An effective web-based approach to support the initial training of science teachers at HKIEd

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Abstract

This paper reports the processes and ways in which a dedicated website has been developed by a group of seven colleagues at the Hong Kong Institute of Education (HKIEd) Science Department to support their student-teachers' development of teaching competence during various kinds of field experience activities such as practicum, teaching practice and school visits etc. From the outcome of our project, a comprehensive web-based system was created with the following specially selected features to help our student-teachers develop confidence and skills for the effective teaching of various science topics in schools:

- A data bank of 20 sets of video clips on exemplary parts of students' teaching performance in schools or microteaching at HKIEd as identified and selected by their supervisors.
- A collection of virtual reality resources which include a typical classroom or laboratory environment with a 3D/panoramic view etc.
- A website called Field Experience Support on Science (FESS) being developed at *http://www.ied.edu.hk/fess/* which provides a platform for the management of the aforementioned 2 types of resources in the WWW plus various synchronous or

asynchronous communication channels as well as sharing of lesson plans, schemes of work and other teaching resources etc.

Each video clip had been reviewed and commented on by a project team member who was also the student-teacher's supervisor or tutor. Those video clips were normally accompanied by the lesson plans, detailed description of teaching materials and/or self-reflection. Besides, a questionnaire survey was administered to about 150 students in 5 different teacher education programmes to collect feedback for evaluating the effectiveness of this website. The initial results indicated the definite success of this project. More detailed findings and analysis of this questionnaire survey and the use of this project to facilitate post-lesson conference will be thoroughly discussed in this symposium paper.

Addressing the needs of student-teachers during the field experience period

This project was formulated in an attempt to address the needs of student-teachers during the field experience period. The experience of student-teachers in teaching practice has been found to encompass mixed feelings of frustration and fulfilment (Sacks and Harrington, 1982). According to a more extensive study conducted by Sacks and Harrington (1982), student-teachers may feel inadequate or incompetent at times in the struggle to find the right way to teach and to become independent teachers. These feelings of incompetence have

many implications for the confidence, attitudes, behaviour, and performance of the student-teachers. Dispoto (1980) found that student-teachers' attitudes towards teaching and school became less favourable after student teaching. One of the purposes of the project was thus to provide emotional support for the student-teachers such that they might feel connected both to their peers and the institute supervisors while are at their teaching practice schools.

Student-teachers need to be supported professionally. In synthesizing findings on the teachers' concerns (Fuller, 1974; George, 1978; Adams, 1980) and their thoughts about teaching (Kagan, 1992), three general stages that characterize the development of novice teachers are revealed. In the early stage, novice teachers are predominantly concerned about themselves, that is, whether they can be classroom leaders and assume the general responsibilities of classroom teachers. During the second stage, in which they are more concerned about classroom management, lesson planning, and the clear presentation of information, the focus of thought moves from themselves to the pupils. In the third stage, the student-teachers are more concerned with the impact of teaching on pupils' learning. This is a more complicated stage, in which the novice teachers attempt to relate their pedagogy to children's learning. Providing support for the student-teachers as they attempt teaching approaches new to them or test out classroom management strategies thus becomes important.

In addition to providing support for the student-teachers, the project creates an arena in which student-teachers can talk about their teaching. Feiman-Nemser and Remillard (1993) suggested that a teacher's knowledge is a form of situated cognition and a teacher's learning is therefore socially supported. In explaining the ways in which pre-service teachers learn, Sutton, Cafarelli, Lund, Schurdell, and Bichsel (1996) pointed out that the interaction among the student-teachers helped to inspire them in their teaching practice. Moreover, other studies (Beals, 1991; Coyle & Harrison, 1993; Ng, 2002) have found e-forum to be an invaluable arena for collaborative learning during the teaching practice period or for stimulating student-teachers to reflect on their professional development. Talking about teaching supports learning and is also an integral part of the learning.

Supporting the student-teachers using an online system can also serve a modelling purpose. Researchers (Bryum & Cashman, 1993) have suggested that teacher educators need to model learning and teaching strategies which incorporate the use of IT.

The development of an online Field Experience Support System (FESS)

In the past, the project team has developed a lot of on-line materials for self-learning (see Yeung et al, 1998 and the HAS Centre at http://www.ied.edu.hk/has) which can be used to

provide or supplement the pre-requisite knowledge for the students at the Institute to study various Science or General Studies (GS) modules. While there are plenty of examples of the creative and effective use of those IT and related technologies for teaching and learning, they are mostly related to the acquisition of academic content knowledge, in a subject-based, a cross-curricular, or an integrated approach. However, fewer efforts have been devoted to creating online resources to support the student-teachers' development of science teaching competence at the primary and secondary levels during various kinds of field experience activities such as practicum, teaching practice, and school visits, etc. The aim of this project was to create a comprehensive online system to help the student-teachers to develop confidence and skills for the effective teaching of various science topics in schools with levels ranging from primary one to senior secondary.

In formulating the design of the online system, our team considered the role of IT support in education. It is envisaged that the most important application of IT in education is the intensive and innovative use of the internet to support a wide variety of web-based teaching and learning activities (see, e.g., Cheng & Chin, 1999; MacIsaac, 2000; Shotsberger, 1996) through its various functions or services, such as the world wide web, e-mail, file transfer, newsgroup, ICQ/chat, video conferencing, remote computer access, and application sharing, etc. Nevertheless, the application of IT in education should not be restricted to the use of

computers and the internet, but should include different kinds of multimedia educational technologies, data logging systems, and 3D (see, Yeung & Ng, 2000 and Yeung, et al, 1996) or virtual reality apparatus.

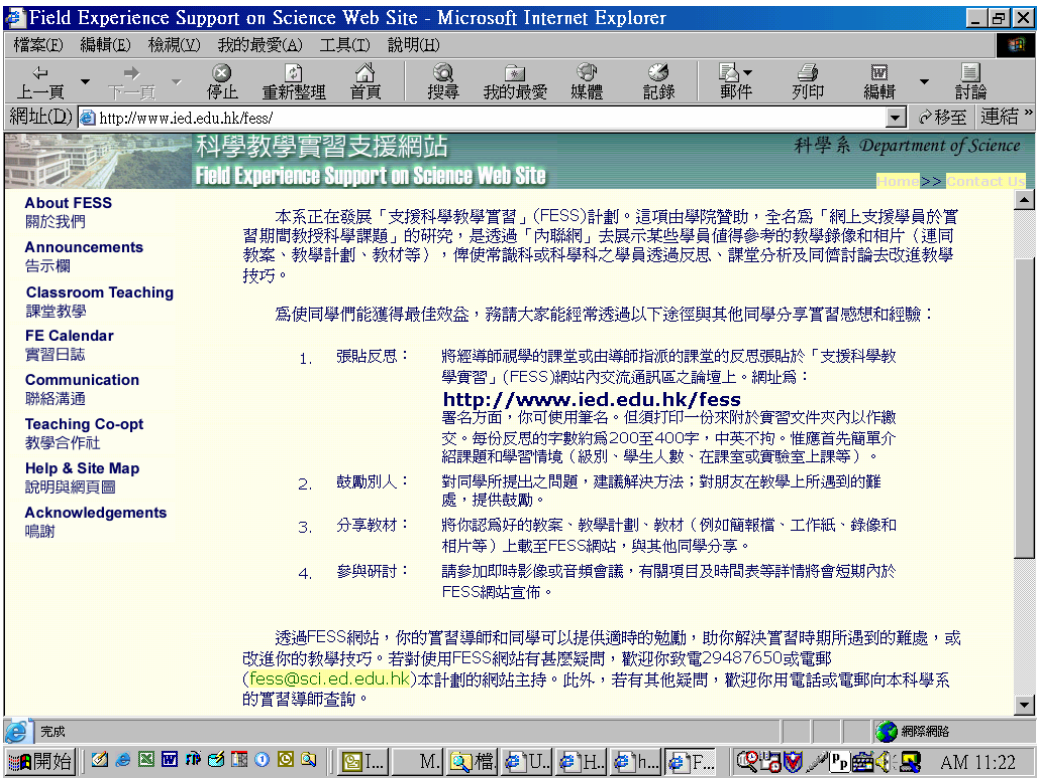
The design of this online system takes advantage of the characteristics of web-based learning to support the learning of the student-teachers during the field experience period. As student-teachers are away from the Institute campus during this period, web-based learning allows students to access and use updated information for knowledge building and sharing at any time and in any location once they are connected to the internet (Kearsley, 1996).

The project team also made reference to the use of the three categories of web-based learning activities suggested by Hackbarth (1997) and Harris (1998). The former (Hackbarth, 1997) proposed web-based learning activities in three categories: communications, information retrieval, and information sharing. The latter (Harris, 1998) proposed 18 activity structures grouped into three categories: interpersonal exchanges, information collection and analysis, and problem solving (see Harris, 1998, for a more detailed description).

Method

Based on the principles above, a comprehensive online system was developed to help the student-teachers to develop confidence and skills for the effective teaching of various science topics in schools. To this end, it is equipped with the following innovative features:

- A data bank of at least 20 video clips of exemplary parts of students' teaching performance in schools or microteaching at the Institute, as identified and selected by teaching practice supervisors or practicum tutors.
- A collection of newly-developed virtual reality resources, which includes 3D and panoramic views of typical classroom and laboratory environments.
- An online Field Experience Support System (FESS) constructed on top of the NextEd platform for the management of the aforementioned two types of resources in the world wide web, as well as various synchronous or asynchronous communication channels, such as open discussion forums (with self-reflection on TP), private chat rooms, audio conferencing, video conferencing, and application and file sharing (of lesson plans, work schemes, and teaching resources), etc.



In launching the system, e-mails have been sent to over 1,000 student-teachers, who are preparing to teach the GS or Science subjects in primary or secondary schools, informing them that the FESS website resources were available for improving their classroom teaching skills through reflection, lesson analysis, and peer discussion. They were also provided with some brief instructions on how to make effective use of those resources.

Individual members of this project team had made use of the FESS website for teaching some General Studies, Science, Biology, and/or Physics methods modules and Science, Technology, and Society (STS) modules, supporting their practicum tutorial and/or the field experience

block practice. The names of the programmes and the number of students involved are reported as follows:

Usage	**Programme**	**Estimated no. of students**
Learning activities in some methods or STS modules	4-Year F/T BEd(P) GS Major and Minor	130
	2-Year P/T PGDE(P) GS Major	100
	1-Year F/T PGDE(S) Biology Major	14
	2/3-Year CE(S) Science elective	50
Support for practicum tutorial or field experience supervision	4-Year F/T BEd(P) GS Minor	30
	2-Year P/T PGDE(P) GS Major	30
	2-Year P/T PGDE(S) Physics Major	14
	2-Year PC GS elective	90
	2/3-Year CE(S) Science elective	50
	Total	508

In order to evaluate the quality of this project, the project team communicated by e-mail and met formally twice to provide critical comments and reflections on various parts of the

materials developed. In addition, the project team administered a questionnaire survey (see attachment) to about 150 students in 5 different programmes.

Results

The results reported in this section draw on the findings from the evaluation questionnaire and an analysis of the contents and interactions on the FESS website. The findings from the evaluation questionnaire suggest that the FESS was successful in supporting student learning. In summary, over 85% of the respondents agree or strongly agree that (a) "The website contains useful materials related to the teaching of science in schools", and (b) "Overall, I feel this website can provide me with a good learning experience and so I will recommend it to other student-teachers." This was a new learning experience for many of the students: 40% of the respondents were unsure or disagreed that they had previously used or found other similar filed experience websites in Chinese. Regarding the usefulness of the various sections of the FESS website, the classroom teaching section received the highest rating, with over 89% of the respondents agreeing or strongly agreeing that it was useful; the teaching co-opt section and the communication section were given this rating by 73% and 63% of the respondents respectively. These findings suggest that student-teachers found the website beneficial to their learning.

Since the formal launching in mid-March, 2002, the website has recorded (according to a third party's web counter) more than 4,000 visits paid by the teachers and students, and approximately 120 comments have been recorded in the communication section, with an average of 240 words per message. An analysis of the contents and the interactions on the FESS website suggests that benefits to students are multiple. The announcements and the FE calendar section on the website provided updated information to students during their field experience period. In the teaching co-opt section, a total of 23 pieces of resources were uploaded by the students for sharing among their peers. These resources included lesson plans, worksheets, experiment ideas, short video clips, photos, and PowerPoint files.

The classroom teaching and the communication sections taken together provided the most significant support. These sections help students to gain some initial experience of teaching practice in a real classroom environment; they also provide a channel for them to share their experiences and feelings concerning their own teaching and to communicate with and gain advice and support from fellow students and supervisors during the field experience period. They thus feel less isolated when they encounter problems related to their teaching practice. In the reflections posted, students shared their feelings and encouraged each other during the field experience period. For example:

> "I have met similar situations in my class. However, the laboratory technician in my school would provide a little more support and distribute the materials in plastic trays. Students just need to obtain one tray. Another point is that we need to be very familiar with the content; we need to be able to answer students' questions under all circumstances (even if it is not very organized). We need to prepare related questions on the topic. I have come across this before and I was dumb-founded! Keep working!"

In this response, the student shared his/her experience and reminded other classmates to be well prepared, encouraging them to work hard.

Tutors had also provided encouragement to the students using this open forum. For example:

> "This piece of reflection is well written. The content reveals in-depth reflection on the teaching strategies and a willingness to seek continuous improvement. This is commendable and other classmates may take this as a reference."

This interaction had served to clarify the tutors' expectations of the student-teachers' performance and provided encouragement for students to work for continual improvement.

Tutors and students also made use of the classroom teaching and communication sections to stimulate analysis of videotaped classroom teaching episodes. In the primary education forum, a total of 7 sets of episodes were posted and these attracted 29 responses from students and tutors. In the secondary education forum, a total of 16 sets of episodes were posted, along with 19 responses that analysed them. In each of these episodes, the discussion could be initiated by a message from the web-manager or a student. The message included a video clip with an invitation for comments. Responses from students covered various areas, including classroom management, ways in which to arouse pupils' interest, and alternative teaching strategies. For example:

> "The lesson is interesting and has aroused pupils' interest. I would suggest integrating more IT resources into the teaching, e.g., introducing some interactive games. In the meantime, the teacher needs to strengthen classroom management."

"The children may not understand why we need to protect the trees…teachers need to arouse their interest…. This means that we would need some short video clips as teaching resources."

"In this topic (conservation of the environment), we may use newspaper clippings or photos to illustrate the situation in more concrete ways."

The discussion based on the video clips of classroom teaching episodes, therefore, stimulated students to reflect on their teaching and suggest possible alternatives. These discussions are beneficial for the pre-service students in their field experience period as they strengthen peer support and interaction with the institute tutors. For in-service programmes, the students may view the video clips at any time and in any place and provide their comments or reflections in the discussion forum with the aim of improving their existing teaching practice.

These video clips and discussions provided alternative teaching strategies for tutors. They may serve a number of purposes, including the demonstration of certain teaching skills and approaches, stimulating students' reflections on critical incidents, starting debates on controversial issues related to science teaching, and allowing criticism of problematic teaching. Lecturers teaching the methods modules or conducting practicum tutorials had made use of the video clips for discussion purposes. Moreover, the FESS website by itself

could be seen as a learning activity that demonstrates an exemplary use of IT in education for the teaching of some Science, Technology, and Society modules. Drawing on the experience of this project, the project team can formulate strategies which serve to further promote and support the learning of student-teachers.

Future directions of development

It is anticipated that this online platform will gradually evolve into a virtual community which will include institute supervisors, student-teachers, and school teachers, providing a range of field experience support to those in-service or pre-service student-teachers through a combination of synchronous or asynchronous communication channels, such as open discussion forums, private chat rooms, audio conferencing, video conferencing, and application and file sharing. The classroom teaching and communication sections could be structured to conduct post-lesson conferences. With the consent of the student and the teaching practice school, the tutor could videotape the lesson, post this on the forum, and invite students to join in an asynchronous discussion in analysing the lesson. Both pre-service and in-service students could participate in such discussions and the forum might yield inspiring ideas for the teaching of science lessons.

There are many functions and computer programmes specifically developed for this website which enable it to provide *Chinese input and display* in the online electronic discussion, a channel for uploading teaching materials as submitted by student-teachers, announcements on the website, and an electronic guest book, etc. This website can be used as a template for other departments, units, and centres to adopt in similar projects. Therefore, it would be worthwhile for us to share our ideas and the outcomes of this FESS website with other colleagues or teacher educators in other subject disciplines through presentations in a departmental retreat, local symposium, or international conference.

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References:

Adams, R. D. (1980). *A developmental study of teacher concerns across time.* Paper presented at the 64th Annual Meeting of the American Educational Research Association, Boston, MA, April 7-11, 1980.

Beals, D. E. (1991). Computer mediated communication among beginning teachers. *Journal of Technological Horizons in Education, 18*(9), 74-77.

Bryum, D.C. & Cashman, C. (1993). Preservice teacher training in education computing: Problems, perceptions and preparation. *Journal of Technology and Teacher Education, 1*(3), 259 – 274.

Cheng, C.W. and Chin, Y.L. (1999). The effects of mentors in electronic forums for preservice teachers. *Asia-Pacific Journal of Teacher Education, 2*(1), 75-86.

Coyle, D. & Harrison, C. (1993). The EHE-ESMAT Project: the development of awareness of electronic mail amongst student teachers. *Journal of Information Technology for Teacher Education, 2*, 89-103.

Dispoto, R.G. (1980). Affective changes associated with student teaching. *College Student Journal, 14*(2), pp.190-4.

Feiman-Nemser, S. & Remillard, J. (1993). Perspectives on learning to teach. In F.B. Murray, (Ed.), *The Teacher Educator's Handbook* (pp. 63-91). American Association of Colleges for Teacher Education.

Fuller, F. (1974). *Achieving affective competencies through the teacher concerns self confrontation model of personalized teacher education.* Chicago: Illinois.

George, A. (1978). *Measuring self, task, and impact concerns; A manual for use of the teacher concerns.* Texas University, Austin: Research and Development Center for Teachers Education.

Hackbarth, S. (1997). Web-based learning in the context of K-12 schooling. In R.C. Branch & B.B. Minor (Eds.), *The Educational Media and Technology Yearbook 1997*. Englewood, CO: Libraries Unlimited.

Harris, J. (1998). Curriculum-based telecollaboration: using activities structures to design student projects. *Learning & Leading With Technology*, *26*(1), 7-15.

Kagan, D.M. (1992). Professional growth among preservice and beginning teachers. *Review of Educational Research*, *62*, 127-129.

Kearsley, G. (1996). The World Wide Web: Global access to education. *Educational Technology Review*, Winter(5), 26-31.

Maclsaac, D. (2000). Communities of on-line physics educators. *The Physics Teacher*, *38*, 210-213.

Ng, E.M.W. (2002). Enhancing flexible and collaborative learning for pre-service teachers through a web-based learning system. *Journal of Quality School Education*, 2, 53-63.

Sacks, S.R. & Harrington, G. (1982). *Student to teacher: The process of role transition*.

Paper presented at the annual meeting of the American Educational Research Association, April 1982, New York.

Shotsberger, P.G. (1996). Instructional uses of the World Wide Web: Exemplars and precautions. *Educational Technology*, Mar.-Apr., 47-50.

Sutton, R.E., Cafarelli, A., Lund, R., Schurdell, D. & Bichsel, S. (1996). A developmental constructivism approach to pre-service teachers' way of knowing. *Teaching and Teacher Education, 14*(4), 413-427.

Yeung, Y.Y., Lee, Y.C., Li, K.M & Ling, S.H. (1996). *Teaching science through three-dimensional visualization: A first step toward implementation*. Science and Technology Education Conference '96 Proceedings, pp.296-302.

Yeung, Y.Y., Cheng, May M.H., So, Winnie W.M., & Tsang, Eric P.K. (1998). Using the internet for education: Training for student-teachers. In J. Bacon-Shone (Ed.) *Vision and Reality of IT in Education - First Glimpse* (Proceedings of the Fourth Hong Kong Web Symposium) (pp. 215-228). Hong Kong: University of Hong Kong.

Yeung, Y. Y. & Ng P. H. (2000). Integration of IT in physics education: The scope of a subject-based approach. In K.S. Volk, Winnie W.M. So & G.P. Thomas (Eds.), *Science and Technology Education Conference 2000 Proceedings*. Hong Kong: Hong Kong Institute of Education.