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Learning Sciences Research in Asia Pacific Countries from 1997 to 2010: A Content Analysis of Publications in Selected Journals

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Learning sciences, as an interdisciplinary field of research, refers to adoption of theories from multiple disciplines to gain understanding of the conditions and processes that lead to effective learning. This paper examines learning sciences research in the Asia Pacific region by means of content analysis of research papers published in three major journals: Journal of the Learning Sciences, International Journal of Computer-Supported Collaborative Learning, and Instructional Science. A total of 24 research papers contributed by authors affiliated to six Asia Pacific countries from 1997 to 2010 were found and analyzed. The main findings suggested that Hong Kong and Australian researchers are pioneers in learning sciences research, while Singaporean researchers have had significant contributions to this field after 2007. In addition, empirical studies were favoured over positional and theoretical papers. It is found that the theoretical frameworks underpinning these empirical studies were strongly influenced by Western research philosophies, including knowledge building pedagogy and learning study theories. Moreover, nearly half of the empirical studies involved the use of computer-supported collaborative learning (CSCL) technologies. The findings of this study may provide insights to promote learning sciences research in the Asia-Pacific region.

Keyword: learning sciences, Asia Pacific, bibliometric study

Learning sciences is an emerging field of study; its short history only began in the late 80s with pioneering researchers in North American universities such as Northwestern, Vanderbilt, and MIT (Kolodner, 1991). Defining the field of learning sciences is difficult owing to its short history, its interdisciplinary nature, and the advent of cross field publications between researchers in learning sciences and other disciplines. As an introduction, we describe a few characteristics of learning sciences that might help our readers form an initial concept of the field. This is followed by highlighting some differences from other fields of study. Interested readers could refer to other

publications for more detailed discussion on the evolution and boundary of the field (e.g., Carr-Chellman & Hoadley, 2004; Kirby, Hoadley, & Carr-Chellman, 2005).

As an interdisciplinary field, learning sciences draws upon the theories and research outcomes from various disciplines such as information sciences, cognitive science, artificial intelligence, neurosciences, design studies, instructional design, cognitive anthropology, and educational psychology (Sawyer, 2006). The main goal is to gain understanding of the conditions and processes that lead to effective learning; that is, research findings are used to redesign learning environments to bring about deep learning. Researchers in learning sciences investigate learning in both formal and informal contexts, and through face-to-face and computer-mediated interactions. The main methodological framework that learning scientists employ is design-based research, which is sometimes termed design research or design experiment (Brown, 1992). It involves iterative cycles of interventions that are guided by theories with dual goals of improving both theories and classroom practices (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003).

Even though the genesis of learning sciences could be traced back to cognitive science with an artificial intelligence perspective (Kolodner, 1991), learning sciences distinguishes itself from other cognitive sciences (e.g., educational psychology) in that its focus is on learning in context (Duffy, 2004). Thus, rather than manipulating or testing isolated cognitive variables in experimental settings, learning sciences focuses on "instantiating theory in a rich learning context" (p. 15). Learning sciences shares similar interest with instructional system design in the application of educational technology (Hoadley, 2004). However, it differs from instructional system design with its orientation toward cognitive or constructivist approach of learning, rather than instructionist approach of learning. Whereas learning scientists seek to first understand learning in context before applying the findings to improve the learning activities and environments, instructional designers tend to begin with questions about design.

In recent years, learning sciences is gradually permeating into the Asia Pacific region. Hong Kong, Singapore and Taiwan, for instance, have set up research communities to coordinate their efforts in learning sciences research. Special interest group in Learning Sciences are also forming among members in the Asia-Pacific Society for Computers in Education (APSCE) community. The diffusion of learning sciences to wider geographical regions of different historical and cultural contexts has its significance. Among the learning sciences researchers with different foci of study, the epistemology of situated cognition is prevalent. These researchers typically employ design research by conceptualizing and implementing interventions in authentic settings so as to advance understanding of theoretical models and scale up these interventions. Asia Pacific countries have their own education systems and contexts, so a review of learning sciences studies in this region could contribute to the understanding of ecological validity of theoretical models, and hence, improve these models.

Given the short history of learning sciences among the Asia Pacific countries, information about the current status and trends in learning sciences research could be helpful to the researchers in this region. For example, it could reveal potential research areas, identify the "key players", and highlight the characteristics of high impact articles or vital studies. Systematic content analyses on publications have been conducted in other fields of research, such as psychology (e.g., Smith et al., 1998), science education (e.g., Lee, Wu, & Tsai, 2009; Tsai & Wen, 2005; Tsai, Wu, Lin, & Liang, 2011), instructional technology and e-learning (e.g., Shih, Feng, & Tsai, 2008). In the field of learning sciences, such bibliometric studies include the analysis by Kienle and Wessner (2006), who traced the development of the computer-supported collaborative learning (CSCL) community. Kirby et al. (2005) also conducted citation analysis to examine the relationship between the field of learning sciences and instructional system design. However, study that focuses on research conducted in Asia Pacific countries is still lacking.To address this gap, this paper provides insights into the research trends in learning sciences among Asia Pacific countries through content analysis of selected journals, including Journal of the Learning Sciences (JLS), International Journal of Computer-supported Collaborative Learning (iJCSCL), and Instructional Science (IS). The rationale for the selection of these journals is presented in the method section.

This study is guided by the overarching question: "Who from Asia Pacific participates in the global learning sciences community and to what extent?" More specific research questions are: From 1997 to 2010, among the three selected journals and researchers affiliated to Asia Pacific countries,

1. what are the variations in the contribution patterns by authors and by years?
2. what are the variations in terms of types of research and research methods?
3. what are the variations in terms of research topics and intervention among the empirical studies (which include the subject domain, the types of participants, the nature of learning context, the types of intervention and the types of technology used in the intervention, if any)?

METHODOLOGY

This paper focuses on a review of learning sciences research in the Asia Pacific Region. Guided by the research questions, this bibliometric study is descriptive in nature and involves three major steps:

- Identification of relevant research papers;
- Coding of key characteristics in each paper; and
- Analysis of the trends in contribution.

Selection of research paper for analysis

A two stage process was employed for selecting research papers for review. First, journals that focus on learning sciences research were identified. The SCOPUS database was searched with the following keywords: "learning science* and design-based research", "learning science* and design research", "learning sciences* and design experiment", "learning science* and Asia-Pacific", and "CSCL". The search resulted in 33 articles appearing in 10 different journals starting from the year of 1997. The journals' websites were consulted to identify journals that target specifically on research related to learning and/or learning environment that contribute "to our understanding of successful learning" (Kolodner, 1991, p.4). Four journals were shortlisted: Journal of the Learning Sciences, International Journal of Computer-Supported Collaborative Learning, Cognition and Instruction, and Instructional Science. This was followed by a search in these four journals for papers of which research was conducted in Asia-Pacific countries. A geographical criterion of what count as Asia-Pacific countries was adopted. Succinctly summarized by the School of Oriental and African Studies, University of London (SOAS, 2007), Asia Pacific countries include China, Japan, Korea, Indonesia, Malaysia, Singapore, Thailand, Brunei, Vietnam, Laos, Myanmar, and the Philippines. Eventually, 24 research papers dating from 1997 to present were identified and selected. These papers appeared in three journals (Journal of the Learning Sciences, International Journal of Computer-Supported Collaborative Learning, and Instructional Science) with authors affiliated to six countries (Australia, Hong Kong, Japan, New Zealand, Singapore, and Taiwan). For simplicity, the term "country" will be used to represent all the six economies even though Hong Kong is, strictly speaking, a special administrative region (SAR) of the People's Republic of China.

After identifying the papers, we performed systematic content analyses informed by Lee and colleagues' (2009) methodological framework. For each paper, the analyses were conducted by at least two authors of this paper. After the first author generated the coding categories, the papers were coded by the other authors. Initial inter-rater agreement was 0.83. Differences were discussed and problems were resolved face-to-face among the authors. Details of the coding processes and findings are provided in the following sections.

Authors' affiliation

The identified papers were contributed by authors across different countries. To compute the research contribution by country quantitatively, a formula adopted from Howard, Cole, & Maxwell (1987) and Tsai and Wen (2005) was used. This formula aims to represent the proportion of contribution of each author in a multi-authored paper in a relatively neutral manner, with a total score of one point for each paper. The formula is:

$$\text{Score} = \frac{(1.5^{n-i})}{\sum_{i=1}^{n} 1.5^{n-i}}$$

In this formula, n represents the total number of authors, and i represents the order of a specific author. For example, if the first author is affiliated to Taiwan and the second author is affiliated to Singapore, then Taiwan will get a score of 0.6 while Singapore will get a score of 0.4. This formula was applied for each multi-authored paper and the accumulated scores for each country were calculated for further analysis.

Research type and design

Three research types were identified among the 24 selected papers: (a) Empirical studies that involve collection of data from a learning environment, (b) position papers that take a certain stance regarding certain issue in the field of learning sciences, and (c) theoretical papers that present a theoretical argument or discuss theoretical methodological issues.

Six categories of research design were identified in the coding of the papers that are empirical studies: (a) experimental design (both true experimental design and quasi-experimental design), (b) case study, (c) single-subject design, (d) design experiment, (e) learning study, and (f) evaluation (for details, see Table 5). These categories for research design were derived mostly from the research papers, including the types that are commonly known to most educational researchers, like experimental design; and those closely associated with learning sciences research, like design experiment (Brown, 1992). Learning study was also listed as a research design in four papers, which is a combination of lesson study and design-experiment approach (Pang & Marton, 2005). During coding, the espoused research design in each paper was validated against the description of research implementation. There were two papers that declared "mixed-method" approach but they were found to refer to data collection method rather than research design. In these cases, the coding was derived from the description of the research implementation.

Research topic and intervention

The research topics and issues were derived using iterative-pattern coding (Miles & Huberman, 1994). Rather than following a pre-determined scheme, the coding categories were derived inductively from the research papers. Emergent categories were compared and merged to achieve a more parsimonious categorization. For example, we first coded "teaching writing" in one paper and "using learning theory for teaching" in another. When these two papers were compared, a more general and inclusive code "teacher education" was developed. In many empirical

Table 1.
Overall Country Scores and the Distribution of the Scores in Three Time Periods

Country	Overall	Overall rank	1997-2001	2002-2006	2007-2010
Australia	3.42	3	1.00	0.00	2.42
Hong Kong	7.11	1	1.00	2.39	3.72
Japan	2.00	4	0.00	1.00	1.00
New Zealand	1.00	6	0.00	0.00	1.00
Singapore	4.97	2	0.00	0.00	4.97
Taiwan	1.82	5	0.00	1.00	0.82

papers, the research focuses on improving the learning of a subject domain (e.g., physics, chemistry). Likewise, a more inclusive and general label was used (e.g, science). The final categories for research topics include learning of the following subjects and skills: Chinese, computing, economics, geography, group skills, health science, instructional design, mathematics, and science. The other two topics are complex system and teacher education. In addition, the theoretical and position papers examine issues related to methodology, online communities, and cognitive tools.

The majority of the empirical research papers report on interventions. We analysed several aspects of interventions: pedagogical approach, types of participants, use of technology, and contexts. Similarly, we derived the coding categories using iterative-pattern coding. Details of these categories can be found in the next section.

FINDINGS AND DISCUSSIONS

The findings discussed in this section are based on the research questions presented earlier in this paper. We first look at the contribution patterns by author's affiliation (see Table 1). The country scores are computed using the formula explained in the Methodology section.

Contribution patterns by author's affiliated countries

The results show that among the Asia Pacific countries, authors in the six countries maintained active contribution to the selected journals over the past 14 years. Hong Kong, Singapore and Australia are among the top 3 countries, while Japan, New Zealand and Taiwan show emergent interest in the field of learning sciences. One possible reason is that these six countries have a more established educational research culture. Among these countries, English is a common language used in the top three countries, which could partly explain why the researchers affiliated to these countries were more inclined to contribute to journals published in English.

The distribution of contribution over the three time periods reveals other trends, which is illustrated in Figure 1.

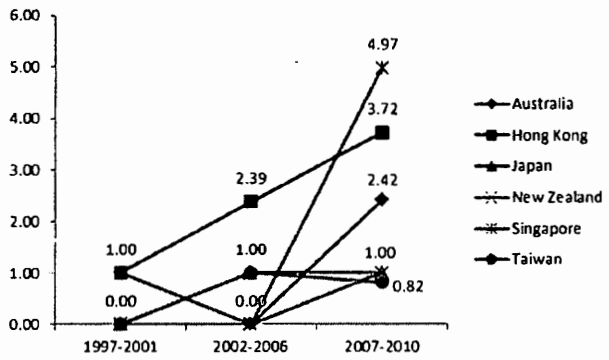

Figure 1. Contribution patterns of the six countries/ regions over three time periods.

Figure 1 shows that with the exception of Japan and Taiwan, all other countries show an upward trend in their contribution. Among these countries, Hong Kong shows a steady increase in scores while Singapore demonstrates a sharp transition from a score of zero to 4.97 after the year of 2007, and surpasses Hong Kong in the last four years. Hong Kong and Australia are among the pioneers to engage in learning sciences research, which could explain their earlier presence in the selected journals. For example, the Senior Editor-in-Chief for Instructional Science is based in Australia. The graph shows a growing interest in Hong Kong in learning sciences research. This may be due to the establishment of a Strategic Research Theme on the Sciences of Learning in The University of Hong Kong (2009), which leveraged strengths and expertise of research staff from various faculties to conduct research and innovation on human learning. On the other hand, the spike in contribution by Singapore-based researchers could be explained by the establishment of the Learning Sciences and Technologies academic group (National Institute of Education [NIE], 2009) and the Learning Sciences Lab (NIE, 2010) in 2005.

The country scores, however, do not reflect whether the contribution is attributed to only a few highly active researchers or is attributed to a larger group of researchers. We examine next the number of distinct authors and first author affiliated to a country (Table 2).

Table 2.
Number of Distinct Authors and First Authors by Countries

Country	Number of distinct authors (rank)	Number of first author affiliated to the country (rank)
Australia	7 (4)	4 (3)
Hong Kong	9 (3)	7 (1)
Japan	11 (2)	2 (4)
New Zealand	3 (6)	1 (6)
Singapore	12 (1)	6 (2)
Taiwan	6 (5)	2 (4)

Together with the country score, the number of distinct author would indicate whether there is a good distribution of research works carried out by various researchers. To some extent, it shows partly the size of the research community as well. The number of first author indicates to some extent, the number of researchers who could lead a research study. The results show that the ranking by the first author is similar to the rank order of the overall country scores, except with the reversal of order between Hong Kong and Singapore. While The University of Hong Kong formed a strategic research theme on learning sciences, the National Institute of Education in Singapore established a dedicated unit to focus on learning sciences research. Both approaches seem to have achieved some success in terms of stimulating research activities and contribution in the field of learning sciences. Japan, on the other hand, featured a high ranking in terms of number of distinct authors but a lower number of first authors. It might reflect a strong team culture in these Japanese research groups.

The activity of learning sciences research could be revealed through the frequencies by which a study is conducted in a country (Table 3).

Taken together with the results in Table 1, the result in Table 3 provides additional evidence of active learning sciences research activities in Hong Kong and Singapore. While the difference in overall country scores between Singapore and Hong Kong is only 2.14 (Table 1), the frequencies of research conducted in Singapore (5) is about half that of Hong Kong (9). This could be partly attributed to the participation of Singaporean researchers in other countries, and partly attributed to the nature of research paper. In addition to the five empirical papers, Singapore-based authors contributed to one theoretical paper and one position paper. Hong Kong-based authors contributed only to empirical papers. This directs our attention to the next research question, which is about the variations in terms of types of research and research methods.

Types of research and research designs

The results in Table 4 indicate a preference by learning sciences researchers in the Asia Pacific region to conduct empirical studies over engagement in theoretical discourse. An analysis of the theoretical underpinning of these empirical papers shows that most of these theories were adapted from the Western researchers, for example, knowledge building communities (Scardamalia & Bereiter, 2006) and variation theory (Marton & Booth, 1997). This indicates a strong influence from the Western research communities where the genesis of the field of learning sciences originates from North America, giving the pioneer researchers lead time to contribute to a database of research findings upon on which further research have been built. After all, the ability to build on the existing scholarship and findings from other researchers (or generativity) is a hallmark of good scholarship (Shulman, 1999). That being said, however, educational theories and philosophies germane in the Eastern societies (e.g., Confucianism) could be untapped sources of theoretical frameworks that could introduce new and diverse perspectives into the research

Table 3.
Ranking of Countries in Terms of Research Sites

Country	Frequency	Rank	References
Australia	2	3	Muller, Sharma, Eklund, Reimann, 2007; Schaverien & Cosgrove, 1997.
Hong Kong	9	1	Chan, 2001; Cheung, in press; Lee, Chan, & van Aalst, 2006; Marton & Pang, 2006; Pang & Marton, 2003, 2005; Tse, Marton, Ki, & Loh, 2007; van Aalst, 2009 ; van Aalst & Chan, 2007.
Japan	2	3	Isotani, Inaba, Ikeda, & Mizoguchi, 2009; Oshima, et al., 2006.
New Zealand	1	4	Baghaei, Mitrovic, & Irwin, 2007
Singapore	5	2	Chin & Osborna, 2010; Hew, Cheung, & Ng, 2010; Jacobson, Kapur, So, & Lee, in press; Kapur, 2010; Kapur, in press.
Taiwan	2	3	Hong, Chen, Chai, & Chan, in press; Guan, Tsai, & Hwang, 2006.

communities. The phenomena of learning and the educators' epistemology in the Asia Pacific may not be the same as that from the west (see for example, Wong & Chai, 2010).

Table 4.
Frequencies of Paper by Research Types

Research type	Frequency	References
Empirical	21	See Table 3
Position paper	1	Hung, Lim, Chen, & Koh, 2008.
Theoretical	2	Kim & Reeves, 2007; Reimann, 2009.

In terms of research design, Table 5 shows that the established experimental methods and case study method are still preferred. Learning study, which amalgamates Japanese lesson study and design-experiment approach (Pang & Marton, 2005), shows a strong presence even though it is a unique approach. This could be a reflection of the research interest of a small group of teacher education researchers based in Hong Kong and Sweden. The sustainability and diffusion of this approach to other disciplines remain to be tested. On the other hand, the adoption of the design experiment appears to be slow. Although advocates for design experiment have presented strong arguments for the role of design experiment in studying learning in authentic environments (Brown, 1992, Cobb et al., 2003), it is a relatively new method that is evolving. Discussions and debates about design experiment are still ongoing. In addition, given the iterative nature of design experiments, there is a dearth of examples of how the reports of design experiments could be written while keeping to the word limits imposed by most journals.

Research intervention

Among the 21 empirical studies, there are 14 different topics or subject domains (Table 6). This indicates a healthy diversity among researchers in studying learning of different subject domains. But still, learning of science subjects shows a strong presence, which could indicate a stronger interest among these countries on science. Corroborating evidence can be found in the recent findings in the Trends in International Mathematics and Science Study (TIMSS). The 2007 study on science achievement has found Singapore, Taiwan, and Hong Kong among the top three countries for fourth graders, and Singapore, Taiwan and Japan the top three countries for eighth graders. Among these six countries, many educational researchers are either working closely with or even directly engaged in teacher education. This could explain the strong interest in teacher education.

Similar to the subject domain, we found a variety of intervention strategies among the empirical studies (Table 7). Researchers seem to show little interest in intervention strategies that have been used extensively, including scaffolding, mentoring and collaborative learning. Among the 12 intervention strategies, the two most frequently used are Knowledge building (Scardamalia & Bereiter, 2006) and Learning Study (Pang & Marton, 2005). In recent years, discussion is rife on whether K-12 education could meet the demand of knowledge-based society (Partnership for 21st Century Skills, 2006) and whether its discourse is associated with the ways to develop 21st century skills among the students. Knowledge building pedagogy (Scardamalia & Bereiter, 1999), which hails to engage students directly in knowledge work, has caught the attention of many researchers, including those in the Asia Pacific region. All the six countries, for instance, can be found in the Knowledge Society Network (IKIT, n.d.), which is established by Scardamalia and Bereiter, the pioneers of knowledge building pedagogy. While knowledge building pedagogy has been used mainly with students, learning study, with its roots traced back to Japanese Lesson Study, has been used exclusively for teacher learning. The high frequency of learning study as an intervention strategy provides evidence for the interest in teacher education. It is worth noting that the emergence of productive failure (Kapur, 2010; in press) is pioneered by a researcher affiliated to Singapore.

Table 5.
Frequencies of Paper by Research Methods

Research designs	Frequency	References
Experimental	8	Chan, 2001; Guan et al., 2006; Isotani et al., 2009; Jacobson et al., in press; Kapur, 2010, in press; Lee et al., 2006; Muller et al., 2007
Case study	5	Chin & Osborne, 2010; Hew et al., 2010; Schaverien & Cosgrove, 1997; van Aalst, 2009 ; van Aalst & Chan, 2007
Learning study	4	Marton, & Pang, 2006; Pang & Marton, 2003, 2005; Cheung, in press
Single subject	2	Hong et al., in press; Tse et al., 2007
Design experiment	1	Oshima et al., 2006
Evaluation	1	Baghaei et al., 2007

Table 6.
Frequencies of Subject Domains Associated with the Empirical Studies

Subject Domain	Frequency	References
Science	6	Chan, 2001; Chin & Osborne, 2010; Guan et al., 2006; Muller et al., 2007; Oshima et al., 2006; van Aalst & Chan, 2007
Economics	3	Pang & Marton, 2003, 2005; Marton, & Pang, 2006
Teacher education	3	Hong et al., in press; van Aalst & Chan, 2007; Schaverien & Cosgrove, 1997
Chinese	2	Cheung, in press; Tse et al., 2007
Mathematics	2	Kapur, 2010, in press
Geography	2	Lee et al., 2006; van Aalst & Chan, 2007
Complex system;	1	Jacobson et al., in press;
Others		
computing;	1	Baghaei et al., 2007;
group skills;	1	Isotani et al., 2009;
health science;	1	van Aalst, 2009;
instructional design	1	Hew et al., 2010

Note. The total frequency is higher than 21 because one of the papers reported three studies on different subject domains

Table 7.
Frequencies of Intervention Strategy Employed in the Empirical Studies

Intervention	Frequency	References
Knowledge building	5	Hong et al., in press; Lee et al., 2006; van Aalst, 2009; van Aalst & Chan, 2007; Oshima et al., 2006
Learning study	4	Cheung, in press; Marton, & Pang, 2006; Pang & Marton, 2003, 2005;
Online moderation	2	Guan et al., 2006; Hew et al., 2010
Productive failure	2	Kapur, 2010, in press
Mentoring,	1	Schaverien & Cosgrove, 1997
Argumentation	1	Chin & Osborne, 2010
Feedback	1	Baghaei et al., 2007
Grouping	1	Isotani et al., 2009
Vicarious learning	1	Muller et al., 2007
Scaffolding	1	Jacobson et al., in press
Collaborative learning	1	Chan, 2001
Perceptual learning	1	Tse et al., 2007

In terms of educational settings, most studies engaged K-12 participants (11 out of 21 empirical studies, Table 8). In contrast, there are fewer studies engaging higher level students, and only one study engaging adult learners. Research involving teacher participants is ranked after K-12 students, which provides corroborative evidence about the interest level in teacher education. Among the 21 empirical studies, the majority (19) were conducted in formal educational settings, such as schools or universities. The other two studies involved informal learning in online communities.

Use of technology

Among the 21 empirical studies, 12 (57%) involved the use of technologies (Table 9). This reflects the increasing important roles of technologies in supporting learning. Among the 12 studies, the majority (9 out of 12) involved the use of computer-supported collaborative learning (CSCL) while sporadic interest remained for technologies that were well explored, including hypermedia and video. There is a variety of technologies associated with CSCL (for example, online forum and blogs) and a range of pedagogies associated with it (for example, knowledge building and

Table 8.
Frequencies of Types of Participants in the Empirical Studies

Participants	Frequency	References
Student-K12	11	Chan, 2001; Chin & Osborne, 2010; Lee et al., 2006; Guan et al., 2006; Kapur, 2010, in press; Oshima et al., 2006; Pang & Marton, 2003; Tse et al., 2007; van Aalst & Chan, 2007; van Aalst, 2009
Teacher	6	Cheung, in press; Hew et al., 2010; Hong et al., in press; Pang & Marton, 2005; Marton, & Pang, 2006; Schaverien & Cosgrove, 1997
Student-undergrad	4	Baghaei et al., 2007; Guan et al., 2006; Jacobson et al., in press; Muller et al., 2007
Student-graduate	2	Hew et al., 2010; van Aalst & Chan, 2007
Adults	1	Isotani et al., 2009

Table 9.
Frequencies of Types of Technologies in the Empirical Studies

Technology	Frequency	References
CSCL (including online forum)	9	Chan, 2001; Chin & Osborne, 2010; Lee et al., 2006; Guan et al., 2006; Hew et al., 2010; Hong et al., in press; Oshima et al., 2006; van Aalst & Chan, 2007; van Aalst, 2009
Hypermedia	1	Jacobson et al., in press
Intelligent tutoring system	1	Baghaei et al., 2007
Video	1	Muller et al., 2007

collaborative learning). The Internet forms the critical backbone that provides the foundation computer network upon which other layers of technologies and additional affordances could be built.

Limitations of the study

The main limitation of this study lies in the difficulty, or more aptly, the impossible task of defining the field of learning sciences. This presents great challenges in operationalizing this bibliometric study. The increasing trend of cross-field publications (Kirby, Hoadley, & Carr-Chellman, 2005) could mean that a potentially "qualified" learning sciences research work could be published in other journals that were not selected in this study. Similarly, the movement of researchers in or out of the Asia Pacific countries could present challenges to our selection criteria. In particular, the institution affiliation of an author does not guarantee that a theoretical paper is conceived and therefore contributed by the Asia Pacific region.

Another limitation was that this study excluded data sources from conference proceedings such as those from the internal conference on Learning Sciences and international conference on Computer-Supported Collaborative Learning. At the final revision phase of this paper, the 9th International Conference on Computer-Supported Collaborative Learning was held in Hong Kong and the imminent 2012 International Conference on Learning Sciences will be held in Sydney, Australia. A bibliometry on the conference proceedings could potentially reveal the expansion of the "invisible colleges" (Crane, 1972) of learning sciences to the Asia Pacific region.

CONCLUSIONS AND RECOMMENDATIONS

This study set out to examine learning sciences research in the Asia Pacific countries by means of content analysis of research papers published in three selected journals: Journal of the Learning Sciences, International Journal of Computer-Supported Collaborative Learning, and Instructional Science. Although this study has only included journal articles published in the three journals that are devoted to the study of the learning sciences, the findings, though not conclusive, are indicative of the status of learning sciences research in the Asia Pacific region. The analysis of the research papers traced the contribution back to the past 14 years up to 2010, starting from the year of 1997 when the first paper was published from researchers in the Asia Pacific region. This paper aims to identify the trends of contribution by authors based in these countries, the types of research and methods being employed, and the types of intervention related to the research.

Our findings have shown that among the Asia Pacific countries, the contributions came from researchers based in Hong Kong, Singapore, Australia, Japan, New Zealand and Taiwan. Among these six countries, researchers in

Hong Kong showed a steady increase in their contribution while those in Singapore demonstrated a quantum leap after 2006. Australian researchers were pioneers in the region though their contribution remained low. The other three countries showed emergent interest in the learning sciences research. The strong contribution from Hong Kong and Singapore is most likely supported by a common factor: the establishment of a research community that focused on learning sciences. The University of Hong Kong (2009) formed a cross-department Strategic Research Theme on the Sciences of Learning, while Singapore established the Learning Sciences and Technologies academic group (NIE, 2009) and the Learning Sciences Lab (NIE, 2010) in 2005. Given that learning sciences is an interdisciplinary field, the formation of a research community could help to leverage the distributed expertise among the researchers and channel their concerted effort into a focused theme of research. This congregation of expertise and resources could also provide the necessary ecology to spur the development of research works.

In terms of research type, empirical papers (87.5%) were favored compared to positional and theoretical papers. A deeper analysis of the theoretical frameworks underpinning the empirical studies revealed a strong influence from the Western research community. For example, there were strong presence of knowledge building pedagogy and learning study, both originating from the West. This could be an indication that researchers in the Asia Pacific region, who embark on this learning sciences journey at a later stage, are mostly engaged in theory improvement efforts. There remains an enormous space for knowledge creation or knowledge innovation effort among the Asia Pacific researchers.

In terms of research method and design, time-tested methods like experimental research and case study are still favored. Despite the strong argument for design experiment as a method for learning sciences, its uptake among researchers in the Asia Pacific countries remains low. While learning study claims to combine Japanese lesson study and design-experiment approach (Pang & Marton, 2005), its unique characteristics are described as an intervention strategy rather than a research method. For example, the iterative nature of design experiment was not emphasized or reported in any of the empirical papers. Learning sciences researchers in the Asia Pacific could explore the potential of employing newer paradigms of research methodologies that could help to study learning in situated and authentic contexts. However, to encourage such effort, researchers in Asia Pacific may need to set up their own journal which can take longer articles that reveal the complex interplay between the myriad variables in learning and the iterative nature of design-based research.

Where intervention strategies are concerned, technology-mediated pedagogies prevail: more than 50% of the empirical studies involved the use of technologies. There is strong corroborating evidence that digital technologies are making their impact on educational practices (Collins & Halverson, 2009). CSCL was favored among the technologies, indicating a strong presence of networked technologies. Consistent with this trend, pedagogies premised on social constructivist or social cultural paradigms are prevalent. For example, both knowledge building and learning study can feature learning in a community where social interactions are critical in the process. Among the Asia Pacific researchers, there seems to be a preference for studying the learning of science subjects. There is also a preference for studying the learning among K-12 students in formal contexts.

Undoubtedly, learning sciences is an emergent field of study among researchers in the Asia Pacific region. This study aims to provide information for the Asia Pacific researchers in learning sciences to consider the next step of research in the field. For example, there is evidence that to stimulate the productivity of research, establishing a research community within a country could be beneficial. Extrapolating this finding, cross-country community could be set up among researchers in the Asia Pacific region to advance the sciences of learning within our unique contexts. We therefore propose that to promote learning sciences research in the Asia-Pacific region, researchers could (1) develop a research community by establishing research centers/labs or special interest groups within national or regional education research organisations; (2) explore the Asian way of learning mathematics, science and languages; and (3) focus on and consider design research as a methodological framework. More importantly, we hope that educational researchers in the Asia Pacific region could create real impact on improving learning environments in their respective countries while continuing to enrich the field of learning sciences by extending our understanding of learning in varying contexts.

REFERENCES

Baghaei, N., Mitrovic, A., & Irwin, W. (2007). Supporting collaborative learning and problem-solving in a constraint-based CSCL environment for UML class diagrams. *International Journal of Computer-Supported Collaborative Learning, 2*,159-190.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences, 2*, 141–178.

Carr-Chellman, A.A., & Hoadley, C.M. (2004). Learning sciences and instructional systems: Beginning the dialogue. *Educational Technology, 44*(3), 5-6.

Chan, C. K. K. (2001). Peer collaboration and discourse patterns in learning from incompatible information. *Instructional Science, 29*, 443-479.

Cheung, W. M. (in press). Effects of hierarchical versus sequential structuring of teaching content on creativity in Chinese writing. *Instructional Science*. doi: 10.1007/s11251-009-9099-4

Chin, C., & Osborna, J. (2010). Supporting online argumentation through students' questions: Case studies in science classroom. *Journal of the Learning Sciences, 19*(2), 230-284.

Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational Psychologists, 32* (1), 9-13.

Collins, A. , & Halverson, R. (2009). The second educational revolution: Rethinking education in the age of technology. *Journal of Computer-Assisted Learning, 26*, 18-27.

Crane, D. (1972). *Invisible colleges: Diffusion of knowledge in scientific communities*. Chicago, IL: University of Chicago Press.

Duffy, T.M. (2004). Theory and the design of learning environments: Reflections on differences in disciplinary focus. *Educational Technology, 44*(3), 13-15.

Guan, Y., Tsai, C.-C., & Hwang, F. (2006). Content analysis of online discussion on senior-high-school discussion forum of a virtual physics laboratory. *Instructional Science, 34,* 279-311.

Hew, K. F., Cheung, W. S., & Ng, C. (2010). Student contribution in asynchronous online discussion: A review of the research and empirical exploration. *Instructional Science, 38,* 571-606.

Hoadley, C.M. (2004). Learning and design: Why the Learning Sciences and Instructional Systems need each other. *Educational Technology, 44*(3), 6-12.

Hong, H., Chen, F. Chai, C. S., & Chan, W. (in press). Teacher-education students' views about knowledge building theory and practice. *Instructional Science.* doi: 10.1007/s11251-101-9143-4

Howard, G.S., Cole, D.A., & Maxwell, S.E. (1987). Research productivity in psychology based on publication in the journals of the American Psychological Association. *American Psychologist, 42*: 975–986.

Hung, D., Lim, K. Y. T., Chen, D. V., & Koh, T. S. (2008). Leveraging online communities in fostering adaptive schools. *International Journal of Computer-Supported Collaborative Learning, 3*,373-386.

Isotani, S., Inaba, A., Ikeda, M., & Mizoguchi, R. (2009). *International Journal of Computer-Supported Collaborative Learning, 4*,445-478.

Jacobson, M. J., Kapur, M., So, H., & Lee, J. (in press). The ontologies of complexity and learning about complex systems. *Instructional Science.* doi: 10.1007/s11251-010-9147-0

Kapur, M. (2010). Productive failure in mathematical problem solving. *Instructional Science, 38,* 523-550.

Kapur, M. (in press). A further study of productive failure in mathematical problem solving: unpacking the design components. *Instructional Science.* doi: 10.1007/s11251-010-9144-3

Kienle, A., & Wessner, M. (2006). The CSCL community in its first decade: Development, continuity, connectivity. *International Journal of Computer Supported Collaborative Learning, 1*(1), 9-33.

Kim, B., & Reeves, T. C. (2007). Reframing research on learning with technology: In search of the meaning of cognitive tools. *Instructional Science, 35,* 207-256.

Kirby, J., Hoadley, C., & Carr-Chellman, A. A. (2005). Instructional systems design and the learning sciences: A citation analysis. *Educational Technology Research and Development, 53*(1), 37-48.

Kolodner, J.L. (1991). The Journal of the Learning Sciences: Effecting changes in education. *Journal of the Learning Sciences, 1*(1), 1-6.

Lee, E. Y. C., Chan, C. K. K., & van Aalst, J. (2006). Students assessing their own collaborative knowledge building. *International Journal of Computer-Supported Collaborative Learning, 1,* 57-87.

Lee, M.-H., Wu, Y.-T., & Tsai, C.-C. (2009). Research trends in science education from 2003 to 2007: A content analysis of publications in selected journals. *International Journal of Science Education, 31,* 1999-2020.

Matron, F., & Booth, S. (1997). *Learning and awareness*. Mahwah, N: Lawrence Erlbaum Associates.

Marton, F., & Pang, M. F. (2006). On some necessary conditions of learning. *Journal of the Learning Sciences, 15*(2), 193-220.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA: Sage.

Muller, D. A., Sharma, M. D., Eklund, J., Reimann. P. (2007). Conceptual change through vicarious learning in an authentic physics setting. *Instructional Science 35,* 519-533.

National Institute of Education (2009). The Learning Sciences and Technologies academic group. Retrieved from http://www.apera08.nie.edu.sg/LST/home/default.asp

National Institute of Education (2010). The Learning Sciences Lab. Retrieved from http://www.lsl.nie.edu.sg/

Oshima, J., Oshima, R., Murayama, I., Inagaki, S., Takenaka, M., Yamamoto, T., Yamaguchi, E., Nakayama, H. (2006). Knowledge-building activity structures in Japanese elementary science pedagogy. *International Journal of Computer-Supported Collaborative Learning, 1,* 229-246.

Pang, M. F., & Marton, F. (2003). Beyond "lesson study": Comparing two ways of facilitating the grasp of some economic concepts. *Instructional Science, 31,* 175-194.

Pang, M., & Marton, F. (2005). Learning theory as teaching resource: Enhancing students' understanding of economic concepts. *Instructional Science, 33,* 159-191.

Partnership for 21st Century Skills. (2006). *Results that matter: 21st Century skills and high school reform.* Retrieved from http://www.p21.org/documents/RTM2006.pdf

Reimann, P. (2009). Time is precious: Variable- and event-centred approaches to process analysis in CSCL research. *International Journal of Computer-Supported Collaborative Learning, 4*,239-257.

Sawyer, K. R. (2006). The new science of learning. In R. K. Sawyer (Ed.), *The Cambridge handbook of learning sciences* (pp. 1-18). New York, NY: Cambridge University Press.

Scardamalia, M., & Bereiter, C. (1999). Schools as knowledge building organizations. In D. Keating & C. Hertzman (Eds.), *Today's children, tomorrow's society: The developmental health and wealth of nations* (pp. 274-289). New York, NY: Guilford.

Scardamalia, M., & Bereiter, C. (2006). Knowledge building: Theory, pedagogy, and technology. In K. Sawyer (Ed.), *The Cambridge Handbook of the Learning Sciences* (pp. 97-115). New York, NY: Cambridge University Press.

Schaverien, L., & Cosgrove, M. (1997). Learning to teach generatively: Mentor-supported professional development and research in technology-and-science. *Journal of the Learning Sciences, 6*(3), 317-346.

School of Oriental and African Studies, University of London. MA Pacific-Asian Studies (2007). Retrieved from http://www.soas.ac.uk/sea/programmes/mapacasstud/

Shih, M., Feng, J., & Tsai, C.-C. 2008. Research and trends in the field of e-learning from 2001 to 2005: A content analysis of cognitive studies in selected journals. *Computers & Education, 51*: 955–967.

Shulman, L. S. (1999). Professing educational scholarship. In E. C. Lagemann & L. S. Shulman (Eds.), *Issues in education research: Problems and possibilities*, (pp. 159-165). San Francisco, CA: Jossey-Bass.

Smith, M.C., Locke, S.G., Boisse, S.J., Gallagher, P.A., Krengel, L.E.Kuczek, J.E. 1998. Productivity of educational psychologists in educational psychology journals, 1991–1996. *Contemporary Educational Psychology, 23:* 173–181.

The University of Hong Kong Sciences of Learning Strategic Research Theme. (2009). Retrived from http://sol.edu.hku.hk/index.html

Tsai, C.-C., & Wen, L.M.C. (2005). Research and trends in science education from 1998 to 2002: A content analysis of publication in selected journals. *International Journal of Science Education, 27:* 3–14.

Tsai, C.-C., Wu, Y.-T., Lin, Y.-C., & Liang, J.C. (2011). Research regarding science learning in Asia: An analysis of selected science education journals. *Asia-Pacific Education Researcher, 20*, 352-363.

Tse, S. K., Marton, F., Ki, W. W., & Loh, K. Y. E. (2007). An integrative perceptual approach for teaching Chinese characters. *Instructional Science, 35,* 375-406.

van Aalst, J. (2009). Distinguishing knowledge-sharing, knowledge-construction, and knowledge-creation discourses. *International Journal of Computer-Supported Collaborative Learning, 4,* 259-287.

van Aalst, J., & Chan, C. K. K. (2007). Student-directed assessment of knowledge building using electronic portfolios. *Journal of the Learning Sciences, 16*(2), 175-220.

Wong, B. & Chai, C. S. (2010). Asian personal epistemologies and beyond: Overview and some reflections. *The Asia-Pacific Education Researcher, 19*(1), 1-6.