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Personalised Learning on MOOCs

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ABSTRACT

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Summary: The aim of this thesis is to investigate the elements for realizing personalised learning and to figure out whether they have been applied on MOOCs. A web questionnaire was distributed to different MOOCs learning communities and individual learners during the spring of 2017. Thirty answer sheets have been selected and analyzed. The results show that there is no correlation between learners' model (personal data and information) and different presentations of the contents and different experiences of navigation on MOOCs. Findings also support the idea that personal traits (learning styles, cognitive styles, etc.) are difficult to be inserted for adaptive hypermedia systems which are the technical foundation for realizing personalised learning. However, the collected data also suggest that course design strategies for MOOCs cater to individual needs and preferences. In other words, the adaptive instructions which serve for personalised learning have been adopted on MOOCs. This research provided an insight of how personalised learning could be realized on e-learning platforms from the educational view. However, the researcher recommends further research on depth study of individual cases and updated issues concerning this field.

Keywords: personalised learning, user model, adaptive instruction, MOOCs

Further information:

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Introduction

1.1 Background and the Context of the Study

Massive Open Online Courses (MOOCs) witnessed a big breakthrough on education field in the year 2012 (Sheu et al., n.d.). Started from that year, MOOCs have evoked furious debates and discussions among education, business, information technology, and other relevant domains. Plenty of researches have been made to study the phenomena, and there was a long time, many advocates held the opinion that MOOCs will take the place of formal education. Before we start to explain what a "MOOC" is, the history of MOOCs will be clarified.

There was a long history before the MOOCs became as massive and popular as today. According to Harber, it is always the breakthrough in the communication technology that triggers the development of educating the masses (2014). At the beginning, it was the arrival of electronic media which leads to the "popularization of radio and television as educational tools in the 20th century" (Marques, 2017). After that, the distance education appeared, they were indispensable for triggering the educational evolution. However, the purview of digital economy soon no longer remained on the information and communication technology themselves, but on the web-based collaborations and networks (McAuley et al., 2010). However, the learning activities, at that time, were still lack of interactions between the instructors and learners, or between the learners and their peer workers.

In the year 1969, the Open University appeared in the United Kingdoms, which revitalized distance education and made the academic knowledge become "openly" accessible (Marques, 2017). Besides that, the presence of Open Education Resources (OER) in 2001, Open Course Ware (OCW) in 2002, and online learning in general have all contributed to the arrival of MOOC (Sheu et al., n.d.).

The first course which can be labeled as a MOOC was launched in the year 2008, it was called *Connectivism and Connective Knowledge/2008* (Marques, 2013). The course was co-organized by two Canadian researchers, Stephen Downes and George Siemens. At that time, about 2,200 people participated in the course. Different platforms, such as Facebook groups, Wiki pages, blogs, forums have been used to build up the for-credit course. (Marques, 2013). Hence, the course was conducted in the way of cMOOCs (the term will be explained later). After that, David Cormier, a co-worker of Downes and Siemens, coined the term "MOOC" during an EdTech Talk interview with the course creator in 2008 (Harber 2014, p.39).

However, it was until the fall of 2011, the University of Standford started to launch a series of MOOCs which reached more than 100,000 enrollments for each of them that MOOCs became national and international renown. (Sheu et al., n.d.) After that, 2012 became "the Year of the MOOC" (Laura Pappano, 2012), and a lot of American prestigious universities started to join the "mainstream".

Just like MOOCs, the advent of personalised learning also attributing to the development of information and communication technology.

Personalised learning first developed from a broad concept -- personalisation, which is always connected with technologies and used in different fields, like health care systems, education activities, business dealings or politic elections. Hence, some educationists held the opinion that personalised learning is derived from personalisation in public services (Prain et. al., 2013).

After that, personalised learning have been developed and recommended because the individual differences in learning also need to be identified in education field, and personalised learning is an effective way to promote student motivation and learning outcomes. It frees students from time or space limited learning, as well as from the fixed methodology for learning. For personalised learning, students do not decide their own

learning subjects, but rather their learning time and methods according to their own preferences and needs (Prain et. al., 2013).

Hence, we can take a look at one definition of personalised learning:

> tailoring learning for each student's strengths, needs, and interests—including enabling student voice and choice in what, how, when and where they learn—to provide flexibility and supports to ensure mastery of the highest standards possible.
>
> (as cited Patrick, Kennedy, and Powell 2013, 4 in Easley, 2017, p18)

From the definition above, we can see that the educating process have been tailored to the individual learners' situations and needs, learners are the locus of the whole process and learners could be highly motivated and self-regulated in a personalised learning environment .

However, the above definition does not point out the role and the importance of the information and communication technologies which ground the personalised learning and form the main studies in this field. Since one important feature of personalised learning is to help the learners reduce the information overload and then to give them the tailored program which based on their implicit or explicit information, this process cannot be realized without the implement of information and communication technologies (Donnell et al., 2015).

Buckingham also made the conclusion that the development of personalized learning will trigger the application of digital technologies in education, and the digital technology will play an important role for the growing of personalized learning in education in turn (2013).

Besides the study of personalised learning, there are two concepts which are similar to it: *differentiation* and *individualization*. The former one means tailor the teaching to meet

the individual learning preferences, while the second one means pace the teaching to meet the individual learning needs (Bartle 2015, p3).

All the three concepts have altered the traditional education from educating the mass to educating the specific people or groups, from applying the general curriculum, instructions to applying tailored curriculum and instruction. However, the focus of *differentiation* and *individualization* are still the instructors, while the personalized learning remains on the learners.

For personalised learning, the role of the learners are shifted from being passive "consumer" to active co-producers and collaborator, they are responsible for adjusting their own studies according to the various assessments (Bartle 2015). Besides that, the assessment for personalized learning are testing the learner's knowledge mastery instead of their correctness of a specific knowledge. In other words, not only the learner's knowledge acquirement will be traced, but also their learning goals, interests, and methods will be traced in personalized learning (Blois, 2013).

1.2 MOOCs

1.2.1 The MOOC and MOOC family

From the previous historical introduction of MOOC, we already knew some features of it. MOOC is an abbreviation for Massive Open Online Course. For *massive*, we know that the number of the participants in MOOCs is considerable bigger than the traditional courses. Besides that, the *massive* here also means the "pedagogical tools and methods applied in the courses are scalable" ("MOOC for Nordic education for teachers in the field of basic skills for adults", 2015, p.7) For example, the video, by applying the videos of a recorded course instead of the face-to face teaching, the use of the resources will not rise along with the increasing of the learners, which brings the possibility of being massive.

Open in this case means that it gives the learners freedom to enter the courses according to their own interests and without paying any fee unless they have some special credits or certificates requirements. In other words, there are no restrictions for entering the course if one has the willingness to learn, as long as they have the technology facilities for the access.

After we explained the general MOOCs, it is inevitable to explain the two branches of MOOC: the xMOOC and the cMOOC.

xMOOC, on the one hand, is actually the representation of the courses that most of the learners can access to in the platforms, like edX, Coursera, and Udacity. According to Stephen Downes, co-founder of one of the first MOOC, the *x* stands for "extended", which means the "programs that aren't part of the core offering, but which are in some way extensions" (cited by Downes, 2013). In other words, the xMOOC is consisted by the traditional university courses. In that circumstance, the teachers still play the main roles for the teaching and learning activities since the knowledge still building on the form of instructors to learners. Besides that, the platform for delivering xMOOC is also unitary. However, the xMOOC has significantly exemplified the number of students who can "attend to" the university-level courses (Hilgerch, 2017; Morrison, 2013).

cMOOC, on the other hand, is applying various of platforms that promote learning. For example, the wikis, blogs, and social media which can provide interaction of the contents are used as the platforms. For *c*, it represents for "connectivist", which makes the core of learning become the networking and interaction with the others. In this case, there is no single role for the participants, all of them are playing as the teacher and the learner at the same time. The importance of the instructors are basically located on the early stage of the course building. After that, the knowledge building relays on the connection and collaboration of the individual participants. (Hilgerch, 2017; Morrison, 2013).

In this paper, xMOOC is the one which has been studied. Most xMOOC courses are launched through the big three, Udacity, Coursera and edX. They were the pioneers for

MOOCs. The first two were born out of the Stanford University; the last one was set up by the Harvard University and MIT in 2012 and runs as a nonprofit platform all the time.

Besides them, other notable platforms are FutureLearn from the UK, Open2Study from the Australia, Iversity by Germany, FUN for France, Spanishmooc for Spain, Ewant from China, etc.

1.2.2 The Essential Components of MOOCs

Lectures is the main component for xMOOCs, they are normally small videos on specific subjects. Since we already know that most of the course providers are from the prestigious universities at whole wide, which guarantees the qualities of the content somehow. Nevertheless, the lecture videos on MOOCs are always reduced version, as Pappano concluded: "8 to 12 minutes is typical"(2012). Besides that, many lecture videos insert once or twice compulsory pausing time for the quiz which leads us to another essential component of xMOOCs, *assessment*. Just like the formal higher education, assessment for a MOOC course could be given before (pre-reading and quiz), during (automatically scored questions during the videos) and after a "lecture" (writing assessments, group work project, etc.). The thing has been criticized a lot is the feedback for the assessment, it is either not prompt or not enough, let alone the cheating problems.

The third indispensable element for xMOOCs is the *discussion and community* which could be more represented by cMOOCs. All the courses on MOOCs have reserved spaces for discussions, many MOOC courses have also built different kinds of social media communities on Facebook, Wikispaces, twitter, etc. Learners can conduct both asynchronous and synchronous communications with the instructors or peer learner there.

Besides the above, there are also a lot of courses reading and extra reading materials available on xMOOCs. Students who are interested in the credits can also gain them by completing the courses with extra payments. With the credits, the learners can get an

official completion documents which bearing the name of those prestigious colleges or universities.

1.2.3 The advantages and disadvantages of MOOCs

If 2012 is “the year of the MOOC” (Pappano, 2012), 2013 was the year of the MOOC backlash (Harber, 2014). The merits of the MOOCs is that once you have the internet access and interest to learn, you do not need to prepare the tuition fee or for other requirements. As return, there is no formal accreditation for the learning (Harber, 2014). These features, on one hand, bring more freedom, chances, and equality to the learning itself; on the other hand, lead to “thorny issues related to grading, feedback, quality, cheating, retention, and learner background present problems for those offering MOOCs” (Harber, 2014, p.3).

For example, the attrition rates for MOOCs are always quite high, one cannot guarantee the tasks are always fulfilled by the same one who registered the courses, and the traditional feedback system is no more suitable for that big amount learners. Besides those, the critics also concern the problem of the conflicts between the nonprofit course providers (teachers) and profit platform providers (organizations). There are already many courses or projects on MOOCs inserting different methods to make profits which contradicts the concept of openness and equality for education (Harber, 2014).

However, there are also some innovations of MOOCs which are deserved to be mentioned. The course videos are no more simple recordings of the formal courses, they are shorter and easier for the learner to focus on comparing with formal course recording videos. The interval quiz during the videos gives the learners the illusion of gaming. An advanced testing system in MOOCs can make the testing and feedback more effective and accurate. The “massive” participants can make the most of the collaboration for learning in a various way. The proper using of big data can bring a lot of benefits for personal learning or even educational revolution. Those perspectives are principal starting points of this research.

1.3 Research Questions and Purpose

The main focus of this study is to examine the conditions of implementing personalised learning on MOOCs and whether the MOOCs have provided personalised learning environment for the learners. The study had the following research questions:

1. Has User Modeling been applied on MOOC platforms?

2. Has Adaptive Instructional framework been applied on MOOCs?

In order to figure out the first research questions, there are two null hypotheses have been put forward.

A. Personal traits: learning styles, cognitive styles

> *H_0: Users of MOOCs do not have preferred learning styles and cognitive styles*
>
> *H_1: Users of MOOCs do have preferred learning styles and cognitive styles*

B. The impact of different personal traits on the adaptation effects on MOOCs

> *H_0: User's learning styles and cognitive styles do not lead to adaptation effects (content or hyperlink differentiation for different learners) on MOOCs.*
>
> *H_1: User's learning styles and cognitive styles do lead to adaptation effects (content or hyperlink differentiation for different learners) on MOOCs.*

So far, we can draw a conclusion that MOOC is a typical example of how information and communication technologies are applied to educational activities (Harber, 2014). Besides that, as some researchers have indicated that the MOOC itself provide a good experiment ground for collecting big data (Eichhorn & Matkin, 2016). There are more than 700 colleges and universities offering MOOCs and 58 million students in 2016

(Shah, 2016). Therefore, a lot of quantitative studies have been made to explain the features of MOOCs learners. For example, their preferences, backgrounds, motivations, facilities, even their learning locus, and habits (Sheu et. al, n.d.).

Relevant studies like, self-directed learning on MOOCs has also been conducted. There are some convergences between personalised learning and self-directed learning. Nevertheless, personalised learning lays more focus on the ICTs, which explains why the realization of personalised e-learning "is still not achievable by non-technical authors". (Donnell et al., 2015, p22)

Besides that, there are several key features of personalised learning have been concluded in some studies, but its distinctive features and the details of implementation still remain vague (Prain et al., 2013). Therefore, a research which helps to figure out the ambiguous part responds to the call.

The features of MOOCs have already shown some features of personalised learning -- learners are supposed to have the freedom to choose where, when, how, with whom to learn due to the easy access of advancing technology (Markness, Mak & Williams, 2010). Still, there are spaces to test the hypothesis, to exam the level of learning "freedom" and also to collect the data about the methodology to achieve it. Those would be the research aims of this study.

2. Theoretical Framework

In this chapter, the theoretical framework for the relevant study will be examined. After studied a number of theories, on the one hand, the theory of Adaptive Hypermedia systems and User Modeling have been chosen as the main theoretical supports in ICTs field. Among them, Brusilovsky's studies, the pioneer research of this field will be the backbone. On the other hand, since the intention of this research is to study the educational phenomenon, the studies from the education sciences should be the focus. Therefore, relevant studies about learning science and course design strategies have been reviewed. Among them, one study worked out in Magoulas and Chen's book has been considered as the most suitable framework to study MOOCs. Besides that, relevant studies about learning styles and cognitive styles have also been discussed in the user modeling part.

2.1 Adaptive Hypermedia System

If we started to talk about the personalised learning from the angle of information technology sciences which give the foundation for realizing this activity in a web-based context, it would be inevitable to start with the study of Adaptive Hypertext Systems (AHSs). AHS is defined as all hypertext and hypermedia systems which can display the traits of the users by collecting the user model and present different links or contents to different users according to the model (Spector et al., 2014). In other words, in an Adaptive Hypertext System, different links or content will be presented to different users based on the user's data which have been gathered from their previous using. The user's data including their own preferences, goals, knowledge backgrounds, etc.; the content and links in AHSs always consist of hypertext and hypermedia. The contents on AHSs are always adaptable, learners can choose among them; the systems are adaptive to deal with the diverse and updated preferences, abilities and backgrounds of the users, not only to provide support, but also to provide guidance (Spector et al., 2014).

Most of the research projects on a daptive hypermedia are located in five areas, they are educational hypermedia, on-line information systems, on-line help systems, information retrieval hypermedia systems, and institutional information systems. Among them, educational hypermedia is the most popular one (Brusilovsky, 1996).

In the educational hypermedia realm, the adaptive hypermedia can be useful to solve the problems like, provide an easier comprehensive knowledge or offer more guidance to a novice learner (Brusilovsky, 1996).

In personalised learning, three kinds of adaptations have been applied by AHSs, they are content level adaptation, presentation level adaptation, and navigation level adaptation (Magoulas & Chen, 2006). However, content level adaptation and presentation level adaptation actually belong to the same family: adaptive presentation (Brusilovsky, 1996).

Adaptive presentation is defined as adapting the content of a web page to meet the knowledge level, learning goals, interests and other traits of a user (Brusilovsky & Pesin, n.d). In other words, the content which the individual user will get access to depends dramatically on their knowledge levels, goals, interests and other traits or preferences. Not only the texts, but also the layout and different kinds of multimedia items can be adjusted to present the individual learners with different contents even within the same web page according to their own backgrounds or needs (Magoulas & Chen, 2006).

Therefore, the goal of the adaptive presentation is to adapt the content of a hypermedia page to the learner's goals, knowledge, preferences, and other information stored in the user model. The techniques include not only adapting the text but also different kinds of multimedia items. (Spector et al. 2014)

Navigation level adaptation is defined as adapting the navigation routes of a web page according to the certain factors of a user. The techniques include direct guidance, link annotation, adaptive sorting and link hiding (Brusilovsky & Pesin, n.d). The

classification of the adaptive navigation techniques depends on the ways that they would like the adaptive links to orientate, guide or restrict the users (Mourlas & Germanakos, 2009).

Direct guidance techniques may give the hints or suggestions for the users to proceed the next stage according to their goals and knowledge backgrounds. *Adaptive annotation* gives the user visualized guidance or cues to show their status behind the links. One example can be the "done" and "undo" icons. *Adaptive hiding* normally hides the irrelevant links to reduce the cognitive load of the user. *Adaptive sorting* rearranges the non-contextual links to fit the specific context of the users (Brusilovsky & Pesin, n.d).

The goal of adaptive navigation support is to assist learners in finding their optimal paths in hyperspace by adapting link presentation and functionality to goals, knowledge, and other characteristics of individual learners (Spector et al. 2014).

So far, the adaptive hypermedia systems and its taxonomies have been discussed. However, if we would like to apply the AHSs in personalized learning, there are three essential elements which need to be considered. They are the user model, the domain model and the interaction model (Martins, Faria, Carvalho and Carrapatoso, 2008). The researches of the latter two are mostly focused on the information technologies, but the research of the user model can be cross-disciplinary (Nurmi & Laine, 2007). Therefore, only the study of user model will be discussed in this paper.

2.2 User or Learner Modeling

The *user model* can be described as the storage of a user's information which is indispensable for an adaptive system to function differently for different users. The process of operating differently for different users is also called *adaptation effect* (Brusilovsky, Kobsa & Nejdl, 2007). In other words, in order to make an adaptive

hypermedia system operate, the user's information are inevitable to be collected. That information are called user model for technologists.

Therefore, the processes of composing, maintaining and applying users' models are u*ser modeling*. These processes collect data by conducting either explicit method (e.g.ask the information from the users), implicit method (e.g.tracing the data), or both methods to gain an up-to-date user model (Brusilovsky et al. 2007).

As a matter of fact, *user modeling* and *adaptation effect* are bond to each other. On the one hand, in order to achieve the adaptation effect, the system must have representations of the relevant aspects of a user. On the other hand, the adaptation effect crucially decide the the amount and the nature of the information represented in the user model (Brusilovsky et al. 2007, p.3). Therefore, in a personalized learning environment, if we would like the systems to provide an adaptation effect to the individuals, we need to make efforts on user modeling. The next question goes to what should and could be captured during user modeling.

There are many studies discussing the features which should be modeled for the users. For example, the goals, the knowledge background, the traits, and the preferences of the individual user.

Martins et al. have classified the data which should be collected for user modeling into two categories, they are: the *Domain Dependent Data* and *Domain Independent Data of* the learners (2008).

For Domain Dependent Data, it refers to the systems' judgments on users' possessed knowledge on the specific domain. This category includes components like task level, logical level and physical level (Martins et al. 2008). In a personalised learning environment, for example, the task level could be tailored according to the learner's fulfillment of previous assignments.

For Domain Independent Data, it includes two elements: the psychological model and the generic model. The psychological data are the relevant cognitive and affective aspects of the student while the data involve the user common knowledge, interests, and background are kept as generic model of the user's profile (Martins et al, 2008).

We can see from the above classification, the results of the DDD sometimes may also rely on the tests of the DID.

Brusilovsky et al. (2007) claimed that they "can distinguish models that represent features of the user as an individual from models that represent the current context of the user's work" (p.5), but the information of a student is not always remained as static and independent (Martins et al. 2008). For example, both DID and DDD include the data of a student's knowledge, named as background knowledge and acquired knowledge respectively. That means not all the data are sharing the same nature, some are more permanent, some are not; some contribute more to the adaptation effect, some are not. In other words, there are some features deserve more studies than the others.

The classification which made by Martins et al.is more specific for Educational AHSs. For the information technologists, there are also some factors which are more import than the others. For example, in the article of Brusilovsky et al. (2007), they underline five most essential features for user model. They are user's knowledge, interests, goals, background, and individual traits.

User's knowledge

User's knowledge can be treated as the most important feature for existing AEH and AHS (Brusilovsky et al., 2007), it can decide what kind of content will be presented to the user to a large extent. The systems can have content and navigation adaptations according to the users' acquired knowledge level (novice-beginner-intermediate-expert) of a specific subject.

User's Interests

Due to the incredible growth of the information volumes, users get more freedom to select their learning subject or platforms according to their own interests, which makes the interests of a user become as important as the user's knowledge. A simple keyword searching can give a hint to the AHSs what could be the next information to show on the screen. Moreover, the techniques to collect the data of a user's interests are more precisely than the ones for a user's knowledge (Brusilovsky et al., 2007).

User's goal

The user's goal is the most immediate and changeable feature among these five, and it is hierarchical (Brusilovsky et al., 2007). According to Brusilovsky et al., "depending on the kind of system, it can be the goal of the work (in application systems), an immediate information need (in information access systems), or a learning goal (in educational systems)" (2007, p.10). The system's work is to find out the current main goals, and then make the adaptation for the users.

Comparing with the above three features, the following two are more stable.

User's backgrounds

User's backgrounds include a range of features about the users, such as the user's specialties, work experiences, and acquired knowledge and views of a specific domain. One common example could be the language ability. This feature is mostly used for the content adaptation (Brusilovsky et al., 2007).

Individual traits

The individual traits include the factors like the individual's personality traits, cognitive styles, cognitive factors and learning styles. However, current works are basically focuses

on cognitive styles and learning styles (Brusilovsky et al., 2007). The study in this part is interdisciplinary.

Cognitive style

Cognition is people's mental processes collection which includes his awareness, perception, reasoning, and judgment of the external world. Cognitive style is then the person's preferred and habitual styles of digesting and organizing the external information. It represents part of people's personalities and cognitive processes. (Stannard, 2003)

There are different theories about cognitive styles, for example, the theories of reflection-impulsivity, theories of field dependence – field independence, theories of holist – serialist, and theories of deep level - surface level processing (Stannard, 2003). However, the one referred mostly for adaptive hypermedia researchers are Witkin's field-dependent / independent and Pask's holist / serialist (Brusilovsky et al, 2007). In this paper, only the theory of field-dependent and independent will be discussed.

On the one hand, field dependent individuals are more holistic oriented, while the field independent individuals are more analytic and serialistic oriented. Field dependent individuals are more likely distracted by the surroundings and their learning outcomes rely more on the interaction with the others. On the other hand, the field independent individuals' learning is more self-directed and can solve the problems by their own analytical approaches (Sims & Sims, 2005).

From the definition we can see that the cognitive style will affect people's way to get information and it will also affect people's searching and browsing behaviors, so for a AHS or a AES, it will affect more for the navigation adaptation (Brusilovsky et al., 2007).

Learning styles

Learning styles normally are defined as the way people prefer to learn or process information. It represents the strategies that people preferred to take for learning and information processing (Stannard, 2003).

Both cognitive styles and learning styles are psychological concepts which represent the ways people perceiving and processing information, many studies even treat cognitive style as a synonymy with learning style, but learning style is more changeable and dependent. Besides that, the study of learning style is more closely connected with the learning circle, and the learning circle is also one important concept which is applied to user modeling. Therefore, the learning styles will be treated as the main measurements for the individual traits later in the data collecting of this research.

There are different models to measure people's learning styles. For example, Kolb (1984) worked out a four-stage experiential learning cycle which starts from concrete experience, reflective observation, abstract conceptualization, to active experimentation. Based on the above four learning stages, Kolb defined four learning styles which are: diverging, assimilating, converging and accommodating (1974). Besides that, there is also Felder & Silverman's model which divide the category into intuitive / sensitive, global / sequential, visual / verbal, inductive / deductive and active / reflective. The model divided people into 32 learning styles (Felder & Silverman, 1988). Moreover, there is also the theory of Stangl which distinguished learners as acting, hearing, reading or seeing learner.

In this paper, the Felder-Silverman Learning Style Model will be discussed and applied. On the one hand, it is the most widely used theory in the design of adaptation learning systems. On the other hand, the theory has some convergence with the theory of cognitive styles which would make the research easier to implement.

In Felder & Silverman's theory, there are five different dimensions have been discussed. Sensing and intuitive is the dimension which distinguishes people from the way they perceiving the world. Sensitive people observe and gather data by their senses; while

intuitive people observe the world unconsciously through their speculation, imaginations, etc. Therefore, the sensitive people prefer data, fact, and experiments while the intuitive people favor theories and principles (Felder & Silverman, 1988).

Visual and auditory learners are different from the ways that they receive information. Visual learners prefer pictures, diagrams, demonstrations instead of the texts or other word explains; while auditory learners digest the information better when it is presented in the verbal forms. Except that, explaining things to others could also be an effective way for auditory learners to learn (Felder & Silverman, 1988).

Inductive and deductive are two different reasoning progressions conducted by different people. On one side, for inductive people, they work from specific observations to general theories, they infer principles; on the other side, the deductive people work from border generalizes to particular hypothesis and they deduce consequences (Felder & Silverman, 1988). This dimension is not only discussed in people's learning style but also classified as the scientific methods for reasoning. In the design of questionnaire, this dimension has not been applied since most of the later studies do not conclude this dimension and it has not been included in the I*ndex of Learning Styles Questionnaire* either.

Sequential learners perceive information in a sequence way, learn things step by step. They can start to deal with things without totally understand them and are good at convergent thinking and analysis. Global learners, however, need an overall picture before they starting to learn the specific knowledge. They process information in a non-linear way and are strong in divergent thinking and synthesis (Felder & Silverman, 1988).

Active and reflective dimension discuss the different methods of how people apply perceived information into practice. Active learners prefer to learn by performing,

discussing and applying and working in groups; while reflective learners prefer to learn by thinking and working alone (Felder & Silverman, 1988).

According to Brusilovsky et al., most of the study on learning style adaptation were applied on content-level adaptation; moreover, there are prominent correlations between student learning styles and interface formats (2007).

There are still not enough practical researches and suggestions for effectively connecting leaning style with the AHSs/AESs. Hence, it remains the benefit and potential to study it (Brusilovsky et al., 2007).

2.3 Adaptive Instruction Framework

Different from other e-learning websites or media, the providers of MOOCs offer various platforms for the international elicit universities to implement their classroom courses online. This special teaching and learning model make the course design become an essential issue.

According to Khan, Web-based instruction (WBI) could utilize the resources and features of World Wide Web to provide a meaningful learning environment based on its hypermedia system(2000). This kind of learning environment should include different resources, not only to support a collaborative learning environment, but also to support the implement of web-based activities and personal differences (Khan 2000).

When designing a learning activity, there are five main issues to consider: authenticity of the activity, formality and structure, retention/reproduction versus reflection/ internalization, the role and importance of other people, and locus of control (Beetham and Sharpe, 2007).

When discuss about locus of control, Beetham and Sharpe mentioned that the ideal learning environment for a learner is when they are more response for their own and others' learning progress, rather than they are strongly guided to achieve the learning goals (2007). That leads us to the learner-centered learning in which the learners are treated as active participants instead of passive recipients.

Current educational practice is more described as 'learner-centred' instead of teacher-centered. Every individual learner carries his own preferences, priorities, different requirements for support and conducts his own approaches to learn.

This paper has cited one instruction framework (Magoulas & Chen, 2006) which can be applied together with an AES in the web-based learning environment.

The main purpose of this framework is to provide the instructional decision supports which maintain the design of adaptation and learner-system interaction in the context of an AES for the researchers with the educational backgrounds. In that case, learners have more opportunities to control the learning activities from all aspects of goals, instructions, assessments and contents (Magoulas and Chen, 2006).

This instructional framework is based on the study of the instructional science and cognitive science (Magoulas & Chen, 2006). Besides that, the framework also includes highly constructivist approaches and prescriptive approaches (Magoulas & Chen, 2006).

Jonassen et al. once pointed out that the initial acquisition phase (the early age of an individual) is better served by classical instruction design techniques while complex and constructivist environments work better for advanced knowledge learners (college-level or university-level students) (1993). For the classical instruction design, when we think about the learning outcomes, normally we will think out the development of those skills: intellectual skills, cognitive strategies, verbal information, motor skills and attitudes.

However, the target groups of MOOCs are mostly college students and people who are working already. Those groups of people already acquire the 'basic skills' and can be treated as advanced knowledge learners. Therefore, a complex and constructivist environment is more suitable for them.

Constructivism is not only about how people learn, but also discusses the nature of knowledge. (Harasim, 2014). Constructivist pedagogy focus on the learner or group of learners, instead of instructional designer or instructor; moreover, it "emphasis on the active 'construction' -- rather than the passive reception or acquisition of students' knowledge" (Friesen 2009, p. 81). In other words, learners are the locus in constructivist learning theory.

Table 2. Magoulas and Chen's adaptive instruction framework

Framework elements	**Design guidelines**
Learning goals *The main topic of the curriculum are presented as learning goals enabling learners to select the one they prefer or need to study*	Define a set of learning goals from the fundamental topics of the curriculum in a way that can be recognized and selected even by a novice learner independently of his/her previous selections. Provide learners with the option to select a learning goal to study according to their needs and preferences. For each goal provide relevant learning outcomes, information about its fundamental concepts, and a brief overview, in order to support learners in selecting the one to study.

Instructional approaches *Different instructional approaches are provided to learners enabling them to select the one most appropriate to their knowledge and preferences*	Define a set of instructional approaches, which differ in the amount of structure, learner control and support provided to learners. Provide learners with the option to select an instructional approach. For each one provide a brief overview of the main idea and its functionality, in order to support learners in selecting the most appropriate. -- individualized content following learner's profile -- individualized support following learner's profile -- multiple assessment opportunities -- meaningful tasks and activities in which learners take an active role -- collaboration opportunities
Assessment *Multiple assessment Opportunities are provided aiming to (i)stimulate learners to assess the quality, quantity and retention of their learning, and (ii)support the system's adaptation by providing data for the learners' progress*	-- Provide self-assessment opportunities in the educational content through a plurality of assessment tasks that actively engage learners and stimulate them to assess and record their own progress and study accordingly (formative assessment) -- Provide formal assessment aligned with the content in order to assess retention of learning following special criteria given in terms of objectives and competences which state what learners must achieve (summative assessment-criterion-referenced assessment) -- Provide feedback to learners' answers in order to support the learning progress, provoke refection on and articulation of what was learned. Feedback to learners' answers might include different types of information such as comments on the correctness, precision, and timeliness of the answers, learning guidance, motivation messages, lesson sequence advisement, critical comparisons, learning focus (Sales, 1993; see also the chapter "An Adaptive Feedback Framework to Support Reflection, Guiding and Tutoring" in this book).

Content *The educational content includes all the concepts important to the curriculum and comprise of multiple independent modules which can be re-used by different instructional approaches*	-- Define a set of learning goals derived from the fundamental topics of the domain (see above for a more detailed description). -- For each leaning goal build a conceptual structure based on design principles extrapolated from instruction theory. This structure should include all the necessary concepts comprising the goal and their interrelations. -- Develop educational material or each domain concept to support learning/ achievement of special skills/ performance levels. Develop multiple knowledge modules of different types of educational resources as well as authentic and meaningful tasks that may support multiple instructional approaches. -- Organize and present the content in hypermedia form.
Individualized support *Individualized support is provided following learner's individual differences and needs, aiming to advice instead of directing learners*	Support learners in taking control over the instructional process and the adaption. Provide learners with information about the different functionaries of the system that lead to the adaptation and about the influence of their actions on the system's functions. -- Support learners in accomplishing their tasks by providing individualized content, guidance, and navigation advice. Learners should be allowed to decide on their next steps and not be restricted to follow system suggestions.
Learner control opportunities *Learner undertake an active role in the learning process and they are allowed to take varying levels of initiative*	Provide learners with the options to: -- decide what to learn; -- decide how to learn; -- decide when to learn; -- control the adaptation; -- control the amount of control;

For a personalised learning environment, personal learning goals could be different from the general goals which are designed for the entirety. Personal learning goals are the the behaviors, knowledge or understandings which the individual learner recognized for their own learning. (*Personal Learning Goals*, 2016). Besides that, in a meaningful learning environment, goal-oriented is also one important factor, which gives students the freedom to define their own objectives.

Setting the learning goals could be a good start point and importance process for an effective instruction. Nevertheless, as we have discussed in the part of *User Modeling*, the goals are always changeable and can be hierarchical; moreover, there are also some differences between learning goals and leaning objectives. For a MOOC's learner, the questions about the goals come to them even before taking one specific course, for example, taking the courses for interests or for professional skills development. However, the study for the goal in this part is within one course.

The levels of instructional approaches can be ranging from an instructional model, a broad approach, to an instructional skill, which represents a specific teaching behavior or technique (*Instructional approaches handbook,* 1991*)*

In instructional models, there are models like, information processing, personal, social interaction and behavioral. For instructional strategies, teachers can use direct, indirect, interactive, experimental and independent study methods which would rely on ongoing students' assessment which are linked to learning objectives and processes. After that, for the instructional methods, there are varieties of methods which link to different instructional strategies. Some examples can be, lecture, simulations, inquiry, case studies, cooperative learning, learning contracts, debate, etc. Besides that, there goes to the most specific level, the instructional skills. Some examples are: planning, presenting, questioning, demonstrating, direction-giving, and evaluating (*Instructional approaches handbook,* 1991*).*

Assessment is also one indispensable factor for effective learning. However, since there are different learning theories, the theories with regard to the place of assessment in education can also be varied. Educators can evaluate the learners' cognitive abilities, intelligent skills, specific knowledge acquisition, etc. according to the original learning goals.

In this frame work, there are two important types of assessment are mentioned, formative assessment and summative assessment (Magoulas & Chen, 2006).

On the one hand, formative assessment always execute in the middle term to test what the learners are already knew in the process of making meaning of new content (Foxbright, 2016). Therefore, based on the student understanding and performance, the assessments can give useful information for the processing learning activities or other improvements. Apart from that, the way to take formative assessment can be either as informal as observing the learner's work or as formal as a written test. In this case, formative assessment can be the most powerful type of assessment to improve student understanding and performance for the later learning (Foxbright, 2016).

On the other hand, the summative assessment normally takes place at the end of a school term, the results are primarily for the teacher's or school's use (Foxbright, 2016). Hence, it gives assessment information that is useful for making final decisions.

Besides the above three elements, there are also content, individualized support and learner control opportunities to constitute the instructional framework. For the content, the main idea is that the adaptive contents should be as various as the instructional approaches, in order to serve them. Individualized support is useful when individualized demands occur, the individual learners can be supported to accomplish their own goals and responsibilities to learn. For learner control opportunities, learners should be informed of the working systems of the instruments and have opportunities to affect the instructional process (Magoulas & Chen, 2006).

There are many different frameworks for instruction. However, the one has been discussed above is more specific for the adaptive system and will be used as one import theoretical support for the following research.

3. Research methodology

3.1 Questionnaire design and structure

In this research, quantitative questionnaire has been applied as the main method for collecting data. Quantitative research usually deal with figures, statistics, or other numeral variables to test the hypothesis which are formed on the basis of existing theories (Johnson & Christensen, 2008). Quantitative questionnaire normally mainly consists of the close-ended questions. Although open-ended question gives more freedom to the participants to respond and to provide various data, closed-ended question is more suitable for confirmatory research that the specific variable can be assessed and also the hypothesis can be tested (Cohen, Manion & Morrison, 2005). Besides that, questionnaire can be used to collect the information of the research participants' behavioral intentions, experiences, attitudes, feelings, believes, personality, knowledge, background and demographic information, etc. (Cohen, Manion & Morrison, 2005). In this research, the MOOCs learners' experience about personalised learning was the focus. However, instead of studying all the factors for personalised learning on MOOCs, this research adopted Brusilovsk's theories about adaptive hypermedia systems and user modeling, Felder and Soloman's theory of learning styles, Pask's theory of cognitive styles, and the framework of Magoulas and Chen's adaptive instruction to test the relevant factors. Therefore, this research had clear objects to test rather than explored new phenomena, so quantitative method was more suitable.

Apart from that, normally when the sample size are large, it is better to have a more structured, closed and numerical questionnaire (Johnson &Christensen, 2008). Due to the nature of MOOCs, it is one of the most massive arena for applying technologies in education, the quantitative questionnaire could help gathering large data.

The structured questionnaire (See appendix I) for this study has 40 items. For the first part, question 1-5 were designed for collecting the demographic data of the participant which can give the basic information about the participants to the researcher, as well as helping to check the validity of the data. For example, question number 2 and 3 asked the age and education backgrounds of the participants which could show if they had the intelligent ability to understand the questions, and also if they had the experience of taking college courses to give estimations about the course design (part 3 of the questionnaire). As we have mentioned earlier in introduction part, most of the courses on MOOCs are university level.

Part 2 was designed to test whether the *User Modeling* has been applied on MOOC platforms. Question 6 to 20 were about the relevance of individual's learning styles and cognitive styles with their learning experiences on MOOCs. It was based on Felder and Soloman's study. Question 6, 7, 9, 10, 12, 13, 15, 16 were took directly from the *Index of Learning Styles Questionnaire*. "If a relevant test is already available that measures the variables of interest to you, then you should seriously consider using it." (Johnson & Christensen 2008, p.202) Question 6 and 7 were testing whether they are active learners or reflective learners; and the question 8 was to test the relevance with their learning experience on MOOCs. Question 9 and 10 were testing whether they are sensing learners or intuitive learners; and the question 11 was to test the relevance with their learning experience on MOOCs. Question 12 and 13 were testing whether they are visual learners or verbal learners; and the question 14 was to test the relevance with their learning experience on MOOCs. Question 15 and 16 were testing whether they are sequential learners or global learners; and the question 17, 18, 19, 20 were to test the relevance with their learning experience on MOOCs.

Question 21 was to test the relevance of user's interests with their learning experience on MOOCs. Question 22 was to test the relevance of user's knowledge backgrounds with their learning experience on MOOCs.

Question 23 was an exploratory question about what are the important factors in the learners' views for the learning platforms to provide adaptation effects, and whether they are the same with which Brusilovsky has pointed out in his study.

Part 3 was about the implement of *Adaptive Instruction* on MOOCs. According to the framework which worked out by Magoulas and Chen in theoretical part, there are six essential elements for personalised instruction. They are learning goals, instructional approaches, assessment, content, individual support and learner control opportunities. Question 24 to 26 were checking whether the learning goals on MOOCs have meet the individual needs. Question 27 to 31 were testing whether the instructional approaches on MOOCs are enough for the learners to select an appropriate one for their own learning. Question 32 was to test whether there are enough (kinds of) assessments available on MOOCs to indicate the learner's progress data that the system can provide the adaptation for individual learners. Question 33 was to test whether the course content on MOOCs are various enough to be adopted into different instructional approaches. Question 34 and 35 were checking whether the learners can be provided with enough individualized technical and other supports when conduct learning on MOOCs. Question 36 to 39 were testing if the learner hold the main control of their learning, do they have the freedom to choose when to learn, how to learn, where to learn, and with who to learn.

Most of the questions were multiple choices; however, among them, question 27, 32, 33 were designed as rating scale. It was not only for improve the diversity of this questionnaire, but also for reducing the load of this questionnaire (otherwise, each of the selections would be an individual question). Besides that, rating scales gave the researcher a opportunity to combine a flexible response with the ability to determine frequencies, correlations and other forms of quantitative analysis (Cohen, Manion & Morrison, 2005).

Johnson and Christensen have pointed out the shorter and medium-length questionnaire achieve more and better responses (2008). Therefore, efforts have been made to keep the questions as short as possible on the base of fitting the research.

Open questions offer more freedom for the respondents to express their ideas and also to reduce the limitations of pre-set categories of responses(Cohen, Manion & Morrison, 2005). Therefore, although most the questions were close-ended, the question number 1, 5, 40 and the answer options for the question number 3 and 4 have been designed for free answers. Question 1 and 5 have designed as open questions because it would be more suitable for them. Question 40 and the answers for question 3 and 4 were giving the freedom to the participants to add any relevant information which they would like to give.

After the questionnaire generated, it is necessary to have pilot tests for it. Altogether 2 bachelor's degree students, one master degree student and one doctor degree students who have enough experience of using MOOCs for learning have been invited to take the tests, as well as one media education teacher has been invited to examine the questions. Feedback suggested to focus the questions of Part 2 on users' learning styles instead of all general data, so the change have been made. Some sophisticated or confusing questions have been modified or deleted after discussions. Some grammar mistakes have been revised and one question for the demographic part have been added to improve the credibility of the respondents. After that, since the questionnaire is a web test, one more bachelor degree student has been invited to check whether there are any technical mistakes and also to make sure if the questionnaire for the last version is understandable as a whole, as well as the approximate fulfilling time for the questionnaire.

3.2 Participants

This research studied the personal learning experience of individuals on MOOCs. Therefore, any people who has enough learning experience on MOOCs and has no

difficulties on understanding English could be a good participant for this study. The total amount of MOOCs learners who can understand English well are considerably huge, but it is not that popular in Finland. Due to the geographic limits, it was not easy to reach a reasonable number of participants on real life and thus, the open and closed MOOCs learning group on different social media became the priority for distributing the questionnaire.

A closed MOOCs learning group which with 13092 (till April 26th) group members and named "Exploring English MOOC Group" on Facebook has been chosen. Besides that one, the public link for the questionnaire has also been distributed on a MOOC community on GOOGEL+ which named "Massive Open Online Courses" and with 2563 members (till April 26).

Although the link exposure rate on those social media groups could be high, but still the answering rate were quite poor. That was why this questionnaire has also been attached with the Lapland University mailing list. Both locally and internationally students who from the university and have been included in the mailing list could see the questionnaire and voluntarily participated in.

Apart from that, invitation letters have also been send to the individual Chinese students who are the friends of the researcher and have the experience of using MOOCs. Moreover, some of the participants have also furthered the questionnaire to their acquaintances who are interested in the research topic.

Earlier studies shown that "most MOOC users are already well educated" and "most typical course registrant hold a bachelor's degree". (*Who uses MOOCs and how*, 2014) Therefore, this information to some extent has guaranteed the age and intelligent backgrounds of the learners. In other words, most of them would be above 18 and have fulfilled the basic education. Besides that, most of them would have enough experience

with college or higher level lectures which make them more qualified for the questions of part 3, adaptive instructions.

To sum up, the research participants were 30 volunteers who have experiences of using MOOCs for learning and are capable of understanding and evaluating the questionnaire. There was no invasion of privacy or enforcement to complete the questionnaire, and the participants were aware of that their answers will be treated confidential and only for academic purpose.

3.3 Data collection methods and sampling

As mentioned earlier, the quantitative questionnaire was used as the data collection method in this research. Questionnaire is preferred because that it is financial economic and time efficiency when the represents are widely distributed (Mathers, Fox & Hunn, 2017).

The Webroprol, a professional survey maker has been adopted for making the questionnaire. This application has enabled the applying of different types of response categories in the questionnaire, as well as a neat and properly organized questionnaire. After the questionnaire has been made, an official website for this questionnaire would be generated. The researcher could choose to use private email, public website, or both methods to collect the data. In this research, only the public website link has been used for the date gathering due to the uncertainty of the prospective participants. Besides that, this instrument could be also used for tracing the data. On the module of “To survey folders”, the survey status, the number, and detailed information of received responses could be checked.

At the beginning, the researcher has send individual emails to three primary MOOC platforms, Coursera, Edx, FutureLearn, to consult if the questionnaire can be distributed

in any area of their websites. For example, the discussing forums of some specific courses, the blog pages. Unfortunately, the answers were negative.

After that, the open and closed MOOCs learning groups on Facebook became the main targets. Besides those, the open MOOCs study community on Googel +, as well as the twitter have also been included as the social media platforms for collecting the data.

Normally a covering letter should be attached together with the questionnaire. It explains the basic information about this questionnaire: the purpose, and data collecting methods of this questionnaire, the researcher's backgrounds, the consent issues and the benefits for the participants to answer the questionnaire, etc. (Mathiyazhagan & Nandan, 2010). However, in this case, for the above social media platforms, some introducing words which take the same function as a covering letter have been composed at the beginning of the questionnaire and been sent out together.

However, self-administered surveys achieve very low response rates, less than 50% of the original simple is the normal case (Visser, Kroseick and Lavrakas, 2017, p.244). Especially, the feedback which were collected from the pre-test stage have pointed out that the questionnaire was not easy to answer. Hence, in reality the answering rate was quite poor at that moment.

Therefore, another collection method has been adopted, snowball sampling. Some participants who reached the qualifications of taking this questionnaire have either been asked or volunteered to contact other potential participants to join in this research. As Johnson and Christensen have pointed out, "this sampling approach can be especially useful when you need to locate members of hard-to-find populations or when no sampling frame is available." (2008, p.239)

In a nutshell, the multi-phase sampling (the data collection have been through different phases, the selection criteria for them are different), convenience sampling (nearest

individuals, the student from university of Lapland have been chose for participating as well) and purposive sampling (although random sample have been included, the researcher specified the criteria first) were all applied as the sampling methods in this research, as well as the snowball sampling (Cohen, Manion& Morrison, 2005).

3.4. Data analysis methods

In order to analyze the data, a statistic analysis software, IBM SPSS (Statistical Package for the Social Sciences) version 22 has been applied in this research. The first stage was data entry, the researcher needed to name the valuables, put them into different categories, named the value labels, decided the values for the answers and defined the missing data. After that, the research could start to import the data and divided the fields of the statistics.

In quantitative data analysis, the researchers are dealing with the numerical data. This kind of data can be further divided into descriptive statistics and inferential statistics. Descriptive statistics are the ones which "focus on describing, summarizing, or explaining the data" (Johnson & Christensen, 2008, p.464.); however, inferential statistics "go beyond the immediate data and infer the characteristics of populations based on samples." (Johnson & Christensen, 2008, p.464.) In other words, for descriptive statistics, the researcher does not need to hold estimations or hypothesis before analyzing the data.

In this study, most of the data have been treated as descriptive statistics. In order to "convey the essential characteristics of the data", the research need to arrange the data into a more interpretable form" (Johnson & Christensen, 2008, p.465). In other words, the researcher can generate frequency table, cross tabulation tables to calculate numbers, compare mean values, measure the spreads, etc. In this research, the data of respondents' demographic characteristics, the data for the second research question and the data for

some other relevant factors have all been treated and analyzed as descriptive statistics. The frequencies, mean values and correlations have been examined and discussed.

However, the data for the main part of first research question, the relations between users' learning styles and adaptation effects of MOOC platforms have been treated as inferential statistics. A sample of 30 respondents have been collected and analyzed. Several null and alternative hypotheses tests of the sample have been analyzed as inferences for the whole population. Although the conclusions drew from the samples might be wrong, "the solution provided by inferential statistics is that we can assign probabilities to our statements, and we can make conclusions that are very likely to be correct." (Johnson & Christensen, 2008, p.495.)

Apart from the analyzing methods, the collected data for this research have also been carefully examined for the reliability and validity, as well as the missing data. All the questions are relevant to the research topic, and those questions concerning the users' learning style are adopted directly from the *Index of Learning Styles Questionnaire* test.

Since all the other close-ended questions, except the question 22 and some open options, were designed as mandatory questions, only the open-ended questions were needed to be checked for the missing data. They have been checked and discussed in following part.

4. Results and discussions of the Study

4.1 Demographic Characteristics of Respondents

In this part, the demographic characteristics of the respondents will be presented. The demographic variables which including the nationality of the participants, the age of the participants, the educational backgrounds of the participants, the most frequently used MOOCs' platforms and the year range of using MOOCs' platforms for learning. Those data would not only give the information about the participants, but also help the researcher to examine the validity of the data, whether the participants are qualified to participate in this research. Detailed analyses will be showed on following.

4.1.1. Nationality of Respondents

The collected data shows that most of the participants of this study are coming from China, which accounts for 56.7% of the total number. After that, the Finnish participants take the second place with 5 participants which constitutes 16.7% of the whole number. Besides that, the data also shows that almost all the participants (with only one exception) are coming from the Eastern hemisphere. More detailed information are presented in

Table 1. **TABEL 1. Nationality distribution of respondents**

	Frequency	Percent
China	17	56,7
Finnish	5	16,7
Spanish	1	3,3
Brazilian	1	3,3
Syrian	1	3,3
Turkish	1	3,3
Vietnamese	2	6,7
Russian	1	3,3
Pekistan	1	3,3
Total	30	100,0

4.1.2. Age of Respondents

The questionnaire has divided the participants into different age groups instead of asking the exact age numbers. Therefore, from the data which has been collected, we can see that the majority group is the one from 25-34 years old, which take the account of 63.3%. The numbers from the age group of 18-24 and the age group of 35-54 are close to each other, with 6 and 5 numbers respectively. However, there are five age groups altogether in the questionnaire, only three of them have been chosen. In other words, the people who are under 18 or who are above 55 take a few ratio of the whole MOOCs' market.

TABLE 2. Age distribution of respondents

	Frequency	Percent
18-24	6	20,0
25-34	19	63,3
35-54	5	16,7
Total	30	100,0

4.1.3. Educational Backgrounds of Respondents

The results in Table 3 show the educational backgrounds of the participants which also reflect which group using MOOCs most frequently. The table has shown that the people who have obtained the bachelor's degree are the majority participants. The proportion for them is 60% of the total number. The one behind are the people who have the master's degree with 10 participants (33.3%).

TABLE 3. Educational backgrounds distribution of respondents

	Frequency	Percent
Bachelor's degree	18	60,0
Master's degree	10	33,3
Vocational training	1	3,3
College	1	3,3
Total	30	100,0

4.1.4. Platforms of Using MOOCs

As we have already discussed in the introduction part, Coursera, edX, Udacity are the most prevalent platforms and also the initiators of MOOCs. However, there are also one or two main platforms for each country. The collected data in Table 4 also proved it. Coursera is the main tool for MOOCs' learners with 16 participants, it accounts for 53.3% of the total number. After it, there are edX and FutureLearn. There are also 4 people who chose 'others', the additional answers are "icourse163", "Aalto Yliopisto" and "WangYi Open Course". On belongs to Finland, the other two are Chinese MOOCs' platforms.

TABLE 4. Platforms distribution of using MOOCs

	Frequency	Percent
Coursera	16	53,3
edX	5	16,7
FutureLearn	4	13,3
Others	4	13,3
Udacity	1	3,3
Total	30	100,0

4.1.5. Time of Using MOOCs

The information of how long the participants have applied MOOCs' platforms for learning would help to check if they are qualified enough to answer the questionnaire. From the table we can see, the measurement unit is "year", the maximum number is 5 year, and the minimum number is 0.1 year which would be around one month. Besides that, the average using time of the participants are around 2 years and 5 months. The standard deviation is small, 1.58386, which means the data are not very spread out. Moreover, the valid number is 25, which means there are 5 people have not given an exact number. One of them said "I was on MOOCs for some moments several years ago." Which is difficult to count the exact time and there are another 2 people in the same situation. Besides that, there are 2 people left this part with no answer.

TABLE 5. Time range of Using MOOCs

	N	Minimum	Maximum	Mean	Std. Deviation
Years of using MOOCs	25	,10	5,00	2,3880	1,58386
Valid N (listwise)	25				

4.2. Individual Differences Presentation on MOOCs

4.2.1. Learning styles and cognitive styles

In order to know if there are correlations between the MOOCs' users learning styles and their learning experiences on MOOCs, we need to know the users learning styles first. Instead of asking the participants to filling a standard learning styles test, 2 questions have been used to test each dimension.

Started from this part, the two hypotheses would be tested.

1) The null hypothesis:

H_0: Users of MOOCs do not have preferred learning styles

2) And the alternative hypothesis against the null hypothesis:

H_1: Users of MOOCs do have preferred learning styles

From table 6 we can see that, 75% of respondents who 'prefer to study in a study group' have also chose to "try it out", which means there are consistencies within their learning styles. Those learners who chose study 'in a study group' and also chose 'try it out' are the active learners; the opposite one are reflective learners. However, half of the people who chose 'study alone' have chosen 'think it through' which makes it hard to tell whether there is a consistency within learning styles or not. However, the total shows most of the respondents are active learners.

TABLE 6. Cross tabulation of active learners and reflective learners

		You prefer to study		
		in a study group	alone	Total
You understand something better after you	try it out	6	11	17
		75,0%	50,0%	56,7%
	think it through	2	11	13
		25,0%	50,0%	43,3%
Total		8	22	30
		100,0%	100,0%	100,0%

The Table 7 shows that there are consistencies within sensing learners and intuitive learners. For example, the respondents who 'find it easier to learn facts" are also more 'likely to be considered meticulous with the details of their (you) work' (57.1%). The respondents who 'find it easier to learn concepts" are more 'likely to be considered creative about how to do their (your) work' (65.2%). Moreover, the total number tells that the majority of the respondents are intuitive learners.

TABLE 7. Cross tabulation of sensing learners and intuitive learners

		You find it easier		
		to learn facts	to learn concepts	Total
You are more likely to be considered	meticulous with the details of your work	4 57,1%	8 34,8%	12 40%
	creative about how to do your work	3 42,9%	15 65,2%	18 60%
Total		7 100,0%	23 100,0%	30 100.0%

The Table 8 shows that there are consistencies within visual learners and verbal learners. The respondents who think they 'remember best of what they (you) see' also more prefer 'to get new information in pictures, diagrams, graphs or maps' (56.5%), which means they are visual learners. On the other hand respondents who prefer to get new information in written directions or verbal information also think they remember better 'what they (you) hear' (57.1%). On the whole, visual learners overtake the verbal learners among the respondents.

TABLE 8. Cross tabulation of visual learners and verbal learners

		You remember best		
		what you see	what you hear	Total
You prefer to get new information in	pictures, diagrams, graphs, or maps	13 56,5%	3 42,9%	16 53.3%
	written directions or verbal information	10 43,5%	4 57,1%	14 46.7%
Total		23 100,0%	7 100,0%	30 100,0%

Table 9 gives a different result from the above tables. The majority of the respondents (22) think when they learning a new thing, they tend to 'understand the overall structure but may be unclear about details', both of the rates are high (75.0% and 72.7%). Therefore, it is hard to tell whether there are sequential learners or serialistic learners among them. The results (errors) might be aroused by the confusing of the questions in the row. However, in this case, we may still draw the conclusion that there are more global and field-dependenlearners among the respondents.

TABLE 9. Cross tabulation of sequential learners and global learners (field-independent learners and field-dependent learners)

		Some teachers start their lectures with an outline of what they will cover. Such outlines are		
		not helpful or somewhat helpful to you	very helpful to you	Total
When learning a new thing, you tend to	understand details of a subject but may be unclear about its overall structure	2 25,0%	6 27,3%	8 26,7%
	understand the overall structure but may be unclear about details	6 75,0%	16 72,7%	22 73,3%
Total		8 100,0%	22 100,0%	30 100,0%

To sum up, most of answers show consistencies with the related ones, which means the null hypothesis for first three dimension could be rejected. In other words, we could draw the conclusion that most of the respondents have preferred learning styles.

Therefore, in the following analyzing, in order to have a more valid results, only one of the each two questions which test the four dimensions of user's learning styles would be

applied to test the adaptation effects on MOOCs. On this part, the the second null and alternative hypotheses would be adopted and tested.

1) The null hypothesis:

> *H0: User's learning styles and cognitive styles do not lead to adaptation effects (content or hyperlink differentiation for different learners) on MOOCs.*

2) And the alternative hypothesis against the null hypothesis:

> *H_1: User's learning styles and cognitive styles do lead to adaptation effects (content or hyperlink differentiation for different learners) on MOOCs.*

TABLE 10 Cross tabulation of Active, Reflective learners and Adaptation Effect on

		You understand something better after you		
		try it out	think it through	Total
After you have learned something on MOOCs, you normally	have the chances to discuss it within a group or receive some problem-solving tests	1 5,9%	2 15,4%	3 10.0%
	are requested to write some reflective logs or take other independent tasks	4 23,5%	4 30,8%	8 26.7%
	Both or neither of them	12 70,6%	7 53,8%	19 63.3%
Total		17 100,0%	13 100,0%	30 100.0%

Firstly, we can take a look on Table 10. There were altogether 17 respondents thinking they "understand something better after they (you) try it out", which means they are active learners. If the courses on MOOCs gave those more chances to discuss the new knowledge within a group or gave them more problem-solving tests, the platforms have adopting adaptation effects and the courses have adjusted for the personal needs. That is

to say, if those 17 participants chose the first option in the row, there were adaptation effects on MOOCs; if they chose the other two options on the row of the table, there are no adaptation effects on MOOCs. Therefore, for this case, we can see, only 5.9% respondents have chosen the first option which means the adaptation effects have not been applied for MOOCs courses.

TABLE 11 Cross tabulation of Sensing, Intuitive Learner and Adaptation Effects on MOOCs

		You are more likely to be considered		
		meticulous with the details of your work	creative about how to do your work	Total
When you take a course on MOOCs, you can always find enough	concrete material	3 25,0%	1 5,6%	4 13,3%
	abstract material	2 16,7%	3 16,7%	5 16,7%
	both or neither of them	7 58,3%	14 77,8%	21 70,0%
Total		12 100,0%	18 100,0%	30 100,0%

The same goes to Table 11. For those participants (12) who thought "they (you) are more likely to be considered meticulous with the details of your work", if they thought they could always "find enough concrete material" on MOOCs, it means that there is a correlation between their learning styles and adaptation effects on MOOCs. However, the number were only 3 (25.0%), so we failed to reject the null hypothesis.

Table 12 shows that the visual learners (who "prefer to get new information in pictures, diagrams, graphs, or maps") were the majority of the participants (16). However, only 3 of them (18.8%) thought they can find enough "diagrams, graphs, pictures to support

their (your) learning" on MOOCs. Therefore, we draw the conclusion that there is no correlation between their learning styles and the adaptation effects.

TABLE 12 Cross tabulation of Visual, Verbal Learner and Adaptation Effects on MOOCs

		You prefer to get new information in		
		pictures, diagrams, graphs, or maps	written directions or verbal information	Total
when learning on MOOCs, normally you can find enough	diagrams, graphs, pictures to support your learning	3 18,8%	1 7,1%	4 13.3%
	videos or other kinds of words' materials to support your learning	5 31,3%	4 28,6%	9 30.3%
	Both or neither of them	8 50,0%	9 64,3%	17 56.7%
Total		16 100,0%	14 100,0%	30 100.0%

Table 13 tells us that most of the respondents are global and field-depende learners (22). However, only 6 among them had the experience of being given "an overall picture and relate the material to other subjects" by the instructors which the number was below half of the total number. Hence, the null hypothesis also cannot be rejected for this one.

TABLE 13 Cross tabulation of Sequential, Global learners (Field-independent learners and Field-dependent learners) and Adaptation Effects on MOOCs

		When learning a new thing, you tend to		
		understand details of a subject but maybe unclear about its overall structure	understand the overall structure but may be unclear about details	Total
When taking a course on MOOCs, you find the instructors always	lay out the material in clear sequential steps	4 50,0%	5 22,7%	9 30.0%
	give you an overall picture and relate the material to other subjects	2 25,0%	6 27,3%	8 26.7%
	Both or neither of them	2 25,0%	11 50,0%	13 43.3%
Total		8 100,0%	22 100,0%	30 100.0%

Till now, the relations between the four dimensions of the participants learning styles and the adaptation effects on MOOCs have been analyzed. We can already draw the conclusion that the null hypothesis failed to be rejected, User's learning styles and cognitive styles do not lead to adaptation effects on MOOCs. However, we could still take a look on Table 14. From the below chi-square distribution table, we can see that the chi-square value for the four dimensions are 1,136, 1,837, 1041 and 1.531 respectfully. The probability value for them are 0.632, 0.549, 0.688 and 0.581 which are all more than the significant level of 0.05. Therefore, we failed to reject the null hypotheses and concluded that the finding are not statistically significant.

TABLE 14 Chi-Square Tests of learners' learning style and adaptation effects on MOOCs

	Pearson Chi-Square			
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Active / Reflective Learner	1,136a	2	,567	,632
Sensing / Intuitive Learner	1,837a	2	,399	,549
Visual / Verbal Learner	1,041a	2	,594	,688
Sequential (Field-independent) / Global (Field-dependent) Learner	1,531a	2	,465	,581

Besides that, the other three questions which test the cognitive styles of the learner, the results of the chi-square value are 1.70, 0,639, 0.455 respectfully, the probability value are 0.645, 0.672, 0.678 respectfully which are all over the significant level of 0.05. In this case, all the other three testing have failed to reject the null hypotheses as well.

Table 15 Users' learning styles and the relation between users' learning styles and adaptation effects on MOOCs. The rejection or acceptance (not reject) of H_0

Four dimensions of learning styles	**User's Learning style**	**Adaptation effect on MOOCs**
Active / Reflective Learner	H_0 rejected	H_0 not rejected
Sensing / Intuitive Learner	H_0 rejected	H_0 not rejected
Visual / Verbal Learner	H_0 rejected	H_0 not rejected
Sequential (Field- dependent) / Global (Field-independent) Learner	H_0 not rejected	H_0 not rejected

So far, we rejected the first groups of null hypotheses but failed to reject the second groups of null hypotheses. Therefore, we could say the MOOCs learners in this study

have their preferred learning styles and cognitive styles. Nevertheless, both the data of learning styles and cognitive styles of the MOOCs learns are failed to be adopted into adaptation effects for the learning platforms. Therefore, we have to go to the next step to analyze the other factors of user modeling, which are users' interests and knowledge backgrounds in this research.

4.2.2. Other Factors of Personal Data

Table 16 Adaptation effects of learners' interests and learner's knowledge backgrounds

		Distributions	
		Frequency	Percent
When choosing courses on MOOCs, are the ones which interest you always jumping out first?	Yes, they are	19	63.3%
	No, they are not	11	36.7%
When you choose a subject before taking courses on MOOCs, are the ones which fit your knowledge level (beginner or advanced) always coming first?	Yes, they are	12	40.0%
	No, they are not	18	60.0%

From the above distribution table, we can see that on one hand, there are 19 (63.3%) participants who think the courses which "interest them (you) always jumping out first" for them. On the other hand, there are 18 (60%) respondents think the courses "which fit their (your) knowledge level" are not always coming first, when they are choosing courses on MOOCs. In other words, the information of learner's interests have been collected for their user models; however, the knowledge backgrounds are not.

From the above analyses, we can see that although some of the learners' data (learners' interests) have been collected as the user's model, majority of them are not. Especially the learners' learning styles and cognitive styles are not. Therefore, we can draw the

conclusion that the MOOC platforms have not value (at least not successfully valued) the individuals' differences, the user modeling has not successfully been applied on MOOCs.

4.3. Adaptive Instruction Presentation on MOOCs

As we have discussed in the theoretical part, there are 6 main elements which constitute the adaptive instruction will be examined in this study. They are, learning goals, instructional approaches, assessment, content, individualized support and learner control opportunities.

4.3.1 Adaptive Learning Goals.

Below three tables are discussing the respondents' feedback of the learning goals for individual courses. From table 17, most of the participants (28) hold the opinion that the instructors have given learning goals for the individual courses; however, half of them (14) think the goals are general ones which aimed for the mass, instead of a more narrowed groups. In addition to the other two participants who think "there are no learning goals at all", more than half of the participants do not have the experience of having a "customered" learning goals.

TABLE 17. When taking a course on MOOCs, normally are there a set of learning goals for you to choose?

	Frequency	Percent
Yes, there are.	14	46,7
No, there is always a general goal for everybody.	14	46,7
No, there are no learning goals at all.	2	6,7
Total	30	100,0

In table 18, majority of the participants (22) consider that the instructors have given explanations for the learning goals which could help them to figure out what specific knowledge and skills they will achieve after finish the courses. However, comparing with

the results of the previous question, if there were no enough learning goals for the learners to choose, enough explanations for each learning goals still cannot guarantee the satisfaction of individualized needs or preferences.

TABLE 18. For each learning goal, are there also explanations for them?

	Frequency	Percent
Yes, there are.	22	73,3
No, there are not.	8	26,7
Total	30	100,0

Table 19 shows that more than half percentage (63.3%) of all the participants think that the instructors do not update the learning goals during the courses, which means the individual differences will not be dealt with during the courses. The individuals cannot choose a more appropriate learning goals according to their own abilities and learning progresses.

TABLE 19. Do the instructors update the learning goals during the courses?

	Frequency	Percent
No, they do not.	19	63,3
Yes, they do.	11	36,7
Total	30	100,0

On the whole, from the results which have been showed in the above three table, the learning goals on MOOCs are not adaptive for individualized needs.

4.3.2 Adaptive Instructional Approaches.

In this part, the results of how the respondents think of the instructional approaches for MOOCs' courses will be discussed. From table 20, we can see that the majority (56.7%) of the participants think that they have the "freedom to choose their (your) preferred instructional methods (ones) to conduct their (your) learning".

TABLE 20 For the instructional methods mentioned above, do you have the freedoms to choose your preferred ones to conduct your learning?

	Frequency	Percent
Yes, I have	17	56,7
Yes, I have, but normally I follow the instructors' lines.	7	23,3
No, I don't have	6	20,0
Total	30	100,0

Table 21 tells us that 25 (83.3%) participants hold the opinion that the instructional methods on MOOCs can give them meaningful task and activities which motivate their self-directed learning.

TABLE 21 Do you think the instructional methods on MOOCs can give you meaningful tasks and activities that help you taking a more active role in your learning?

	Frequency	Percent
Yes, I think so	25	83,3
No, I don't think so.	5	16,7
Total	30	100,0

In addition to the table 22, more than half (17) of the respondents think that "the instructional methods on MOOCs can provide them (you) enough collaboration

opportunities", which means people with different learning styles (active) or cognitive styles (field-dependent) would have enough choices for them to conduct their studies.

TABLE 22 Do you think the instructional methods on MOOCs can provide you enough collaboration opportunities?

	Frequency	Percent
Yes, I think so	17	56,7
No, I don't think so.	13	43,3
Total	30	100,0

In table 23, most of the respondents (73.3%) are still looking for "more kinds of instructional methods on MOOCs", although the results from the previous table show that they already satisfied with some characters of current instructional methods.

TABLE 23 Are you expecting for more kinds of instructional methods on MOOCs?

	Frequency	Percent
Yes, I am	22	73,3
No, I am not.	8	26,7
Total	30	100,0

Table 24 calculates the average satisfaction level of different instructional methods on MOOCs. "3" stands for "very helpful", "2" stands for "somehow helpful", "1" stands for "not helpful at all" and "not sure, depends on the feedback" is coded as "0". From the table, we can see that most of the mean values are over 1.5 point which is the mean of 3.0 (very helpful). Therefore, the respondents are satisfied with most of the instructional methods (except the "Links to other social media learning") on MOOCs.

The three methods which gain the highest satisfaction levels are "course instruction and syllabus", "course videos", and "case study" with 2.6667, 2.3667 and 2.3000 points respectfully. From the analyses in previous part of respondents' learning styles, we know

that there are more “active” learner (who prefer practical activities in learning) than “reflective” ones (who prefer thinking) among the respondents; hence, “case study” becomes top three is understandable and also shows that the availability of different instructional methods is valuable for different kinds of learners.

TABLE 24 Satisfaction level of different instructional methods on MOOCs

	Mean	Std. Deviation
Course instruction and syllabus	2,6667	,47946
Course videos	2,3667	,88992
Reading resources	2,2000	,96132
Learning notes (logs)	2,1000	,84486
Quiz during the videos	1,9667	,92786
Tasks (e.g.multiple choices)	2,0000	1,01710
Discussion boards/forums	1,6333	,96431
Links to other social media learning groups (e.g.tweeter, wiki page)	1,4000	,85501
Group problem-solving and collaborative tasks	1,7000	,87691
Case study	2,3000	,98786

4.3.3 Adaptive Assessment

From table 25, we can see that majority respondents are agree (13) or somehow agree (12) that “there are enough self-assessments” for MOOCs courses. In this case, it means mostly the learners can check and record their own progress accordingly.

Nine (30%) of the respondents “agree” and 14 (46.7%) of the respondents “somehow agree” that “there are enough formal assessments” on MOOCs, which means the most of the learners can check their mastering of specific contents or skills by testing the specific objectives.

Besides that, 17 respondents agree or somehow agree that they can “always receive timely feedback”, which the numbers are only two more than those who are not sure or not agree.

Moreover, for the forms of feedback for MOOCs course, most respondents think they are either “not sure” (12) or “not agree” (4) if there are enough choices. However, this number is just one more than the other side who are agree or somehow agree. In this case, we might still think there are enough forms of feedback for the respondents.

TABLE 25 Statements of the course assessments on MOOCs

	valid				
	Agree	Somehow agree	Not sure	Not agree	Total
There are enough self-assessments (e.g. question, exercise, for which you have to check the answers by yourself and can help you to identify your own progress).	13 43.3%	12 40.0%	4 13.3%	1 3.3%	30 100.0%
There are enough formal assessments (e.g., select answers, quiz, for which the correctness are clear and can indicate your mastering of some specific contents during a course).	9 30.0%	14 46.7%	4 13.3%	3 10.0%	30 100.0%
I could always receive timely feedback.	4 13.3%	13 43.3%	9 30.0%	4 13.3%	30 100.0%
I could receive different forms of feedback.	6 20.0%	7 23.3%	12 40.0%	4 13.3%	30 100.0%

To sum up, by the analyzing of the results, the feedback on MOOCs have given the respondents enough space to conduct their personalised learning.

4.3.4 Adaptive Content

Table 26 displays three statements about the course contents on MOOCs. The results show that most of the respondents “agree” (17) or “somehow agree” (10) that “the course

materials always contain hypermedia forms (contents contain graphics, audio, video, text, hyperlinks, etc. And indicated by hyperlinks)" which can guarantee the extra learning resources for the learners.

Besides that, altogether 20 respondents "agree" or "somehow agree" that the "course contents always organized in different levels" and 25 respondents "agree" or "somehow agree" that "the course materials always include multiple types of resources". Both of the two make the course contents possible to serve for different instructional approaches which in turn to guarantee the personalised learning environment.

TABLE 26 Statements of the course contents on MOOCs

	Valid				
	Agree	Somehow agree	Not sure	Not agree	Total
The course materials always contain hypermedia forms (contents contain graphics, audio, video, text, hyperlinks, etc. and indicated by hyperlinks).	17	10	1	2	30
	56,7%	33,3%	3,3 %	6,7%	100,0 %
The course contents are always organized in different levels (from simply explain the subject to how to apply them in reality).	7	13	8	2	30
	23,3%	43,3%	26, 7%	6,7%	100.0 %
The course materials always include multiple types of resources (questions, exercises, examples, other activities).	13	12	4	1	30
	43,3%	40,0%	13, 3%	3,3%	100.0 %

4.3.5 Individualized Support

Individualized supports follow the individual learners' preferences and differences, one importance aspect of individualized supports in e-learning environment is to help the learners to be familiar with the functions of the systems. From table 27 we can see that 96.7 % (29) respondents think the courses on MOOCs have given them "enough explanations about the platform features that could help them (you) to navigate or get familiar with the learning tools." Only one respondent is not agree with this one.

TABLE 27 When taking a course on MOOC, are there enough explanations about the platform features that could help you to navigate or get familiar with the learning tools?

	Frequency	Percent
Yes, there are.	29	96,7
No, there are not.	1	3,3
Total	30	100,0

Table 28tell us that majority respondents (21) have not tried to consult supports from "the instructors, technical staffs, other workers, or other learners on MOOCs" before. For those who have asked for supports, almost all of them (8) think can get the supports in time.

TABLE 28 Normally, if you ask for supports from the instructors, technical staffs, other workers, or other learners on MOOCs, will you receive it in time?

	Frequency	Percent
Yes, I will	8	26,7
No, I won't.	1	3,3
Not sure, I have not tried before.	21	70,0
Total	30	100,0

Hence, we can draw the conclusion that the individualized supports have been provided for MOOCs learners.

4.3.6 Learn Control Opportunities

If the learners want to take an active role in learning process, they need to have the options to decide therefore, from table 29, we can see most of the participants are "not sure" if they have the freedom to choose their learning peers. For the remained group, most of them think the working peers for group tasks are always being selected for them. With whom to learn, when to learn, how to learn, etc. Besides that, they also need to have the options to control the adaptation.

TABLE 29 Normally, if you have to participate in the group works on MOOCs, do you have the freedom to choose your learning peers?

	Frequency	Percent
Yes, I have.	3	10,0
No, I don't have.	7	23,3
Not sure.	20	66,7
Total	30	100,0

For table 30, only 7 respondents think it would not be difficult for them to conduct a course learning when the course is overdue. In other words, only these 7 participants think that they do not feel restricted by "when to learn".

TABLE 30 Do you feel more difficult to conduct your study when the course is beyond the launching time than when the course is still within the launching time?

	Frequency	Percent
Yes, I do.	9	30,0
No, I do not.	7	23,3
Sometimes.	14	46,7
Total	30	100,0

From table 31, we can see that majority respondents (24) think that changing the learning status would help them to direct their following learning. in other words, most of them think that by controlling the adaptation would help them to process their learning.

TABLE 31 By changing the marks of your tasks, will it help you to indicate your following learning?

	Frequency	Percent
Yes, it will.	16	53,3
No, it won't.	6	20,0
sometimes	8	26,7
Total	30	100,0

4.4 Other Relevant Results

4.4.1 Other important factors for personalised learning on MOOCs

TABLE 32 Preferences of personal data for user modeling

		Responses	
		N	Percent
Personal Data	Backgrounds	10	12,2%
	Learning goals	17	20,7%
	Learning style	17	20,7%
	Interests	15	18,3%
	Cognitive style	8	9,8%
	Knowledge level	15	18,3%
Total		82	100,0%

From the table, we can see the total number of responses are 82, but the questionnaire has asked for 3 options of each participants, which accounts for 90 responses in total. Therefore, the 'percent' shows here are the percentages of each data making up of the total response numbers instead of the whole number. Therefore, we can see both the "learning goals" and "learning styles" are the most important factors in the respondents' opinions. After that one, comes the factor of "interests" and "knowledge lever". Nevertheless, there is no big deviations among all the factors which have proved Brusilovsky's opinion that all these factors are essential factors for adopting adaptive effect which guarantee the personalised learning environment further.

TABLE 33Cross Tabulation of educational backgrounds and personal data factors

		Educational Backgrounds					
		Vocational training	College	Bachelor's degree	Master's degree	others	Total
Personal Data	Back-grounds	1	0	3	6	0	10
	Learning goals	1	1	8	6	1	17
	Learning style	0	1	11	5	0	17
	Interests	1	1	8	5	0	15
	Cognitive style	0	0	7	1	0	8
	Knowledge level	0	0	10	4	1	15
Total		1	1	18	9	1	30

From table 33, we can see that the preferences among different educational backgrounds' learners are also different. The most important three factors for bachelor's degree students are "learning styles", "knowledge level", "learning goals" and "interests". However, the most important three factors for master's degree students are "backgrounds", "learning styles" and "interests". These also show that with different educational backgrounds, the learners have different references.

4.4.2 Respondents' general learning experience on MOOCs

TABLE 34 Retrospecting your learning experience on MOOCs, do you think it is easy to conduct your learning there?

	Frequency	Percent
Yes, it is	24	80,0
No, I always feel restricted	6	20,0
Total	30	100,0

The above table tells us that 80% respondents hold the opinion that "it is easy to conduct their (your) learning" on MOOCs, only 20% of them always feel restricted when using MOOC platforms to learn. In other words, this result shows that MOOCs have provided accessible learning resources for the learners to conduct their personalised learning as a whole.

TABLE 35 Cross Tabulation of MOOC platforms and learning experiences

		Platforms of using MOOCs				
		Coursera	edX	Udacity	Future-Learn	Others
Retrospecting your learning experience on MOOCs, do you think it is easy to conduct your learning there?	Yes, it is	12	4	1	3	4
		75,0%	80,0%	100,0%	75,0%	100,0%
	No, I always feel restricted	4	1	0	1	0
		25,0%	20,0%	0,0%	25,0%	0,0%
Total		16	5	1	4	4
		100,0%	100,0%	100,0%	100,0%	100,0%

Nevertheless, are the results different among the users of different MOOC platforms? If we take a look on table 35, we can see that except the users of Coursera, basically all the other platforms' users feel no restrict during their learning, and 25% of Coursera users have met some restrictions during their studies. However, since the total sample of Coursera are also more than the other platforms, this result could remain for discussions.

5. Discussion and Conclusions

The main purpose of this research were finding out how personalised learning could be implemented on a e-learning environment; what are the principal factors to realize personalised learning in practice. The theoretical reviews have solved the second problem; hence, the first one became the main research target for this study.

This paper has tested part of Brusilovsky's theory, user modeling (2007), whether it has been applied on MOOCs, as well as the application of Magoulas and Chen's framework for adaptive instruction (2006) on MOOCs. MOOCs have been a hot topic for educators since the year they emerged. Personalised learning has also been discussed frequently these years. Plenty of studies for relevant concepts, like individualize learning, self-directed learning have been done by educational researchers. However, the studies for personalised learning are mainly conducted by technology researchers. This study chose MOOCs, a typical combination of educational and technology sciences, as the context to study whether and how personalised learning has been realized. The study were conducted by a online quantitative questionnaire, 30 participants from different countries have devoted their time and insights of learning experience on MOOCs for this research. Main findings are as below.

5.1 Summary of the results

As it has been claimed that there are no enough practical researches and suggestions for effectively connecting leaning style with the AHSs/AESs (Brusilovsky et al., 2007). The results in this paper also proved that almost all the tests of the learners showed no correlation between learners' model (personal data and information) and different presentation of the contents and experiences of navigation on MOOCs. Especially for the learning styles, there was no correlation within even one dimension of the four dimensions.

However, the result showed that learners' "interest" was the only factor among the tested factors (learner's learning styles, cognitive styles, interest, knowledge background) which has been taken for consideration on MOOCs. The reason could be that "interest" cater to the main course classification methods (classified by subjects) on most MOOCs platforms. Besides that, due to the high attrition rate of MOOCs, earlier studies have been done to figure out the main motivations for MOOCs learners, one of them is "learn for interest" (Sheu et. Al, n.d.). Hence, it is no surprise that the suppliers tried various ways to improve the engagements of the learners by taking consider of their "interest".

For adaptive learning goals, the result has shown that the courses on MOOCs gave general and static goals for all the learners. Adaptive instruction approaches on MOOCs showed different answers, except most of the participants were expecting more kinds of instruction approaches on MOOCs, most findings showed the personalised features of instruction approaches on MOOCs. Besides that, the course assessment, course content and individual support on MOOCs have met the personalised criteria in this test. The factor of learner control opportunities showed negative inclination, but still remained vague. Therefore, majority modules of Magoulas and Chen's framework for adaptive instruction has been proved to be applied on MOOCs.

The results of the most important factors for user modeling from these tests were "interests", "knowledge lever", "learning goals" and "learning styles". They agreed with Brusilovsky's opinion. (2007).

To sum up, the research results agreed with Brusilovsky's studies. Not every e-learning platform has applied user modeling, the foundation for personalised learning. MOOCs platforms might have collected some data of the users, but not all the essential ones for realizing personalised learning. However, the courses on MOOCs did provide personalised learning opportunities to the learners.

5.2 Limitations of the study

This study presented the personalised learning experience of MOOCs users by collecting answers from the questionnaire. Therefore, some data would be missing due to the subjective understanding of the questions, as well as the lack of communicating between the researcher and participants.

Besides that, the questions in part 2 were not enough to get a more reliable conclusion. That is because that this part could be a interdisciplinary research between education, information technology and even psychology. The user's learning style was difficult to test with limited questions (normally it is better for them to take another standard learning style tests). Therefore, the number of other questions had to be sacrificed for testing user's learning style which weakened the results for other factors.

Moreover, although the original intention to take quantitative questionnaire was because MOOCs have abundant users, it proved to be difficult reach enough qualifiers for the questionnaire. That has reduced the sampling number.

5.3 Suggestions for further research

Personalised learning is an effective solution for frustrated learners to improve their learning behaviors rather than a fancy term. A lot of interests have been focused on the "tailored" of learning, but still the details of implementation remained vague (Prain et al., 2013). This study has examined the fundamental elements for personalised learning and tested them with users learning experiences on MOOCs which is one of the biggest breakthrough of education in these years. Therefore, the conditions of implementing personalised learning on MOOCs has been studied and the strengths and drawbacks of personalised learning on MOOCs has been shown. However, there are still spaces for adding other important factors of personalised learning. Some case studies or observation which could show the details of individual learner's cases are recommended.

Besides that, the results showed that the learning goals on MOOCs were not adaptable and the users' control for their own learning were also limited. Hence, researches about how to solve those problems could be valuable for both the MOOC learners and suppliers.

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Appendix 1: Questionnaire of Personalised Learning on MOOCs

This questionnaire is for my master research on Personalised Learning on MOOCs (Massive Open Online Courses), Faculty of Education, University of Lapland, Finland.
By participating the questionnaire, you will provide me the essential data for this research and you might also get some new ideas about your own learning on different MOOCs platforms.

The questionnaire would take 10-15 minutes to complete.

Your responses will be treated strictly confidential and only be used for academic purpose.

Part I

1. Nationality: _____

2. How old are you?*
   ◎Under 18
   ◎18-24
   ◎25-34
   ◎35-54
   ◎Above 55

3. What is your educational background? *
   ◎No formal education
   ◎High School
   ◎Vocational training

◎College

◎Bachelor's degree

◎Master's degree

◎Doctorate/ PHD

◎Other, (please specify) _____

4. Below are some English language platforms for MOOCs, which one do you use the most frequently? *

◎Coursera

◎edX

◎Udacity

◎FutureLearn

◎Other, (please specify) _____

5. How long have you been studying on MOOCs?

_____

Part II

Below are some questions concerning your preferred learning styles, cognitive styles and their relevance to your learning experience on different MOOCs platforms.

6. You understand something better after you, *

A. try it out.

B. think it through.

7. You prefer to study *

A. in a study group.

B. alone

8. After you learn something on MOOCs, you normally *

A. have the chances to discuss it within a group or receive some problem--solving tests.

B. are requested to write some reflective log or take other independent tasks.

C. Both of them

D. Neither of them

9. You are more likely to be considered *

A. meticulous with the details of your work.

B. creative about how to do your work.

10. You find it easier, *

A. to learn facts (e.g. maths)

B. to learn concepts (e.g. philosophy)

11. When you take a MOOC course, you can always find enough *

A. concrete material (facts, data)

B. abstract material (concepts, theories)

C. Both of them

D. Neither of them

12. I prefer to get new information in *

A. pictures, diagrams, graphs, or maps.

B. written directions or verbal information.

13. You remember best *

A. What you see

B. What you hear

14. When learn something on MOOC, normally can find enough *

A. diagrams, graphs, pictures to help you to learn.

B. videos, or other kinds of words' explanations to support your learning

C. Both of them

D. Neither of them

15. When learning a new thing, you tend to *

A. understand details of a subject but may be fuzzy about its overall structure.

B. understand the overall structure but may be fuzzy about details.

16. Some teachers start their lectures with an outline of what they will cover. Such outlines are *

A. not helpful or somewhat helpful to you.

B. very helpful to you

17. When visiting a MOOC's website (coursera, edX, etc.), you find the information always: *

A. organized in a Non-linear way

B. organized in a linear way

18. When taking a course on MOOCs, you find the instructors always *

A. lay out the material in clear sequential steps

B. give you an overall picture and relate the material to other subjects

C. Both of them

D. Neither of them

19. Do you think there are enough collaborative activities (discussion forums, group assignments) on MOOCs to support your learning? *

A. Yes, there are.

B. No, there are not.

20. Do you think there are enough reading resources (extended reading) on MOOCs to support your learning? *

A.Yes, there are.

B. No, there are not.

21. When choosing courses on MOOCs, are the ones which interest you always jumping out first? *

A. Yes, they are.

B. No, they are not.

22. When you choose a subject before taking courses on MOOCs, are the ones which fit your knowledge level (beginner or advanced) always coming first? *

A. Yes, they are.

B. No, they are not.

23. If collecting your personal information would help the platforms to improve your learning outcomes, what personal information do you think are the most valuable three? *

◎Backgrounds

◎Learning goals

◎Learning styles

◎Interests

◎Cognitive styles

◎Knowledge level

◎Others

Part III

Below are some question about the implement of *Adaptive Instruction* on MOOCs

24. When taking a course on MOOCs, normally are there a set of learning goals (e.g. what you can learn from the courses) for you to choose? *

A. Yes, there are.

B. No, there is always a general goal for everybody.

C. No, there are no learning goals at all.

25. For each learning goal, are there also explanations (e.g. relevant learning outcomes, previous knowledge requirements) for them? *

A. Yes, there are.

B. No, there are not.

26. Do the instructors update the learning goals during the courses? *

A. Yes, they do.

B. No, they do not.

27. Below are some **instructional methods** which have been applied on MOOCs. Indicate the scale of help which they offer to you for your learning. *

	Very helpful	Somehow helpful	Not helpful at all	Not sure, depends on the feedback
Course instruction and syllabus				
Course videos				
Reading resources				
Learning notes (logs)				
Quiz during the videos				
asks (e.g. multiple choices)				
Discussion boards/forums				
Links to other social media learning groups (e.g. tweeter, wiki page)				
Group problem-solving and collaborative tasks				
Case study				

28. For the instructional methods mentioned above, do you have the freedoms to choose your preferred ones to conduct your learning? *

A. Yes, I have

B. No, I don't have

C. Yes, I have, but normally I follow the instructors' lines.

29. Do you think the instructional methods on MOOCs can give you meaningful tasks and activities that help you taking a more active role in your learning? *

A. Yes, I think so

B. No, I don't think so.

30. Do you think the instructional methods on MOOCs can provide you enough collaboration opportunities? *

A. Yes, I think so.

B. No, I don't think so.

31. Are you expecting for more kinds of instructional methods on MOOCs? *

A. Yes, I am.

B. No, I am not.

32. Below are some statements about the **assessments** on MOOCs. Indicate your agreement for each of them. *

	Agree	Somehow agree	Not sure	Not Agree
There are enough self-assessments (e.g.question, exercise, for which you have to check the answers by yourself and can help you to identify your own progress).				
There are enough formal assessments (e.g., select answers, quize, for which the correctness are clear and can indicate your mastering of some specific contents during a course).				
I could always receive timely feedback.				
I could receive different forms of feedback.				

33. Below are some statements about the **course materials and contents** on MOOCs. Indicate your agreement for each of them. *

	Agree	Somehow agree	Not sure	Not Agree
The course materials always contain hypermedia forms (contents contain graphics, audio, video, text, hyperlinks, etc. and indicated by hyperlinks).				
The course contents always organized in different levels (from simply explain the subject to how to apply them in reality).				
The course materials always include multiple types of resources (questions, exercises, examples, other activities).				

34. When taking a course on MOOC, are there enough explanations about the platform features that could help you to navigate or get familiar with the learning tools? *

A. Yes, there are.

B. No, there are not.

35. Normally, if you ask for supports from the instructors, technical staffs, other workers, or other learners on MOOCs, will you receive it in time? *

A. Yes, I will

B. No, I won't.

C. Not sure, I have not tried before.

36. Normally, if you have to participate in the group works on MOOCs, do you have the freedom to choose your learning peers? *

A. Yes, I have

B. No, I don't have.

C. Not sure.

37. Do you feel more difficult to conduct your study when the course is beyond the launching time ('archived course') than when the course is still within the launching time ('ongoing course')? *

A. Yes, I do.

B. No, I don't have

C. Sometimes

38. For example, by changing the marks of your tasks (finished/unfinished), will it help you to indicate your following learning? *

A. Yes, it will.

B. No, it won't.

C. Sometimes

39. Retrospecting your learning experience on MOOCs, do you think it is easy to conduct your learning there? *

A. Yes, it is

B. No, I always feel restricted (by the course arrangement, or the system suggestion, etc).

40. Other comments: _____

If you have any questions about the survey, please email me: yisong@ulapland.fi

Thank you for your participation!

The original online version of this questionnaire can be found on the following website: https://www.webropolsurveys.com/Answer/SurveyParticipation.aspx?SDID=Fin1269867&SID=01d8d2c8-bf6c-4ca2-82cc-7c7506fae8a5&dy=152710999