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A Comparative Analysis of Research Trends in Educational Technology and Learning Sciences through Reviewing of ETR&D and JLS from 2003 to 2012

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Educational technology (ET) and learning sciences (LS) are two related disciplines that have shared interests in studying technologies for advancing human learning. This study conducted a content analysis of articles published in authoritative academic *journals, Educational Technology Research and Development (ETR&D)* and *Journal of the Learning Sciences (JLS)* from 2003 to 2012. By selecting and examining 93 issues with 429 articles during this decade with three analytical frameworks, the purpose of this study is to determine research trends precisely and create a scientific communication and theoretical connections for these two disciplines. The illustrated results indicate the dialogue between these two communities has begun yet accompanied by some certain limitations, whereas, they still need be more cooperative and communicational to move towards further integration, so as to contribute to promoting progressive education, learning theory and practice.

Keywords : Educational Technology, Learning Sciences, Research Trends, Content Analysis

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Introduction

Recently, along with the rapid development of constructivism theories and technologies, two communities, educational technology (ET) and learning sciences (LS) can share interdisciplinary and inter-regional practice and research. Jonassen, Cernusca, and Ionas (2007) described that constructivism changed from instructional science to learning science perspectives for instructional design in ET. Hoadley and Van Haneghan (2014) also introduced the origin and focuses of LS and addressed the implications for instructional design. The results of research in LS, such as studies on thinking and knowledge, learning processes, and learning environments can contribute to instructional design, focusing on the importance of context and intervention for real educational problems. From the perspective, design practice and research in ET for learner-centered, technology-enriched learning environments can make better intervention based on LS.

However, being divided by narrow disciplinary boundaries, research on the two disciplines are in a loose state with fragmented knowledge. This division inevitably affects the integrity and comprehensiveness of educational research. To make them clear, the discussion on the efficiencies and inefficiencies associated with the separation of these two fields is strongly required. For instances, some scholars give their perspectives on the emergence of learning science. Besides, Hay and Deaton (2003) and Kirby, Hoadley, and Carr-Chellman (2003) conducted the citation analyses between both fields. With variances in their research coverages, they came to surprisingly similar conclusions that these two fields had little overlap on citations, however, other scholars believed that both fields shared a large portion and much overlap did exist. This gap motivated us to analyze these two fields, which has been broadly agreed to share much common thoughts among their communities, so as to find what overlap and difference did exist. Besides, there is a lack of comprehensive and systematic studies to reveal the research trends and development of LS and ET.

Therefore, it is essential to analyze the research trends and development of ET and LS through *ETR&D* and *JLS*, the representative journals and the key area of ideas. Both *ETR&D* and *JLS* have their dominant focuses and overlapping interests on research topics such as learning environment design, learning process and so on. It leads to the overlapping in the content of their researches. In view of this, some scholars believe that it is of great possibility to combine these two disciplines into one and the two communities are and should be converging. Hoadley (2004) claimed that there are many points of overlap and differences. He believed that these fields have future together in studying educational technology because of developments in design-based research methods. The division of research range of these two disciplines is not obvious in many aspects, and to avoid misunderstandings and confusions, it is of great value to study whether a division actually exists between the two fields. For this problem, it is necessary to have in depth understanding and address the research topics, related scopes, core concepts, in order to find the development trends and directions for each field. As expected by those pioneers, these two areas need more understanding, more mutual benefit and collaboration to achieve that, which is extremely important for the development and innovation of LS and ET. In this regard, the research questions in this study are as follows: What are the differences and similarities in research topics, research methods, and background theories in ETR&D and JLS?

Research in Educational Technology

The first great paradigm shift in the field's central interest occurred when teaching machines and programmed instruction burst upon the public consciousness. The main topic of the research from the 1950s-1970s was related to what content should be taught by using auditory and visual materials and how to use them to enhance instruction. Robert Gagne had an important contribution, by this time to the instructional design research, stating that knowledge acquisition

could be facilitated by hierarchical sequencing of instruction, from subordinated knowledge to more complex abilities (Gagne, 1962). Later, the second paradigm shift occurred after the birth of micro-computers in the early 1980s (White & Gagne, 1978). And the task analysis became the main tool of organizing the teaching content. Probably the most widely accepted approach to the analysis of tasks was proposed by Gagne (1985) and is referred to as hierarchical task-analysis. The main purpose of ET in that period was to make the computer assisted instruction as good as the one delivered by the teacher and so, the early educational software tried to teach the same content the teachers teach and in the same way (Winn, 2002). Therefore, the main research method used in that time was the so-called comparison of media, i.e., comparing the computer-assisted teaching with the traditional instruction delivered by the teacher (Kulik et al., 1983) conducted some meta analyses concerning the effect of computer-assisted instruction on learning performance at several educational levels: primary, secondary and college.

By the early 21st century the field was into its third paradigm shift from CAI to web-based learning environments and facing the possibility of a fourth, ubiquitous learning through mobile media. Also, the major conceptual shift brought by the constructivists in the 1980s (Ross et al, 2010) is a switch of attention from how the information is presented, to enhance the learner to use the medium in order to arrive at a unique and idiosyncratic understanding. In the views of learning, the cognitive constructivism claims that an active, self-regulated, goal-directed and reflective learner constructs personal knowledge through discovery and exploration in a responsive learning environment. The implication of this view is that it is important to design learning environments that facilitate social interaction and cooperative learning in the classroom (Vosniadou, 1996) as a premise for a successful internalization of distributed learning. Because the center of this learning environment is not the teacher's fixed curriculum objectives, but rather the learners' emergent practices in relation to the need at hand, it should be considered to design an inquiry-based, participatory learning environment (Barab et al., 1998). By

supporting participatory learning environments, ET has moved from a "teacher curriculum" to a "learner curriculum" (Lave & Wenger, 1991), or from an "acquisition" metaphor to a "participatory" metaphor (Sfard, 1998). The researchers have asserted that an artificial environment could serve to achieve some specific learning objectives through so-called cognitive apprenticeship (Brown et al., 1989) or professional apprenticeship (Lave & Wenger, 1991).

Research in Learning Sciences

Defining the field of LS is difficult owing to its short history, its interdisciplinary nature, and the advent of cross field publications between researchers in LS and other disciplines. LS is a convergence of design of activity systems, cognition, and socio-cultural context (Jonassen, 2007). The goal of the LS is to better understand the cognitive and social processes that result in the most effective learning, and to use this knowledge to redesign classroom and other learning environments so that people learn more deeply and more effectively (Sawyer, 2006). Following the writings of Vygotsky (1978), a number of researchers agree that learning is not an endogenous generated process, but is an activity that has its roots in participation in sociocultural interaction (e.g., Lave, 1988; Saxe, 1990). Therefore, Kolodner (2005) takes LS as an interdisciplinary cross-discipline, the main goals of LS can be summarized as follows (1) to understand what is learning for applicability and study the different levels of description for the development path of learning, understanding and ability. The ultimate goal is to enable learners to effectively use the concepts, skills and practice they have learned; (2) to explore the ways of promoting deep and lasting learning. In specific, the learning of complex skills, exercises and content; classroom learning, workplace learning, informal learning; face-to-face learning and distance learning; (3) to explore the environmental factors that affect people's learning, such as what can work together, the roles to play, the specific details of these roles; (4) to design software, steps of activities, lesson

materials, environment and teacher's professional development to promote learning; (5) to design methods to study intra-individual learning.

In short, LS is a very complicated discipline, different from the traditional study of learning theory confined from psychology perspective. From a multi-disciplinary vision, learning breaks the research of learning singly based on laboratory and school education. Learning for experts, children, daily life, practitioners in workplace, traditional apprenticeship as well as technology-mediated learning are incorporated into the sight of learning research.

Methods

Data Source and Collection

This study attempts to identify issues and trends within the past ten years (2003-2012) through a comparative analysis of two journals which are widely regarded as key indicators of thought in each of the respective fields. In terms of on these two disciplines, a standard reference called *Educational Media and Technology Yearbook* always evaluate the professional strength of worldwide universities by means of counting actual research reports that appeared in one of two journals, *Educational Technology Research and Development (ETR&D)* and the *Journal of the Learning Sciences (JLS)*. These two journals were primarily selected based on general sense that they are the leading journals of each field.

The method used for the collection of *ETR&D* and *JLS* in this study is to retrieve the name of journals by searching databases of Springerlink and Taylor & Francis Online in the time span from January 2003 to December 2012. During this decade, 302 research articles containing 53 issues of *ETR&D* were found in Springerlink. And 40 issues included in 137 journal articles of *JLS* were examined in Taylor & Francis Online. However, commentaries, research abstracts, international

review, book review, book ideas and editorials were excluded in this study.

Data Analysis

For analysis, first, three researchers shared the analytical framework as coding scheme. In the second step, two researchers first classified total 439 articles according to the analytical framework with their abstracts and keywords. Third step included reading the body of each article to verify the previous classification and, if needed, to reclassify some under two researchers' agreements. In the fourth step, three researchers finally verified and reclassified articles.

For content analysis, the analytical framework was developed. Analytical frameworks in the previous studies, except for the research methods, are quite different in accordance with the purposes of their studies. Centered on the articles published on *ETR&D* and *JLS* for the past decade, this study tries to determine the trends of three dimensions: research topics, research methods, and background theories. Within the category, each framework was developed based on the definition of Educational Technology in 2008 (Januszewski & Molenda, 2008) and previous studies (e.g., Kwon & Lim, 2006).

The details of the analytical framework are shown as in the table 1. First, the criteria for the framework of 'research topic' is determined by the definition of educational technology in 2008 (Januszewski & Molenda, 2008) which mainly includes these four subcategories 'creation' 'utilization' 'management'. The subcategory of 'learning process' which was emergent mainly from JLS and some from ETR&D was added. The subcategory of 'creation', the papers related to suggestion and discussion which about innovative research methodology, learning theories and epistemology are categorized in this study.

Second, the framework of 'research methods' was identified based mostly on previous studies. Some codes such as alternative method and others were emerged from our analysis, representing recent research methods in ETR&D and JLS.

Research Topic	Creation	Instructional design	T1	ID model development, design guideline suggestion, stages of ID(analysis, design, development, implement, evaluation), message design, interface design, instructional material development	ETR&D, *60*(6), Ormel
		Learning environments design and development	T2	Design and development of learning product, community; the exploration of learning courses supported by new technology	JLS, *12*(3), Enyedy
		Instructional strategies/ methods	T3	CAI, WBI, problem-based learning, case-based learning, goal-based scenarios, collaborative learning, scaffolding	ETR&D, 2003, Ge& Land
		Learner characteristics	T4	Learning motivation, interest, prior knowledge, learning styles	ETR&D, *60*(1), Kyprianidou
		Theoretical research	T5	utterance or exploration of theory, model, framework, epistemology and methodology	JLS, *21*(1), vandeSande
		the effect of emerging technology during creation	T6	Emerging technologies such as artificial intelligence, mobile & hypermedia, and kinds of assessment systems	ETR&D, *58*(1), Traphagan
	Utilization	Implementation and institutionalization	T7	Adopter's awareness, conceptual acquisition, literacy, perspectives, attitude towards changes such like new technologies, pedagogy, policy and regulations	JLS, *21*(4), Cobb & Jackson
	Manage-ment	Project, resource, delivery and knowledge management	T8	Factors deciding the success of a project; conditions that manage and guarantee the learning resources knowledge can be developed, maintained, and made available	ETR&D, *59*(1), Rooij
	Learning process	Individual learning process	T9	Centered on the learning that takes place in collaborative situations with the use of pre- and post-tests that measure capabilities of the individuals when they are working alone	JLS, *21*(3), Lobato
		Group learning process	T10	To provide valuable information about important group functions, such as socialization, influence, and communication in a CSCL environment.	JLS, *14*(4), Muukkonen
		Individual & group learning process	T11	Researches which are interested in both individual and group learning process.	JLS, *20*(2), Zhang
		Representation	T12	Knowledge representation strategies, representation tools, representational gesture, meta-representational knowledge	ETR&D, *58*(5), Erkens
		Others	T13	Researches not classified by items above	*ETR&D*, *59*(5), Zhao

	y	Code	Examples	Representative Articles
Research Methods	Quantitative	M1	(Multivariate)analysis of variance, analysis of covariance, t-test, Cohen's d effect size	*ETR&D, 60*(5), Shaw
	Qualitative	M2	Case study, ethnography, interviews, fieldwork, video analysis, learning portfolios, discourse analysis	*JLS, 18*(1), Roth
	Mixed	M3	Six major mixed methods design framework by Creswell & Clark(2011)	*ETR&D, 59*(2), Liu
	Theoretical	M4	Literature review, conceptual framework, design principles	*JLS, 16*(2), Barab
	Alternative	M5	Design-Based Research, Design and Development Research, Formative Research	*JLS, 17*(2), Tatar
	Others	M6	Delphi, SNA, Commentary, reply	*ETR&D, 59*(5), Zhao
Background theories	Cognition-focused	BT1	Information processing theory, mental model, cognitive load, Piaget's theory	*ETR&D, 60*(3), Cheon
	Sociocultural-focused	BT2	activity theory, distributed cognition, situated cognition, case-based reasoning, communities of practice	*JLS, 18*(1), van ES
	instructional design model / learning environment model focused	BT3	ADDIE, Rapid Prototyping, 4CID, Open-ended learning environment, Constructivist learning environments(CLEs), Technology-Enhanced Student-Centered Learning Environments (SCLEs)	*ETR&D, 57*(1), Lim et al.
	Performance technology	BT4	Organizational development, IBSTPI competencies model	*ETR&D, 59*(6), York & Ertmer
	Others	BT5	Network theory, Functional conceptualism, Diffusion of innovations	*ETR&D, 54*(1), Fox

Therefore, the framework for research method is drawn as 'quantitative', 'qualitative', 'mixed', 'theoretical', and design-based-research (DBR) and 'alternative' method.

Last, the framework for background theories in ETR&D and JLS included 'cognition-focused', 'sociocultural-focused', 'ID models/(constructivist) learning environment model- focused'(developed by immanent systems theory in ET field), and 'performance technology' through referring to previous studies.

To guarantee the validity and reliability of this study, agreement check and specialist review were included. Further, in the process of categorizing and coding of research topics, methods and background theory, any disagreement were discussed and modified by researchers together to achieve a consensus.

Results

Comparison of Research Topics

Research Topics in *ETR&D*

From 2003 to 2012, results of research topics for papers published on *ETR&D* in last 10 years are as follows. 216 articles (71.5%) are categorized on 'creation' with the most proportion, others from most to least proportion are: 'utilization' (38 articles, 12.6%), 'learning process' (27 articles, 8.9%), 'management' (15 articles, 5%) (see Table 2). The most detailed contents of 'creation' involve instructional strategies/methods (74 articles, 34.3%), instructional design (56 articles, 25.9%), learning environments design & development (36 articles, 16.7%), theoretical research (29 articles, 13.4%), and learner characteristics (21 articles, 9.7%) respectively. In terms of 'utilization', articles on the effect of emerging technology during creation (25 articles, 8.2%) charge the most proportion. Articles about group learning process (18 articles, 6%) are the main research topic on 'learning process.'

Table 2. Summary of Research Trends in ETR&D and JLS

Domain		Category and Subcategory	*ETR&D*(%)	*JLS*(%)
Research topic	Creation	Instructional design	56(18.5)	8(5.8)
		Learning environments design and development	36(11.9)	7(5.1)
		Instructional strategies /methods	74(24.5)	29(21.2)
		Learner characteristics	21(7.0)	3(2.2)
		Theoretical research	29(9.6)	24(17.5)
	Utilization	the effect of emerging technology during creation	25(8.3)	3(2.2)
		Implementation and institutionalization	13(4.3)	2(1.4)
	Management	Project, resource, delivery and knowledge management	15(5.0)	2(1.4)
	Learning process	Individual learning process	1(0.3)	12(8.7)
		Group learning process	18(7.0)	19(13.8)
		Individual & group learning process	3(1.0)	13(9.5)
		Representation	5(1.7)	15(10.9)
	Others		6(2.0)	0(0)
Research methods		Quantitative	98(32.4)	15(10.9)
		Qualitative	47(15.5)	57(41.6)
		Mixed	52(17.2)	24(17.5)
		Theoretical	20(6.6)	16(11.6)
		Alternative	71(23.5)	21(15.3)
		Others	14(4.6)	4(2.9)
Background theories		Cognition-focused	118(39.1)	40(29.2)
		Sociocultural-focused	108(35.7)	84(61.3)
		Instructional design model / learning environment model focused	26(8.6)	2(1.4)
		Performance technology	8(2.6)	4(2.9)
		Others	42(13.9)	7(5.1)
Total			302(100)	137(100)

In the past 10 years, *ETR&D* articles are carried out to analyze the changes on research topics showed as the figure 1. First, It has been shown that topics in domain of creation have been the dominant direction of ET research, which has been taking a higher percentage than others. Detail field of the domain of creation all showed a rise tendency, 'scaffolded learning with technology (Volume 56, issue 1)'and 2012 'personalized learning (Volume 60, issue 4)' stand out in 2008. Practical use effect research of emerged technology from domain of utilization (e.g., Lee & Thomas, 2011) charge a lot, such the research about barriers of technology integration (Hew & Brush, 2007), research on implement and innovation are also consistent. Domain of management, as research analyzing on preliminary successes PT3@ASU program from (Volume 51) issue 1 (Brush et al., 2003) in 2003, these PT3 Program's sub project articles that five of six articles show a downward trend. Domain of leaning process is the comparison on group performance from computer based collaborative learning (e.g., Kapur & Kinzer, 2007), knowledge creation research (e.g., Hong & Sullivan, 2009) and so on. Research on group learning process is being achieved constantly.

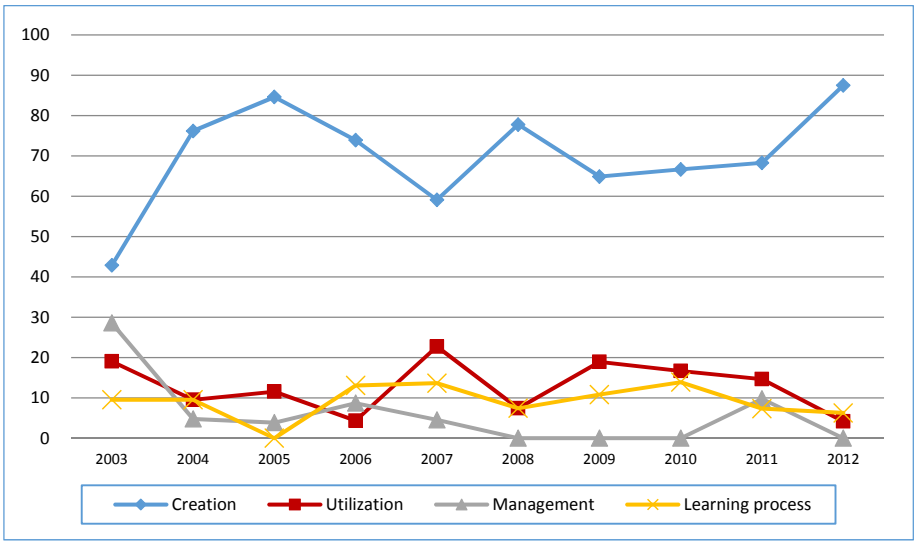

Figure 1. Trends of Research Topics in ETR&D

Research Topics in JLS

According the analysis results about research topic of 137 articles published *JLS* in the last 10 years 2003-2012, 'creation' (71 articles, 51.8%) and 'learning process' (59 articles, 43.1%) are concentrated obviously. (see Table 2) Detail content of 'creation' is instructional strategies / methods (29 articles, 21.2%) and theoretical research (24 articles, 17.5%) which accounted for a similar proportion. Detail content of 'learning process' is group learning process (19 articles, 13.9%), representation (15 articles, 11%), individual learning & group learning process (13 articles, 9.5%), individual learning process (12 articles, 8.8%) were studied averagely.

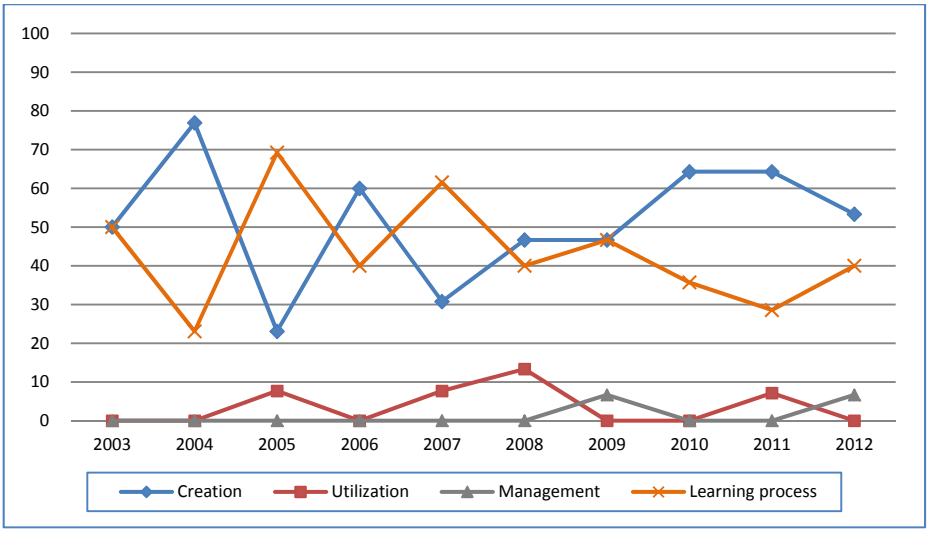

Figure 2. Trends of Research Topics in JLS

As the time goes, changes on research topics are analyzed and presented as figure 2. *JLS*'s articles focus on 'creation' and 'learning process, field of 'utilization' and 'management' appeared as once two years weakly. In addition, 'creation' field is a steadily increasing trend, whereas, 'learning process' is a rather slow state. Field of 'creation' can be found as the A Comparison of Lecture-Based and Challenge-Based Learning in a Workplace Setting Research (O'Malhony et al., 2012) and other

6 articles focused on instructional strategies/methods. Theoretical research concerns design research, design-based research, design experiments and innovative methodologies from the Volume 14 issue 1 2004. The detailed content of learning process is evenly involved, and high interests can be seen on development and application of representation (e.g., Parnafes, 2007).

Comparison of the Trends of Research Topics

A comprehensive research topics trend of *JLS* and *ETR&D* are shown below. In domain of creation, two communities are interested in instructional strategies/ methods, the proportion is 24.5% (74 articles), 21.17% (29 articles) relatively. Furthermore, topics on learning process have become an annual theme of research, and the number of it in researches has exceeded the topics in the domain of management. Although far less than LS's 43.5%, it proves that ET has begun to do researches on learning process, the same situation can be seen on research topic, representation and interaction, which is consistent with the constant concern of learning process in *JLS* over the years.

However, although *ETR&D* has the difference on frequency, studies are

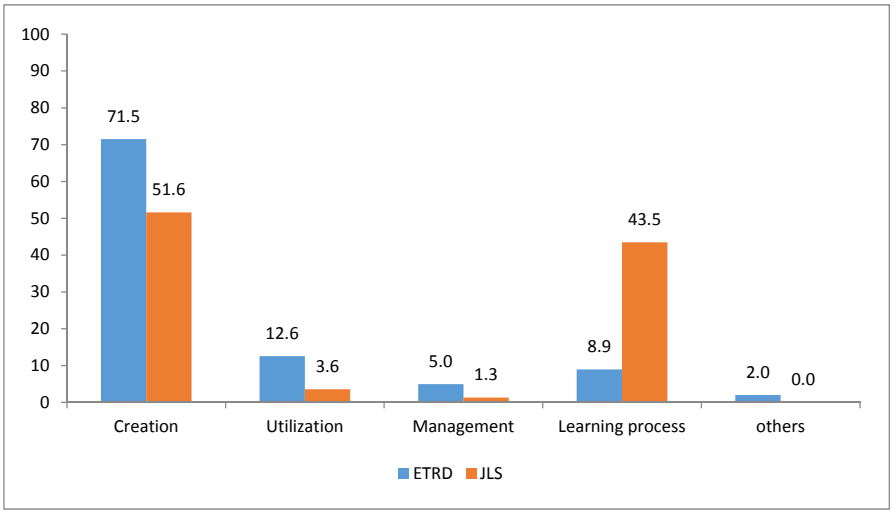

Figure 3. Comparison of Research Topics in ETR&D & JLS

conducted on five domains with average proportion. On the other hand, the study was conducted only on creation and learning process. Absolutely, utilization and management are the traditional research areas of ET. In detail, content of *ETR&D*, research topics related on instructional systematic design which includes design, development, implementation, and evaluation got the most proportion, while as *JLS* focus theoretical research, discussion on design based research and new methodology is carried out a lot. In addition, theoretical research of *ETR&D* always was applied by literature analysis to draw design principles, while *JLS* is mainly discuss the new methodology and epistemology.

Comparison of Research Methods

Research Methods in *ETR&D*

According to analysis results of research methods on articles published on *ETR&D* in the last 10 years 2003-2012, 'Quantitative' accounts for 98 articles (32.4%) to charge the most, 'Alternative' (71 articles, 23.5%) , 'Mixed' (52 articles, 17.2%), 'Qualitative' (47 articles, 15.5%), 'theoretical' (20 articles, 6.6%) according to priority (see Table 2).

As the past 10 years goes, changes on research methods of *ETR&D* are analyzed and presented as figure 4. Trends of *ETR&D* for the research methods were presented as figure 4. First, quantitative method research is steadily increasing. Researches by using mixed method and the alternative method are still increasing with a new trend that using a variety of data collection and analysis to represent research results. In contrast, besides steady development trend of qualitative method, theoretical method showed a downward trend since 2004. Others methods were carried out and paid much attention to, social network analysis, Delphi method and other various methods are also being utilized.

Figure 4. Trends of Research Methods in ETR&D

Research Methods in JLS

According to analysis results of research methods on articles published on *ETR&D* in the last 10 years 2003-2012, 'Qualitative' accounts for (57 articles 41.6%) to charge the most, 'Mixed' (24 articles, 17.5%), 'Alternative' (21 articles, 15.3%), theoretical' (16 articles, 11.6%) 'Quantitative' accounts for (15 articles, 10.9%) according to priority (see Table 2).

As the past 10 years goes, changes on research methods of *JLS* are analyzed and presented as figure 5. Changes on *JLS* analysis results on the research methods are

presented in figure 5. First, qualitative method is steadily increasing with big proportion of articles each year. Mixed method and alternative method are still increasing and showed big interest on DBR. LS carried out a large number of long-term studies to complete research results which hardly can be concluded by quantitative method for in-depth understanding of the learning phenomenon. Since discussions on DBR of theoretical research were talked in 2004, although articles on DBR are in a low proportion, amount of researches on discussing theoretical theory and methodology are carried out continuously.

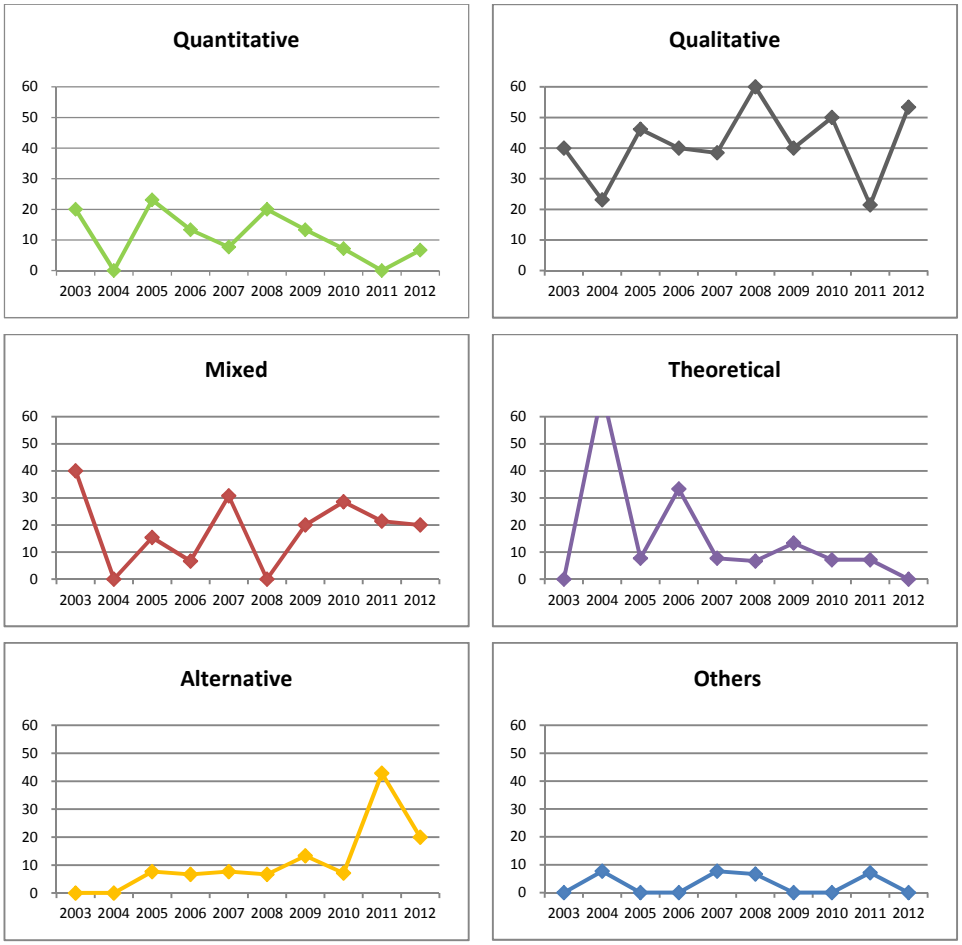

Figure 5. Trends of Research Methods in JLS

Comparison of the Trends of Research Methods

A comprehensive research method result of *ETR&D* and *JLS* are shown as below. First, both *ETR&D* and *JLS* articles which using mixed methods and alternative methods are increasing. Researchers are actively exploring and practicing a variety of new methods and technologies for new learning environment. Undoubtedly, it is the source of power that promotes the rapid development of LS & ET. Therefore, Hoadley (2004) is that these fields have future together in studying educational technology because of developments in design-based research methods. And these contents can be reorganized as similar results.

However, as a traditional research method, 32.4% with 98 frequencies of articles from *ETR&D* were found to use quantitative method, whereas, it appeared to be inadequate in complicated learning context in LS. Only 10.9% articles can be found that use quantitative method all along. LS attaches great importance to the qualitative research method and uses various analysis methods, such as video tapes,

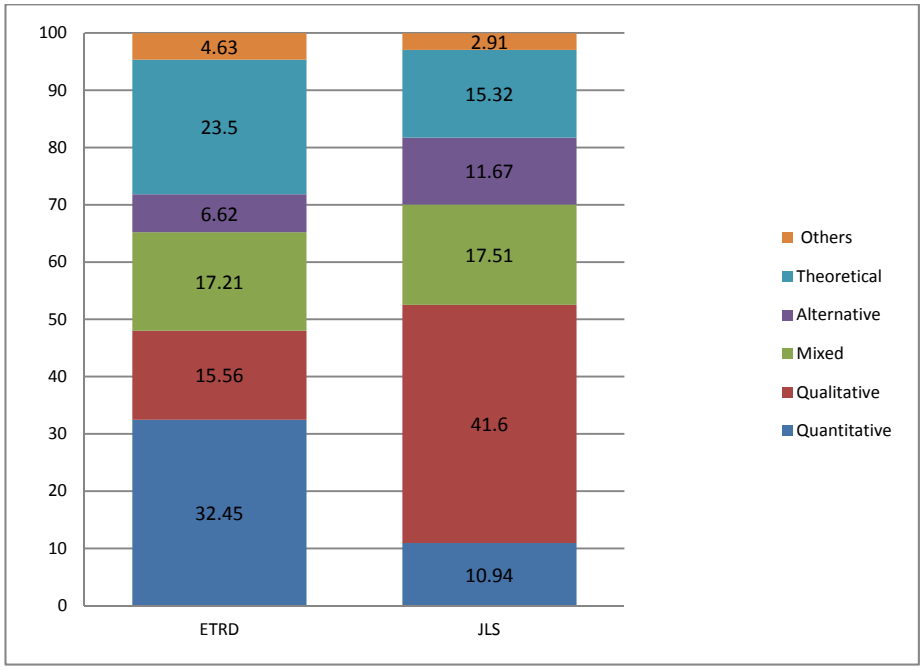

Figure 6. Comparison of Research Methods in ETR&D & JLS

discourse analysis, ethnographic observation, portfolios, as well as new ways established in dynamic learning environment. The utilization rate of this method is very obvious with the highest frequency compared with the other methods, which closes to an half the total articles in JLS. The main reason is that, according to the research trend initiated by JLS, these interpretive research methods are particularly helpful for the study of learning in the real world.

Comparison of Background Theories

Background Theories in *ETR&D*

According to analysis results of background theories on articles published on *ETR&D* in the last 10 years 2003-2012, 'cognition-focused' accounts for 118 articles (39.1%), 'sociocultural-focused' has 108 articles (35.7%) showed similar levels with part of 'cognition-focused'. Articles focused 'instructional design model / learning environment model were 26 articles (8.6%), 'performance technology' 8 articles (2.6%) appeared. Also 42 articles (13.9%) cannot be reorganized were not included in this study (see Table 2).

As ten-year goes, changes on background theories are analyzed and presented as figure 7. First, researches on 'cognitive load' (Volume 53), 'hypermedia learning' (Volume 56) were published as special issues for 'cognition-focused'. 'Cognition-focused' got the characteristic rise and developed into the gradually increasing. In contrast, 'sociocultural-focused' is studied continuously and steadily. topics such as the CSCL, learning communities appeared in part of 'sociocultural-focused'. 'instructional design model / learning environment model' focused applied research of ADDIE, 4CID model, the small number of articles about open Learning Environments (OLEs), Constructivist learning environments (CLEs) appeared, while 'sociocultural-focused' articles were completed with learning environment designing. As 'performance technology' is a unique theoretical basis for educational technology, but York & Ertmer (2011) did not

carry out researches related with IBSTPI competencies model each year. Others were about Constructivism and Functional contextualism which never appeared after a big discussing in 2006.

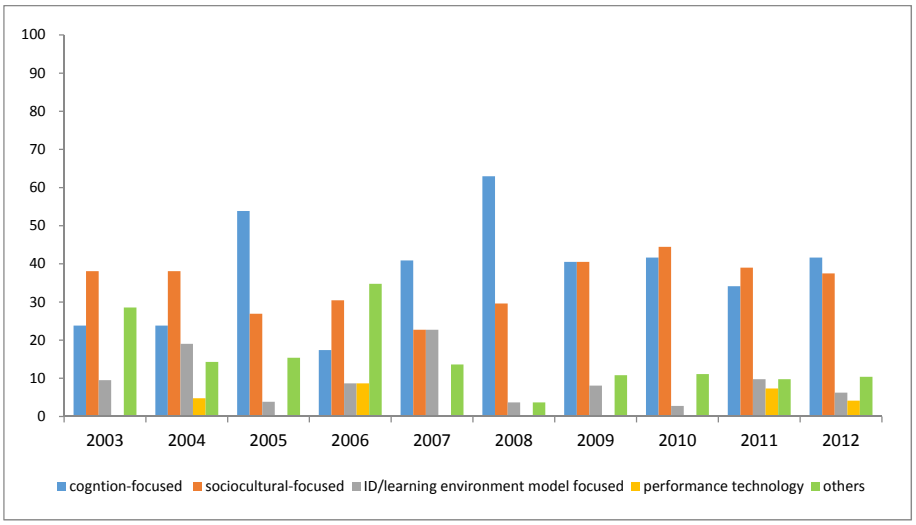

Figure 7. Trends of Background theories in ETR&D

Background Theories in *JLS*

According the analysis results about background theories of articles published on *JLS* in the last 10 years 2003-2012, 'sociocultural-focused' accounted 84 articles (61.3%) for more than a half proportion. The rest researches were 'cognition-focused' for 40 articles (29.2%). Researches about 'instructional design model / learning environment model focused' and 'performance technology' were conducted rarely. (see Table 2)

As the time goes, changes on background theories are analyzed and presented as figure 8. Researches of 'sociocultural-focused' charged the proportion over half consistently, as well as, researches on background theories of 'instructional design model / learning environment model focused' or 'performance technology' and others also appeared after 2006. In particular, embodied cognition (Volume 21, issue 2), transfer strand (Volume 21, issue 3) the 'cognition-focused' were focused

with 13-15 articles published each year and made a contribution to influencing the trend of *JLS*.

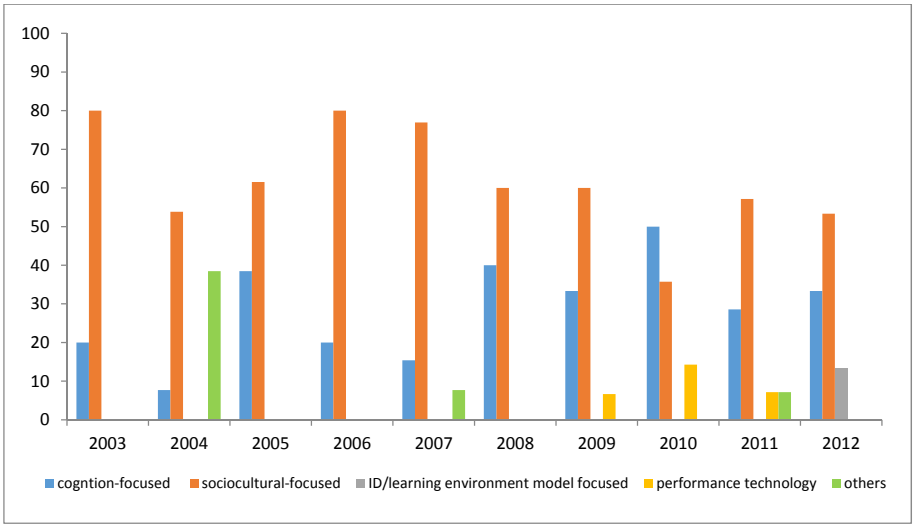

Figure 8. Trends of Background theories in JLS

Comparison of the Trends of Background Theories

A comprehensive background theories trend of *JLS* and *ETR&D* are shown below. Both *ETR&D* and *JLS* focused on part of 'cognition-focused' and 'sociocultural-focused' theories. It is known that all ET and LS field intended to understand 'learning' by taking into account aspects of social and individual. Difference of proportion can be found between *ETR&D* and *JLS, ETR&D* concerned theories of 'cognition-focused' and 'sociocultural-focused' (39.1%, 35.7%) similarly, whereas, JLS concentrate 'sociocultural-focused with a '61.3% proportion. 'sociocultural-focused' theories research has been steadily conducting in *ETR&D* and recently researches on 'cognition-focused' theories are to be active gradually in *JLS*.

In addition, as ET-specific knowledge base it is a proportion lack on performance technology articles for these two fields. Considering the aspect on combination of theory and practice, field of training have to be studied

continuously. A thing to note is that other theories which not belong to the categorization are *ETR&D* accounted for 13.9%, JLS 5.1%. Six articles about constructivism and functional contextualism appeared in *ETR&D* 2006. Five theoretical research articles about DBR methodologies appeared to discuss new epistemology and research methodology of learning in *JLS* 2004. It is necessary to pay attention to development of epistemology and methodology in future.

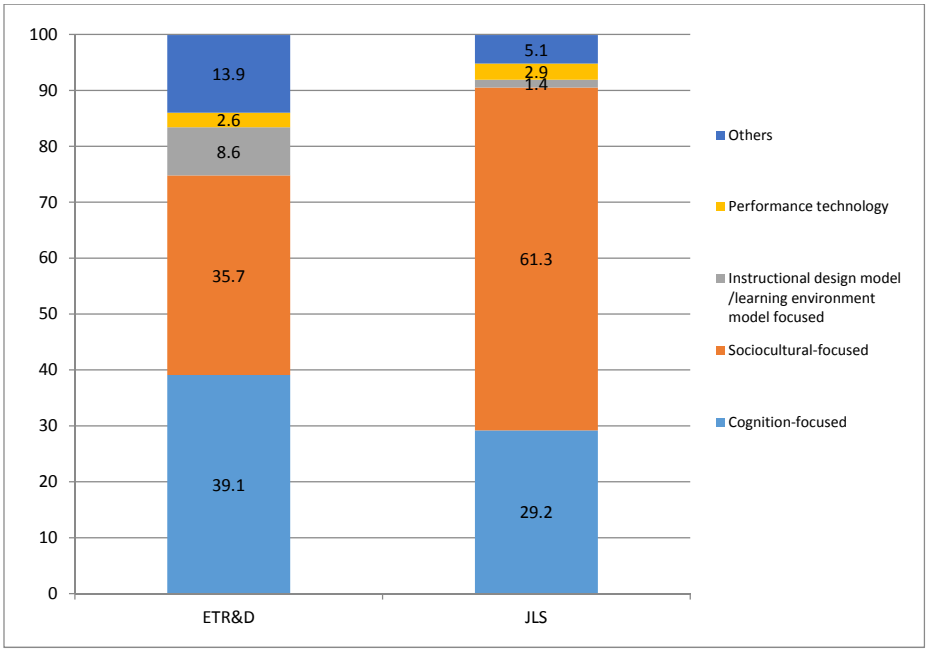

Figure 9. Comparison of Background theories in ETR&D & JLS

Implications and Conclusion

Based comparative analysis results from above, it can be seen that LS and ET have differences and common inclination of research topics, methods and background theories within the last decade. First, both of them have their own research focuses. ET is mainly stick to the core research topics of instructional

strategies & methods(24.5%), instructional design (18.5%) as well as learning environment design and development (11.9%). *ETR&D* increasingly lays more and more emphases on the design of learning environment, learning process and nature, which is different from the earlier findings in previous studies by Klein (1997) and Masood (2004) et al. LS has been focusing topics on instructional strategies & methods (21.2%), learning process (51.8%), and theoretical research (17.5%), in accordance with Randall et al (2011) and Yang's (2012) studies. At this point, these two disciplines are quite overlapping in interests on research topics.

Second, on the application trend of research methods, they get similar trend on employing qualitative, alternative, mixed method and in depth research; As described in previous researches, ET dominantly uses quantitative (32.4%) method; however, the dominant position of this approach is weakened by increasingly qualitative and alternative method, similar with the studies conducted by Chung & Yang (2005), Zaugg et al (2011). LS gets a special emphasis on qualitative method that is used in nearly half of the articles. However, mixed, alternative method are increasingly applied, Therefore, Hoadley (2004) is that these fields have future together in studying educational technology because of developments in design-based research methods. And these contents can be reorganized as similar results.

Third, both ET and LS are concentrating the human learning, cognition-focused and sociocultural context-focused theory is considered. Due to the historical factors those LS born out of cognitive science and emphasis on the learning context, cognition-focused theory and sociocultural context-focused theory are paid considerably attention to, all the time. At the same time, as complex as two communities, it is necessary for them to pay close attention to a variety of other theories.

These two fields are sharing many common grounds and similarities, yet have their own focus, which can also be certified by previous studies on the relations between the two subjects (Hay & Deaton, 2003; Hoadly, 2004). With a new path of

cooperation and making full use of experts and researchers in these two fields, it is more efficient and targeted to explore and resolve issues related to teaching and learning.

ET and LS are disputing on intrinsic topics, theories and research methods which contribute to their combination together. With the emerging and development of constructivism paradigm, it is meaningful to balance and share original community to facilitate the members to a nascent research community for development of disciplines. In accordance with this study, some implications aiming to foster two communities to be more cooperative and communicational are summed up as follows: Firstly, in order to be more likely to get relevant benefits and thoughts from LS, not only the core research topics, *ETR&D* is also expected to pay close attention to research topics about learning environments design and development, learning process, representation and so on. As Hoadley and Van Haneghan (2014) mentioned before, research on instructional design for technology-enriched, learner-centered learning can refer to the results of LS, including their DBR approach for tracking learning processes and integrating design into research.

Secondly, in terms of research method, it is conjectured that the real integration cannot be far with high utilization of qualitative method. The cooperative bridge is mix-method, DBR, probably, which focused on qualitative method and creating new theories. LS is able to produce such a large influence on the practice of teaching and learning, it does change the tradition of simple experimental research from cognitive science, as for ET researchers, the useful reference role to the advantages of qualitative method is expected to get a deeper understanding about learning. Thirdly, more attention should be paid by ET researchers to understanding and utilizing sociocultural context-focused, so as to cater for the emphasis on real-life situation of learning.

Though *ETR&D* and *JLS* are authoritative journals in these two disciplines, the selection of these two journals in this study fails to select all authentic and

individual journals of in these areas of study. Besides, this study does not comprise articles (e.g., book and international review in *ETR&D*, books & ideas in *JLS*, commentaries) which are expected to study in further study. Due to the rapid development of disciplines with the emergence of perpetual new topics, comparative analyses of development trends of the two subjects in future will not only stick to the analytical framework employed in this study for coding. In addition, though this study analyzed the journals based on content analysis and reported the main categories, it is also necessary to use quantitative method such as index analysis and to analyze subcategories to give deeper understandings of research trends of two communities.

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