Improving learners' cognitive adjustment in a network multimedia learning environment

Zhi-guo Yin

Shaoyang Polytechnic
Hunan, People's Republic of China

ABSTRACT: In a network multimedia learning environment, many students' performance suffers because of poor ability in independent learning, self-supervision and introspection. Strategies to improve the cognitive ability of the learners are proposed based on an analysis of the internal and external factors that affect the learner's cognitive ability in a network multimedia environment. The strategies are: maintain learning motivation; strengthen self-efficacy; and develop metacognition. These strategies can help learners to adjust their cognition, apply learning strategies in learning, voluntarily seek help, self-observe their learning and conduct self-feedback. This should enable students to improve their self-cognition adjustment ability.

INTRODUCTION

Multimedia learning came into being with the development of information technology. Multimedia computer and computer networks are at the heart of this teaching mode, dramatically changing the transmission, storage, processing, retrieval and display of information. This learning style is greatly superior to those using other media. Guided by modern educational theories, multimedia learning can promote the reform of existing teaching structures and organisations.

Learning style in a multi-media environment stresses the importance of students, who are the learning subjects and active constructors of knowledge. Teachers are the organisers, guides and designers of the teaching. Information technologies provide the tools for students' cognition and motivation. This interactive, open and initiative-based learning can also leverage students' enthusiasm and creativity, as well as guide them to acquire knowledge in their own, personalised way [1].

Distance education is regarded as an important part of the Chinese national education development strategy, as it is important for the building of a lifelong learning and learning-oriented society. However, there are many difficulties in distance learning regarding autonomous learning, self-monitoring and reflection. In this article, the author presents and discusses methods to improve learners' cognitive adjustment in a network multimedia learning environment based on external factors.

STUDENTS' COGNITIVE DISSONANCE IN A NETWORK MULTIMEDIA ENVIRONMENT

Learning in a network multimedia environment and traditional classroom learning are very different. Information organisation in a network multimedia environment is non-linear, flowing, interactive and open. It is different from the linear organisation of set texts in traditional classroom learning.

Network multimedia learning content and learning process are non-scheduled. Network learners engage in non-linear learning, which gives learners more rights to make decisions and regulate the rhythm of their learning. This makes it important for network learners to acquire the ability to adjust their cognition.

Metacognition is a learner's cognition of their cognitive activities. More specifically, when learners engage in cognitive activities, they can understand the essence and content of knowledge acquired, as well as learn how to further apply knowledge to find solutions to problems [2]. Metacognition includes knowledge about learners' individual characteristics, knowledge about their cognitive tasks, and knowledge about learning strategy and its application.

Adjustment of metacognition or *adjustment of self-cognition*, is the regulation and control of cognitive behaviours. It is a process by which subjects consider their ongoing cognitive activities as the perceived object, and actively and voluntarily supervise, control and regulate these activities in the whole process of cognition.

In network learning, learners with stronger cognitive ability can voluntarily plan for their learning and supervise the progress of their learning, as well as manage problems. They evaluate their cognitive activities, and actively take relevant remedial measures. Learners who cannot adapt to a network learning environment often suffer cognitive dissonance, which severely impacts their learning efficiency and enthusiasm.

Learners' cognitive dissonance can be mitigated by direct teaching with guidance, as well as by the elimination of elements affecting cognitive regulation. This deserves attention: whether learners' cognition can be improved through network teaching, so as to indirectly improve their cognitive adjustment, or whether learners can be guided to have cognitive adjustment through network teaching design.

There are internal (students) and external (environmental) factors that can cause cognitive dissonance, as shown in Figure 1.

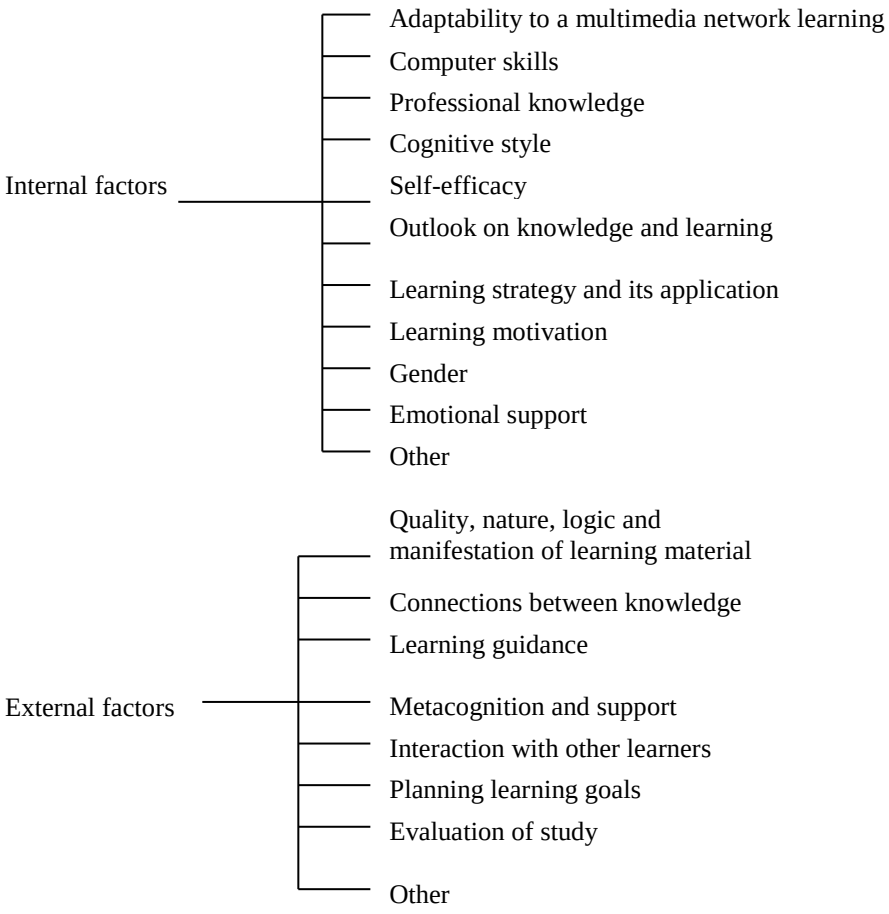

Figure 1: Factors affecting learners' cognitive adjustment in a network multimedia environment.

IMPROVING COGNITION AJUSTMENT IN A NETWORK MULTIMEDIA LEARNING ENVIRONMENT

Maintaining Learning Motivation to Promote Cognitive Dissonance

Motivation of students' learning in a net multimedia environment is different from that in traditional class. The means to motivate belong to the network class designer. Here, one can draw from TC (time continuum) motivation model theory [3].

Some strategies to motivate learning can be in accord with the research results of Wlodkowski [4]. These show how to improve the learning and make the students more interested. This mode focuses on the teaching process and divides motivation into six aspects, viz. situation, need, stimulation, emotion, ability and intensification [4]. Motivation in the learning process is considered to be dynamic and changeable.

This mode analyses the motivation elements at the start of teaching, during the teaching, and at the end of teaching, as shown in Figure 2.

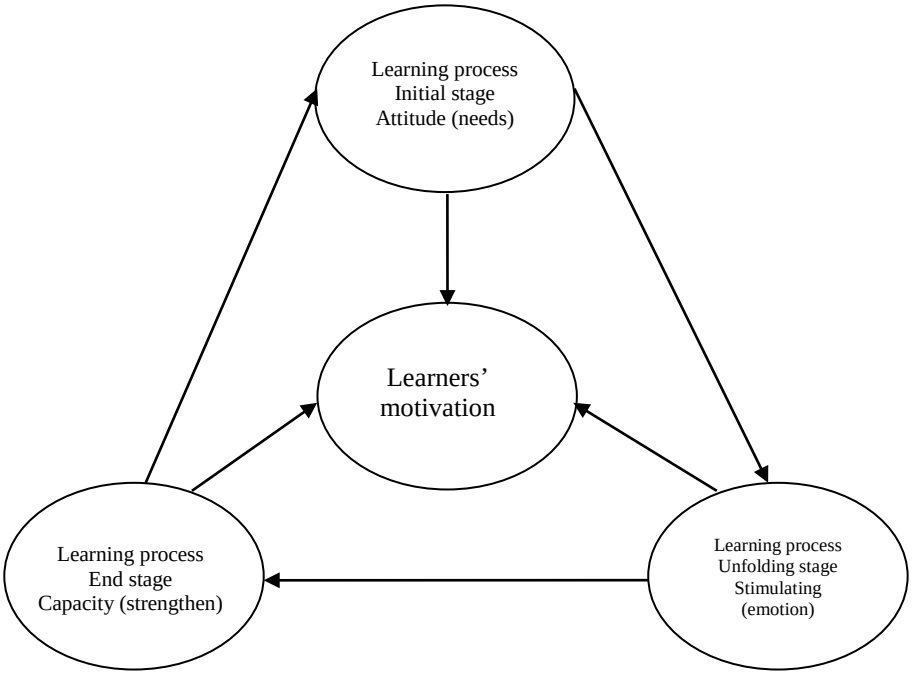

Figure 2: Mode of stimulating learning motivation.

Following is a discussion, in a network multimedia environment, of the three stages of teaching; the starting stage, the actual teaching process and the ending stage:

- The starting stage of teaching:

  In the primary starting stage of network learning, students need to understand the learning goals and the value of the knowledge to be acquired. Relevant studies show that people's internal motivation is affected by their external goals. They also show that external goals will not decrease students' interest and will motivate students to higher achievement. It is this motivation that enables students to regulate themselves, to consciously use in-depth learning strategies, put more effort into the learning, and actively seek support. When network learners think the learning content is valuable, they set specific and viable learning goals for themselves, participate in network learning and observe and critique themselves. They will make every effort to overcome difficulties and adjust strategies based on feedback, so as to self-adjust the learning. Therefore, it is better for class designers to fully describe the learning goals to the learners. These designers should also consider the enjoyment and usefulness of learning materials, so as to stimulate learners' interest.

- The middle, teaching stage:

  The middle stage of network learning is the actual learning process. During this stage, attention should be paid to the emotional elements. Stimulating elements include intuitive and cognitive stimulation. Students' attention should be attracted, to make learning more interesting and to sustain their learning activities. Students focus on specific learning content in the middle stage. Designers need to carefully design learning content and its manifestation [5].

  Multimedia can not only display text and pictures, but also play audio, video and animations; hence, providing multiple sensory stimulations. As to the manifestation of learning content, designers should consider the age and learning level of the learners. The manifestation should take account of specific learning content, so as to give learners continuous stimulation, attract their attention and maintain their learning motivation.

  The learning content can involve multiple learning methods, such as task-driven learning, the competitiveness method, discussion, co-ordination learning and situational learning. A student's initiative should be leveraged, so as to produce learning activities. On-line discussion and BBS (bulletin board systems) allow learners to seek help from companions when they face difficulties; thereby, sustaining their learning motivation by allowing them to overcome obstacles to learning.

- The end stage of teaching:

  In the last stage of network learning, students have acquired knowledge and skills, and learning motivation can be maintained by evaluation. According to students' mastery of knowledge, their progress, co-ordination and

interaction, teachers should give students positive feedback, so as to enhance their sense of achievement, progress and confidence.

Strengthen Self-efficacy to Promote Learners' Cognitive Adjustment

Self-efficacy is the subjective judgement a person has that they can succeed in a behaviour; that is, the confidence to successfully complete a task [6][7]. In network learning, self-efficacy influences a learner's selection of learning tasks, their perception of difficulty and their persistence. The learners with high self-efficacy are fully confident in their learning and are capable of coping with difficulties. They study while in the best mental state, and think they are capable of achieving the learning goals. So learners with high self-efficacy have a relatively high ability for cognitive adjustment. How to improve the learners' self-efficacy in a network learning environment will now be considered. There are four aspects to consider:

- Network learners to *own* successful experiences:

  In a network multimedia environment, the main elements influencing learners' self-efficacy are the operation of the computer, including whether there are any malfunctions and the adequacy of the network speed; the computer skill of the learner; the difficulty of questions; and whether students and other learners or students and teachers have smooth interactions. All these elements will influence a learner's self-efficacy. Learners with relatively poor computer skills may have a negative psychology on network courses through a lack of confidence. These problems should be addressed in network teaching design. As for solutions, besides improving a learner's computer skills through training before the network course, network courses should be carefully designed, so that learners do not require excessive computer ability. For example, the operating procedures can be simplified, and the interface designed, so as to reduce or avoid the possibility of mis-operation.

  The degree of self-efficacy influences a student's learning tasks. People with high self-efficacy are more likely to choose challenging tasks, set comparatively high goals, use a variety of strategies to overcome difficulties and conduct positive meaning construction. People with low self-efficacy would like to choose easier tasks. In designing the network courses, designers can sequence learning tasks according to the degree of difficulty, so that learners can complete learning tasks, from lower to higher degrees of difficulty. Learners with relatively high self-efficacy and a solid foundation of knowledge can directly choose relatively difficult tasks. Through such a design, learners' self-efficacy can be enhanced. In addition, it is better to use Lev Vygotsky's zone of proximal development [8] (or ZPD, is the difference between what can be done without help, and what can be done with help), when designing easy questions. Particular attention should be paid to this point.

- Stress successful experiences:

  Before the network learning, teachers should introduce the advantages of network learning to students, particularly those new to network learning. Teachers can also cover successful network learning cases or visit experienced successful learners, to introduce the advantages of network learning, as well as the problems. This should enhance learners' confidence in network learning.

- Encouraging self-efficacy:

  When evaluating network learners, particularly by formative evaluation, stress should be placed on personal efforts and abilities, as well as on other internal controllable elements, for learners with high self-efficacy. By comparison, stress should be placed on the external uncontrollable elements for learners with low self-efficacy, so as not to reduce their self-efficacy.

- Effect of physiology and emotion:

  When judging self-ability, people depend on physical and psychological information. People are more likely to have a high expectation of success when they are not suffering negative emotions, and are not anxious or fretful. A learner's attention level is a physical condition influencing self-efficacy. The less attention paid to learning, the more attention is paid to this unsound physical state. To reduce the influence of a learner's physiology and of negative emotions, the network course designers should carefully include pictures and other multimedia learning content, so as to attract students' attention on network courses. But, there does not need to be too much perceptual stimulation. Clear goals and simple style are enough, so as to avoid being a distraction.

Metacognition to Improve Cognitive Adjustment

Identifying Solutions

In network learning, learners will face various kinds of difficulties because of the independent learning rather than the systematic instruction by teachers. Designers of network learning courses should consider all possible difficulties and

try to identify solutions, which is a challenge facing the designer. In traditional teaching, teachers design courses, which are conducive to student learning centred on classroom teaching, with specific learning points. In a multimedia environment, many teaching strategies can be adopted, such as an *entering learning strategy* or *anchoring method*.

Teaching materials on the network are interconnected and the study is open. Learners in a network learning situation are likely to deviate from their learning points and place too much emphasis on details, while ignoring the important themes. Under such conditions, learners should self-plan their cognition and learning.

At the beginning of network learning, an electronic notepad could be opened for students to write down their study plan, and their expectations; thus, internalising their learning goals. This plan could be made available by a single touch button, so learners can review their learning plans anytime. This encourages learning to be centred on the teaching goals by guiding students not to deviate from these goals. For successful students with high motivation and who are good at studying on the net, this method could be a barrier to their study and the single touch button might be greyed-out or unavailable.

In traditional teaching, teachers learn of students' understanding by their performance and by questioning. Teachers take relevant measures to ensure they have a deep and comprehensive explanation for issues students do not understand. Teachers can provide individual assistance if necessary. In the network multimedia environment, students themselves need to supervise the cognition process, pay attention to information and ask themselves questions. They control the steps in their learning, allocate their learning time and conduct formative evaluation in the learning process. When designing courses, to guide students, designers can underscore important information with different colours and typefaces. When students tackle difficult knowledge areas, designers can include prompts to help learners.

If students find they do not understand certain material, they can check whether their cognitive strategies are appropriate and whether there are shortcomings in their basic knowledge. Successful learners can quickly find solutions to problems; they transfer their cognitive strategies or supplement their basic knowledge. But, other learners need guidance. When designing network courses, designers should identify the important parts and potential problems. This feeds into help menu designs and areas requiring detailed information. However, it is better not to tell learners about their knowledge deficiencies. It is better to use a design mode based on the zone of proximal development of Lev Vygotsky. In addition, for difficult content, learners can consult the experts by e-mail and carry out discussions with teachers and classmates.

Emotional Support to Promote Learners' Cognition

Reaching Self-achievement

Traditional classroom teaching enjoys one obvious advantage: teachers and students can have emotional exchanges and the teaching exists in an emotional environment. Teachers can create an atmosphere by their language and actions in which they closely interact with students; thus, attracting students' attention to the teaching content. This is most important for students' understanding of teaching content. In a network multimedia environment, students just have a computer and lack the study atmosphere of the traditional class. During extended periods of study, learners find it increasingly difficult to concentrate. Many students suffer physiological problems, such as eyestrain after long periods of study.

As indicated by Cui; for example, humanistic learning theory by Abraham Maslow, and the humanistic approach (client centred to learning) by Carl Rodgers, is important for emotional teaching design [9]. Humanism learning theory combines knowledge and emotion, and stresses self-achievement. Emphasis is placed on people's integrity, uniqueness and individuality. It stresses that a learner should become a comprehensive and integrated person in knowledge, emotion and will.

Self-achievement is the biggest driving force in learning. Therefore, in the process of network learners acquiring knowledge, it is of particular importance that the teaching mode meets their emotional developmental requirements. Thus, the learning becomes self-achievement. Learners can actively and voluntarily apply various kinds of learning strategies, use all kinds of learning resources and are persistent in study. They employ higher-level thinking and voluntarily seek help from companions and teachers.

Multimedia teaching should integrate animations, pictures, audios, videos and text based on psychological principles to match student characteristics. The multimedia material should inspire interest and invigorate students' learning.

Stimulating Emotions, Promoting Participation

The design of teaching content should be based on the principle of stimulating students' emotions and promoting students' active participation. A design should be specific to the teaching content. However, the design should be analysed to see whether teaching content captures the emotional element. If the learning content contains many emotional elements, the designer can meet learners' emotional requirements. For science subjects, such as physics,

chemistry and mathematics, learning content can include questions, so that students can carry out independent study that is co-ordinated, competitive and exploratory. Design might reflect students' real life, so as to make students interested in the learning and generate the experience of success.

Study folders serve as an effective tool by which students' performance can be evaluated. Learners can put their creative and personalised electronic work in the folder. Thus, students will feel satisfaction seeing their results and this will improve their confidence in network learning. Network course designers need to design creative, open and challenging problems, to encourage students to bring their imagination and creativity into play. Teachers should have timely comments on students' homework, with a focus on learners' creative, personalised learning and an appreciation of student progress. When students have an incorrect understanding of a problem, it is better for teachers to guide students, put forward questions and, then, let students rethink and question rather than directly saying they are wrong. After careful reflection, students will develop the right understanding of the problem without it causing a loss of confidence and enthusiasm. By these means, learners are more willing to study through the network and improve their cognitive adjustment.

CONCLUSIONS

To improve learners' cognition adjustment ability in a network multimedia learning environment, the external elements affecting learning can be designed, so as to alleviate learners' cognitive burden, improve learners' motivation, enhance their self-efficacy and involve them in network learning. Also, the learning style can help learners to adjust their cognition, and make them effectively apply learning strategies in the learning process, voluntarily seek help, self-observe their learning and conduct self-feedback.

REFERENCES

1. Li, M. and Hou, D., Network autonomous learning based on computational thinking. *World Trans. on Engng. and Technol. Educ.*, 12, **3**, 576-580 (2014).
2. Ackerman, R., Parush, A., Nassar, F. and Shtub, A., Metacognition and system usability: incorporating metacognitive research paradigm into usability testing. *Computers in Human Behavior*, 54, 101-113 (2016).
3. Zhao, Y. and Qi, P., Discussion on promoting learner's cognitive regulation ability in network-based multimedia. *E-educ. Research*, 4, 45-49 (2007).
4. Wlodkowski, R.J., How to plan motivational strategies for adult instruction. *Performance Instruction*, 24, **9**, 1-6 (1985).
5. Yao, J., Multilayer model for on-line learning resources based on cognitive load theory. *World Trans. on Engng. and Technol. Educ.*, 13, **3**, 245-250 (2015).
6. Bandura, A., Self efficacy: the implementation of control. Shanghai: *East China Normal University Press*, 69-72 (2003).
7. Huang, C-H., Investigating the attitudes toward calculus of engineering students in Taiwan. *World Trans. on Engng. and Technol. Educ.*, 9, **2**, 80-85 (2011).
8. Zone of proximal development, 19 February 2016, https://en.wikipedia.org/wiki/Zone_of_proximal_development
9. Cui, H., Design of affective teaching in network education. *Chinese Audio-visual Educ.*, 1, 59-62 (2006).