Digital Entrepreneurship Education

The Role of MOOCs

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Abstract—Digital entrepreneurship has gained more attention in theory and practice in recent years. Among other forms of digital entrepreneurship education, MOOCs (massive open online courses) are one of the strongest trends and influence the content and flow of teaching and learning. The paper contributes to a better understanding of the necessary skills, opportunities and risks arising from the use of MOOCs as a new way of teaching entrepreneurship. It empirically examines challenges and drivers for the use of MOOCs as a novel pedagogical concept. The results show that a lack of self-discipline to complete a MOOC and a lack of interaction with others are the main obstacles compared to lectures with compulsory university attendance. However, the results also show that MOOCs are flexible in time and space and can thus facilitate the accessibility of education, especially entrepreneurial education.

Keywords—Digital entrepreneurship, digital entrepreneurship education, massive open online course, mooc

1 Introduction

Academic entrepreneurship has attracted major attention both within the academic literature and academic practice where it is considered to be an important element in the movement to become a knowledge society [1] An emerging perspective of academic entrepreneurship includes wider social and economic benefit to the university ecosystem overcoming the traditional goal of economic revenue from research commercialization. Today the creation of students and alumni start-ups, entrepreneurially equipped students, and job creation in the local region or state have become the priority [1].

We understand entrepreneurship as "the process of designing, launching and running a new business" [2] with its distinct characteristic of new value creation, though entrepreneurship is more than starting up a new business. Applying a holistic perspective, entrepreneurial activity arises of the interplay of institutions (e.g. education or business development), stakeholders and entrepreneurs themselves [3].

Parallel to the evolution of academic entrepreneurship, another interesting phenomenon is the rapid acceleration of digital technologies that in the past 10 years are reshaping the markets and society globally [1]. The infusion of new digital technologies,

such as mobile computing, cloud computing, social media, 3D printing, and data analytics into various aspects of innovation and entrepreneurship has transformed the nature of entrepreneurial processes and outcomes [4]. As the digitalization phenomenon causes various implications through rapid and transformative change, it is relevant for entrepreneurs and entrepreneurship researchers to be aware of related outcomes and connections and identify emerging opportunities on business [3].

Digitization has upended two assumptions that underlie our understanding of entrepreneurial processes and outcomes. First, digital technologies have rendered entrepreneurial outcomes and processes less bounded. We see a shift from discrete impermeable, and stable boundaries to increasingly porous and fluid boundaries [4]. In terms of outcomes, this relates to the structural boundaries of the product, service, etc. In terms of processes, this relates to the spatial and temporal boundaries of entrepreneurial activities. Digitization of products and services allows for greater flexibility by separating function from form and contents from medium. Second, digitization has led to less pre-definition in the locus of entrepreneurial agency as it increasingly involves a broader, more diverse, and often continuously evolving set of actors [4].

The relevance of entrepreneurship education (EE) to foster entrepreneurship culture and activity is widely recognized. Entrepreneurial education provides key skills to identify a winning business. Teaching entrepreneurship has a number of positive effects and benefits. These benefits include the inculcation of thinking as well as collaborative and communication skills that are highly valued by employers [6].

Although more and more engineering students are being exposed to EE, minimal research has examined engineering student attitudes toward it, its impact on their learning, or professional competence. This is not surprising given the fact that the integration of entrepreneurship in engineering is a relatively new effort, where definitions of what it means to be entrepreneurial within an engineering program as well as program models vary greatly [7].

Compared to the increasing importance of digital entrepreneurship, surprisingly few papers address the teaching of digital entrepreneurship. Digital entrepreneurship education usually comes with low start-up and running costs. Thereby, teaching of digital entrepreneurship is not only a current hot topic but also feasible in many educational environments and directly addresses student's real life [3].

The paper at hand therefore discusses two questions. First, what are the necessary skills, opportunities and risks arising from the use of digital EE, specifically MOOCs, as a new way of teaching entrepreneurship? Second, what are the challenges and drivers for the use of MOOCs as a novel pedagogical concept?

2 The Concept of Digital Entrepreneurship

In recent decades, digital technologies have seen widespread use across global society and adoption at all levels of education. These digital technologies are opening up fascinating innovation opportunities for entrepreneurs [1]. New opportunities are quick to arise and vanish, combined resources unexpectedly acquire or lose their original value, and testing becomes a vital feature of the entrepreneurial learning process [8].

At the same time digital technology and associated entrepreneurship has not only sparked economic growth, but also competitive turbulence and creative destruction along with institutional change [9].

In this paper digital entrepreneurship is understood as "a subcategory of entrepreneurship in which some or all of what would be physical in a traditional organization has been digitized" [10]. Digital entrepreneurship is a phenomenon which arose through technological assets like internet and information and communications technology [3].

The concepts of academic entrepreneurship and entrepreneurship are closely linked, as both are based on the emergence of entrepreneurial opportunities in different contexts [11]. Digital academic entrepreneurship highly utilizes new digital technologies. From digital academic entrepreneurship different forms of academic entrepreneurship evolves, such as the development of digital spinoffs and alumni start-ups, the creation of entrepreneurial competence supported by digital platforms and a broader range of innovation development. Digital academic entrepreneurship engages more stakeholders through the use of digital technologies to develop the academic entrepreneurial process [1].

3 Digital Entrepreneurship Education

Today's classrooms are highly connected and provide both teachers and students easier, faster, and more affordable access to information, resources for learning and teaching as well as access to peers. Several studies proposed that EE cannot be taught with traditional methods [12]. Traditional education teaches students to obey, duplicate, and be employed while entrepreneurship tells students to make their own judgements and create their own jobs and these cannot be taught using traditional teaching [13].

Class-delivered lectures can be successfully replaced by rich media formats including videos, podcasts of lectures, online presentations or interactive content or online tutorials, and are effective in instructing large amounts of conceptual content [14]. Table 1 gives an overview of modern digital learning methodologies, tools and contexts.

Table 1. Digital learning methodologies, tools and contexts [15]

Methodologies, Tools and Contexts	Examples
Digital learning methodologies	Project based learning; problem based learning; digital stories; online learning environments; digital moments; technology integrated teaching methods; digital storytelling; educational games; authentic learning
Digital learning contexts	Collaborative communities; cooperative learning; digital combinational system; collaborative learning; flipped classroom using digital media; moving from fixing to online space; experiential online development; open educational practice; network participation
Tools and simulators	Web-based video; computerized environments; spatial science technology; slowmation: narrated stop-motion animation; generic modelling language; digital video; augmented reality; design based research; gamification; learning manager; simulation; computer based teaching; library webinars
Support system for digital learning	eLearning; mobile learning; learning object repository; blended learning; blackboard; moodle learning manager; twitter; videoconferencing; MOOC – massive open online courses

Video presentations can enable self-directed learning and provide effective overviews or vivid examples of different situations and cases. Videos may be focused on specific knowledge points or known problem concepts and practical problems [16].

From surveying students, the following advantages of videos over live lectures have been reported: Notes from video presentations were handy because they should not miss any content when writing; some students found it easier to focus attention on videos than in a live class. Most students watched the videos at appropriate times and watched them again to prepare for the exams. They spent more time on the topic than usual. The ability to watch, pause and rewind the video several times helped students understand the content, especially those struggling with language [10], while others preferred to listen to the topic being "spoken". Video also offers alternative representations of information and hosts various learners who prefer visuals, audio or text.

An investigation of viewing habits of videos revealed how adaptable students are in their frequency of video viewing, and how engaged they are while doing it. Results show that even though video engagement declined steadily during the semester, students tended to adapt, depending on factors such as exam difficulty and the value of the material. While the length of a lecture video had no effect on video engagement there was a noticeable trend in increasing total views. [17].

While the traditional lecture can be more effective at communicating information than supporting the development of skills, values or personal development, the value of digital learning is challenged when it is teacher-centered pedagogy [19]. Teacher-centered pedagogies that lack commitment or interaction often lead students to adopt a passive attitude to learning while encountering focus problems and not taking responsibility for their own learning. Moreover, the limited interaction makes it difficult for teachers to differentiate the pace and the teaching, which adapts to the different progress of learners [16, 20].

Distributed flipped classrooms (FC) with massive open online courses (MOOCs) open up new opportunities to provide online content resources such as videos and assignments when running alongside campus courses [16, 18]. However, FC may fail due to monotonous and impersonal video presentations, which can inevitably lead to loss of interest and poor teaching presence. The composition of a video affects how students choose to watch it. If videos are too complicated, lack visual change, or include portions with perceived minimal academic value, students shy away from, or skip through them [17].

Videos that present technology-delivered lectures aimed solely at the transmission of content are poor compared to well-planned interactive lectures. Videos can also be overrated as a teaching tool when students are unable to watch videos due to the unavailability of computers and the internet [21]. Therefore, the format of the variety of materials and activities used in different contexts is less important than ensuring that students actually accessed these materials. In addition, teachers find it difficult to find suitable videos, despite the extensive online offerings [16].

The most important component in an FC was the involvement of students in the face-to-face component. FC teachers agree that instructional videos alone do not improve teaching; it depends on how they are integrated into an overall approach [19]. A well integrated approach can spread the students' attitude to flipping, which is sometimes

negative because they perceive a higher workload or a lack of cohesion between classroom and extracurricular work.

4 Massive Open Online Courses (MOOCs) in Entrepreneurship Education

Massive open online courses (MOOCs) are changing the way in which people can access digital knowledge, thus creating new opportunities for learning and competence development. MOOCs leverage the free and open use of digitized material through supportive online systems. Many education providers have started to offer courses in different domains such as entrepreneurship tackling recent demands for better self-employability [22].

4.1 The emergence of MOOCs

MOOCs are one of the strongest trends in online education [22]. MOOCs as the name suggests are large-scale initiatives in the provision of online courses. They has appeared as a disruptive innovation that permits to engage a large number of persons in an open online course available through internet to anyone aiming to enroll [23]. MOOCs developed from the increasing expertise of the universities in the use of distance learning and open educational resources [24].

The multiple breakthroughs achieved by the MOOCs include the capacity to assemble some of the finest academics in the leading international universities, to develop what are often superb learning materials, and to offer the courses for free [24]. Leading universities such as Harvard, MIT and Stanford have launched MOOC platforms such as Udacity, Coursera, edX, MIT Open Courseware, and Stanford eCorner. The courses were realized with the help of various technological support for self-learning (papers, short videos about well focused contents, flash animation) and for synchronous and asynchronous interaction as well. Asynchronous delivery realizes the idea that anyone can approach education at any time and from anywhere; synchronous delivery requires learners to synchronize their learning activities with those of others [22].

In addition to individual learning, there are positive effects of online learning group processes reported recently [25]. MOOCs offer the possibility to learn online to a massive number of students, and part of their features is free of charge for the participants. Over the past few years, MOOCs have achieved a widespread, global profile. Enabled by technology, they have arisen from a mixture of experimentation with educational technology and pedagogic approaches [26]. MOOCs have a high potential to allow the massive development of knowledge and certain competences among adult learners' showing enough motivation, self-regulation [20] and cognitive quality time to engage, and succeed in this online courses. For this reason, MOOCs could be considered as an excellent opportunity to achieve education objectives among massive number of participants in informal contexts, such the development of an entrepreneurship culture [23].

MOOCs have four main characteristics. First of all, they are open to everyone, meaning that there are no entry requirements. Secondly, there is no participant restriction regarding the number of participants. Thirdly, the courses are offered free of charge. Fourthly, the courses are conducted completely online. Therefore, there are no technical laboratory phases [27].

MOOCs can be thus considered forerunners of course exemplars - early prototypes of improved learning environments which frequently recover flexible educational practice. The online courses are made for various target groups e.g. for school students, individuals or university students. Teachers are allowed to make selected learning materials available as Open Educational Resources (OER). Without violating copyrights, they can use the materials for the purpose of teaching [28].

However, there are also critical aspects when it comes to MOOCs. The problems often associated with distance education are the limited quality of the resources and materials supporting online learning, the interaction of students and academics, the high fees charged by premier online courses, and difficulties with assessment and accreditation [24].

Insights of media didactics regarding the structuring of the subject matter, the depth and speed with which content is conveyed and the design of performance reviews for learners are not yet sufficiently taken into account [29]. The open nature of MOOCs makes it challenging to show if any learning is taking place. Participants have a wide distribution of incoming knowledge, and very few courses impose prerequisites or try to measure the initial level [29].

Moreover, MOOCs have high abort rates. Depending on the course, only 2 to 10 percent of those who have registered for a course take the final examination [30]. The development, implementation and support of a MOOC involves considerable effort. This concerns the universities or university lecturers who are developing the courses. However, this also applies to the platform providers who make the courses available to participants [31].

4.2 MOOCs in entrepreneurship education

To prepare students for the new reality, universities are increasingly aware that they must graduate engineers who not only understand science and technology, but who are also able to identify opportunities, understand market forces, commercialize new products, and have the leadership and communication skills to advocate for them. This has prompted a significant increase in the delivery of EE to engineering students through new courses, programs, and experiential learning opportunities [14].

The massive development of MOOCs on entrepreneurship has been predominantly useful in providing digital content both inside and outside the classroom to students involved in entrepreneurship initiatives [21]. Free online courses on entrepreneurship also allow educators and students far away from pulsating business ecosystems to access a wider range of support, skills and content [6]. Researchers have studied the phenomenon in depth to understand the positive impact of social media engagement on the motivation, performance, course participation and completion of learners in MOOCs [1]. In addition, other researchers have focused their studies on evaluating the learning

outcomes of students in entrepreneurship courses offered as MOOCs. The results suggest that MOOC is an appropriate platform for teaching entrepreneurship, as it provides tools that enable students to facilitate collaborative learning and improve the most important affective entrepreneurial aspects of individuals, such as opportunity recognition and resource acquisition [6].

4.3 The MOOC "Start-up Journey" in entrepreneurship education

Students have plenty of ideas, from which many could be developed further, transferred to interesting business ideas and become the basis to set up a new company or startup. The path from the initiation of an idea to its implementation into a business model raises many questions and requires entrepreneurial competences as an obligatory prerequisite for founding a company.

Encouraging entrepreneurship has become a topic of high priority in the university policy of Graz University of Technology. Several entrepreneurial activities and lectures are offered, encompassing a MOOC in digital entrepreneurship education, the "Start-up Journey: Business Model Generation".

The MOOC "Start-up Journey" consists of four units with eight videos in total (two videos each unit), where one unit is offered weekly. The course doesn´t require any special prerequisites and aims to be used by students for their own business idea. Therefore, within the course basic knowledge and methods as well as their handling are imparted to gain the competence for generating a business model by the end of the course. Additionally, elements and methods are explained step-by-step, with a focus on the customer value as the reason why customers want to consume or purchase the product or service.

An important step in the foundation process is the creation of a business model. For this reason, students learn in the MOOC what a business model is and how to create one. Figure 1 shows an overview of the units of the MOOC "Start-up Journey: Business Model Generation". Unit 1 starts with an introduction of the topic with definitions, basics of the business model framework and patterns. Unit 2 explains, why the USP (unique selling point) is important, how customer value is identified and which helpful methods and tools can be used to fill in a business model canvas. Building up on this, the generation of a business model canvas is demonstrated in unit 3, using Tesla as an example. Optionally a task is given to create Lego´s business model canvas and a link to a possible solution is provided. To underline the practicability of the concept, two founders are interviewed in another video, giving an insight into their experiences with startups. To top off the "Start-up Journey" unit 4 provides experience reports with dos and don´ts when creating a business model canvas and how to successfully communicate the business idea with a pitch. Completing the "Start-up Journey", participants get an overview of helpful methods for their project and are able to create a business model for their own start-up idea.

For actively participating in the course students receive an automatic confirmation of participation (certificate) which confirms that the user answered at least 75 % of the self-assessment questions correctly. Furthermore, the MOOC can be completed by TU

Graz students as part of a corresponding course and is therefore provided with 1 ECTS as an elective subject.

Table 2. Overview of the modules of the MOOC "Startup-Journey: Business Model Generation"

MOOC Start-up Journey: Business Model Generation			
Unit 1	*Unit 2*	*Unit 3*	*Unit 4*
Business Model Patterns and Framework	**Customer Value**	**Business Model Generation**	**Experience Reports**
Business Model Framework Development	Identifying Customer Value	Generating a Business Model	Do´s and Don´ts
55 Business Model Patterns	Introduction of Entrepreneurship Methods	Business Model Journey Interviews	Pitch

4.4 Experiences with the MOOC "Start-up Journey"

To get an insight into student's experiences regarding MOOCs in EE, an empirical study was conducted in 2018. Students enrolled at the lectures "Entrepreneurship", "Gruendungsgarage" and "Process Management" held by the Institute of General Management and Organization at TU Graz were asked to take part in the study. Information was derived from 40 students who got in touch with MOOCs. The questionnaire used for this purpose consisted of 10 questions, whereby three of them were open ones.

Of the 40 respondents who were surveyed, 34 claimed that they have never attended a MOOC before participating. 7,5 % (k=3, n=40) respondents maintained that they have joined a MOOC several times before and 7,5 % only once before the three listed lectures.

Students were asked to evaluate different statements concerning MOOCs shown in figure 1. With reference to the data, it was stressed that 25 out of 40 students fully agreed to regularly use digital media for learning. However, only a small number of respondents expressed they would prefer a pure online course. Overall, students claimed that they would recommend the MOOC.

Additionally, students were asked about advantages and disadvantages in correlation with MOOCs. According to the ratings in figure 2, 39 out of 40 respondents claimed that time flexibility is a main advantage and 38 fully agreed on the local flexibility of MOOCs. Moreover, students appreciate the fact that there are no course fees, only 4 students disagreed little and 1 student fully disagreed. Overall, respondents also agreed on the fact that someone can adapt the online courses to the individual learning pace. Surprisingly, three respondents see it differently and disagreed little.
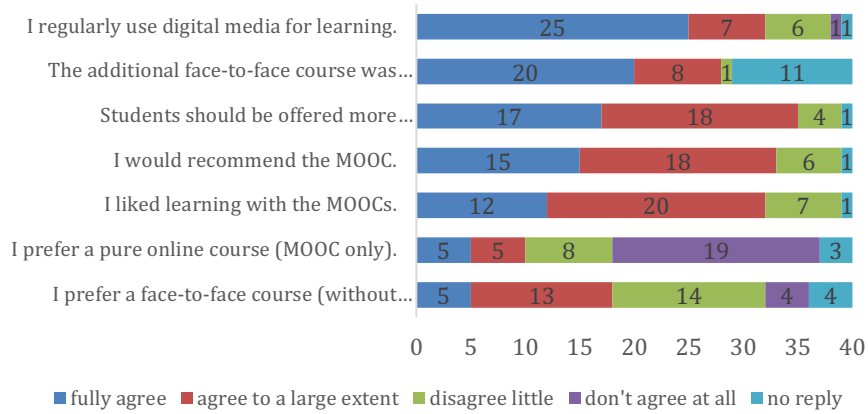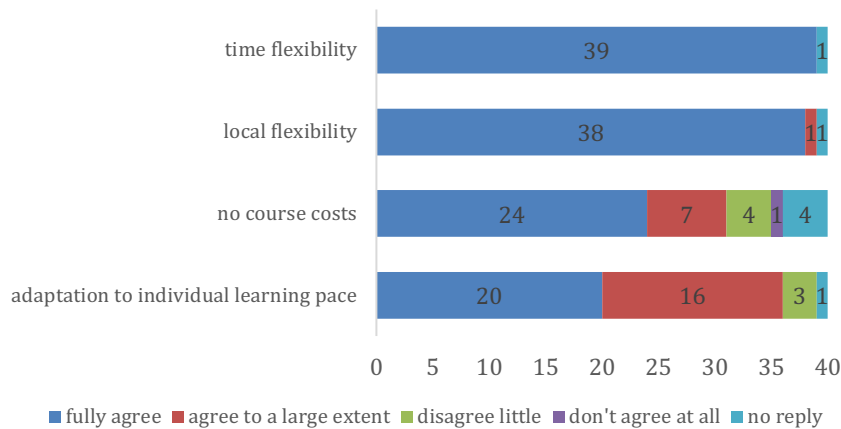
Fig. 1. Statements on MOOCs

Figure 1 shows the following horizontal stacked bar chart data (scale 0 to 40):

Statement	fully agree	agree to a large extent	disagree little	don't agree at all	no reply
I regularly use digital media for learning.	25	7	6	1	1
The additional face-to-face course was…	20	8	1		11
Students should be offered more…	17	18	4	1	
I would recommend the MOOC.	15	18	6	1	
I liked learning with the MOOCs.	12	20	7	1	
I prefer a pure online course (MOOC only).	5	5	8	19	3
I prefer a face-to-face course (without…	5	13	14	4	4

Legend: ■ fully agree ■ agree to a large extent ■ disagree little ■ don't agree at all ■ no reply

Fig. 2. Advantages of MOOCs

Figure 2 shows the following horizontal stacked bar chart data (scale 0 to 40):

Advantage	fully agree	agree to a large extent	disagree little	don't agree at all	no reply
time flexibility	39				1
local flexibility	38	1			1
no course costs	24	7	4	1	4
adaptation to individual learning pace	20	16	3		1

Legend: ■ fully agree ■ agree to a large extent ■ disagree little ■ don't agree at all ■ no reply

Several disadvantages in accordance with MOOCs have been stated in literature. The results of the survey show that 16 students (n=40) fully agree that "less exchange with fellow students" is a disadvantage (figure 3). It is interesting that 10 students claimed that they don't agree at all on the disadvantage that more motivation is required to complete a MOOC.
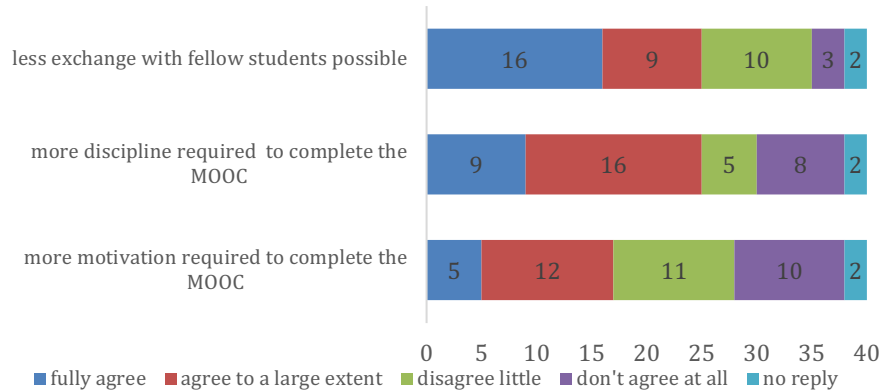
Fig. 3. Disadvantages of MOOCs

In addition, participants were asked to answer open questions about the MOOC to gain further insight and input for possible developments in future. As successful and well done in particular, participants perceived the MOOC as very understandable, professional and vividly explained with examples. The MOOC gives a good overview of the topic briefly, is available at any time, easy to use and a valuable supplement to lectures with physical presence. The quiz at the end of each unit of the MOOC was mentioned positively e.g. as a helpful tool for self-monitoring in the learning process. Challenges of digital EE using MOOCs were identified by the respondents too. The lack of self-discipline to finish the MOOC is mentioned as a hurdle compared to lectures with compulsory attendance at university. Challenges for lecturers were identified (e.g. costly to create to contents and develop the videos, need of special equipment and infrastructure for the video recording and production, focus on a small area of content) as well as for students who are confronted with theoretical input only online. Taking a course only online, respondents would miss the chance to ask the lecturer for rephrasing, discuss the content in real time and learning in interaction with others.

5   Conclusion and Outlook

Digital technologies are changing the way people do business and start new businesses. Universities start new initiatives to realize new forms of academic entrepreneurship. The debate on academic entrepreneurship should include a holistic perspective on this emerging phenomenon, according to the dimensions of why, what, who and how digital technologies will change academic entrepreneurship processes [1].

Digital technologies are ubiquitous and offer open and flexible opportunities that foster convergence and creativity. These technologies herald new forms of organization and new business models. Digital technologies mean that academic enterprises can use standardized tools to support academic business processes across the enterprise, and as a result more data and processes are shared across enterprise boundaries. This new way

of exchanging data and processes has implications for conventional configurations or relationships between the actors involved in academic business processes. Researchers and students in academia can now turn to a wider audience to discover new opportunities and reinforce their ideas [1].

MOOCs are changing the way people use and share digital knowledge, creating new opportunities for learning and skills development in market-relevant areas such as innovation management and entrepreneurship. MOOCs are predestined to reach a large audience that can enjoy the autonomy of self-directed teaching through the network of online peers. MOOCs can be seen as an appropriate tool to teach courses on entrepreneurship as they can increase personal entrepreneurial attitudes and inclinations, improve problem solving skills and facilitate the execution of multiple tasks. With its ease of scalability, operational flexibility and cost advantage, MOOCs can provide a large heterogeneous audience with economics and convenience in achieving education, especially entrepreneurship education.

But different to learning traditional subjects, entrepreneurial learning can best be disseminated through hands-on practical process, though the available pedagogy is deficient on this aspect. Further research therefore is required to evolve methods for improving cognitive skill, maintaining regularity and reducing dropouts. Given the large number of students to be catered to, it is essential to develop meaningful and cost-effective evaluation processes, innovate new meta-tutoring for effective learning, and make teaching increasingly practical.

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