



Sociocultural Perspectives on the Internationalization of Research in Mathematics Education: A Survey Based on JRME, ESM, and MTL

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ABSTRACT

The current main research trend in mathematics education is publishing studies by Western scholars pertaining to educational issues of the world in general. but Asia is mostly overlooked. Since international comparisons show Asian students outperform others in mathematics, the imbalance should receive more attention. To gain insight into this disparity, this study surveys all theoretical and empirical articles published by Journal for Research in Mathematics Education (JRME), Educational Studies in Mathematics (ESM), and Mathematical Thinking and Learning (MTL) from 2000 to 2012. Issues regarding westernization vs. internationalization of mathematics education and how to build a self-identity in research in mathematics education are addressed. A sociocultural framework for conducting and publishing educational research in mathematics is needed to develop multicultural perspectives.

Keywords: Internationalization of Mathematics Education, Socio-cultural Perspective, Research and Practice

INTRODUCTION

Improving research and practice in mathematics education has gained international appeal regardless of economic developments and cultural differences. Among the various disciplines of higher education, mathematics education is perhaps the most internationalized subject (Robitaille & Travers, 1992). The teaching and learning of mathematics are truly international activities (Atweh & Clarkson, 2001) and therefore, research in mathematics education has become an international enterprise (Heid, 2009). Making this academic enterprise stronger is dependent, to a great degree, upon constructive input coming from different areas and cultures around the world. In achieving this goal, an extensive concern covering the teaching and learning of mathematics around the world is indispensable, and the effect of a dominative

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State of the literature

- The teaching and learning of mathematics are truly international activities and therefore, research in mathematics education has become an international enterprise.
- It has been recognized that issues about practices of mathematics education are more likely local ones. Different cultural factors and social needs may contribute to the diversity of this educational engineering.
- Among all the forms of international communication, academic journals bear the most responsibility for transferring input from country to country and igniting intellectual sparks.

Contribution of this paper to the literature

- There is an increasing tendency toward qualitative research, suggestion that contemporary researchers are more interested in revealing hidden causes and variables behind the visible phenomena via exploring various cases in depth.
- The statistics clearly indicate that Western scholars in general and American scholars in particular have put forth a tremendous effort in building the enterprise of mathematics education research.
- The teaching and learning of mathematics by Western teachers and students in general, and American teachers and students has been widely documented whereas the practices in mathematics in Asian regions receive less visibility.
- A sociocultural framework for the research in mathematics education may not only help researchers and teachers gain an international vision, but also shed more light on the local issues of mathematics education.

perspective should be minimized, if not avoided. However, an imbalanced phenomenon has long existed in this enterprise. This article explores the issue in terms of sociocultural perspectives by revealing the current status of international research based upon data drawn from three significant international journals in mathematics education.

BACKGROUND OF THE STUDY

Mathematics – A Locally-Developed Global Language

Without a doubt, mathematics is one of the oldest, most fundamental, and most cultured disciplines in the history of human civilization. Both the Six Arts of ancient Chinese culture and the Quadrivium of ancient Greek philosophy regard mathematics as a significant liberal art for education. Nowadays, mathematics has been proved to be the most successful scientific language and has therefore become the most globalized subject. Contemporary mathematicians from every corner of the world can communicate their ideas with each other in identical symbols and forms. From a historical and cultural sense, however, mathematical concepts, though similar in nature, have been demonstrated by various ancient civilizations in different forms. For instance, instead of representing the area of a circle in a precise symbolic formula, πr^2 , Archimedes said *“the area of any circle is equal to a right-angled triangle in which one of the sides about the right angle is equal to the radius, and the other to the circumference of the circle”*

and *Nine Chapters on the Mathematical Art*, an ancient Chinese mathematical text, claimed “*Multiplying half the circumference by half the diameter yields the area*”. Such a culturally heterogeneous but mathematically homogeneous phenomenon has caused an ongoing epistemological debate on “Is mathematics discovered or invented?” (Fine, 2012).

Despite of the epistemological debate, mathematics becomes a global language for its central value in the study of several disciplines. For practical purposes, mathematics meets the needs of commerce, industry and engineering so much so that it has become the most fundamental training in school. For scientific reasons, mathematics has constantly showed its power in disclosing the secret of the universe and served as the dominated language of physical science since the age of the scientific revolution (Kline, 1985). Even though pure mathematical thought did not arise until the 19th century, abstract mathematics has ultimately demonstrated its unexpected effectiveness in the physical sciences no matter how intangible it may seem to be to our real world (Wigner, 1960). Nonetheless, contrary to praising it for its instrumental utility, Bertrand Russell (1917) asserted that:

Not only is mathematics independent of us and our thoughts, but in another sense we and the whole universe of existing things are independent of mathematics. The apprehension of this purely ideal character is indispensable, if we are to understand rightly the place of mathematics as one among the arts. (p. 70)

Russell’s philosophical interpretation of mathematical knowledge ostensibly devalues the human side of mathematics, yet he actually solidifies the foundation of mathematics as a global language.

Mathematics Education – A Globally-Exchanged Local Practice

Along with the rapid growth of global higher education, the rate of studying abroad has accelerated over the past several decades. The number of students enrolled outside their country of citizenship has risen from 0.8 million worldwide in 1975 to 4.1 million in 2010 (Organization for Economic Co-operation and Development (OECD), 2013). Particularly, according to official data of the OECD, the number has doubled during the first decade of the 21st century (see [Table 1](#), OECD, 2013), indicating talent movement is already an inevitable trend in this global village.

Mathematics may be the only truly international language (Reid & Petocz, 2008) since mathematics notations, from elementary arithmetic to the level of calculus, can be read by persons receiving higher education in any country. With the instrumental utility of mathematics in several professional domains, all sorts of mathematical knowledge constitute an academic base for the internationalization of education and the objectives of mathematics education should take this global movement of talent into account.

Table 1. Number of students enrolled outside their country of citizenship

	Worldwide	OECD	Europe	North America	Oceania	Asia
2000	2,071,960	1,588,860	920,140	569,640	118,650	214,740
2001	2,146,690	1,647,620	980,880	576,060	136,730	205,650
2002	2,444,220	1,904,150	1,043,810	695,810	202,020	242,570
2003	2,648,640	2,092,530	1,186,160	712,300	219,190	264,600
2004	2,843,690	2,272,060	1,311,100	712,290	240,530	297,800
2005	2,982,590	2,373,010	1,388,030	738,400	251,900	322,450
2006	3,069,790	2,446,160	1,437,360	733,050	258,700	344,050
2007	3,198,200	2,534,410	1,483,310	728,190	283,570	367,360
2008	3,459,350	2,647,000	1,580,210	809,940	298,180	398,820
2009	3,707,760	2,838,030	1,665,830	850,970	335,300	446,060
2010	4,119,000	3,181,940	1,968,420	880,430	350,010	486,080

In contrast to the global role of mathematics, issues about practices of mathematics education are more likely local ones. Different cultural factors and social needs may contribute to the diversity of this educational engineering. By reviewing several cross-national studies, Cai and Lester (2008) indicated a significant difference between U.S. and Asian students' problem-solving approaches. U.S. students tended to use visual representations, while their Asian counterparts preferred arithmetic or algebraic symbols. A further investigation found that Chinese teachers expected their students to solve problems using algebra, yet U.S. teachers accepted a variety of strategies involving visual approaches (Cai, 2004). Even for European countries, which are held to be more homogeneous in culture, only around half of all countries have an official publication of teachers' guidelines (Education, Audiovisual and Culture Executive Agency, 2011), demonstrating a diversity on practices within this discipline. To catch up with the rapid globalized pace, internalization becomes inevitable.

The Status of the Internationalization of Mathematics Education

Research in mathematics education has become an international enterprise for two reasons. First, given its universal features and societal functions, children start to learn mathematics almost from the very beginning of their schooling. Second, attributable to its symbolic form and generally acknowledged operating norm, language barriers can be reduced to a minimum level. With such a privileged position in education, an increasing trend of developing international activities for improving the quality of mathematics teaching and learning has arisen. Despite attempts at sharing knowledge through academic discussions at regular international meetings, such as at the International Congress on Mathematical Education (ICME) and at the annual gathering of the International Group for the Psychology of Mathematics Education (IGPME), several international comparisons done over the past decades, mostly involving Western versus Eastern countries, have revealed an imbalance. For instance, an early international comparative study of elementary students' mathematical concepts and skills was conducted among the United States, Japan, and Taiwan (Stigler, Lee, & Stevenson, 1990); Geary et al. investigated young American and Chinese pupils and adults'

arithmetical, computational and reasoning abilities (Geary et al., 1996; Geary et al., 1997); Kaiser, Luna, and Huntley (1999) published a synthetic report on findings from several cross-nation studies. In recent years, the most well-known and influential international event in the mathematics education community is Trends in International Mathematics and Science Study (TIMSS) organized by the International Association for the Evaluation of Educational Achievement (IEA) and the Programme for International Student Assessment (PISA) conducted by OECD.

Previous studies consistently indicated that students of several East Asian countries outperformed those of Western industrialized countries, causing Western scholars' educational curiosity about how mathematics curricula were implemented in these East Asia countries. Judson (1999) proposed that Japan has a different model in mathematics education and Ginsburg et al. (2005) claimed that:

Singaporean students ranked first in the world in mathematics on the Trends in International Mathematics and Science Study-2003...Because it is unreasonable to assume that Singaporean students have mathematical abilities inherently superior to those of U.S. students, there must be something about the system that Singapore has developed to teach mathematics that is better than the system we use in the United States. (p. ix)

On the other hand, the practice of the teaching and learning of mathematics in Asian countries has long been criticized for its teacher-centered and authoritative context in which content rather than concept is the focus of classroom activities. A call for mathematics education reform has been made to meet the future needs of the information technology century. In response to such an appeal and being heavily influenced by Western countries, several East Asian countries "adopted a Western model of mathematics education...The teacher education programmes in these countries, for example, all introduced Western rather than indigenous theories of mathematics education" (Leung, 2001, p. 37). These international comparative studies urge countries, both Western and Eastern, to benchmark their curriculum standards against other countries (Reid & Petocz, 2008). Understanding and appreciating cultural and educational diversities should be seen as a central belief and value of international comparison and cooperation, and the aforementioned international exchanges are ideally expected to lead globalized mathematics curriculum to a rational middle ground. However, it is seemingly not the case. There is a great concern about the dominance of Western thought on the practices and theoretical development of mathematics education in the world (Atweh & Clarkson, 2002; Atweh et al., 2008; Leung, 2001). Several reasons may contribute to this unbalanced phenomenon such as political colonial issues, the demands of technological or economic development, and academic factors, among which, academic factors probably play the most significant role. Due to the growth of higher education around the world and the rooted belief of "publish or perish", doing research in mathematics education and making it public have become collective actions of all scholars. Furthermore, since competitive international publications are usually valued more highly than local publications in many

countries (Atweh et al., 2004), the status of international journals is the key concern of this study.

Journals as International Forums

Among all the forms of international communication, academic journals bear the most responsibility for transferring input from country to country and igniting intellectual sparks. Academic journals in education set their goals on reporting original empirical and theoretical studies and analyses in education for sharing knowledge among scholars and teachers. In addition to publishing quality articles from a wide community of researchers, the international journals in particular aim to further international discourse and look for a mutual understanding among international communities in building a global view (but not a universal norm) of how mathematical ideas can best be communicated in classrooms. International academic journals earn their authoritative positions by drawing from a wide range of contributions from around the world and publishing quality studies via rigorous peer review and editorial processes. As Heid and Zbiek (2009) indicated, each reviewer brings a lens of individual expertise and the set of reviews touches on the main aspects of the submitted article, informing “the editor’s decision not as ‘votes’ but as sources of insight and perspective” (p.474). Therefore, any perspectives or values expressed in the published article, though originally proposed by the author, can be seen as a G.C.D (greatest common decision) shaped through the peer review and editorial processes. To connect their studies with past research, potential journal authors are expected to refer to influential journals and cite significant studies or authoritative documents to establish a firm theoretical framework for their own investigations. It is undeniable that, through such a submit-review-revise-review-accept cycle, the published article either intentionally or accidentally passes on particular perspectives or values to its readers and these perspectives or values thereafter constitute, either implicitly or explicitly, another theoretical base for future relevant research. The educational views expressed in the quality journal articles are thus the final product of collective intellectual work. Therefore, if we want to know the trends of research in mathematics education, looking into the status of the major quality journals seems to be more appropriate than reviewing other forms of academic publication. The present study aims to do a preliminary survey on three highly reputable academic journals exclusively publishing mathematics education studies to investigate the current status of international research in mathematics education including what kind of methods have been adopted, what topics have been studied, who conducted the studies, and whose practices and perspectives have been documented.

METHODOLOGY

Content analysis was the method used to serve the purpose of the present study. By referring to existing academic journals in mathematics education, three journals, *Journal for Research in Mathematics Education (JRME)*, *Educational Studies in Mathematics (ESM)*, and *Mathematical Thinking and Learning (MTL)* were selected. There are two reasons why the three journals are targeted. First, the three journals are all indexed by Social Science Citation Index

(SSCI), which is a well-recognized trademark for the quality journal. Second, though there are some other journals indexed by SSCI also publish studies in mathematics education, such as *International Journal of Science and Mathematics Education* and *Eurasia Journal of Mathematics, Science and Technology Education*, the three selected journals have long-term reputation in exclusively publishing research articles in mathematics education.

All 962 theoretical and empirical studies published in the three journals (excluding editorials and book reviews) between 2000 and 2012 were selected. These articles were then categorized by four major research methods – quantitative, qualitative, theoretical, and meta-analysis. Quantitative approaches are used to testing the hypotheses for a particular problem; qualitative inquiries attempt to make sense of phenomena in terms of the meanings people bring to them (Gall, Borg, & Gall, 1996). Meta-analysis is a statistical procedure reviewing the literature involving the same research problem to identify potential trends. Theoretical study aims to integrate various results of scientific investigations to establish a common ground in terms of educational theories. In response to the contemporary methodological issues, the frequencies and percentages of the four major research methods used by article authors – qualitative study, quantitative study, theoretical study, and meta-analysis – were calculated. For those studies adopting a mixed methodology involving both statistical data and qualitative observations, a further check was made to determine which category was most appropriate.

To reveal the geographical distribution of the research, authors' affiliated countries were counted according to the institutions to which they belonged at the time of publication. Considering researchers may not conduct studies in the countries in which they live, research sites were also taken into account. Namely, if an author's affiliated country was A but research was conducted in country B, both countries receive one credit for each category. For those theoretical studies and meta-analysis articles, the country of each author's affiliated institution is added to the statistics of that country.

Regarding the method of categorizing research topics, we referred to the scheme of Tsai and Wen (2005) and Lee et al. (2009) because similar studies in mathematics education were not available. In like manner, all research topics were sorted into the following nine categories, TE: teacher education, T: teaching, LC1: learning – conceptions, LC2: learning – contexts, GP: goals and policy, CSG: cultural, social, and gender issues, HPE: history, philosophy, epistemology, and the nature of mathematics, ET: educational technology, and IL: informal learning.

Two reviewers with Masters Degrees in Mathematics Education were trained to do the sorting on the basis of the scheme of Tsai and Wen (2005) and Lee et al. (2009). The inter-rater reliability was as high as 91% and the final judgment was made by the author if any inconsistency occurred between the two reviewers.

RESULTS

According to our statistics, three major results surfaced: (a) there is an increasing tendency toward qualitative research, (b) there exists an imbalanced geographical distribution among mathematics education research, and (c) student learning draws more attention than instructional topics. What follows are the details and issues behind these statistics.

The Increasing Tendency toward Qualitative Research

Table 2 shows the frequencies and percentages of the four major research methods, qualitative study (QL), quantitative study (QT), theoretical study (TH), and meta-analysis (MT) from 2000 to 2012. It can be seen that QL ranks as the most popular methodology for these article authors. A proportion of 60.7% of articles in *JRME*, 62.9% in *MTL*, and 71.2% in *ESM* adopted qualitative approaches as the means for investigating educational issues in mathematics. As for the individual case for each journal, QL overwhelmingly surpasses QT (71.2% vs. 15.5%) and has seemingly become the favored method in *ESM*. Though QL is also the major methodology adopted by *JRME* and *MTL* authors, the gap is not as significant as that seen in *ESM*. Contrary to quantitative research adopting a positivist view that “social environment constitute an independent reality and are relatively constant across time and settings” (Gall, Borg, & Gall, p.28), qualitative approach assumes a post positivist position that “the social environment are constructed as interpretations by individual” (Gall, Borg, & Gall, p.28). This increasing trend in preferring qualitative methodology might imply that contemporary researchers are not satisfied with merely catching an overall picture of the educational setting. Rather, they are more interested in revealing hidden causes and variables behind the visible phenomena via exploring various cases in depth.

Actually, a more detailed look at the statistics reveals that the percentage of QL has arisen most during recent years. **Table 3** indicates a 5% increment between the periods of 2000-2005 and 2006-2012. The percentage of QL before 2010 was consistently below 70%, but it jumps to 71.8%, 79.5%, and 75.3% in 2010, 2011, and 2012 respectively.

Table 2. Frequencies and Percentages of Research Methods from 2000 to 2012

Method	JRME (n=201)	MTL (n=167)	ESM (n=594)
QL	122 (60.7%)	105 (62.9%)	423 (71.2%)
QT	71 (35.3%)	53 (31.7%)	92 (15.5%)
TH	14 (7.0%)	15 (9.0%)	75 (12.6%)
MT	4 (2.0%)	7 (4.2%)	9 (1.5%)

Table 3. Frequencies and Percentages of Research Methods between 2000-2005 and 2006-2012

Method	2000-2005 (n=393)	2006-2012 (n=569)
QL	253 (64.4%)	397 (69.8%)
QT	96 (24.4%)	120 (21.1%)
TH	53 (13.5%)	51 (9.0%)
MT	6 (1.5%)	14 (2.5%)

Imbalanced Geographical Distribution

Table 4 indicates the percentage of authors' affiliated countries for articles in each of the three journals. The total sum of percentages exceeds 100% because a single study may involve several authors from different regions. Data shows studies published in the three journals were mostly authored by Western researchers among whom those affiliated with the U.S., the U.K., Israel, Canada and Australia contributed nearly 70% of the studies, with U.S. scholars playing the most significant role. Journal by journal, U.S. researchers made an overwhelming contribution to *JRME* and *MTL* (67.2% and 67.7% respectively), while *ESM* exhibited more diversity among its authors' affiliated countries. The statistics clearly indicate that, in terms of the three journals, Western scholars in general and American scholars in particular have put forth a tremendous effort in building the enterprise of mathematics education research.

Table 4. Country Rankings of Authors for the Three Journals from 2000 to 2012

All (n=962)		JRME (n=201)		MTL (n=167)		ESM (n=594)	
Country	n (%)	Country	n (%)	Country	n (%)	Country	n (%)
US	409 (42.5%)	US	135 (67.2%)	US	113 (67.7%)	US	161 (27.1%)
UK	117 (12.2%)	UK	11 (5.5%)	UK	13 (7.8%)	UK	93 (15.7%)
Israel	72 (7.5%)	Israel	10 (5.0%)	Canada	10 (6.0%)	Israel	54 (9.1%)
Canada	71 (7.4%)	Canada	9 (4.5%)	Australia	9 (5.4%)	Canada	53 (8.9%)
Australia	56 (5.8%)	Australia	8 (4.0%)	Israel	7 (4.2%)	Australia	39 (6.6%)
Asian	54 (5.6%)	Asia	14 (7.0%)	Asia	10 (6.0%)	Asia	30 (5.1%)
Others	287 (29.8%)	Others	35 (17.4%)	Others	38 (22.8%)	Others	214 (36.0%)

Though most articles were authored by Western researchers, the studies might have been conducted in other regions. Therefore, the distribution of research sites deserves further attention. As can be seen in **Table 5**, a trend, consistent with data shown in **Table 4**, emerges – U.S. students have been the most studied group by *JRME* (66.7%?) and *MTL* (61.7%) authors, yet the statistic drastically drops to 24.2% in *ESM*. The combined population of the top five countries (U.S., U.K., Canada, Australia and Israel) occupies 6.28% of the overall population of the world, but their students and teachers attracted more than 70% of the researchers' attention. The results suggest that the teaching and learning of mathematics by Western teachers and students in general, and American teachers and students in particular, has been widely documented whereas the practices in mathematics in Asian regions, which host nearly 60% of world's population, receive less than 10% of visibility in the three journals and Asian mathematics education researchers' voices are apparently feeble (lower than 6%, see **Table 4**). The statistics show an imbalanced geographical distribution in the research of mathematics education. The status of Western scholars dominating the field of mathematics education has been well documented. The present study further reveals that the top five countries are mostly English-speaking regions, suggesting a language threshold exists for publishing relevant studies in prestigious international journals.

Table 5. Rankings of Research Sites for the Three Journals from 2000 to 2012

All (n=962)		JRME (n=201)		MTL (n=167)		ESM (n=594)	
Country	n (%)	Country	n (%)	Country	n (%)	Country	n (%)
US	381(39.6%)	US	134(66.7%)	US	103 (61.7%)	US	144 (24.2%)
UK	97 (10.1%)	UK	11 (5.5%)	UK	10 (6.0%)	UK	76 (12.8%)
Israel	63 (6.6)	Australia	8 (4.0%)	Australia	8 (4.8%)	Israel	53 (8.9%)
Canada	57 (5.9%)	Canada	6 (3.0%)	Canada	8 (4.8%)	Canada	43 (7.2%)
Australia	56 (5.8%)	South Africa	5 (2.5%)	Israel	5 (3.0%)	Australia	40 (6.7%)
		New Zealand	5 (2.5%)	Germany	5 (3.0%)		
		Israel	5 (2.5%)	Netherlands	5 (3.0%)		
Asia	63 (6.6%)	Asia	18 (9.0%)	Asia	14 (8.4%)	Asia	31 (5.2%)
Others	297 (30.9%)	Others	39 (19.4%)	Others	21 (12.6%)	Others	237 (39.9%)

*Theoretical studies and meta-analysis are not included in this statistics.

Student Learning Draws Much More Attention

To show the recent trend in research topics in mathematics education, all research was categorized into nine topics: teacher education (TE), teaching (T), learning—conceptions (LC1), learning—contexts (LC2), goals and policy (GP), cultural, social, and gender issues (CSG), history, philosophy, epistemology, and the nature of mathematics (HPE), educational technology (ET), and informal learning (IL). **Table 6** indicates that learning issues drew the attention of many more researchers than did instructional ones. There were 50.8% of articles in JRME, 65.8% in MTL, and 63.9% in ESM dedicated to the topic of students’ conceptions and the learning context. Exploring the effect of the teaching approaches and discussing issues in teachers’ professional development received secondary concern.

Table 6. Frequencies and Percentages of Research Topics from 2000 to 2012

Research topics	JRME (n=201)	MTL (n=167)	ESM (n=594)
Teacher education (TE)	45 (22.4%)	5 (3.0%)	33 (5.6%)
Teaching (T)	32 (15.9%)	21 (12.6%)	121 (20.4%)
Learning—conceptions (LC1)	53 (26.4%)	55 (32.9%)	220 (37.0%)
Learning—contexts (LC2)	49 (24.4%)	55 (32.9%)	160 (26.9%)
Goals and policy (GP)	35 (17.4%)	15 (9.0%)	40 (6.7%)
Cultural, social, and gender issues (CSG)	25 (12.4%)	18 (10.8%)	34 (5.7%)
History, philosophy, epistemology, and the nature of Mathematics (HPE)	12 (6.0%)	5 (3.0%)	36 (6.1%)
Educational technology (ET)	9 (4.5%)	1 (0.6%)	22 (3.7%)
Informal learning (IL)	5 (2.5%)	2 (1.2%)	4 (0.7%)

JRME in particular focused more on research in teacher education compared to the other two journals. This may be attributed to the fact that JRME is published by National Council of Teacher of Mathematics (NCTM), an organization mainly constituted by teachers. Another

commonality found was that little research regarding educational technology or informal learning appeared in these journals. Besides the fact that there have been a lot of journals dedicating to technological issues, one of the plausible reasons is that JRME, ESM, and MTL are the most historical journals in the mathematics education area, which are more likely to focus on contextual issues regarding teaching and learning.

Table 7 shows elementary and middle school were the most studied levels across the three journals. Elementary school is building children's fundamental concepts and mathematics taught in middle school is preparing students for implementing abstract objects in their future learning. Their high proportion is therefore reasonable and expected. Nonetheless, considering the facts that high school mathematics is more abstruse, more in-depth, and plays a preliminary role in entering college, it should receive more attention than it does.

Table 7. Frequencies and Percentages of Participants Educational Level from 2000 to 2012

Research levels	JRME (n=201)	MTL (n=167)	ESM (n=594)
Pre-K	6 (3.0%)	0 (0%)	0 (0%)
Kindergarten	4 (2.0%)	13 (7.8%)	13 (2.2%)
Elementary school	40 (20.0%)	51 (30.5%)	120 (20.2%)
Middle school	59 (29.4%)	41 (24.6%)	128 (21.5%)
High school	20 (10.0%)	15 (9.0%)	68 (11.4%)
College	16 (8.0%)	18 (10.8%)	79 (13.3%)
Post-undergraduate	67 (33.3%)	35 (21.0%)	180 (30.3%)

ISSUES BEHIND THE PHENOMENA

Aforementioned data consistently show that most of the studies published in the three journals were overwhelmingly conducted in the U.S. and other Western countries by Western scholars. In this manner, theoretical perspectives and practices in mathematics education of Western countries are widely documented and spread out through these academic publications. Though this result is no surprise to the mathematics education community, to attain a sustainable global vision, there is a need to ponder upon the potential issues behind the fact.

Whose Voices Are Ignored

An international academic journal is expected to serve as a platform for initiating communication among relevant communities. Do these journals generally, if not precisely, reflect what is actually happening in mathematics teaching and learning around the world? The answer is apparently negative. Besides a few studies investigating the differences between the Eastern and Western models in mathematics education (e.g., Ferrini-Mundy & Schmidt, 2005), voices of other regions are nearly overlooked and their teaching and learning issues are ignored by the international community (Liu, 2008; Leung, 2008). Liu (2008) reminded us to

pay attention to whose voices are given prominence and whose voices are ignored in research journals. Leung (2008) even named such a 'high ability but low visibility' phenomenon as a paradox in mathematics education. The paradox could be delved into via an in-depth study in terms of cultural aspects.

A Barrier for Non-English Speaking Researchers

Previous data clearly indicates qualitative approaches have become the major methodology for probing educational issues in mathematics. This trend is in response to the contemporary epistemological change in the social sciences stressing the sociocultural context of teaching and learning. Educational reports of any kind ought not to depart from this track, and journal articles should be without exception. We may wonder why and how such imbalanced phenomena occurred. Various reasons may be posited to explain this situation and the first critical factor is language. As shown in **Tables 4** and **5**, the top five countries are nearly all English-speaking regions. Since only English manuscripts are accepted by JRME and MTL, to a certain extent this requirement creates a barrier for non-English speaking researchers, as indicated by Mesa (2004).

Culture Does Matter

The other potential major cause is that only quality studies are considered for publication. By quality studies, we typically refer to the significance of the research problem, the firmness of the theoretical framework, the appropriateness of the methodology, the credibility of the interpretation of the data, and the preciseness of the writing. No official data base is available here for making a judgment as to which of the above components contributes to the higher rejection rate of international manuscripts submitted to the JRME, MTL and ESM, but one thing for certain is that the criteria for several of the aforementioned components are subjective and value-laden (Gall, Borg, & Gall, 1996). The determination of the significance of the problem could be a regional or cultural issue, which may not be appreciated or approved by reviewers from other areas. For establishing a sound theoretical framework, citing important studies and connecting to past relevant studies is essential. However, "it is also true that most of the research appearing therein has U.S. authorship, and the overwhelming majority of the citations contained in the published articles refer to work by U.S. authors" (Silver & Kilpatrick, 1994, p. 747).

A major concern that has often been raised is that the currently available international channels of communication are dominated by voices from Anglo-European educators (Atweh & Clarkson, 2001) because the call to establishing an agenda for international research in mathematics education usually refers to building theories from both European and American perspectives, as manifested in the Handbook of International Research in Mathematics Education (English, 2008). Consequently, how is it possible for a study claiming that practicing Vedic skills of multiplication, an ancient system of Indian mathematics, is essential for improving pupils' arithmetic ability to be published in a contemporary educational journal

that particularly stresses meaningful learning? Would the reviewers be convinced by the findings that going to cram schools, a widespread phenomenon in several East Asian countries, may well prepare students for entering top high schools and universities? What kind of criticism would be received if someone advocated the use of an imported mathematics curriculum, exactly what several Asian countries have done, to promote African economic development (e.g., Kuku, 1995)? It may be appropriate to say that reporting educational practices of non-Western countries on the basis of Western theories might be like describing a traditional Eastern drama by using terminologies of Western opera, or interpreting aboriginal dance through the lens of ballet. Is this a bad thing? Not necessarily! But it could only turn out good within a cultural context of mutual understanding.

RESEARCH AS A CULTURAL AS WELL AS AN EDUCATIONAL ENTERPRISE

As a human heritage, mathematics has played a significant role in societal and cultural development throughout history. Teaching and learning in mathematics have been cultural and educational activities for transmitting this heritage from generation to generation. During the long stages of transmission, each culture gradually established its own mathematical identity through philosophical debates and practices. Nonetheless, owing to the rise of scientific thought during the 16th and 17th centuries and following an instrumentalist approach in science and deductive development in mathematics during the 18th and 19th centuries, Western mathematics not only assumed its dominant role in recent centuries but also permeated into traditional curricula of other regions. In contrast to the development of mathematical knowledge, studies in the social sciences are important but historically young (Krathwohl, 1997). Due to the pressure of being recognized as a scientific discipline, studies in mathematics teaching and learning are required to build upon a solid theoretical base and follow rigorous methodological guidelines, mostly defined and developed by Western scholars. The resultant Eurocentrism in mathematics and mathematics education has strongly influenced the practices and theories in mathematics education around the world, and thus a cultural or epistemological conflict may occur. Therefore, the Eurocentrist perspective has been increasingly questioned by Eastern as well as Western scholars along with the rise of ethno-mathematics (Atweh & Clarkson, 2001; Powell & Frankenstein, 1997; Leung, 2001).

While reviewing the relevant literature to establish an international agenda for research/action in mathematics education, Atweh and Clarkson (2001) were troubled by the scarcity of voices from developing countries. The cultural imbalance phenomenon has also been found in that chapter authors of books titled "International" are often Western scholars from developed countries who hardly deal with issues regarding other regions (e.g., Bishop et al., 1996; English, 2008). Sociocultural approaches to mathematics education should build upon a framework that recognizes that the individual's cognition originates in social interactions and the role of culture, motive, values, and social practices are fundamental (Lerman, 1996; Harré & Gillett, 1994). Such a sociocultural framework may not only help researchers and teachers gain an international vision, but also shed more light on the local issues of mathematics education.

Understanding diverse teaching and learning paradigms across cultures allows researchers and teachers to take advantage of the experience of others all over the world, and reminds us to re-exam the things taken for granted in our own society (Stigler, Gallimore, & Hiebert, 2000). In this manner, journals inviting multicultural studies may benefit their local mainstream readers as well as show their international characteristics.

CONCLUSION AND RECOMMENDATIONS

The purpose of this article is to respond to the issue of the internalization of academic journals in the research of mathematics education by taking the three major mathematics education journals as examples. Statistics reveal an apparent trend of Americanization and Westernization in the research of mathematics education, which may not be the editorial teams' intentions. For editorial team members, the quality of submitted articles is their major concern and any irrelevant factors should be set aside. However, it is claimed here that criteria for judging the significance of the problem and firmness of the theoretical framework should be culturally independent. Research in mathematics education in particular and education in general is not only an educational enterprise but also a cultural activity. To establish a global vision of practices and theories in mathematics education, it is necessary to raise concerns about the dominance of certain views and research paradigms (Atweh & Clarkson, 2001). Through such a dialectically interculturalized process, an impartial global vision can thus be established and allow our communities to think globally but act locally, as Nebres (1995) reminded us, "[t]he more global and multicultural we seek to become, the deeper must be our local and personal cultural roots" (p. 39).

A concern has been raised about the standardization of research and practice in mathematics education in that the way of looking at the research question, the methodology of studying educational issues, and the approach in designing curriculum are becoming more similar (Atweh & Clarkson, 2001). However, it is our differences rather than similarities that are providing the best dialectical reflection for curriculum development and implementation (Usiskin, 1992). Recent studies in mathematics education have moved beyond purely psychological and pedagogical perspectives and toward a domain of historical, cultural, and societal investigation (English, 2008). Any "scientific inquiry must focus on the study of multiple social realities, that is, the different realities created by different individuals as they interact in a social environment" (Gall, Borg, & Gall, 1996, p. 19). The intention of this article is not to propose that studies in mathematics education from all corners of the world ought to occupy equal space in an international journal at the expense of quality. Rather, a call is made here to establish an intercultural and societal framework for conducting, reviewing, and publishing educational studies in mathematics and to improve the quality of international studies in mathematics education as seen through the lens of sociocultural differences.

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