and the course staff provides stellar help with **questions** on the discussion forums.'
> 'I think taking **questions** and putting up videos of answers to **questions** from learners was an excellent idea and a useful learning tool.'

Within this theme, the *questions-discussion* path is an important connection. The likelihood of co-occurrence between 'questions' and 'discussion' is 11%, which is higher than the likelihood of the concept 'questions' being linked to every other concept on the thematic map. This connection shows that *discussion boards* are an important space to ask *questions* and get help from teaching staff: 'The mentors…answered as many questions as they were able in the discussion forum and their comments were significant to the course.'

Learners also highlighted that teaching staff addressed their questions in a timely manner: 'Questions on the discussion board are answered very quickly', and 'The educators… were ready to take part in the forum with further explanation and responded promptly to correct occasional inaccuracies.'

In summary, Table 5 displays the six important themes expressed by MOOC learners in their positive ratings and reviews. The table also highlights the characteristics of each theme, including the theme scope, key connections within the theme, and relationships with other themes.

Discussion

This study has two research objectives. First, the study aims to identify the key themes contributing to the positive learning experience in MOOCs. Second, the study aims to investigate the characteristics of each identified theme. To achieve the research objectives, this study employed a semiautomatic text mining solution and processed 8,475 text segments submitted by learners who participated in 1,794 courses delivered by 382 HEIs and organisations across more than 20 MOOC platforms. Major findings revealed in this study are reported in this section and discussed in conjunction with the MOOC literature and the broader education literature. This study moves the field forward by making five important contributions.

Firstly, this study identified six important, frequently occurring themes related to the positive learning experience in MOOCs. The themes provide new insights into how the learning experience in MOOCs can be enhanced by addressing these six areas. 'Learning' emerged as the most salient theme. A closer inspection of the theme 'learning' shows that learners placed high importance on making connections between MOOC content and their everyday lives. In view of this, it is recommended that MOOC content should focus on more realistic learning contexts, and instructional conditions in MOOCs should be engineered to facilitate the acquisition of knowledge that can be readily transferred to real-world practices. For example, MOOC instructors could explicitly explain in videos how theories and findings of scientific research are relevant and can be directly applied to daily routine. This finding substantiates Kovanović et al.'s (2018) observation

Table 5 Six key themes and their characteristics

Key Themes	Characteristics of each theme	
Theme 1: Learning	Theme scope	'Learning' incorporated the characteristics of knowledge learned in MOOCs (e.g. 'basic', 'life')
	Important connections	'Learning-basic' (24% co-occurrence likelihood): MOOCs afforded people the opportunity to learn *the basic knowledge* and revisit *the basic knowledge* they learned previously 'Learning-life' (20% co-occurrence likelihood): MOOCs were designed in a way that showed direct and immediate relevance for *life*
	Relationships with other themes	'Learning' is in proximity with the theme 'recommend'
Theme 2: Understanding	Theme scope	'Understanding' incorporated strategies adopted to make course concepts easier to understand (e.g. 'understand', 'concepts') and mental efforts invested to understand the complex, difficult course content (e.g. 'time', 'week')
	Important connections	'Understand-concepts' (22% co-occurrence likelihood): *instructors* made concepts more understandable and less abstract, and *learners* made an effort to understand complex, difficult concepts 'Time-week' (17% co-occurrence likelihood): learners emphasised the importance of investing *time and efforts* when studying MOOCs
	Relationships with other themes	'Understanding' is in proximity with the themes 'learning' and 'videos'
Theme 3: Interesting	Theme scope	'Interesting' incorporated learners' emotional reactions towards a MOOC (e.g. 'interesting', 'engaging') and the source that elicits positive emotions from learners (e.g. 'professor', 'content')
	Important connections	'Interesting-professor' (14% co-occurrence likelihood): *instructors* played a central role in making MOOCs interesting
	Relationships with other themes	'Interesting' is in proximity with the theme 'videos'
Theme 4: Videos	Theme scope	'Videos' incorporated the quality of video lectures (e.g. 'clear', 'easy') and course components relevant to video lectures (e.g. 'reading', 'examples')
	Important connections	'Videos-reading' (31% co-occurrence likelihood): *video lectures* and *reading materials* were valuable resources and often complemented each other to provide a positive learning experience in MOOCs
	Relationships with other themes	'Videos' is in proximity with the themes 'understanding', 'interesting', and 'questions'
Theme 5: Recommend	Theme scope	'Recommend' incorporated learners' intentions to recommend a MOOC to other people (e.g. 'recommend', 'courses')
	Important connections	'Recommend-anyone' (30% co-occurrence likelihood): the connection explains *why* learners recommended a MOOC
	Relationships with other themes	'Recommend' is in proximity with the theme 'learning'
Theme 6: Questions	Theme scope	'Questions' incorporated getting answers to questions (i.e. 'questions')
	Important connections	'Questions-discussion' (11% co-occurrence likelihood): *discussion boards* are an important space to ask *questions* and get help from teaching staff
	Relationships with other themes	'Questions' is in proximity with the theme 'videos'

that the ability to describe applications of knowledge and apply learning in real settings is a critical dimension of the online learning experience. The findings also aligns with the pedagogical approach of authentic learning, which situates learning activities in real-world contexts and provides learning opportunities by 'allowing students to experience the same challenges in the curriculum as they do in their daily endeavors' (Herrington, Reeves, & Oliver, 2014, p. 402). Authentic learning has been operationalised in the higher education context (e.g. Herrington & Herrington, 2006) but its application has not been well researched in the MOOC context at this point. An important research avenue is to identify and understand the strategies instructors use to make the MOOC content more relevant to learners' everyday lives. Future research could also adopt a grounded theory approach to provide insight into how MOOC learning can positively affect people's life. This line of research is important as the learning-life path emerged as a distinct, meaningful connection within the theme 'learning', which is one of the core themes contributing to the positive learning experience in MOOCs.

Secondly, this study identified that 'understanding' was a prominent theme linked to positive learning experiences in MOOCs. The analysis showed that instructors implemented a variety of strategies to assist MOOC learners with comprehension. Useful strategies reported by MOOC learners included providing short, concise supplementary materials, explaining concepts with visual aids and real-world examples, and repeatedly testing learners on concepts throughout a course. This study provides empirical evidence that improved comprehension is an important contributor to positive learning experiences in MOOCs. This is consistent with the notion that an individual's appraisal of an event's comprehensibility elicits interest (Silvia, 2008), and that interest in turn predicts the quality of learning experience (Schiefele & Csikszentmihalyi, 1994). As MOOCs evolve, researchers have proposed several guidelines for designing MOOCs. These guidelines are useful sources for reflecting on the complexity of the MOOC design. However, many of these design principles are based on descriptive and conceptual research (e.g. Spyropoulou, Pierrakeas, & Kameas, 2014) or personal experiences and opinions (e.g. Manallack & Yuriev, 2016). Future research could establish a clear relationship between specific MOOC design principles (e.g. assessments, pedagogies, technologies) and learner comprehension. This is a promising research direction as the current study empirically reveals that learner comprehension is an important contributing factor to the positive learning experience in MOOCs.

The 'understanding' theme also had a second layer of meaning that merits further discussion. The analysis demonstrated that learners exerted mental effort to comprehend complex, difficult course content. This included strategies such as re-watching the same video lecture and spending extra time to study MOOCs. This finding confirms the importance of the presence of cognitive engagement in the MOOC learning process. Cognitive engagement is interpreted as individuals' mental investment in learning to comprehend complex ideas, master difficult skills, and strengthen performance (Deng et al., 2020a). The measurement of cognitive engagement in MOOCs is achieved through either platform-generated log files (Li & Baker, 2018) or self-administered surveys (Deng, Benckendorff, & Gannaway, 2020b). Li and Baker (2018), for example, found that the learner cohort with higher levels of cognitive engagement achieved higher grades in a MOOC, particularly for individuals who followed the learning path intended

by instructors. More recently, Deng et al. (2020b) discovered that learners with higher levels of cognitive engagement were more likely to have completed a MOOC and earned a certificate. These empirical studies show that higher levels of cognitive engagement are associated with favourable MOOC learning outcomes, such as better academic performance and higher completion rates. The results of this study add to past findings that cognitive engagement is also associated with learners' perceived quality of instruction in MOOCs. An important research direction is to explore learning designs (e.g. educational multimedia design, design of assessments) that bolster cognitive engagement without creating extraneous cognitive load for MOOC participants.

Thirdly, this study identified that 'interesting' is a prominent theme linked to positive learning experiences in MOOCs. This finding draws attention to emotional engagement in MOOCs. Deng et al. (2020a) conceptualised emotional engagement as individuals' affective reactions to peers, instructors, and course content. Empirical research reveals that interest is a key affective component that underlies positive engagement within MOOCs (Deng et al., 2020a). In the MOOC literature, emotional engagement is often investigated by analysing participation in discussion boards (e.g. Comer, Baker, & Wang, 2015). However, only a small percentage of MOOC learners choose to participate in forum discussions. Emotional engagement of the individuals who do not post on MOOC discussion boards should not be overlooked or misrepresented. This study adds to the discussion about emotional engagement beyond MOOC discussion boards. The findings showed that instructors played a central role in making MOOCs interesting to learn through (1) designing the course content and materials to be interesting and (2) employing communication styles and techniques to add interest. A promising avenue for future research is to explore instructional conditions that trigger and maintain MOOC learners' interest. MOOC platforms can be designed to capture learners' emotions at different points in time and store the longitudinal trajectories in databases for further analysis. This data would also provide valuable empirical evidence for developing just-in-time support and scaffolding strategies for potential at-risk learners and emotional disengagers.

Fourthly, this study identified that video lectures played a significant part in positive MOOC learning experiences. In this study, 'videos' is the only theme in the thematic map that represents instructional strategies. Other instructional strategies, such as reading and discussion, appeared as concepts in the thematic map but did not evolve into bigger themes. This finding confirms other observations that videos were perceived to be an important instructional tool for learning in MOOCs (Stöhr, Stathakarou, Mueller, Nifakos, & McGrath, 2019; Walji, Deacon, Small, & Czerniewicz, 2016; Watson, Kim, & Watson, 2016). A recent study showed that video lectures had more mouse click events than any other learning opportunity on MOOC platforms (Hu, Zhang, Gao, & Wang, 2020). The importance of video lectures is also indicated by the proximity of the theme 'video' to three other themes—'understanding', 'interesting', and 'questions'. The proximity of 'videos' to 'understanding' suggests that video lectures enhanced MOOC learners' understanding of the course. This result is consistent with the findings of the broader education research showing that educational videos are effective in helping students understand difficult concepts when compared with a course session where the videos were not used (Zubair & Laibinis, 2015).

The proximity of 'videos' to 'interesting' suggests that video lectures can amplify emotional engagement in MOOCs. This result substantiates findings of previous studies. Chen, Wong, Teh, and Chuah (2017) shows that five types of MOOC videos were able to induce positive emotions—picture in picture, text overlay, Khan-style tablet capture, screencast, and animation. However, the study undertaken by Chen et al. (2017) had a relatively small sample size (n = 50) and did not consider learner-based factors (e.g. prior MOOC experience) and teaching context-based factors (e.g. disciplinary focus). Failure to control for these factors may misrepresent the effectiveness of certain video types and lead to flawed assumptions about the use of MOOC videos. Future research should take into consideration personal and environmental factors when investigating the impact of video and multimedia design on learners' emotional engagement. Furthermore, emotional engagement in MOOCs is often captured by log files (Deng & Benckendorff, 2017) and self-reported measures such as surveys (Deng et al., 2020b). Physiological measures have the advantage of capturing emotional engagement at the activity level without having to disrupt students from learning (Henrie, Halverson, & Graham, 2015). An important research avenue is to analyse biometrics such as galvanic skin response, heart rate, and facial emotion (e.g. Ninaus et al., 2019). The results can be used to guide the design of MOOC videos that elicit positive emotions from learners.

Lastly, this study identified that providing a social space for people to ask questions and seek support contributed to positive learning experiences in MOOCs. In this study, the theme 'questions' is relevant to social engagement, which is used to describe learner-instructor and learner-learner interactions (Deng et al., 2020a). Past MOOC research shows that responding to other learners' questions and contributing to course discussions are indicative of social engagement (Deng et al., 2020a), and the presence of teaching staff in discussion boards facilitates social engagement (Poquet, Jovanovic, & Dawson, 2020). The majority of MOOCs follow a cognitive-behaviourist pedagogical approach (Deng et al., 2020b), which has been criticised for limited social engagement and an excessive focus on content delivery (Agonács & Matos, 2017). As MOOC learners tend to be well-educated and highly motivated (Deng et al., 2019), some scholars claim that teaching and learning in MOOCs needs to shift from instructor-directed pedagogy to self-directed andragogy or the self-determined heutagogy. Ntourmas, Avouris, Daskalaki, and Dimitriadis (2019), for example, claimed that TAs acted more as 'omniscient interlocutors' (Ntourmas et al., 2019, p. 247), and teaching staff providing direct, instant, and comprehensive answers did not promote problem-based learning. Connected to this point, the boarder education literature also shows that two-way, dialogic interactions were more effective than unilateral instructor feedback for promoting high-order learning outcomes (Tan, Whipp, Gagné, & Van Quaquebeke, 2019).

This study provides empirical evidence that MOOC learners valued the answers provided by teaching staff (e.g. TAs, forum moderators) and the immediacy of such support. In other words, learners seemed to be comfortable with taking a consumptive role in forum communication and perceived the teaching staff as the primary source of knowledge and information. This observation leads to a series of important questions. Should MOOCs provide a more flexible structure to promote self-directedness in learning? If the goal is set to advance self-determined learning and achieve higher levels of learner agency, how can instructors reconfigure the teaching and learning space to achieve this

goal? Kizilcec, Pérez-Sanagustín, and Maldonado (2016) have shown in their experimental study that simply embedding self-regulated learning study tips in MOOCs did not improve persistence. Moreover, most teaching staff moderate the MOOC discussion boards on a pro bono basis. Although some people 'felt uneasy about making postings that might seem too…directive' (Beaven, Hauck, Comas-Quinn, Lewis, & de los Arcos, 2014, p. 35) and '[tried] to help learners reach the solution themselves' (Ntourmas et al., 2019, p. 245), it is not clear whether all teaching staff have the capacity (e.g. knowledge, time) to scaffold the learning process and guide a massive number of learners along a path of inquiry. Future research should establish a working set of best practices for cultivating self-directed and self-determined skills in MOOCs.

Conclusions

This study has made two important theoretical contributions to the literature. Firstly, this study demonstrated the importance of MOOC learners in co-creating a positive learning experience. Past learning research typically conceives desirable learning outcomes in MOOCs as achieving higher grades, persisting longer, or obtaining a certificate of accomplishment. This study argues that there are underlying differences between MOOCs and credit-bearing university courses, and learning outcomes valued in traditional HEIs (e.g. achievement, persistence) may not be the best indicators to represent MOOC learning outcomes. It is argued that perceived quality of instruction is an important alternative outcome indicator in MOOCs, and shows that the key themes contributing to positive learning experiences can be identified through an analysis of learners' ratings and reviews. Secondly, this study identified six important themes associated with the positive learning experience in MOOCs. The identified themes are 'learning', 'understanding', 'interesting', 'videos', 'recommend', and 'questions'. The study reported the characteristics of each identified theme based on the investigation of the proximity of themes, distribution of concepts within themes, and important connections. The study discussed the findings in conjunction with prior theories and pedagogical practices to provide new insights into the conceptualisation of the positive learning experience in MOOCs. A number of future research avenues have been proposed based on the discussion of research findings and the existing literature.

A number of practical recommendations are evident for MOOC designers, administrators, and policy makers. The study demonstrates that positive MOOC learning experiences are complex and multifaceted. Practitioners should take into account the prominent themes identified in this study and the characteristics of each identified theme when designing or revamping a MOOC. Based on research findings, this study presents the following propositions for promoting the learning experience in MOOCs: (1) provide *realistic* learning contexts and instructional conditions in MOOCs to facilitate the acquisition of knowledge that transfers more readily to *real-world* practices; (2) carefully design the instructional conditions so that some *mental challenge and stimulation* is required for learners to achieve a full understanding of the content, rather than making MOOCs too simple or effortless to complete; (3) design the *course content, materials, and communications* to generate interest; (4) allocate *sufficient* resources to create *high-quality* video lectures; (5) employ video lectures to elicit *positive emotions* from MOOC learners and simplify *complex, difficult concepts*; and (6) incorporate

discussion boards in MOOCs and invest in human and digital resources to address learners' *queries.*

Limitations

Three potential limitations should be kept in mind when discussing the research findings. First, the importance of a theme is indicated by the connectedness of concepts within that theme. Some researchers may disagree about how 'importance' is defined in this study, and there are definitely alternative ways to conceptualise 'importance'. It is possible that some less connected concepts and themes will also provide clues to construction of the positive learning experience in MOOCs. Future research could employ a more qualitative approach to identify other latent themes that may contribute to this topic of interest.

Second, non-English reviews and negative were excluded in this study. An analysis of non-English reviews may provide additional insight into the learning experience idiosyncratic to these learners (e.g. individuals who use non-English MOOC platforms, individuals whose primary language is not English). Future research could overcome this limitation by analysing non-English reviews to provide a more comprehensive understanding of the positive learning experience in MOOCs. While the scope of this study was focussed on positive reviews, it would also be equally interesting to conduct a similar analysis of negative reviews to identify attributes that cause dissatisfaction amongst learners.

Third, learner characteristics and environmental factors were not controlled in this study. It is possible that learners belonging to different cohorts (e.g. ethnic groups, generation cohorts) can perceive the positive learning experience differently. The control of disciplines may also provide additional insight into the design of pedagogy and assessments specifically related to MOOCs in a given discipline. It is also possible that individuals enrolled in social science MOOCs can perceive the positive learning experience differently than people studying STEM MOOCs. Future research could control these factors to provide a more nuanced understanding of the positive MOOC learning experience.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s41239-021-00244-3.

Additional file 1: Review data.

Availability of data and materials
All data generated or analysed during this study are included in Additional file 1.

Author details
[1] Department of Educational Technology, School of Education, Hangzhou Normal University, Hangzhou, China. [2] UQ Business School, The University of Queensland, Brisbane, Australia.

Appendix A

See Table 6

Table 6 Retained and merged concepts

Retained concepts	Merged concepts
courses	Course/courses/MOOC/MOOCs
learning	Learn/learned/learning
makes	Makes/making
students	Student/students
professor	Professor/teacher
take	Take/taken/taking
topics	Topic/topics
understand	Understand/understanding
use	Use/used/using
videos	Video/lectures/videos
week	Week/weeks
work	Work/working
interesting	Fun/interesting/interested

Appendix B

See Table 7

Table 7 Text co-occurrence counts of a concept with every other concept on the thematic map

Themes	Concepts	Co-occurrence counts
Theme1: learning	Learning	3125
	Take	1782
	Work	1025
	Knowledge	883
	People	757
	Experience	691
	Life	591
	Better	574
	Things	538
	World	497
	Online	468
	Basic	467
	Job	353
	Data	346
	Real	342
	Research	330
	Science	317
	Doing	294
	Team	280

Table 7 (continued)

Themes	Concepts	Co-occurrence counts
Theme 2: understanding	Understand	1556
	Time	1227
	Use	1177
	Students	1033
	Week	810
	Concepts	771
	Assignments	610
	Makes	561
	Different	518
	Need	448
	Feel	393
	Language	377
	Helped	363
	Problems	302
	Simple	256
	English	171
Theme 3: interesting	Interesting	1782
	Excellent	1099
	Topics	915
	Professor	739
	Useful	734
	Information	709
	Enjoyed	680
	Content	618
	Subject	611
	Introduction	605
	Level	397
	Engaging	394
	Thought	385
	Teaching	363
	Important	347
	Background	343
Theme 4: videos	Videos	1890
	Easy	903
	Material	887
	Clear	559
	Examples	502
	Presented	445
	Reading	349
	Discussion	307
Theme 5: recommend	Courses	1708
	Recommend	1614
	Class	1055
	Best	772
	Anyone	580
	Interested	548
	Approach	255
Theme 6: questions	Questions	424

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