

# Closing the gap: Pre-service teachers' perceptions of an ICT based, student centred learning curriculum



Chwee Beng Lee, Timothy Teo, Ching Sing Chai, Doris Choy, Ashley Tan and Jimmy Seah  
Nanyang Technological University

As technology continues to influence many aspects of our social and work lives, it is important that school experiences equip students the skills and knowledge that will enable them to develop into effective independent, creative, and lifelong learners to cope with the influx of changes. Given that teachers play a key role in the effective use of technology in education, there is a need to ensure that teacher education programs prepare teachers for the effective integration of ICT in the classrooms. We believe that there is a need to adopt a student-centered learning framework to design our ICT based Student-Centred Learning (SCL) curriculum for all pre-service teachers. In this paper, we presents parts of the findings from a curriculum review which evaluated 483 pre-service teachers' overall satisfaction level towards an ICT based SCL course. We also provide some recommendations to the ICT curriculum based on the results found.

Key words: ICT, student-centred learning, pre-service teachers

## Introduction

As we move into a technology-rich society, our education landscape has simultaneously gone through tremendous changes. It is crucial that school experiences equip students the skills and knowledge that will enable them to develop into effective independent, creative, and lifelong learners to cope with the influx of changes. It has long been accepted that, among other resources, technology is one of the chief change agents. Given that a teacher is key to effective use of technology in the educational system (Zhao, Hueyshan, & Mishra, 2001); there is a need to ensure that teacher education programmes prepare teachers for the effective integration of ICT in the classrooms. We believe that there is a need to adopt a student-centered learning framework to design our ICT based SCL curriculum for all pre-service teachers. We use a set of guiding principles based on the research-validated Learner Centered Psychological Principles (APA, 1993, 1997) and the suggestions made by several researchers (Bonk, & Cunningham, 1998; Glasgow, 1997; Jonassen, 1998) to guide our planning and implementation of a curriculum that seeks to offer our pre-service teachers a systemic training in employing student-centred learning strategies to incorporate ICT into the school curriculum.

This paper presents part of the findings of a curriculum review which evaluated 483 pre-service teachers' overall satisfaction level towards an ICT based SCL course. It is hypothesised pre-service teachers' perception of their ICT competence will significantly influence their perception of the course usefulness, which in turn influenced their course satisfaction.

## Literature review

### Student-centred learning

The shift from teacher-centered, didactic pedagogy to student-centered constructivist pedagogy has redefined the meaning of learning. Most teacher preparation courses on integrating ICT into classroom have shifted their focus from equipping students with technical skills to activities that were informed by constructivist learning theories and instructional methods. However, this does not guarantee a good grasp on how to effectively integrate ICT into classroom teachings. One of the reasons could be attributed to the compartmentalisation of coursework (Niederhauser, Salem, & Fields, 1999) when learning theories and pedagogies are taught in courses that provide little opportunities for pre-service teachers to make connection between theory and practice. Pre-service teachers may learn to implement different constructivist instructional strategies such as cooperative learning (Slavin, 1983), problem-based learning (Savery & Duffy, 1995), or knowledge building (Berierter & Scadamalia, 2003) without realising the underlying theoretical considerations. If pre-service teachers are not provided with opportunities to

experience a student-centered learning environment in which they could make the connection between pedagogy, learning theories, and the use of ICT to support thinking, it is likely that they will adopt a traditional teacher-centered approach in using technology as a tool for information transmission. Teacher preparation programmes should therefore seek to provide pre-service teachers with opportunities to engage in constructivist learning activities to help them develop a better understanding of the importance of constructivist teaching and learning practices.

To provide our pre-service teachers with a relevant and meaningful learning experience, the ICT based SCL curriculum at the National Institute of Education was designed and implemented using the characteristics of the student-centred learning. We describe some of these characteristics in this paper.

#### *Self-monitoring of own learning process*

In our ICT based SCL, pre-service teachers were encouraged to set their own learning goals and guided to monitor their own learning processes so as to determine if the strategies they use to accomplish their learning goals were appropriate (Glasgow, 1997; Hannafin, Hill, & Land, 1997; Palincsar, & Brown, 1984). In other words, they must seek to be reflective practitioners (Guild, 1997). To guide our pre-service teachers as they embark on the self-monitoring process, we have incorporated reflection component in both the individual assignment and the pair project work (ICT-based SCL package). This crucial process culminated in the final assignment which required the pre-service teachers to work on an authentic and complex task that foster different levels of higher order thinking skills.

#### *Meaningful collaboration*

Meaningful collaboration is an integral component of our ICT based SCL curriculum. The major assignment required pre-service teachers to work closely with a partner. This process encouraged pre-service teachers to learn to negotiate, compromise, and scaffold each others' learning (Lim & Chan, 2007). If learning is a social process and learners develop understanding through interaction with the environment around them (Vygotsky, 1978), we must allow our pre-service teachers to actively collaborate with their peers, so that they may compare their thinking processes to that of their peers and engage in questioning to revise their understanding on a concept or theory (Jonassen, 1996).

#### *Technology to support deep thinking*

One of the key goals of our ICT based SCL curriculum is to help our pre-service teachers explore and understand the affordances of technology and to tap onto such affordances to enhance classroom teaching and learning. When technology becomes more powerful, teachers need to be "pedagogy-design experts" Fullan (2000). The role of technology changes the role of teachers from that of an information transmitter to a promoter of deeper thinking that induces conceptual change. The latter role is made possible by an effective use of technology. In our ICT-based SCL curriculum, pre-service teachers learn to use technology to support teaching and learning in various ways. For instance, they learn to use technology to work collaboratively on real-world problems and build online-communities which extend beyond the school walls for knowledge building (Bransford, Brown, & Cocking, 1999).

#### *Instructor as active facilitator*

It is crucial that our instructors perform the role of an active facilitator and model the facilitation process so that pre-service teachers are able to understand how facilitation works in a student-centered learning environment and transfer such skills to their future classroom teaching. In our ICT based SCL curriculum, instructors actively facilitate and guide the pre-service teachers in their learning, so that they gradually learn to be independent and develop their own strategies to manage and achieve their learning goals. It is our hope that pre-service teachers will also become "facilitators of learning" (Dinchak, 1999) who can help their students to make meaningful connection between classroom learning and the real-world (Brown, 2003).

#### *Active knowledge construction process*

In our ICT-based SCL curriculum, we seek to impress upon our pre-service teachers that knowledge can be constructed, provided learners are actively involved (McCombs, 2001) in the meaning making process. In such a learning environment, pre-service teachers' understandings are considered improvable and are treated with respect and valued according to their contributions to the group's knowledge base. They are given opportunities to articulate and refine their understanding through the constant revision of their ICT based SCL project. This SCL characteristic is congruent with one of the knowledge building principles whereby pre-service teachers assume collective cognitive responsibility in an environment of diversity and complexity to achieve new level of knowledge and understanding (Scardamalia and Bereiter, 2006).

### *Engaging in authentic task*

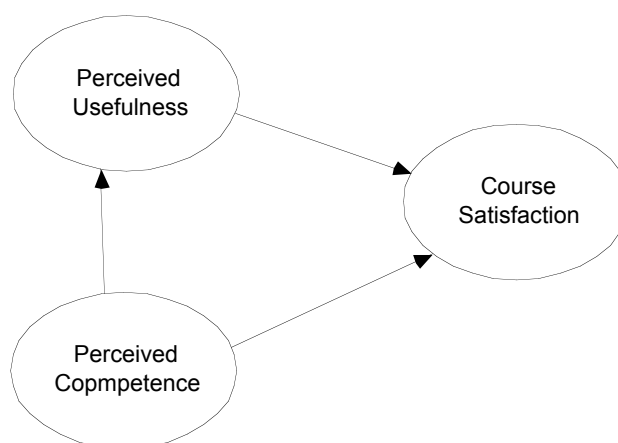
To ensure that learning is meaningful, our ICT based SCL curriculum encouraged pre-service teachers to engage in authentic task which are situated within realistic context. They select a topic pertaining to their teaching subject and develop an ICT based SCL instructional package. In this package, the instruction focuses on real-world application and not on skills and esoteric concepts that have little practical use in everyday life (Brown, 2003). Moreover, it emphasises the importance of ill-structured, complex tasks that have multiple solution paths, multiple solutions or no solution at all (Kitchner, 1983). Through this designing process, pre-service teachers develop a deeper understanding of making connections between textbook information and real-world application.

### *Multiple forms of scaffolding*

Scaffolds are designed to assist our pre-service teachers engaged in student-centered learning activities (Krajcik, Soloway, Blumenfield, & Marx, 1998; Roehler & Cantlon, 1997; Vygotsky, 1978). They play an important role in the ICT based SCL curriculum. Such scaffolding tools include various ICT tools, strategies, and guides that support pre-service teachers in attaining a higher level of understanding in ICT based SCL. Some of the examples include descriptive assessment rubrics for the individual assignment and ICT based SCL package, templates to guide their reflection on their understanding of the SCL concepts, a suggested timeline for the development of their SCL package, and engaging them in meaningful activities that help them develop and design their SCL package.

## **Factors contributing to pre-service teachers' perceived satisfaction of the ICT curriculum**

The main intent of this paper is to present our findings on pre-service teachers' overall perceived satisfaction of the ICT based SCL curriculum. Figure 1 shows the hypothesised relationship among the variables. It is hypothesised that perceived competence in ICT integration contributes to perceived usefulness of ICT which will influence the overall perceived satisfaction of the course.



**Figure 1: Proposed research model**

### *Perceived usefulness*

Perceived usefulness reflects the prospective users' subjective probability that applying the new technology will be beneficial to his/her personal and/or the adopting organisation's well-being. Perceived usefulness has been shown to be a significant predictor of course satisfaction. Drennan, Kennedy and Pisarski (2005) used a pre- and post-test design to survey students' course satisfaction toward online learning management education and found that, among all the variables, perceived usefulness was the strongest predictor of course satisfaction. In many cases, a stronger influence by perceived usefulness on course satisfaction in a post-test situation may be due to participants being more able to form an educated opinion about the course in question hence leading them to perceiving that the skills and knowledge gained from a course would be useful to making them more productive in their work.

### *Perceived competence*

Perceived competence refers to the extent to which an individual feels confident about using technology. The positive relationship between perceived competence and course satisfaction is well-supported by the literature. Using regression analysis, Debrough (2003) found perceived confidence was significant in predicting the satisfaction of a distance-delivered graduate course among nursing students. From another perspective, the student teachers in Drenoyianni's (2003) study reported their dissatisfaction as a result of

a perceived lack of technology competence after having attended a project-based course. In these studies, participants reflected on their experiences gained from the courses.

## Research context and methods

The purpose of this study is to find out the pre-service teachers' perceived usefulness, perceived competences, and satisfaction of the ICT based student-centered learning (SCL) course after they have completed their course and their 10-week teaching practicum. Furthermore, using multiple regressions, the results of these three variables are further analysed to find out if perceived usefulness and perceived competence are able to predict pre-service teachers' satisfaction of the course. There are two main research questions in this study:

1. What is the pre-service teachers' perceived usefulness, perceived competences, and satisfaction of the ICT based student-centered learning (SCL) course?
2. Can perceived usefulness and perceived competences be used to predict pre-service teachers' course satisfaction?

## Participants and setting

The ICT based SCL curriculum titled ICT for Engaged Learning is a 13-week long course for all pre-service teachers. Participants were 483 students in the Post Graduate Diploma in Education (PGDE) programme. This course comprises two online sessions and 10 face-to-face 2-hour tutorials. In the first few sessions, pre-service teachers are introduced to the concepts relating to student-centered learning. To help them better understand the concepts, students completed an individual assignment that requires them to articulate their understanding of SCL concepts and how these concepts can be applied to teaching and learning. They then spent the last four to five weeks of the course designing, creating, and refining their ICT based SCL package with a partner of their choice. In this SCL package, student decided on the topic, the type of approach (problem-based learning, inquiry-based learning, project-based learning, or cased-based learning), learning outcomes, activities, scaffolding tools, and the type of ICT tools to support learning.

## Procedures

Data was collected from pre-service teachers who attended and instructors who taught the ICT based SCL course. The study used a mix of quantitative and qualitative methods to collect data related to the perceived usefulness, competencies and satisfaction of the course. Online survey questionnaire were administered to all pre-service teachers who were enrolled in this course and focus groups were conducted with selected pre-service teachers. Face-to-face interviews were conducted with selected instructors to collect their views about the ICT based SCL course as well.

## Survey of pre-service teachers

The survey questionnaire was completed by 483 participants after their return from a 10-week teaching practicum in school. The questionnaire was administered during a post-practicum debrief session where participants logon into the campus learning management system. A seven-point Likert scale was used for the 19-item questionnaire, with values of 1= 'strongly disagree', and 7= 'strongly agree.' There are two parts in the questionnaire. The first part consists 13 items that pertain to the skill level of common software and platforms. The second part consists of 6 items that were derived from the baseline standard established by the Educational Technology Division (ETD) of the Ministry of Education, Singapore. Here are some selected statements from the online questionnaire:

- I am able to use word processor to create, edit and format documents for specific purposes (e.g. Microsoft Word)
- I am able to use spreadsheet to record data, compute simple calculations and represent data in the form of tables and graphs (e.g. Microsoft Excel)
- I can manage ICT-based learning activities in a computer laboratory.
- I am able to adopt and adapt activities that incorporate the use of ICT to assess pupils' learning and provide immediate and constructive feedback

## Interviews with pre-service teachers and instructors

Twenty five focus group interviews were conducted with the pre-service teachers upon the completion of the ICT based SCL course. Approximately 6 to 8 pre-service teachers were randomly selected from each tutorial group. Such interviews, which lasted about 30 to 40 minutes, were designed to gather insights into the pre-service teachers' experiences and to gauge the level of their satisfaction level for the ICT based SCL course. During the interviews, the pre-service teachers were assured that their confidentiality will be maintained. The focus group questions focused on two main aspects, the *process* and the *product* of the pre-service teachers' perceived usefulness, perceived competencies and course satisfaction of ICT. In the process, we focused on pre-service teachers' views of the ICT based SCL course when they were attending the course. Some questions we asked included:

- How appropriate were the assignments?
- Were the online (E-Learning) sessions meaningful?
- How useful were the materials found in the BlackBoard course management system?

In the product aspect, we asked the pre-service teachers about the use of ICT in schools during their 10-week teaching practicum and their perceived applicability of what they have learned in the ICT based SCL course to their teaching practicum. We asked various questions such as:

- Did you have opportunities to use ICT during the practicum?
- What type of ICT tools was used in your lessons?
- To what extent you think the ICT module prepared you for teaching with ICT? What aspects, if any, were useful?
- What are any areas/your ideas for improvement in using ICT?

To obtain a more systemic perspective of our ICT based SCL course, we also conducted face-to-face interviews with 11 course instructors. These focus group and face-to-face interviews were audio-recorded and were transcribed for data analysis purpose. The interview questions were designed to find out what do the instructors views about the curriculum, the delivery method, the communication channels provided to instructors, and the availability of resources of the course. .

## Data analysis

Quantitative data obtained from the online questionnaire survey were analysed using SPSS and descriptive and inferential statistics were obtained. Qualitative data obtained from interviews were analysed using a grounded approach. Two qualified raters coded 10 transcripts independently to obtain inter-rater reliability and thereafter all transcripts were coded by different raters following the themes generated by the first two raters. Both types of data were then compared and matched for convergent purposes.

## Results

This section reports the pre-service teachers' satisfaction level towards the ICT based SCL course. We examined the usefulness of the course and the perceived levels of competency (table 1) of pre-service teachers from the July 2006 intake using data from the survey questionnaire, focus group interviews with participants and one-to-one interviews with instructors who have taught the course.

**Table 1: Mean, standard deviation and reliability alpha for each factor (N = 483)**

Construct	No of Items	Mean	SD	Alpha
Satisfaction (SAT)	4	4.33	1.27	.94
Perceived Usefulness (PU)	7	4.19	1.19	.96
Perceived Competence (PC)	9	4.70	1.03	.96

Table 1 shows the composite mean score for each factor. All mean scores are slightly above the mid-point. The range of mean scores is within one interval point (4.19 to 4.70). Overall, these mean scores suggest that respondents were fairly non-committal about all the factors. They did not show strong

agreement or disagreement for any factor. The reliability coefficient for each factor is above 0.8 and this is regarded as high.

Using 'Satisfaction' as a dependent variable and PU and PC as independent variables, a multiple regression analysis using the enter method was performed. A significant model emerged ( $F(2, 480) = 364.0, p < .0001$ ), adjusted R square = .601, indicating that the variables accounted for 60.1% of the variance in the research. Perceived usefulness and perceived competence were found to be significant in predicting satisfaction (PU:  $\beta = .681, p < .001$ ; PC:  $\beta = .132, p < .001$ ).

### **Perceived usefulness**

The results generated from the online survey which was conducted in May 2007 with a sample size of 483 pre-service teachers revealed a composite mean score of  $M = 4.19, SD = 1.19$  on the factor of perceived usefulness (PU).

Examining the data from the coded transcripts from the focus groups interviews, the low mean scores of PU could be due to the misalignment of pre-service teachers' expectation and the course's objective. The course entitled "ICT for Engage Learning" connotes a process which gave pre-service teachers a perception that the use of ICT to engage students' learning would be catered for in the course as well. They felt therefore mastery of ICT skills was a necessary condition. Although the objective of the course which placed an emphasis on Student-Centered Learning was clearly communicated to the pre-service teachers at the beginning of the course, pre-service teachers commented that since the concept of SCL was repeated in other Curriculum Courses (CS) courses and in Educational Psychology class, ICT based SCL course is therefore redundant. Pre-service teachers also felt that they needed a course that can equip them for the immediate use once they are out in school. They expect instructors to be able to share informative real-life experiences with them. Similarly, instructors also felt that there was an over emphasis on the notion of SCL. Some of them were concerned that the ICT based SCL course may not be able to prepare the pre-service teachers for the real world challenge. For instance, one instructor commented that if pre-service teachers were working in schools not committed to a similar approach, then "we've done them a disservice because we haven't prepared them for what might be going on in the schools." When interviewed, many pre-service teachers felt that the ICT based SCL course did not equip them with sufficient skills in multimedia. They believed that having sufficient IT skills is important as it would enable them to teach well. They were not able to see the relevance of the ICT based SCL course as it mainly focused on the theoretical aspects of SCL. Having the knowledge of its theoretical concept alone did not help them to create better lesson. Hence, many of them commented that they need the competency with software like Microsoft PowerPoint, Microsoft Word, Microsoft Excel, Photoshop, Macromedia Flash and how to effectively facilitate in the school LMS environment as they perceived these to be more useful for teachers in the schools.

### **Perceived competence**

Comparing to the performance PU, perceived competent (PC) had a higher composite mean score of  $M = 4.70, SD = 1.03$ . This might suggest that the ICT based SCL course had sufficiently prepared pre-service teachers in terms of integrating ICT into their teaching. However, the data from focus group interviews suggested that there might be other factors contributing to pre-service teachers' perceived competence.

Some pre-service teachers commented that they had opportunities to use ICT in their practicum school. This was especially true in the primary schools. Some pre-service teachers said that because they had observed how their Cooperating Teachers used ICT in teaching, they were pressurised to incorporate ICT into their lessons, and as a result of this, they had many opportunities exploring and using ICT tools. Pre-service teachers also commented that there were good IT facilities and strong support in their practicum schools. For instance, in one primary school interactive whiteboard is widely used and training is provided even for pre-service teachers attached to the school. Also, as a result of recent change in lower primary Chinese syllabus, MOE has provided schools with website resources specific to content units and readily accessible online. These resources included flash animations. Hence, pre-service teachers need not spend time preparing PowerPoint slides for the teaching of these units. Moreover, in some schools, there were rules within the department that teacher must use PowerPoint slides to delivery their lessons and trainees were just told they had to do it. They were assigned some units to prepare the PowerPoint slides for presentation during class. In most schools, they would upload these PowerPoint slides into the teachers' sharing folder for dissemination to teachers for their use in class. Specific guidelines were given like how each slides are supposed to look like, with page number, what font types to use, what size, what structure and what sort of pictures should be included to standardised the PowerPoint slides across the

whole school. Pre-service teachers found these guides useful as the expectations were clearly spelled out to them. On the whole, they agreed that incorporating ICT into the lesson delivery helps to save time and makes a bigger impression on the students

## **Conclusion**

The purpose of the study is to find out the pre-service teachers' views about their perceived usefulness, perceived competence, and satisfaction of the ICT based SCL course. Online questionnaires were used to collect quantitative data from 483 pre-service teachers who participated voluntarily. The quantitative results showed that pre-service teachers view about the course is fairly neutral among the three variables: Satisfaction (4.33), Perceived usefulness (4.13), and Perceived competences (4.70). Qualitative information was analysed to find out that some pre-service teachers' expectations of the course were quite different from the course curriculum. They expected to learn different ICT related skills in the course to prepare them for their teaching in the future while the emphasis of the course was on student centered learning. Some commented that they were able to apply what they have learned from the ICT course to their schools during teaching practicum as resources and infrastructure were available. Some schools also promoted ICT use in teaching and provided professional development opportunities to the pre-service teachers to strengthen their abilities to incorporate ICT into their teaching. Therefore, even though some pre-service teachers viewed that the ICT based SCL course focused too much on theory but not the ICT skills, some felt that they were able to apply what they have learned in the course to their teaching during practicum with the support of schools and cooperating teacher.

## **Discussions and recommendations**

### **Aligning SCL with available IT**

To ensure that the ICT based SCL course is relevant to the pre-service teachers, several suggestions were collected from the pre-service teachers themselves and their instructors. One suggestion is to introduce pre-service teachers to the various IT tools and platforms such as LEAD.com which are currently available in schools and to teach pre-service teachers how to design customised solutions that can help schools connect different technology components through SCL. Several instructors have also raised the need for a more flexible course structure so that technology skills and tools could be introduced according to the needs of students. Some suggestions provided by them include offering IT workshops outside class, organising IT fair and invite software vendors to demonstrate various technologies.

It was commented by some pre-service teachers that the course content was too brief and lacked focus, and they found themselves lacking in confidence to comfortably use ICT to engage students' learning in an authentic school environment, least of all maximising the use ICT to engage students in SCL environment. Although the main objective of the ICT based SCL course was not on IT literacy, there is perhaps a need to provide pre-service teachers with sufficient basic IT skills to scaffold their learning on designing and implementation of IT based student-centred lessons. To ensure that the ICT based SCL course remains current and relevant, it is necessary to gain a greater understanding of schools' IT practices, and design interventions that will enable pre-service teachers to make use of the affordances of IT, create and deliver IT based lessons that would support thinking, and engage their students in meaningful learning. Perhaps there is a need to redefine and reposition the relationship of IT skills, learning theories, and pedagogy in the ICT based SCL curriculum so that it can create a greater impact on our pre-service teachers in terms of integrating ICT into their future classroom teaching.

### **Strengthen modeling of student centred learning and ICT**

To ensure that pre-service teachers better understand the concept of SCL, instructors proposed that modeling of student-centred learning and ICT could be further strengthened through various means. This could be done with the use of more authentic school-based video examples, encourage pre-service teacher to engage in peer sharing of projects and ICT tools through online forums, set-up evaluation criteria, and designate "bands" to resources so that students know how to judge between good and poor implementation of ICT and student-centred learning. Some instructors also highlighted the need for careful matching of pre-service teacher cohorts to trainer expertise. Instructors felt that they would be better able to advice students on pedagogy and ICT issues if they were assigned to content areas of their expertise as ICT integration cannot be taught in a "generic" fashion. Coincidentally, a number of pre-service teachers also pointed out that there is a need to assign instructors who are knowledgeable in their

content areas to guide them. They felt that the mismatched between pre-service teachers' and instructor's content areas hindered the communication and learning processes.

### Flexible customised curriculum

It was reported that instructors generally felt that there is a need to make adaptations to their contents based on the profile of students. Although instructors reserved the rights to make changes to their lessons to cater to the needs of their students, challenges were faced by instructors when attempting to customise course contents. While instructors generally understood that materials and resources given to them served as a baseline, the notion of receiving such a comprehensive and well-prepared set of materials tend to make them uncomfortable about making changes, especially during their first semester of teaching. Even though increased experience and comfort with the course contents was sufficient to dissipate these initial apprehensions, several instructors still perceived the course structure to be "prescriptive" and lacking in flexibility for them to feel fully autonomous about making changes.

To better cater to the diverse needs of pre-service teachers and the profile of the instructors, there is perhaps a need to grant greater flexibility and autonomy to instructors and pre-service teachers in terms of determining their own learning goals and directions that are aligned to an overarching framework of IT integration in a student-centred learning environment.

### References

- APA Work Group of the Board of Educational Affairs (1993). *Learner-centered psychological principles: Guidelines for school redesign and reform*. Washington, DC: American Psychological Association.
- APA Work Group of the Board of Educational Affairs (1997). *Learner-centered psychological principles: A framework for school reform and redesign*. Washington, DC: American Psychological Association.
- Bonk, C. J., & Cunningham, D. J. (1998). Searching for learner-centered, constructivist, and sociocultural components of collaborative educational learning tools. In C.J. Bonk & K. S. King (Eds.). *Electronic Collaborators: Learner-Centered Technology for Literacy, Apprenticeship, and Discourse* (pp.25-50). Mahwah: Lawrence Erlbaum.
- Brown, D. M. (2003). Learner-centered conditions that ensure students' success in learning. *Education*, 124 (1), 99-107.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.) (1999). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.
- Debrough, G. A. (2003). Predictors of student satisfaction in distance-delivered graduate nursing courses: what matters most? *Journal of Professional Nursing*, 19(3), 149-163.
- Drennan, J., Kennedy, J., & Pisarki, A. (2005). Factors Affecting Student Attitudes toward Flexible Online Learning in Management Education. *Journal of Educational Research*, 98(6), 331-338.
- Dinchak, M. (1999). Using the worldwide web to create a learner-centered classroom. Paper presented at the *International Conference on Teaching and Learning*: Glendale, AZ.
- Drenoyianni, H. (2003). Designing and implementing a project-based ICT course in a teacher education setting: rewards and pitfalls. *Education and Information Technologies*, 9(4), 387-404.
- Fullan, M. (2000). Change forces: The sequel. 2000 CHANGE Council Keynote Address presented at the annual meeting of the *Association for the Educational Communications and Technology*, Long Beach, CA.
- Glasgow, N. (1997). *New curriculum for new times: A guide to student-centered, problem-based learning*. Thousand Oaks, CA: Corwin.
- Guild, P. B. (1997). Where do the learning theories overlap? *Educational Leadership*, 55, 30-31
- Hannafin, M., Hill, J., & Land, S. (1997). Student-centered learning and interactive multimedia: Status, issues, and implication. *Contemporary Education*, 68 (2), 94-99.
- Jonassen, H. D. (1996). Scaffolding diagnostic reasoning in case-based learning environments. *Journal of Computing in Higher Education*, 8 (1), 48-68.
- Jonassen, H.D. (1997). Instructional design models for well-structured and ill-structured problem-solving learning outcomes. *Educational Technology Research and Development*, 45, 656-94.
- Kitchner, K. S. (1983). Cognition, metacognition, and epistemistic cognition: A three-level model of cognitive processing. *Human Development*, 26, 222-232.
- Krajcik, J., Soloway, E., Blumenfeld, P., & Marx, R. (1998). Scaffold technology tools to promote teaching and learning in science. In C. Dede (Eds.), *ASCD 1998 Yearbook: Learning with Technology*. Alexandria, VA: ASCD.
- Lim, C. P., & Chan, B. C. (2007). Microlessons in teacher education: Examining pre-service teachers' pedagogical beliefs. *Computers and Education*, 48, 474-494.



- McCombs, B. L. (2001). What do we know about learners and learning? The learner-centered framework: Brining the educational system into balance. *Educational Horizons*, 79 (4), 182-193.
- Niederhauser, D. S., Salem, D.J., & Fields, M. (1999). Exploring teaching, learning and instructional reform in an introductory technology course. *Journal of Technology and teacher Education*, 7(2), 153-172.
- Palinscar, A., & Brown, A. (1984). Reciprocal teaching and comprehension-fostering and monitoring activities. *Cognition and Instruction*, 1 (2), 117-175.
- Roehler, L., & Cantlon, D. (1997). Scaffolding: A powerful tool in social constructivist classrooms. In K. Hogan & M. Pressley (Eds.), *Scaffolding student learning: Instructional approaches and issues*. Cambridge, MA: Brookline.
- Savory, J. R., & Duffy, T. M. (1995). Problem based learning: An instructional model and its constructivist framework. *Educational Technology*, 35, 31-38.
- Scardamalia, M., & Bereiter, C. (2003). Knowledge Building . In *Encyclopaedia of Education*. (2nd ed., pp.1370-1373). New York: Macmillan Reference, USA
- Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy, and technology. In Sawyer, R. K. (Eds.). *The Cambridge handbook of the learning sciences* (pp97-118). Cambridge University Press.
- Slavin, R. E. (1983). *Cooperative Learning*. New York: Longman.
- Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes* (M. cole, V. John-Steiner, S. Scribner, E. Souberman, Eds. and Trans). Cambridge, MA: Harvard University Press.
- Zhao, Y., Hueyshan, T., & Mishra, P. (2001). Technology: Teaching and learning: Whose computer is it? *Journal of Adolescent & Adult Literacy*. 44(4), 348-355.

**Please cite as:** Lee, C.B., Teo,T., Chai, C.S., Choy, D., Tan, A. & Seah, J. (2007). Closing the gap: Pre-service teachers' perceptions of an ICT based, student centred learning curriculum. In *ICT: Providing choices for learners and learning. Proceedings ascilite Singapore 2007*.  
<http://www.ascilite.org.au/conferences/singapore07/procs/lee-cb.pdf>

Copyright © 2007 Chwee Beng Lee, Timothy Teo, Ching Sing Chai, Doris Choy, Ashley Tan and Jimmy Seah. The authors assign to ascilite and educational non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to ascilite to publish this document on the ascilite web site and in other formats for *Proceedings ascilite Singapore 2007*. Any other use is prohibited without the express permission of the authors.