Investigating a MOOC educational model and the attitude of university students towards digital education

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Abstract: COVID-19 pandemic was a global crisis in one hand but at the same time it positioned distance learning in the forefront of the education worldwide. Digital educational and MOOC methodologies were suddenly utilised in wide spectrum – but with mixed results. In our paper we show that MOOC type of education can be an operational model for mass personalisation in higher education. Building on Technology Acceptance Models (TAM), we demonstrate the results of an empirical exploration research proving that such an autonomous – kind of 'campusless' – digital educational solution can be acceptable to higher education students. We conclude that MOOC education has proved to be viable/relevant based on the experience of our analysed population, but only if it efficiently supports learning and is suitable to promote autonomous learning. It also means that a simple solution does not necessarily result in a positive attitude among students.

Keywords: digitalisation; e-learning; online learning; MOOC; digital education; student's attitudes; TAM; technology acceptance model.

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1 Learn anything, anytime, at any age

Americans already spent on average 6.3 hours in the digital ecosystem in 2018,[1] which is not limited to 'googling' or browsing the articles of Wikipedia, as online courses, video conferences, music channels and the consumption of social media are also listed here. It all inevitably affects the world of work and learning (education, training and retraining). The human resource management of organisations, including educational and development strategies cannot stay intact either.

We claim that the digitalisation of education will shortly become a reality which currently resembles a sci-fi rather than the present classroom practice.

Various global organisations, educational and research networks, as well as multinational companies, or civil society organisations make significant efforts to map the changes in this area. They are trying to elaborate and spread innovative solutions in which then they lead the way (see Singularity University; Cisco Education Connector, Skype Teach Online, Walmart Education Partnership; European University Network)

Pro-active adaptation to changes applies not only to the leaders or staff of organisations and refers to continuous acquisition of skills even considerably different from previous ones, but also to the way in which newer and newer skills can be acquired and learned. Consequently, besides managers engaged in HR and further training or retraining, knowledge providing organisations (ranging from public education through vocational training to higher education) also need to rethink what knowledge to provide, how to train future professionals and how to transfer adequate knowledge in an 'exponential world'.

Analysing one of the latest forecasts (Diamandis, 2019) and examining the related reports (Singularity University 2019, Coursera Skill Report 2019), the following picture emerges:

- It needs to be explored how new technologies change the learning process.
- It needs to be clarified how students and people can learn together (collaborative learning), with special emphasis on virtual reality.
- It needs to be defined how artificial intelligence will transform educational and training practice.
- It needs to be assessed how devices creating augmented reality will help and transform learning environment.
- It needs to be examined what role portable, even implanted smart devices will have in this process.
- It needs to be explored how to adapt to each person, develop its efficiency and change the training process.
- It needs to be examined how personalised education transforms radically.
- It needs to be considered that in the future the 'brand name' and ranking of knowledge providers, and qualification levels (degrees) will be less important than today in labour market competitiveness.
- On a pilot basis human-computer interface has been already realised. The computer can be controlled by its means and soon it will be possible to upload and download information to the computer and from the computer directly to the brain and from the brain.

According to papers, these changes affect not merely the stakeholders in the market of knowledge services; continuous increase and expansion of general knowledge levels may become a strategic question of national economy, thereby growing labour productivity. There are programs from Anglo-Saxon language areas which aim at completely eliminating functional analphabetism among adults (People For Words), developing the digital system of preparing workforce for the future labour market (Adult Literacy XPRIZE) and implementing publicly funded, life-long learning (Learning Upgrade).

The ultimate goal is the full renewal of the current education and training system in the spirit of the concept 'Learn Anything, Anytime, at Any Age'. It all naturally entails free (demonetised) mobile-based access to services (contents), extensive use of artificial intelligences and devices providing virtual reality, i.e. involving the so-called 'exponential technologies'. The motto is 'We don't let anyone behind!' We believe that it also has a lesson in the relation of national higher education. Through the lens of everyday it may all seem distant; however, this stall can be explained by that we still think in a linear manner in an exponential world. For this reason, the starting points of our paper are the following:

- Renewing education in terms of content and methodology is essential in an economic environment based on automation, robotics and artificial intelligence and characterised by the buzzword INDUSTRY 4.0.

- Digital competence is one of the eight key competences of the concept of Life Long Learning, thus it should be featured on each level and in each form of education with appropriate emphasis.
- Renewing education in terms of content and methodology can be realised along a 360-degree, full digital transformation.

In our paper we intend to show it through the lens of an economist that the models, elements and building blocks of higher educational digital transformation have been completed, the necessary and sufficient conditions for adaption are available.

In universities, we have been able to leave the traditional classroom behind for many years. For example, flipped classroom has been conquering the world. Almost all students had a high level of satisfaction in the flipped classroom and generally enjoyed learning in the flipped classroom environment (Alamri, 2019). The integration of ICTE (Information and Communication Technologies in Education) in higher education is a growing success in many countries (Riyami et al., 2019). The question is: can the successful transformation of one element lead to the full digitalisation of universities? In our view, today this is not only possible, but will inevitably happen after COVID.

2 The historical encounter of education and digitalisation

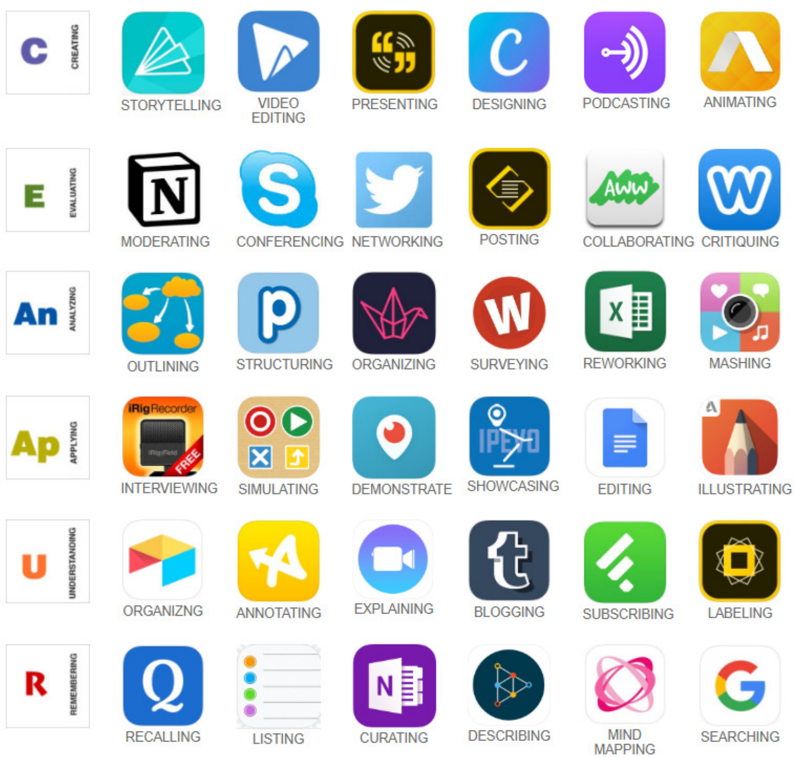
The integration of electronic, then digital solutions into education can be characterised by a long list of precedents. From the aspect of our article, it is practical to go back up to the middle of the 20th century. The educational model of Bloom et al. (1956) was defining in the area of educational methodology. Bloom et al. (1956) divided learning objectives and acquirable competences into three, then six areas. This powerful model was transformed by Anderson and Krathwohl (2001) (Bloom's Revised Taxonomy) in a way that the nouns in the model were replaced by action verbs, indicating that this new model was activity oriented. Anderson and Krathwohl's revised model was further elaborated by Churches (2007) integrating today's digital competences and digital devices. It resulted in Bloom's revised digital taxonomy. It assigns a special digital competence and an activity to be carried out in a digital environment to the cognitive categories. According to the complemented and revised model, 'digital knowledge' can be interpreted in the following dimensions:

- *Remembering*: e.g., using bookmarks in a digital environment, it serves highlighting and searching, by which the needed knowledge can be indicated.
- *Understanding*: in a digital environment understanding is served by categorisation (tagging) and reading the explanation provided by experts.
- *Applying*: in a digital environment applying knowledge refers to completing tasks and calculations and preparing statements, i.e., when the information is already used and not only recalled.
- *Analysing*: in a digital environment there are various methods of analysis available, ranging from mind-mapping through analysing an online questionnaire to the word cloud method, and to connecting the available results through links.

- *Evaluating*: in a digital environment it indicates that we are not merely passive recipients but also evaluators and contributors of available information, i.e., we analyse the information for others based on our own knowledge and value judgment.
- *Creating*: The highest level of digital knowledge, when we are able not only to receive and understand but also to create content, whether it is blogging, wlogging or making podcast.

This digital system taxonomy has several practical adaptations (Trotter, 2011), a large part of which connects specific digital devices to each competence level. One of the well-known adaptations was created by Kathy Shrock[2] educational expert, who links the 6 levels of Bloom's digital system taxonomy to specific programs and applications including several popular applications known and used by most young people (e.g., Skype, Hangouts, Twitter), and involving several programs which are already used in education, only not necessarily purposefully (Canva; Wordle; Google Sheets). Figure 1 shows Shrock's other adaptation, where she assigned iPad apps to each competence level.

Figure 1 Mobile applications helping to develop digital competence



Source: http://www.schrockguide.net/bloomin-apps.html

This type of categorisation of programs has been particularly popular in the past years: the composition of Allan Carrington, Australian education methodology expert matched as many as 188 applications with each digital competence, by which these competences can be applied, practiced and developed.[3]

It can be concluded that the development of young people's digital competence can be achieved using digital devices. In other words, trying to develop digital competences through solutions outside the digital environment does not seem to be a sensible approach. Nevertheless, it still remains a question to what extent the current teaching community is prepared to involve these devices in education on a broad scale; one may even ask the embarrassing question to what extent the same teaching community itself is able to use these applications on a daily basis.

2.1 Digitalisation and online courses: the possibility of mass personalisation in higher education

Besides the traditional classroom teaching, distance learning cannot have been born in the 'cradle' of the internet making digitalisation massive: according to Pomerol et al. (2015), mailing audio and video cassettes, television, radio and finally, the internet are parts of a 'development chain'. The authors claim that each information communication has so far inspired the actors of learning in various places and/or at various times (Pomerol et al., 2015). There are many examples for the spread of using internet in education: educational institutions integrate almost every ICT device in their processes, whether it is an electronic report book or course book, computer exam or sharing the presentation material of lectures online.

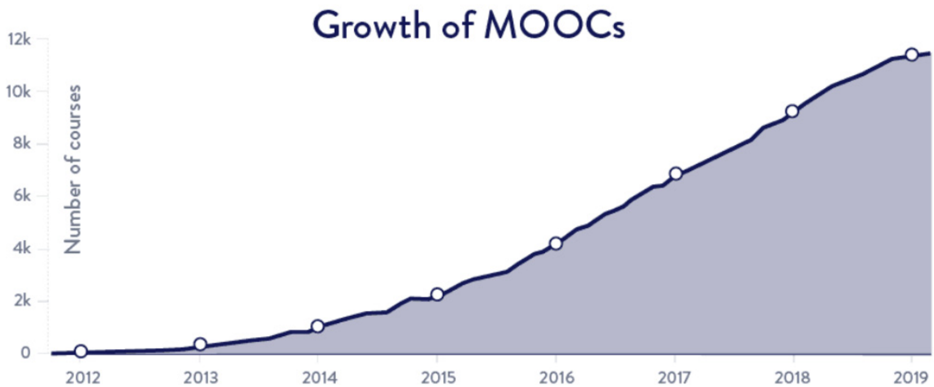
Today the question is whether the use of web and electronic solutions results in a new quality? As the internet has been integrated into corporate value-adding processes and become e-business, which does not equal electronic commerce or online marketing, this question has become relevant in education. In the long term, is the method of Massive Open Online Course (MOOC) having today tens of millions of students only another technological innovation – i.e., integrating web2 into educational practice – or does it induce a new operational model, which transforms the value creating processes of educational institutions? Are the buzzwords 'online, free, open' for registration of the coursera.org, where in 2019 already 38 million people study in higher education, only an excellent marketing action/concept or a part of a new business model? These questions were summarised in international literature as whether MOOC will be a new panacea in higher education (Brown et al., 2015) or does remain on the level of another practical instrument?

3 Massive open online course (MOOC): emergence and spread of the digital building block

The concept has been clarified in international literature: massive open online courses are web courses which provide unlimited participation and online access through the worldwide web. Besides videos, presentations, reading lessons and case studies, interactive forums and quizzes ensure knowledge sharing, teamwork, communication for users between students, teachers and staff assisting education.

MOOC appeared in as early as 2008 in Anglo-Saxon academic practice, but it became a popular platform of learning in 2012. If we consider both the theory and practice of distance learning, MOOC can be regarded as a relevant, widely researched development in the topic of distance learning as well (Bozkurt et al., 2015). It has a significant tradition of autonomous work outside the school and independent learning strategies. The speed of the spread of MOOCs between 2012 and 2015 depended primarily on the factors of 'open and free'. Figure 2 shows the global spread of MOOC courses.

Figure 2 The development of the number of starting MOOC courses between 2012 and 2019



Source: https://www.classcentral.com/report/mooc-stats-2018/

The early MOOCs often emphasised the characteristics related to open access, such as open access to content, structure or learning objectives, with an aim to support the repeated use and processing of educational resources. Several later developed MOOC also apply closed licenses for educational materials which are freely accessible for students but require registration (Zemsky, 2014). Zemsky (2014) claims that MOOC already reached its peak in 2014: 'They came, conquered a little and now they face significantly smaller prospects.' However, current numbers show otherwise: leaving the Anglo-Saxon higher educational environment, it becomes a global phenomenon, the reason of which as we see it is not being free of charge or open access.

The reason is much rather that, on the one hand, learning habits and attitudes of young generations are changing, on the other hand, the digitalisation of the classroom represents an actually more efficient learning environment than a traditional classroom. *The reason has also become apparent: such service providers can exploit the possibilities of massive personalisation through digital transformation.*

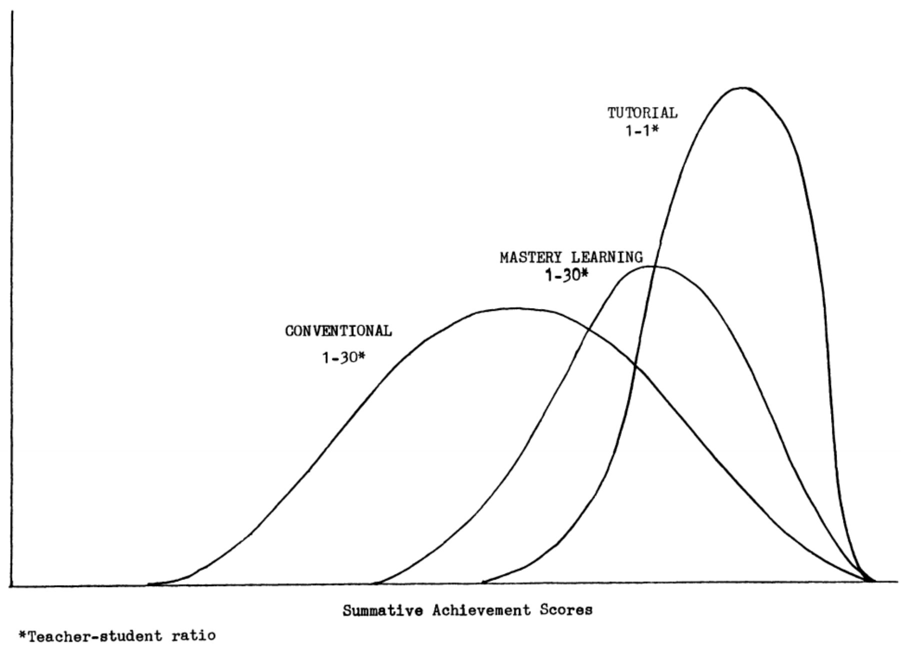
The reactions to MOOC were rather slow from the academic sphere as Billsberry (2013) pointed out 'despite the cacophony in the corridors and at conferences; there has been silence in the academic journals'.

3.1 The background of MOOC's success

The fact that the classroom is not the most efficient knowledge transfer solution in terms of personalisation has long been well-known, it is not by chance that one of our well-known sayings is 'the better ones are always bored, and the weaker ones are lagging behind' because the teacher teaches at an average speed in such environment.

Massive personalisation is one of the greatest opportunities in this area because it allows us to solve a more than 30-year-old problem. Educational researcher, Benjamin Bloom raised the 2 sigma problem in Bloom (1984), which he observed while studying three student populations. In the first case, the students took part in lecture-based classroom education. In the second case, the students also used traditional lecture-based classroom education but applied an acquisition-based approach, thus each student could move on to the next topic if they demonstrated the acquisition of the former study material. Finally, there was a student population where the teacher tutored each student individually throughout. In this experiment it was referred to as 'one to one tutoring'. Bloom (1984) found that if the teacher tutors each student individually, the Gauss curve representing classical classroom performances (normal distribution function) changes. In his original article it was illustrated by the curves shown by Figure 3.

Figure 3 Change in students' performance in the case of one-to-one tutoring



Source: Bloom (1994): The 2 sigma problem; Educational Researcher.

Consequently, if everyone can be tutored individually, the curve changes: up to 80% of students can reach the range of excellence. In other words, the normal distribution of a class's grades is not about the students but rather about the learning environment. It is presented in the literature as the 2 sigma problem. Obviously, after Bloom's article everyone started to work on how it is possible to make 'even more' schools, how to deal more with the students and break the predestined 'weak, medium and excellent' categories. It was served by two resource allocations in the long 20th century: one of them was that the school had the energy for this, and the other was that the parents had the energy for this (in our article, energy refers to money, time, expertise and the overall educational infrastructure).

The topic profoundly addressed by educational researchers can also be investigated through the lens of an economist. The institutional model of the classroom, teacher and school is scalable and the sources required for its maintenance can be defined in algorithms. A smaller class size requires more classrooms and more teachers: the costs of the way to individual tutoring are steeply rising. Besides, almost every parent as a customer expects their child to be tutored individually if possible, having the opportunity to personalise. It is served by extra lessons, remedial classes and specialised classes.

Recent studies also revealed several aspects of MOOC-type courses. Vlachou et al. (2020) asked secondary education ICT teachers who were ambivalent about this methodology as they considered online forms of education as equal to traditional ones, however they considered personal contact of great importance. Sammour et al. (2020) examined the readiness of students to take MOOC courses and their acceptance by their universities. However, some concerns were unfolded, generally MOOCs have been found a suitable option for delivering learning content. Monitoring the MOOC was also considered as an important success factor by Riyami et al. (2019), who found teacher coaching, collaboration, prerequisites in the module element and the rate of MOOC follow-up as the most important factors for the integration of MOOC.

We claim that the digitalisation of higher education through MOOC-type courses creates the possibility of massive personalisation. The key of total personalisation is exactly digital transformation, i.e., being able to tutor everyone individually in the educational process: this is the 4.0 of education, similarly to industrial 4.0 and also the solution for Bloom's 2 sigma problem in an environment with limited 'energy'.

Video lessons can be viewed over and over again, quizzes and tests can be completed over and over again, the virtual assistants can tirelessly help to solve the tasks and correct the tests without repeatedly asking the teachers to return to the classroom with the students.

This is exactly the lever of the continuous spread and growth of massive open online courses: in this market several organisations (e.g., university, institution or business venture) were started, now there is a clear picture of the major service providers (platforms): based on the number of users, the Coursera, Edx, XuetangX, Udacity and Future Learn stand out. The first three have built a user community of 10 million in the past years. Given that in 2016, 19.6 million students studied in higher education in the European Union, the Coursera had 23 million students in the same year and 38 million users in 2018. It is evident where expansive growth can be found today.

3.2 A possible pattern of a MOOC-based digitalised university

In our view, the question whether digitalisation results in the emergence of a new operational model in higher education has been answered. Massive personalisation is operating. Most MOOCs apply video recordings in education, they often digitalise classroom lectures and traditional educational practices (Yousef et al., 2014). Many consider videos and other contents produced by MOOC as the next form of course books, the term 'MOOC is the new book' is not uncommon (Young, 2014). Based on research about edX students it can be concluded that students' attention cannot be maintained in the long term either in the classroom or in front of the screen: a simple recording of classroom lessons is a dead end. In general, students stop the videos after 6–9 minutes. According to another data set, half of the students watched at least 4.4 minutes of 12–15-minute videos (Holmes, 2015).

Since thousands of students may take part in a course, because of massive enrolment and personalisation the MOOC requires a technical background which provides massive feedback besides interactions, i.e., the instruments for evaluation and progress check. In the past years, owing to innovative pedagogical theories and methods, two approaches have spread (Rivard, 2013):

- self-check by student communities and collective cooperation
- automated feedback: online tests, in addition to automated grading of complex written exams

Evaluation is the most difficult to carry out in an online environment: here is the most difficult to build and maintain trust, furthermore, online evaluation methods are quite different from traditional evaluation methods. Therefore, in MOOC special attention is paid to supervision and detecting occasional cheatings (Eisenberg, 2013).

Group checking (checking by other students) is based on sample answers or multiple-choice questions, thus the evaluator can adequately assess how many points can be given for each answer. It is to be noted that the evaluation methods cannot be as diverse in group checking as if it was done by educational personnel.

Furthermore, another advantage of group checking is that among the students who grade others the grading process is accompanied by learning, and the evaluators become more committed to the course (Adamopoulos, 2013). Examinations can be supervised in regional examination centres or other exam tracking home devices can be applied (using a webcam, identifying the algorithms in the habits and patterns of using mouse or typing).

Recently special techniques have been elaborated, such as adaptive testing, where the test is personalised based on the student's previous answers by displaying easier or more difficult questions in accordance with the student's knowledge. However, several limitations still exist.

Bawa (2016) did an in-depth literature analysis unfolding the following factors affecting attrition rates in online environments: Misconceptions relating to cognitive load; Social and family factors; Motivational factors; Technological constraints and the digital natives; Lack of instructor understanding of online learners; Faculty limitations of using technology; Digital immigrant issues; Institution limitations to training faculty.

The digitalisation of courses, including the hybridisation of MOOC and higher education can appear as an inflection point in the world of education based on the above. Hortoványi and Vilmányi (2018) propose to exploit the possibilities of IT-based competitive advantages instead of the traditional, i.e., linear and product-based operation. Based on this we claim that a conscious MOOC-based digital transformation promotes the development of a hybrid higher educational model which can be a solution to several common problems for new generations, institutions, as well as employers. A MOOC-based digital transformation can have an effect through the factors shown by Table 1

Considering this set of aspects, we regard MOOC to be suitable to develop a new educational model, where students start their studies in a network nod, at campuses but each element of the network provides them educational services and the completed MOOC courses are the building blocks in the operation of the network.

Table 1 MOOC-based higher educational model

Factor	*Effect in higher education*	*Extent of change: (low, medium, high)*
course digitalisation, MOOC developments	creating unlimited access to teaching material elements, modernising the course content	*high*: digital skills required by the labour market can be integrated
MOOC-based networking, strategic alliances	the student can participate in the courses of several institutions, course offer depends on the size of the network	*high*: the practice so far has been built on the cooperation of few actors (e.g., part-time training, double-degree)
flexibility in time and space	courses can start not only at the beginning of the semester and not only in one place	*high*: the practice so far has linked the starting date and place to fixed times and venues
open source approach	joining is free: the user may pay by course and credit	*high*: the practice so far has connected commencing studies to paying tuition fee
extension of market	between age 6–99 'living room' instead of 'classroom'	*medium*: the practice so far has had primarily classroom approach and functioned with high dropout rate
authorisation of customer	students are not audience: they learn not only from the teacher but also from each other	*medium*: the practice so far has acknowledged it implicitly

Source: Own construction.

4 Examining user attitudes towards MOOC

In the course of our explorative empirical research, we intended to investigate student attitude towards MOOC-type education. We were interested in the extent of acceptance such a digitalised solution can expect among students in Hungary. It is important to know that the Hungarian literature has addressed the topic of MOOC, but it has focused primarily on the aspects of teaching methodology and teaching material development: an example is the works of Námesztovszki et al. (2017), in which they explored among others the patterns of student activity in the online space.

4.1 Methodology and test model

In the development of the investigation, we started out from two test models commonly applied in the economic literature and prepared their adaptation corresponding with the topic.

One of them is the Technology Acceptance Model (TAM), an extensive approach, whose original model (Davis, 1989; Davis et al., 1989) is 30-years-old, but both the original TAM1, and its adaptations TAM2 model (Venkatesh and Davis, 2000) and TAM 3 (Venkatesh and Bala, 2008) are still widely used instruments in the examination of the acceptance of new technologies (Keszey and Zsukk, 2017). The other broadly applied approach is the Unified Theory of Acceptance and Use of Technology (UTAUT) created by Venkatesh et al. (2003) by the adaptation of eight different models, whose extended version is also known as UTAUT2 (Venkatesh et al., 2012).

A shared characteristic of all the models is that they ultimately intend to examine the actual use, regarding which they assume behavioural intention to be crucial, influenced by different factors in each model. Our present research is mostly based on the approach of the TAM1 and UTAUT1 models and we developed our test model by one of their combinations.

The population we analysed is a group of students who are majored in Business Administration and Management in a distance training program of a Hungarian university. This program was significantly transformed 2 years ago, completely becoming a MOOC-type training, i.e., students acquire the course material without contact hours through digital study materials (video and reading lessons) and take an exam online. Our research focuses on the examination of the acceptance regarding this new technology (MOOC-type learning). As MOOC-type learning is not an optional but the only option, there is no need to examine the actual use, because every student uses the system. Consequently, there is no need to examine behavioural intention, thus in our adapted model we intended to investigate the students' attitude to MOOC-type learning as a new technology. Hereinafter, wherever we write about 'MOOC-type education' we refer to the accredited distance learning system and platform specifically examined in our research.

It is thus important to emphasise that the substantive difference between the above-mentioned models and our test model is that we did not intend to investigate behavioural intention and actual use, but the attitude related to the technology. This approach is similar to the TAM1 model in a way that attitude is presented as a dependent factor. However, the TAM1 model includes quite few explanatory factors (perceived usefulness, perceived simplicity of use), therefore we considered it justified to involve explanatory factors from the revised models in our model.

Besides four direct explanatory factors of the UTAUT model, we integrated two additional explanatory factors of the TAM3 into our test model. These six factors were all featured in the original examinations of Vankatesh et al. (2003) in the composition of the UTAUT model, but the latter two were not found significant. The same applies to the attitude to use, which was also presented in the original analysis.

We can conclude that the factors in our model was each featured in the analysis applied for the composition of the UTAUT model, thus we measured them by the validated scales used by Vankatesh et al. (2003) for each variable.

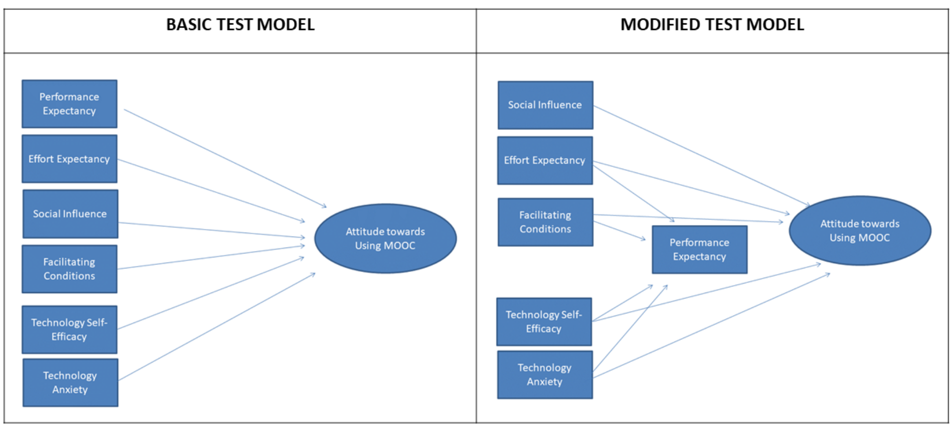
The only exception was in the case of attitude, which was measured by four variables in the original UTAUT article, which we extended. Based on this the factors of our model were the following (in the Hungarian versions and interpretation the terminology of Keszey and Zsukk (2017) is used):

- *Performance expectancy*: It refers to the learning performance a student expects to be able to achieve with the MOOC system.
- *Effort expectancy*: It refers to extent of effort a student expects to be required to make in the use of the MOOC system.
- *Social influence*: It refers to the extent of social acceptance of MOOC-type teaching.
- *Facilitating conditions*: These are the organisational and infrastructural conditions which help students in the use of the MOOC system.

- *Technology self-efficacy*: How much a student feels that they have the competences required for using the online learning platform.
- *Technology anxiety*: How much a student feels nervousness and anxiety regarding the technical use of online learning platform.
- *Attitude towards using technology*: It refers to the general attitude of students towards the MOOC-type system.

Based on our research results, according to the Cronbach's alpha test carried out on the above factors, the 'Facilitating Conditions' factor did not prove to be sufficient (0.557), so we removed it from the test model (the Cronbach's alpha values of the other factors are shown by Table 4). Based on this, we set up two test models; a simpler one, in which we analysed the effect of the remaining five explanatory factors in terms of attitude, and a more complex one, where we assumed that learning performance is of particular importance in the case of educational platform, illustrated by Figure 4.

Figure 4 Structure of our applied test models



Source: Own construction.

4.2 Primary research results

We forwarded our research to all the students of the examined training program (138 persons) in July 2019 via the usual contact platform of the University of Szeged, asking them to participate in the research anonymously. We received in total 56 completed questionnaires (40.5% response rate), and after data cleaning we could analyse a sample consisting of 54 respondents. Two thirds of the respondents were women, which corresponds with the distribution of the population. The same applies in terms of age and place of living: 54% are between the ages of 20 and 29; 26% are between 30 and 39 and 17% are between 40 and 49. As for the place of living, slightly less than half of them live in the town where the university is located, 9% is an inhabitant of Budapest and 3 persons live abroad. One third of the respondents have a degree already. Only 11 respondents claimed to have taken another MOOC-type course before the current training program (9 persons of them still does), based on which 80% of the sample encountered this digital technology for the first time in the case of the examined training program, thus the analysis of their attitude seems relevant.

The respondents in general had a positive attitude towards the MOOC system, their vast majority considered the transition to be a good idea and only three respondents disagreed with it. 69% were satisfied or very satisfied with the system, while only 12% were dissatisfied and 5 persons claimed they would not recommend the online course to others. Two thirds like learning online, while only 2 respondents disagreed with it. The respondents stated that it is more interesting to learn online, although it is not necessarily more entertaining. However, the question whether an online course can replace a classroom lecture was more divisive. 24% of the respondents disagreed with it, while 37% agreed; one third of the respondents could not decide. They especially missed the direct interaction with the teacher (57%) and nearly half of them claimed that it is impossible to make friends in an MOOC program.

If we analyse the respondents' opinion according to the examined factors, contained by Table 2, we can find that they consider the use of the system particularly easy, a considerably high proportion (93%) agreed that it was easy to learn to use the system.

Table 2 Consolidated average values related to the tested factors

Factor	*Mean*	*SD*
Effort expectancy*	4.2	0.7
Social influence	3.8	0.9
Performance expectancy	3.7	1.0
Attitude towards using technology	3.4	1.2
Technology self-efficacy	3.1	1.0
Technology anxiety	1.8	1.0

Notes: * Higher value means they assess the use of the system easier; Own construction based on research results.

The respondents in general reported about supportive environment (Social Influence), and they assess the MOOC system efficient in terms of learning. 47% agreed (13% disagreed) with that they can learn faster in this way, while 43% it is more efficient as well. It is also an interesting finding that the majority claimed their chance to gain a degree became higher by online learning.

To analyse the connections between the factors in the test model first we conducted correlation calculus, the results of which are shown in Table 3.

It can be concluded that there are close correlations between the factors of the model, but *the strongest correlations are found between Attitude and three explanatory variables: Performance Expectancy, Technology Self-Efficacy and Social Influence*. It is to be noted that in the case of Spearman correlation calculus, only the former two factors have a significant correlation to attitude. It is also evident that Performance Expectancy and Technology Self-Efficacy have a significant correlation with every other factor. We developed our modified test model assuming the above.

Table 3 Pearson correlation values between the tested factors

	Attitude	*Performance expectancy*	*Social influence*	*Effort expectancy*	*Technology self-efficacy*	*Technology anxiety*
Attitude	1.00	.945**	.878**	0.52	.905**	–0.41
Performance expectancy	.945**	1.00	.553**	.383**	.572**	–.350*
Social influence	.878**	.553**	1.00	.381**	.480**	–0.19
Effort expectancy	0.52	.383**	.381**	1.00	.456**	–0.21
Technology Self-efficacy	.905**	.572**	.480**	.456**	1.00	–.468**
Technology anxiety	–0.41	–.350*	–0.19	–0.21	–.468**	1.00

Notes: *. Correlation is significant at the 0.05 level (2-tailed); **. Correlation is significant at the 0.01 level (2-tailed); Own construction based on research results.

Next, we analysed the compliance of the two test models with the method of path analysis. The factors of the models proved to be reliable, and the values are presented in Table 4.

Table 4 Reliability of the models: values of original model (values of modified model – if they differ from the values of the original model)

	Cronbach's Alpha	*rho_A*	*Composite reliability*	*Average variance extracted (AVE)*
Attitude	0.899	0.920	0.919	0.523
Effort expectancy	0.710	0.737 (0.742)	0.834	0.628 (0.626)
Technology self-efficacy	0.804	0.868 (0.854)	0.866	0.571
Technology anxiety	0.706	0.631 (0.674)	0.692 (0.714)	0.411 (0.426)
Performance expectancy	0.819	0.864 (0.871)	0.882 (0.881)	0.657 (0.656)
Social influence	0.767	0.801	0.848	0.585

Source: Own construction based on research results.

The results of the tests of the two models do not differ much. Both models have specifically high explanatory power. While in the original model the factors tested for attitude have explanatory power of 78.5%, it is almost identical in the modified model with 78.2%. It thus can be concluded that overall the modified model does not improve the explanatory power of Attitude, at the same time, it allows to further examine the correlations between underlying factors in more details.

In the modified model, we analyse Performance Expectancy not only in connection with Attitude, but also with the three variables in the model. The results indicate that Effort Expectancy (β=0.088; p=0.377) and Technology Self-Efficacy (β=0.252; p=0.052) have no effect on Performance Expectancy, but Technology Anxiety (β= –0.508; p=0.000) has a strong, negative effect on Performance Expectancy. It all indicates that the more a student feels anxiety about the technology applied in teaching, the less high their performance will be.

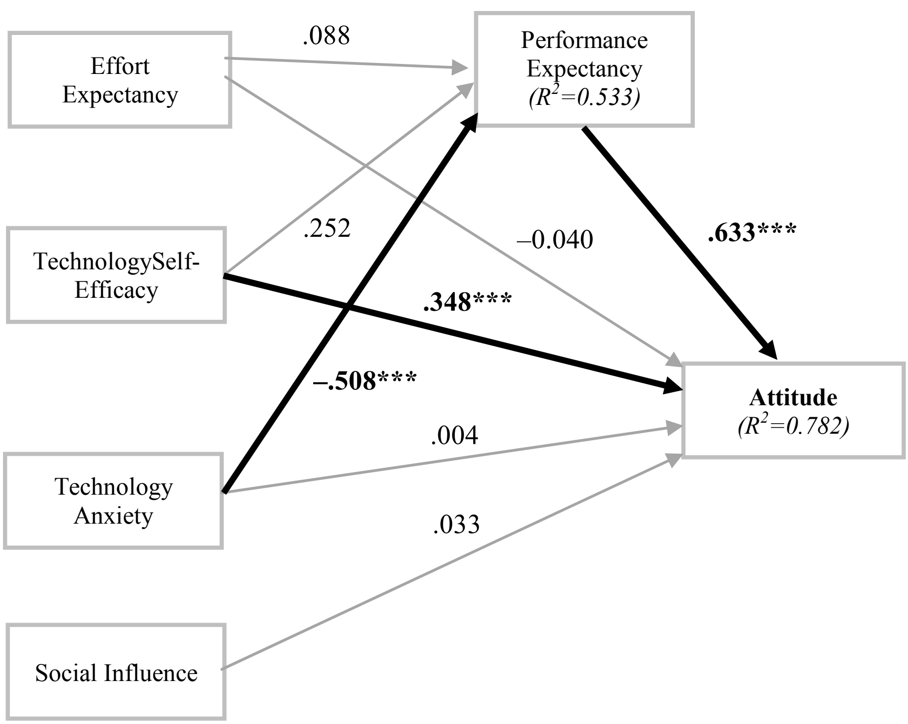
Table 5 R^2-values of original and modified models

	R^2	R^2 *Adjusted*
Original model		
Attitude	0.785	0.763
Modified model		
Attitude	0.782	0.760
Performance expectancy	0.533	0.505

Furthermore, in both models the same two factors have a significant effect on Attitude: A Performance Expectancy (β=0.633; p=0.000) and Technology Self-Efficacy (β=0.348; p=0.000) (see Table 4). On the other hand, Effort Expectancy (β= –0.040; p=0.629) and Social Influence (β=0.033; p=0.761) have no direct effect on Attitude.

It can be concluded about the modified model that in total three factors had an effect on Attitude, out of which Performance Expectancy and Technology Self-Efficacy have a direct effect, while Technology Anxiety has an indirect effect on Attitude through Performance Expectancy; the related results are summarised by Figure 5.

Figure 5 The values of factors affecting attitude



Source: Own construction based on research results.

The opinions on the above statements show a substantial change. The proportion of those who claim that online courses are much more aligned with students' pace of life increased significantly (by over 20% points), furthermore, more and more students consider online courses to be suitable for replacing classroom lectures.

In 2019, compared to the respondents of 2015, more students think they prefer to learn in online courses rather than in classrooms. In addition, fewer students believe that friendships cannot be formed in virtual courses and also fewer students find the lack of direct interaction with lecturers disadvantageous.

5 Conclusions

Our research focused on investigating the attitude of students taking part in distance learning at a local university towards MOOC-type teaching as a new technology. To set up our test model we used the TAM 1 and UTAUT models as a basis.

- Our most important finding is that the explanatory power of the model we set up proved to be considerably high, a significant proportion of the factors involved in the test affect attitude.
- The most significant influencing factor on Attitude was Performance Expectancy, which indicates that for students the attitude towards a new educational method primarily depends on the extent it serves their efficient learning. In this respect, it is gratifying that the students were generally particularly satisfied with Performance Expectancy provided by the MOOC system in the examined training program. It can also explain that they had a more positive attitude than the average towards the whole system.
- Technology Self-Efficacy also had a significant influence on Attitude. It means that if someone can handle the platform individually and confidently, they in general have a more positive attitude towards it. In the light of this, it can be considered interesting that neither Technology Anxiety nor Effort Expectancy influence attitude significantly. Overall, the respondents were less characterised by the former, although the Performance Expectancy of those who have this characteristic is influenced by in in a negative way. The fact that Effort Expectancy does not affect Attitude directly implies that a system being user-friendly and easy to learn does not necessarily mean it will be liked and those who can handle it individually and confidently will like it.

We can conclude that MOOC education has proved to be viable/relevant based on the experience of our analysed population, but only if it efficiently supports learning and is suitable to promote autonomous learning. These two characteristics apply to a system if, e.g., it serves preparation and learning in versatile and diversified ways. It also means that a simple solution (e.g., teaching videos put only on a YouTube channel) does not necessarily result in a positive attitude among students.

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