

## Using Teaching Cells to Establish Effective Online Learning Environments

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**Abstract:** In China, researchers suggest education can be transformed from a drain to a driver of economic growth where “human capital is duly recognized and respected” (Glazebrook & Song 2013; Altbach 2013). Since the curriculum taught in kindergarten through twelfth grade in China is highly standardized throughout the entire country, online supplement to this education should be possible. China’s online learning platform for public school students should support the learning of these students, and provide 1) a supplement to students outside of class, 2) guidance for tutors who support the students outside of class, and 3) it should even provide supplemental materials for public school teachers to use if they choose. Improving the Chinese online teaching system in this way would also lower education costs while allowing learners to fully enjoy the equal rights of learning without regard to geographic location and ability to hire a tutor.

Considering these factors, to improve China’s implementation of online learning, a concept of modular “teaching cells” is proposed, which are basic units of curriculum. Specifically, each teaching cell will consist of the four components of educational resources described, and promote connectivist learning as well as a high-quality personal learning environment (PLE). Each teaching cell would cover two subjects and contain these four resource categories (teaching materials, courseware, case studies and examinations). The teaching cell will be able to continually develop and evolve in response to student input, and will be reusable. The teaching cell concept itself has four specific features which will be described: openness, evolutionary development, intellectuality, and micromation.

The purpose of this paper is to introduce and propose the “teaching cell” approach in providing an online supplement to China’s public school education system. This paper reviews the literature on the subject, then defines a teaching cell, and describes four main features of a teaching cell. Finally, this paper recommends future research design considerations for exploring the use of teaching cells in online learning.

**Keywords:** Online instruction, pedagogy, teaching cells, China, teaching resources.

### 1. Introduction and literature review

In the article, “Is China up to the Test? A Review of Theories and Priorities for Education Investment in Modern China,” Glazebrook and Song (2013) review key theories about the role of education in economic development and social change taking place in China. The authors suggest education can be transformed from a drain to a driver of economic growth where “human capital is duly recognized and respected” (Glazebrook & Song 2013).

Currently, children in kindergarten through twelfth grade in Chinese public schools sit in classrooms of approximately 70 students. Although the teachers are excellent, they have no individualized time for students, and they are forbidden to tutor students outside class. This forces parents to set up daily tutoring arrangements for their children in order for them to get ahead, as competition is fierce in China for educational advancement. These tutors tend to be of varying quality, and students must be driven to the tutor after school, increasing China’s already thick traffic and stress on parents. Costs are also a problem, and worse, many poor students like those in the Tibetan region cannot afford tutors and simply fall behind.

To achieve the goals of education reform in China, the online education system should be optimized to make full use of resources, also popularizing and promoting civil qualities. It should support the learning of these students in public schools. It should provide 1) a supplement to students outside of class, 2) guidance for tutors who support the students, and 3) it should even provide supplemental materials for public school teachers to use if they choose.

Education is increasingly becoming internationalized due to the availability of online study through the internet (Guruz 2011). Massive open online courses (MOOCs), popularized by the educational provider Khan Academy (Thompson 2011) have been promoted as a possible model of general education for lifelong learning

(Miklowitz et al. 2003). In China, the use of MOOCs has changed the traditional pattern of higher education, and brought both opportunities and challenges (Chai & Yang 2014). For example, the Massachusetts Institute of Technology (MIT) provides MOOCs on their OpenCourseWare web site. This MOOC offers teaching materials such as video lectures, courseware such as simulations, applets and visualizations for students to modify and control experiments, case studies that foster problem-solving, and assignments, quizzes and exams.

However, MOOC approaches to learning do not really promote student-centered learning, which should be a goal of online learning, because the instructor's role is very "hands-off". Student-centered learning requires the instructor to play a different role than that required by a MOOC (Stewart, 2014). In student-centered learning, the teacher must fill the role of an authority, through providing feedback as to correctness ("grading"). The teacher must also be a guide, and lead the student through the topic. China's implementation of an online supplement to its public school education system must therefore not use a MOOC format, and instead use a student-centered approach.

In addition to student-centered learning, implementing online educational support for China's public school students would be improved by using a personalized learning environment (PLE) approach rather than a MOOC approach (EDUCAUSE Learning Initiative, 2009). A PLE can be contrasted with a learning management system (LMS) in that an LMS is "course-centric" and a PLE is "student-centric" (EDUCAUSE Learning Initiative, 2009). A successful implementation of PLE is "a learning platform that is by definition always involving [and] requires students to engage in ongoing decision-making to maintain, organize, and grow their environments" (EDUCAUSE Learning Initiative, 2009).

A PLE can be easily set up to promote connectivist learning (Downes, 2012). In his 2012 collection of essays on Connectivism and Connective Knowledge, Stephen Downes wrote, "Connectivism is the thesis that knowledge is distributed across a network of connections, and therefore that learning consists of the ability to construct and traverse those networks" (page 9). A PLE could be enhanced with intelligence to help the student connect with other learning resources that are related to the student's interests based on what elements of the PLE the student is leveraging.

Considering China's current challenge with supporting public school students with an online platform, a concept of modular "teaching cells" is proposed, which are basic units of curriculum. Each teaching cell would cover two subjects and contain these four resource categories (teaching materials, courseware, case studies and examinations), and promote connectivist learning as well as a high-quality personal learning environment (PLE). They will also allow the teacher to take an appropriate role in online learning as a guide and an authority. The teaching cell will continually develop and evolve in response to student input, and will be reusable. The teaching cell concept itself has four specific features which will be described: openness, evolutionary development, intellectuality, and micromation.

## **2. Definition of a Teaching Cell**

As described earlier, in this new paradigm, the teaching cell is the basic unit comprising components of curricula built into an online instruction system. First, each teaching cell is limited to two subjects, allowing the cell to retain a very small "micro" size, to be standardized in format, and can be included in any part of a higher level online instructional resource. To maintain the attention and interests of learners during the informal learning process, the learning content design must follow the rules of cognitive load theory (Sweller et al., 2011). This theory holds that human learning takes place best under conditions that are aligned with human cognitive processes and the human cognitive architecture. The knowledge chunk taught in a teaching cell should be small so that learners do not need to spend too much time and working memory to learn the content.

Second, the teaching cell can continually develop and evolve in response to student inputs. The nature of a teaching cell similarly features are intellectuality, generativity, the capability of evolution, and adaptability, so it can improve over time as it is used through the input given. Third, the teaching cell is reusable, so over time it can be refined through the accrual of information and the sharing of learning throughout the learning platform.

Using the teaching cell to organize online educational curricula is an advanced and elegant format for creating learning content. The teaching cell approach is based on theories about learners and their learning activities

which have found that learning can be stimulated through the sharing of teaching resources (Dougiamas et al., 2003). The approach maintains the basic features necessary for learning content in the online environment, which includes accessibility, adaptability, acceptability, durability, interoperability, and reusability. The next section will describe the four main features of the teaching cell: Openness, evolutionary development, intellectuality, and micromation.

### **2.1. Openness feature**

The teaching cell concept has strong openness, meaning it is designed to easily exchange information with other media and environments. Each teaching cell has a teaching system connector inside that collects intelligence through its use of different components, as a traditional learning management system has now about its components. Having this intelligence available to teachers and tutors will help them select teaching cells to recommend to students, and the openness built into the online educational platform will allow them to share teaching cells.

### **2.2 Evolutionary development feature**

The neuron is a good analogy for a teaching cell, which has the functions of both “growth” and “division”. The teaching cell can automatically search related teaching cells using the online educational platform’s database and establish dynamic connections to create an evolving, high-quality PLE through connectivist principles. In these ways, the teaching cell concept takes advantage of the core idea of Web 2.0, which is “architecting systems so that they get smarter the more people use them,” as well as “leveraging collective intelligence” (O’Reilly, 2005). The teaching cell concept allows learners contribute to modifying the evolution of the teaching cell to achieve the ongoing development.

### **2.3 Intellectuality feature**

The teaching cell would be designed to have a strong intellectuality, meaning it can sense and adapt to the PLE being created through interaction with the student. For example, it can switch its display format based on different devices (such as laptop, smartphone, PDA, etc.), adjust the learning content and teaching order in response to the user experience, and give appropriate feedback depending on the users learning records.

### **2.4 Micromation feature**

“Micromation” refers to automation at the micro level. Using teaching cells can bring to teaching resources micromation and intelligence via self-evolution and development. For example, micromation could be used to hide or present certain components of the teaching cell to certain students depending upon certain parameters (e.g., if they did not do well on questions on an online test surrounding a particular topic). As time goes on, a self-evolution will occur, and will optimize the function of the teaching cell for individualized learning.

## **3. Future Research Design**

Based on these features of teaching cell, the next step is a study comparing results of learning from using the teaching cell online learning pedagogy vs. results of learning from typical online pedagogy, and see if teaching cell use results in a high-quality PLE and successful connectivist learning. The results of the study will reflect the new proposed teaching cell pedagogy is effective or not. In addition, future research will need to focus on the structure of the teaching cell, and optimal teaching cell structures and processes will need to be discerned.

## **4. In Conclusion**

In conclusion, in China, the “teaching cell” is proposed as an approach to developing an online learning system to support public school students. Each teaching cell covers two subjects and contains teaching materials, courseware, case studies and examinations. Teaching cells feature openness, evolutionary development, intellectuality, and micromation, and thus promote connectivist learning and a high-quality PLE for students while being managed by an enterprise educational platform. Future research into teaching cells will compare if this approach to online education is comparable or superior to current approaches in terms of teaching effectiveness and learner satisfaction, and studies into optimal implementations of teaching cells.

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