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A personalised learning service for MOOCs

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ABSTRACT: In the field of MOOCs (massive open on-line courses), the characteristics of the learner and the improvement of the experience of the learning process requires more in-depth studies. Based on this, curriculum design should be adjusted to raise the quality of the learning support services of MOOCs and, hence, improve the quality of learning. The work outlined here is a construction of the MOOCs' personalised learning service mode from three aspects: personalised guidance service; the guidance of the learning path; and the establishment of a learning community. Advisory research suggestions are also provided for the future development and construction of MOOCs platform systems.

INTRODUCTION

In July 2014, studies made by the US software company, Qualtrics, and the education technology company, Instructure, found there were two reasons for students dropping out of MOOCs (massive open on-line courses) [1], viz. the personal time availability of the learner; and the learning experience, with the course failing to meet the expectations of the learner [2]. It is pointed out in many blogs that it is difficult to find a learning path through a MOOC. Also, when a learner has difficulties in comprehending knowledge, they cannot acquire timely learning support. The MOOCs neither create a knowledge community nor provide an interactive platform between teachers and learners. This makes MOOCs more like carrying out textbook training [3]. The instructional designers of MOOCs should not only grasp the essential characteristics of MOOCs, i.e. *large-scale*, *open* and *timely feedback*, but also the need to respect the learner's individual learning experience.

It is necessary to define the pre-course requirements and the orientation of the curriculum, so as to design an adaptive teaching mode, providing effective personalised learning support services for learners [4-6]. The MOOCs' personalised learning services should satisfy the personalised learning demands of students, i.e. the system uses. The learning services should include a learner inventory and study follow-up agent, to obtain the characteristic information of students and analyse the personal demands of learners; and a curriculum knowledge map to organise teaching content and to locate the learner's position in the area of knowledge.

STUDY OF THE ESTABLISHMENT OF MOOCS' PERSONALISED LEARNING SERVICE MODE

Learners' characteristics and how to improve the experience of learning through MOOCs should be studied. Based on this, the MOOCs' curricula could be adjusted to raise the quality of learning support services. Although important, there are few studies on the measurement of MOOCs as an open learning platform [7]. The MOOCs' learning services aim to provide guidance on a personalised learning path through the course and of the presentation of the course content. Hence, by constructing an adaptive learning environment, the personalisation of MOOCs can be achieved. The overall model is shown in Figure 1 below.

The first time a learner logs in, they register with the system and take a test on learning style and learning strategy. Then, the study follow-up agent automatically records the test results and constructs the user's personal dynamic Bayesian learning network. Using the information from the Bayesian learning network, the information agent gets the learner's personalised features and *pushes* adaptive courses and learning companion.

Then the formal course studies start. A task-driven strategy is adopted for the courses, so that learners and learning companions could choose learning tasks automatically. According to each knowledge point, the system automatically generates a personal dynamic curriculum knowledge map. Learners should have a clear, visualised understanding of the curriculum knowledge using the knowledge map.

The technical focal point of the service mode is to use the information agent to extract relevant information and to push courses and learning companions. The technical difficulty is how to form a simple visual course knowledge map interface. The system generates the visual interface of course knowledge points directly, according to the information provided by the study follow-up agent, with no need for a learner's manual operation.

The design includes three parts, viz. personalised learning guidance services, learning path guidance and the learning community.

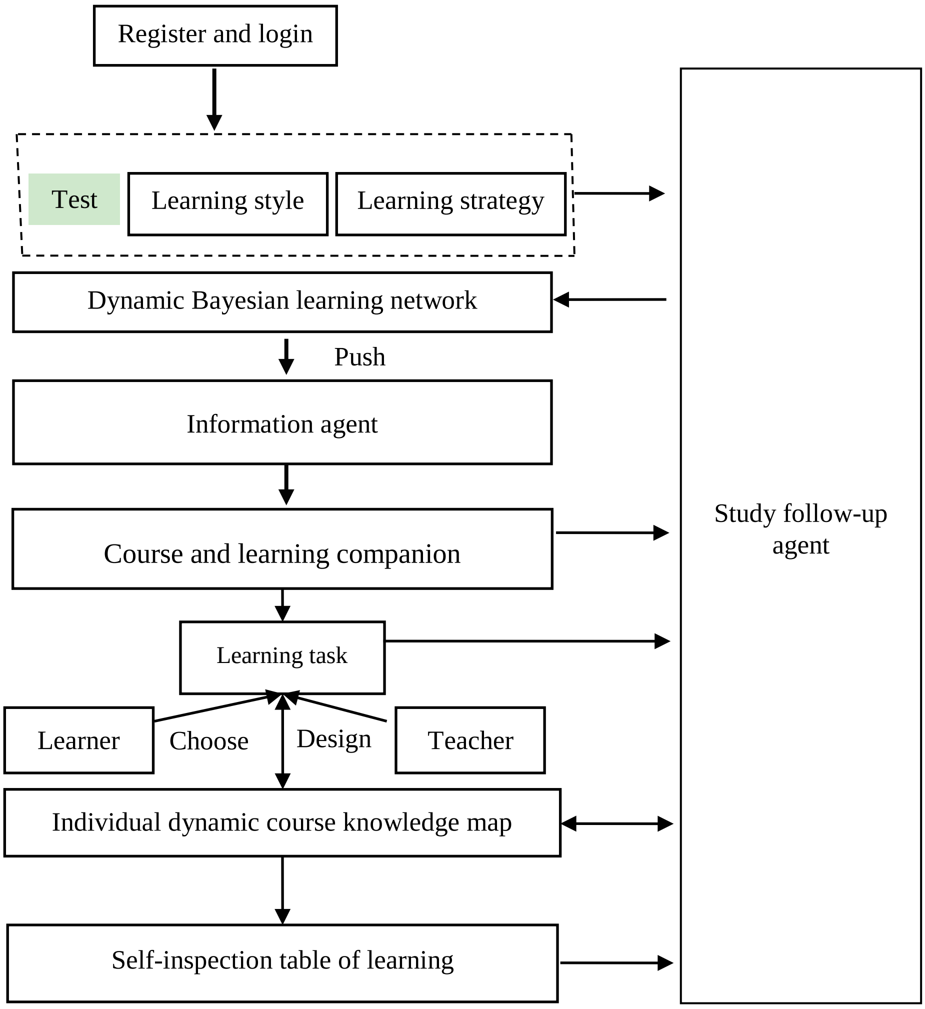

Figure 1: MOOCs' personalised learning services.

Personalised Learning Guidance Services

The system tests the learner when first registered on the learning style and learning strategy. Then, the system recommends courses and learning companions to the learner, according to the automatically generated test analysis results.
The learner and learning companion develop a learning plan together, so as to complete the course synchronically according to the learning plan:

- Learning style and strategy test:

  Learners have differences in planning, monitoring, group study and information processing abilities, as well as having different perceptual preferences. To adapt to MOOCs learners' individual differences requires the nature of these differences be understood. Learning style reflects the individual differences of learners most directly and, thus, could be used as the basis for the design of personalised guidance strategies [8].

  There are many different kinds of learning style tests, among which the Solomon learning style test has relatively high reliability and validity [9]. There is a corresponding Moodle self-testing plug-in for the Moodle platform, which could be used. The student registering for a MOOCs course for the first time takes the Solomon learning style test. The test includes 44 questions, to identify the four learning types, viz. active or reflective type, perceptive or intuitive, visual or verbal, sequence or comprehensive. Instructional designers set different learning tasks according to the learning type and the system will push the appropriate learning task automatically as per the test results.

The learning strategy chosen by a learner should match cognitive and learning style. The Weinstein learning and studies strategy inventory (LASSI) scale is designed for determining the appropriate learning method and learning strategy for a student [10]. The LASSI is comprehensive, easy to implement and quick to score. Therefore, it is an ideal assessment tool, to determine the learning method and learning strategy for a student.

Seventy-six self-reporting assessments are involved in the scale. These can be divided into 10 categories, viz. attitude, motivation, time management, anxiety, concentration, information processing, selecting main ideas, study aids, self-testing and test strategies. The test uses international norms, with raw scores converted into percentages. The application of LASSI to MOOCs personalised learning services could measure learning strategies, which is beneficial for further studies and the assessment of a learner.

- Course and learning companion:

Combined with the information on students' learning style and strategy, the study follow-up agent can generate a Bayesian learning network based on data related to a student's learning [11]. These data include: the time used by students to learn knowledge points; visited links; test scores; the time taken for tests; and forum answers and questions.

Bayesian theory is an important tool with which to deal with uncertain information, and has been applied successfully in medical diagnostics, statistical decision making, expert systems, learning predictors and in intelligent systems. The Bayesian learning network can be updated from the original network using the information collected by the study follow-up agent during a student's on-line learning. The application of Bayesian technology and dynamic Bayesian networks (DBNs) provides a formalised mathematical framework and processing tool for the learning information agent. This can be used to solve the decision problems of the information agent, and realise the intelligent push of the courses and learning companions.

The push process is shown in Figure 2. After obtaining the characteristic information about the learner, the information agent generates the user's learning information push model. This utilises information in the curriculum resources and learner types databases to filter course resources, and to match learning companion type, and, then, pushes the course resources and learning companions suitable for the learner's characteristics, styles and learning strategies, to the learner.

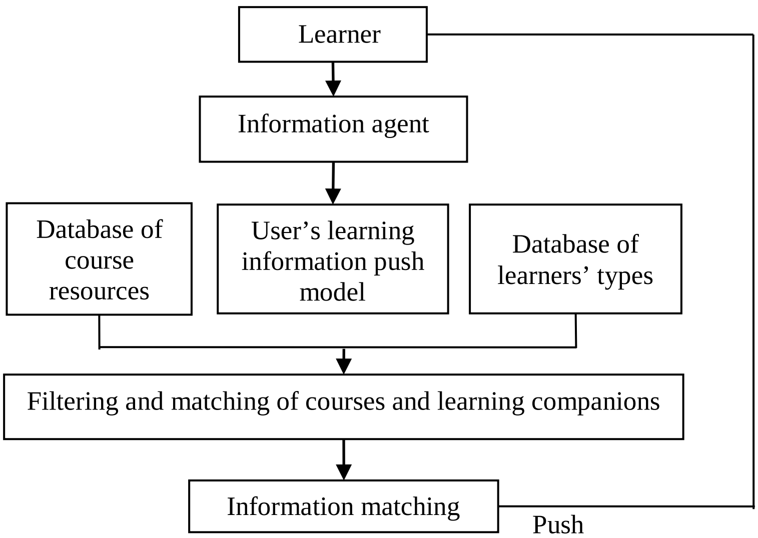

Figure 2: Course and learning companion intelligent push service.

Personalised Learning Guidance

A basic teaching pattern for MOOCs is the high dropout rate. This is not solvable solely by self-learning and must involve providing guidance to the learners. However, considering the large number of learners in MOOCs, teachers alone could not provide this guidance. On-line learning provides good interactive technology support and abundant on-line resources, beneficial to independent learning. Individual factors and the learning styles of learners will affect the choice of on-line resources and activities, forming personalised learning paths for learners. Therefore, the design of MOOCs system platforms should allow learners to learn autonomously under the guidance of a system-determined path. This would improve the learning experience of learners, and also help solve the problem of high dropout rates in MOOCs.

- Task driven learning:

  The MOOCs teaching should arouse the student's internal learning motivation. Research shows that task-driven on-line learning is very effective [12]. Task-driven learning is designed to strengthen and sustain the motivation of learners using *tasks*. The system includes learning tasks to choose from, as per the requirements of the curriculum knowledge points and reflecting the learning styles and strategies of different learners.

- Guidance for the learning path:

  A learner's choice of teaching content is not random, but is based on choosing a sequence of knowledge points required for meaning construction reflecting the knowledge network relationship among knowledge points [13]. Knowledge maps apply to the educational field and help teachers to organise teaching content. They also reflect the learning objectives, subject, hierarchical relationships and associations in the course. This is beneficial for students in finding their position in a knowledge area and to establish knowledge linkages, as shown in Figure 3 [14].

  The knowledge map provides the visual interface for task-driven learning, making learners clear about their own learning progress. Learners construct the knowledge maps of courses independently as per the learning tasks, and use the final knowledge to integrate and make connections among knowledge. After completing the specific learning tasks, learners need to finish the self-inspection table of learning effect, through which learners obtain a clear idea of the key knowledge and their own learning.

- The formation of learning community:

  Compared with other on-line courses, the learners of MOOCs have the enthusiasm to learn, but lack practical support. Learners like to follow the learning materials prepared carefully by teachers and are able to spend time discussing problems related to courses with other learners on the same course. The close mutual help between learners generates a good learning atmosphere. A learner's sense of belonging to a community of learners and the respect of other members enhances the involvement in the community, and promotes continuous, in-depth studies. The personalised learning service supports this community of learners for MOOCs.

  The MOOCs personalised learning service constructs the learning companion database, which is used for the learning companion push. The learning companion database follows the principle of learning type complementation on matching learning style and learning strategy.

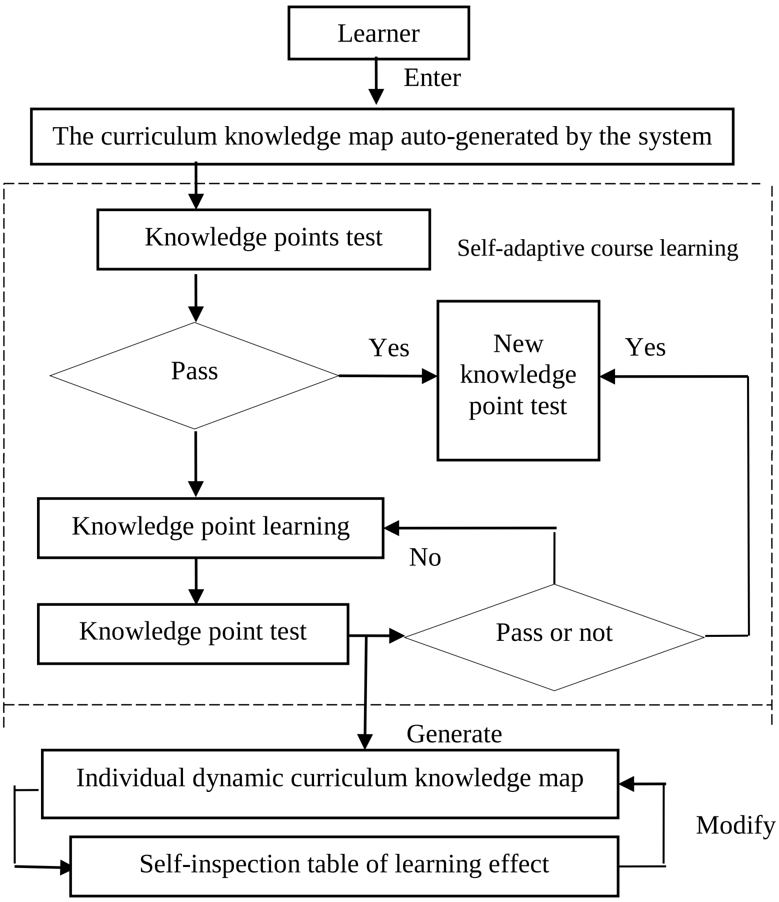

Figure 3: Personalised learning path.

According to the results of the system push or automatic search, learners select learning companions independently. Learners communicate and co-operate with learning companions to form a co-operative learning mode, constructing and sharing knowledge together. As shown in Figure 4, learners, learning companions, teachers and teaching assistants form a MOOCs-based learning community. The solid arrows represent strong interactions and the dotted weak interactions. In traditional MOOCs network learning platforms, the relationship between learners and learning companions is just a random weak interaction in learning forums. Most learners lose the emotional communication between teachers and students in the traditional classroom, and often feel lonely and helpless. This highlights the role of the learning companion. Information flows to move freely within the circle, forming a strong interaction as a whole.

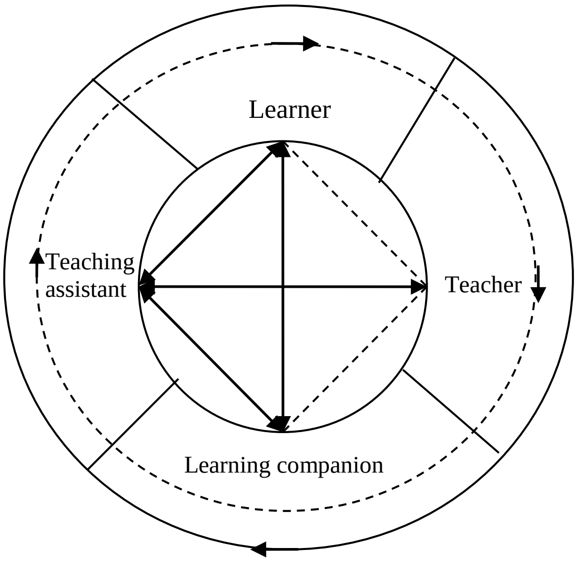

Figure 4: The learning community.

The current fragmented communication in MOOCs has weakened the student's ability in deep, logical, coherent thinking [15]. The form of co-operative learning frequently adopted by a learning community is much valued by researchers. Although there are various forms of co-operative learning, they all share common features, viz. learners and learning companions carry out co-operative learning, help each other and learn from each other [16]. The studies of Cohen found that the effect of co-operative learning is subject to many conditions [17]:

- The learning task should be a team task. A single learner will not have all the resources in the form of information, knowledge, skills and material required by the task. Without the co-operation of, and communication with, learning companions, learners cannot complete the task. The task objective is common and resources are interdependent, which promotes learners' participation in activities.

- Co-operative learning is better if problems are ill-structured. An open question without a unique answer can stimulate deep communication among students.

- The effect of co-operative learning depends mainly on the frequency and form of interactions among students. Research shows that the number of detailed explanations provided by team members is significantly related to their learning effect. Successful learning groups generally tend to put forward more questions related to tasks and spend more time on strategy and strategic explanation.

- The degree of structure in the co-operation can also affect the learning. A relatively highly structured level of co-operation is more suited to conventional learning tasks, while lowly structured co-operation is better suited to open, explorative learning tasks.

Therefore, when designing learning tasks, the nature of learning tasks, and the frequency and form of learning communication, need to be considered. In order to enhance the function of learning companions, the system definition is that only when learners and learning companions have all met the course requirements, have their studies been successfully completed. The role of the learning community can only be realised through the reasonable design of learning tasks and by appropriate co-operative forms.

CONCLUSIONS

The study mainly has three important aspects:

- The MOOCs use the reputation of an elite school to guarantee quality, but lack effective learning support services, and a complete systematic teaching management system [18]. On the basis of learners' characteristics analysis, the study pushes adaptive learning content and realises the personalised guidance of the learning path and constructs a learners' autonomous learning environment.

- Applied in this study is an agent and knowledge map, so as to provide guidance on the learning path in MOOCs for the first time, and the intersection of pedagogy, computer science, and library science, is realised, hence, improving understanding of the learning process in MOOCs.

- This is an early study of MOOCs' personalised learning services and could provide advisory research suggestions for the future development and construction of MOOCs platform systems.

REFERENCES

1. Qualtrics. Qualtrics and Instructure Partner Reveal Top Motivations for MOOC Students (2014), 12 December 2015, www.qualtrics.com/press/pressreleases/qualtrics-and-instructure-partner-reveal-opmotivationsfor-mooc-2students
2. Boyatt, R., Joy, M., Rocks, C. and Sinclair, J., What (use) is a MOOC? *The 2nd Inter. Workshop on Learning Technol. for Educ. in Cloud. Springer Proc. in Complexity*, Berlin: Springer Netherlands, 133-145 (2014).
3. DeJong Peterson, R., MOOC Fizzles. *Academic Questions*, 9, 316-319 (2014).
4. Zhu, H., The exploration and practice of SPOC based on the idea of S+C+H. *World Trans. on Engng. and Technol. Educ*., 13, **4**, 577-581 (2015).
5. Zhu, S. and Tang, C., College computer course reform using a cloud environment based on the MOOC mode. *World Trans. on Engng. and Technol. Educ*., 12, **4**, 628-632 (2014).
6. Cui, L., Li, H. and Song, Q., Developing the ability for a deep approach to learning by students with the assistance of MOOCs. *World Trans. on Engng. and Technol. Educ*., 12, **4**, 685-689 (2014).
7. Heutte, J., Kaplan, J., Fenouillet, F., Caron, P-A. and Rosselle, M., *MOOC User Persistence*. In: Uden**,** L., Sinclair, J., Tao**,** Y-H. and Liberona, D. (Eds), Learning Technology for Education in Cloud, MOOC and Big Data. Berlin: Springer International Publishing, 13-24 (2014).
8. Zhong, K. and Liu, Y., Design and practice of online tutoring strategy based on the theory of learning style. *Open Educ. Research*, 3, 83-89 (2012).
9. Felder, F.M. and Soloman, B.A., Index of Learning Styles (2014), 12 December 2015, http://www.engr.ncsu.edu/learningstyles/ilsweb.html
10. Weinstein, C.E and Palmer, D.R., *LASSI 2nd Ed User's Manual.* Florida: H&H Publishing Company, 42-47 (1990).
11. Fenton-Kerr, T., Clark, S. and Cheney, G., Multi-Agent Design in Flexible Learning Environments (2014), 12 December 2015, http://ascilite.org.au/conferences/wollongong98/asc98-pdf/fenton-kerr0057
12. Borji, A., Ahmadabadi, M.N., Araabi, B.N. and Hamidi, M., Online learning of task driven object-based visual attention control. *Image and Vision Computing*, 7, 1130-1145 (2010).
13. Li, Y., Zhao, B., Gan, J. and Xu, T., The research of the MOOCs study custom service model. *Chinese Audio-visual Educ*., 11, 39-49 (2014).
14. Trucano, M., *Knowledge Maps: ICT in Education*. Washington, DC: infoDev World Bank, 28-29 (2005).
15. Li, Y., Zhao, B. and Gan, J., A culture public network education school based on the construction of MOOC. *National Forum*, 5, 81-84 (2014).
16. Slavin, R.E. *Co-operative Learning: What Makes Group-work Work?* In: Dumont, H., Istance, D. and Benavides, F. (Eds), The Nature of Learning: Using Research to Inspire Practice. London: OECD Publishing, 161-178 (2010).
17. Hirsh, H., *Incremental Version-Space, Merging: A General Framework for Concept Learning*. Berlin: Springer US, 29-48 (1990).
18. Yao, Y., Han, X. and Liu, Y., A comparative study on the running mechanism of distance education. *J. of Distance Educ.*, 6, 3-10 (2013).