# TEACHERS TALKING ABOUT THEIR CLASSROOMS

## Learning from the Professional Lexicons of Mathematics Teachers around the World

Edited by Carmel Mesiti, Michèle Artigue, Hilary Hollingsworth, Yiming Cao, and David Clarke

First published 2021

ISBN: 978-0-367-37697-0 (hbk)
ISBN: 978-0-367-37693-2 (pbk)
ISBN: 978-0-429-35562-2 (ebk)

# Chapter 1

# THE INTERNATIONAL CLASSROOM LEXICON PROJECT

*Carmel Mesiti, Michèle Artigue, Hilary Hollingsworth, Yiming Cao and David Clarke*



DOI: 10.4324/9780429355622-1

The funder for this chapter is Carmel Mesiti

Routledge
Taylor & Francis Group
LONDON AND NEW YORK

# 1

# THE INTERNATIONAL CLASSROOM LEXICON PROJECT

*Carmel Mesiti, Michèle Artigue, Hilary Hollingsworth, Yiming Cao and David Clarke*

## Background

Comparisons of student achievement on international tests have prompted a wide variety of international comparative research projects examining good practice in the mathematics classroom. Since the first TIMSS video study was reported by Stigler and Hiebert (1999), international comparative research in mathematics education can largely be identified with three dominant approaches: large-scale studies of student achievement (TIMSS and PISA); video survey studies of typical classroom practice (Hiebert et al., 2003); and, cross-cultural video case studies of well-taught classrooms, as in the Learner's Perspective Study (LPS; Clarke, Keitel & Shimizu, 2006).

The search for legitimate units of cross-cultural comparative analysis for the LPS led to the identification of *lesson events* with sufficiently universal form to support cross-cultural comparison. One such example is the event *kikan-shido (Jap.) 'instruction between desks'*. This event refers to moments when the teacher walks around the room observing students as they work; a familiar teaching occurrence. An international comparative analysis identified differences in function of this event as illustrated by teachers in different classrooms around the world (O'Keefe, Xu & Clarke, 2006).

Such comparative analyses of *lesson events* have provided insights into local norms and differential learning outcomes (Clarke, Mesiti, O'Keefe, Xu, Jablonka, Mok, & Shimizu, 2008); however, the reasonable translation or adaptation of these events into forms likely to be workable in classrooms around the world remains a challenge. Our LPS colleagues (whose first language is not English) engaged in collaborative work that revealed differences in the way that classroom phenomena are described and interpreted. They found that there are some educational terms, particularly relating to classroom practice, that

a. have no reasonable English translation, or;
b. have never made the transition and thus are absent from the educational literature in English.

The following section expands on each of these points.

DOI: 10.4324/9780429355622-1

### *Terms with no reasonable English translation*

Teacher actions recorded by outside observers run the risk of disconnecting instructional acts from the culture, language, and pedagogical traditions that give them meaning and effectiveness. Stengers (2011) argues: "No comparison is legitimate if the parties compared cannot each represent his own version of what the comparison is about; and each must be able to resist the imposition of irrelevant criteria" (p. 56). Consider the difficulty of translating the Russian word *obuchenie* into English. Does one choose the term "instruction" (p. 350) as favoured by Hedegaard (1990) in his translation of Vygotsky, or the term "learning" (p. 90) as found in an earlier translation (Vygotsky, 1930–34/Vygotsky, 1978)? Similar difficulties present with the Dutch term *leren* and the Japanese term *gakushushido* (discussed in Clarke, 2001). These three terms recognise the interdependence of instruction and learning and capture both activities within a single term. In the English language, however, we appear compelled to "dichotomize classroom practice into teaching or learning" (Clarke, 2012a).

The examples above illustrate how the English translations of educational terms originating in non-English languages can misrepresent the meaning of the original terms, and potentially distort the educational practices that the terms are intended to represent. It also illustrates the handicap of doing all our writing and theorising in English (Clarke, 2001, 2006). In particular, the use of English as the international *lingua franca* of the research community in education denies use of many sophisticated terms developed in languages other than English. This means that however productive a collaborative analysis might be, the international search for effective classroom practice is hampered by the universal use of English as the classificatory, analytical, and communicative medium of international research.

### *Terms absent from the educational literature*

Further to terms that have no reasonable English translation, a second consideration is even more significant: There are educational terms, particularly relating to classroom practice, that have no obvious English equivalent, and which have never made the transition into the educational literature in English. Consider the following examples:

i. *pu dian* 铺垫 and *jiao shi jiang ping* 教师讲评
   In 2007, Professor Cao from Beijing Normal University spent some time working with Professor Clarke coding Chinese classroom data. Through lengthy conversation, it became clear that Professor Cao was using Chinese terms for which there were no precise English equivalents: *pu dian* 铺垫, an event occurring ahead of the introduction of new content which can take a variety of forms (Cao, Clarke & Xu, 2010); and, *jiao shi jiang ping* 教师讲评, an activity involving teacher's public evaluation of student work (see also *Chapter* 7 *Chinese Lexicon*).
ii. *narration de recherche*
   The French pedagogical term, *narration de recherche*, identifies a programme of work that may last several lessons where students are invited in groups to solve a rich mathematical problem. Students are expected to produce a report detailing their avenue of explorations including those that were unsuccessful; they are advised that the teacher is more concerned with the description in the report than the final result. The final

lesson is devoted to a whole class discussion (Sauter, 1998; see also *Chapter* 13 *French Lexicon*).

iii. *matome*
*Matome* refers to a teacher-orchestrated discussion, named in Japanese, that draws together the major conceptual threads of a lesson or extended activity, most commonly a summative activity towards the end of a lesson (Shimizu, 2006; see also *Chapter* 17 *Japanese Lexicon*).

Each of the terms discussed above names an activity that has been refined and elaborated over time. These activities are essential components of accomplished practice, and essential elements of teachers' professional vocabulary in their respective national contexts. The terms, and their meanings, cannot be captured accurately with a term (or short phrase); each of these activities has no precise English equivalent.

There are many terms, employed in non-English speaking countries, which describe aspects of classroom practice, but which do not have English equivalents and therefore, are not available to support research, theorising, or teacher reflection in English. To put this simply, the absence of such terms in English makes those aspects of classroom practice less visible to English speakers. And, possibly most significantly, educational theorising regarding classroom practice and learning may be undertaken in English in ignorance of the potential insights and accumulated wisdom embedded in terms which are not English in origin.

The international dominance of English has denied researchers, theoreticians and practitioners access to many sophisticated, technical classroom-related terms used in languages other than English, which might otherwise have contributed significantly to our understanding of classroom instruction and learning. Since our practice and our theory may be constrained by available terminology, a significant challenge that continues to confront researchers is the reasonable translation or adaptation of documented practice into forms likely to be viable in classrooms internationally.

## The International Classroom Lexicon Project

The International Classroom Lexicon Project was established to identify the key pedagogical terms from various educational communities around the globe. It employed a novel approach to address the challenges in identifying and naming practice, and, it sought to engage with mathematics research and teaching communities around the world.

The ten research teams whose research is reported in this volume are situated in universities in Australia, Chile, China, Czech Republic, Finland, France, Germany, Japan, Korea, and the United States. Captured in this combination of countries are different educational traditions and pedagogical histories. This book is the product of a concerted effort by each of these research teams to identify a pedagogical lexicon, "the vocabulary of a person, language or branch of knowledge" (Stevenson, 2015), from their community. A significant distinguishing characteristic of this study is the documentation of classroom pedagogical practices in their original language, supported by English descriptive detail and illustrative, classroom examples. Unlike any previous international study, this project has the capacity to compare and contrast identified teacher practices with those from other communities. Such analyses have the potential to contribute significantly to the study and promotion of reflective practice for teachers of mathematics, as constructs

found in other communities and which are otherwise absent from one's own may operate as reflective tools.

Although the objective of this project is to document a professional lexicon of middle-school mathematics teachers, the researchers recognise that a professional lexicon is a dynamic, changing and evolving entity, varying in its substance and its use according to the geographic and socio-demographic characteristics of the individual teaching communities in question. As such, a definitive lexicon that would hold for all across a single country is not a plausible or realistic goal. Instead, the aim of this project is to document a lexicon that is a reasonable representation of the language in use by mathematics teachers, validated as reasonable by members local to the national research teams as well as others, nationally, whose opinions the researchers were able to access.

## *Theoretical framework*

The International Classroom Lexicon Project began with the recognition that classroom practice named in one community is not necessarily named in another. Some communities have had their named activities translated into English in ways that misrepresent their true meaning, whilst other named activities have been omitted from the *lingua franca* of research (see also Background). The chapters in this book confirm that lexicons of mathematics teachers from different cultural communities do differ.

The notion that 'language shapes thought,' sometimes referred to as The Whorfian hypothesis (Whorf, 1956) or the Sapir-Whorf hypothesis (Sapir, 1949), has been the subject of much debate. Whorf and Sapir argued that a person's thoughts and actions are determined, and thus restrained, by the language the individual speaks. This strong interpretation of the hypothesis, *linguistic determinism*, has been much less favoured than its weaker version, commonly identified as *linguistic relativity*, specifically, that differences amongst languages may influence thinking and behaviour and hence our lived experience (Boroditsky, 2001; Casasanto, 2008; Levinson, 2003). The theoretical position adopted for this project is that of *linguistic relativity* that differences in language are important; they indicate and shape the diversity of teachers' worldview about the classroom.

The researchers involved in this project have recognised that the languages in which our lexicons are expressed differ in a variety of ways. These include differences in vocabulary, grammatical structure and organisational categories.

### *Differences in vocabulary*

The terms of the ten lexicons differ in content and number (see also Book Structure and Character). The benefit of a 'named' activity is that it can be readily observed and recognised within a classroom setting. In this way, it becomes easier to question how well the activity is executed and how it might be improved. Schoenfeld (2011) makes a related point, "what you see and don't see shapes what you do and don't do" (p. 228). It might follow that a classroom activity that cannot be named is less likely to be observed; the activity is less 'visible' for the purpose of reflective analysis. Given the complexity of classroom instruction teachers will make decisions about where to focus their attention (Sherin et al., 2011); an unnamed practice might deny teachers the recognition of an activity that at least one teaching community has identified as sufficiently important to have been assigned a specific name.

### *Differences in grammatical structure*

The nine languages involved in this project differ in grammatical structure. They differ, for example, in their approach to grammatical gender (a noun class system). The languages *English* and *Finnish* have no grammatical genders as do the languages *Chinese*, *Japanese,* and *Korean*; however, the latter East Asian languages have noun classifiers (words or affixes that classify nouns). The *French* and *Spanish* languages have masculine and feminine genders whilst the *German* language includes a third gender, neuter. The *Czech* language has more than three grammatical genders. Boroditsky, Schmidt, and Phillips (2003) found that structural differences in gender have an effect on people's descriptions and assessment of similarity between objects thus forcing the speaker to attend to certain aspects of a language. Other ways in which the languages involved in this project differ are discussed in later chapters.

### *Differences in organisational categories*

Language assists in organisation of the world into identifiable labels and categories. Winawer and his colleagues (2007) conducted a study that explored the influence of different colour terms for dividing the colour spectrum. For example, the Russian language compels a distinction between lighter (*goluboy*) and darker (*siniy*) blues. When this boundary distinction was subjected to testing, Russian speakers displayed faster perceptual ability in discriminating between light and dark blues. There is a growing body of research that supports the notion that differences in organisational language appear to influence how the world might be conceived, structured, and divided by speakers of a language (Gelman & Roberts, 2017).

By virtue of having been born into a culture with an accompanying language, thinking and behaviour and lived experience, appear to differ. Different languages vary with respect to vocabulary, structure, and organisational language, and appear to influence thinking about certain aspects of the world.

## The research methodology

The research question,

> *What are the terms that teachers use to describe the phenomena of the middle-school mathematics classroom?*

united the collaborators of the International Classroom Lexicon Project in pursuit of the documentation of national lexicons for each participating teaching community. These national lexicons consist of the familiar terms (and short phrases) used by teachers of middle-school mathematics. The focus on middle years was chosen to complement international research studies such as TIMSS (Hiebert et al., 2003; Stigler & Hiebert, 1999) and LPS (Clarke, Keitel & Shimizu, 2006).

The terms featured in each lexicon were included in their original language, supplemented with literal and closest English translations where appropriate, as well as descriptive detail and illustrative examples from classrooms. These lexicons are intended to capture the language that the educator communities of practice (CoP) (Lave & Wenger, 1991) use to talk *about* the phenomena of the middle-school classroom; that is, the language

used by teachers in conversation with each other to identify classroom events, actions, and practices. The project shares traits with the study of cultural anthropology (Mercier, 2019) as the lexicons may be regarded as cultural and social artefacts, representative of the vocabulary of a professional discourse amongst teachers of mathematics, and their method of documentation is ethnographic in nature. The researchers allowed the terms (and agreed meanings) to emerge from the ethnographic encounter between the researchers and the teachers who represented our 'insiders' (Hammersley & Atkinson, 1995; Hoey, 2014). The insiders' input was sought to refine and ratify the lexicon in a variety of face-to-face formal and informal meetings.

More broadly, the documentation of the lexicons involved putting into practice a 'negotiative' methodology (Clarke, 2012b). Central to this methodological approach was the incremental, iterative negotiation of the national lexicons both in the progressive aggregation of terms and in the progressive expansion of the community with whom the content was negotiated from local to national in each participating country. This protocol is explained in more detail in the following section.

## *The research design*

In preparation for the identification and documentation of key lexical items, national teams were advised to include 'teachers as researchers' and invited to contribute video material from one middle-school mathematics classroom.

### *Composition of national research teams*

Each national research team comprised both senior and junior researchers and teachers of middle-school mathematics. The only constraint on team membership was the inclusion of a minimum of two experienced teachers with strong preference given to mathematics teachers of years seven to nine who were currently teaching. It was felt that this membership, by varying in expertise, knowledge, and experience, would produce a knowledgeable team capable of meeting the task of documenting the lexicon.

### *Stimulus package*

A project-wide package of nine[1] lessons was assembled to include a middle-school lesson of mathematics from each participating community. Each national team contributed video material and time-stamped transcripts that were then re-configured into a single viewing window (Figure 1.1). This package of lessons, presenting a variety of instructional approaches and classroom settings, was made available to each national team and functioned to stimulate thinking about the candidate terms of the draft lexicon.

The collaborative documentation of key lexical terms, by national research teams, involved three distinct main phases: *Identification*, *Validation,* and *Clarity Check*. Figure 1.2 summarises the significant elements within each phase and illustrates a pathway from the initiation of the documentation process (*Identification*) to its conclusion (*Final Lexicon*). This research design is elaborated through a discussion of each of these phases in the following subsections.


**FIGURE 1.1** Video material re-packaged into a single viewing window (illustrative only).

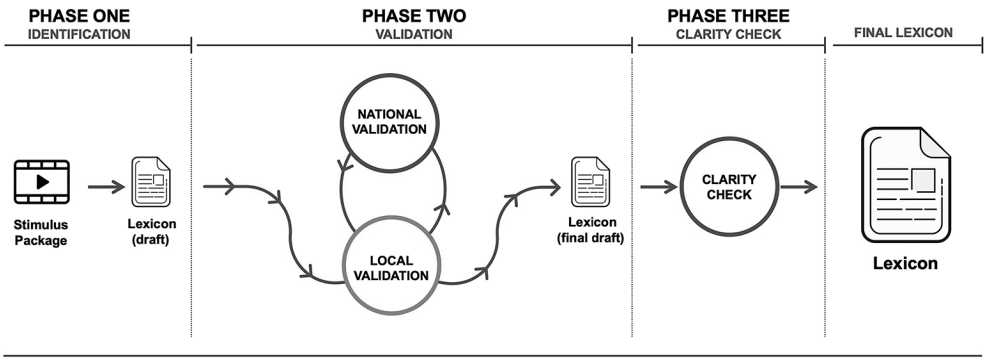


**FIGURE 1.2** Main phases for the documentation of national lexicons.

## Phase one – Identification

Throughout the *Identification* phase, each research team worked to identify the candidate terms empirically by viewing the videos of mathematics lessons from around the world. These videos had been distributed via the stimulus package and members of each research team proposed a name for the observed phenomena within the classroom. These proposed names were recorded as candidate lexical terms and they additionally served to bring to mind related terms that might also be considered for inclusion in a draft lexicon illustrative

of a teacher's professional vocabulary. The initial prompt used for stimulating thought about the video was,

> *What do you see that you can name?*

This general prompt and approach were developed to facilitate what could be named. That is, a researcher might identify a classroom characteristic whilst another might identify an activity engaging a group of students. An important decision was the exclusion of language that:

a. identified material objects in the classroom, such as rulers, textbooks, calculators, and protractors;
b. referred to mathematical domains, such as Geometry and Algebra; and
c. referred to mathematical objects such as equations or functions.

The videos were intended to promote one's thinking about candidate terms, whether present in the video or not, as identifying one classroom phenomenon may call others to mind. Hence, whether or not observable in the video recordings, both terms would be recorded for inclusion in the draft lexicon.

### *Operational definitions*

Once each national research team developed an initial draft assemblage of terms, composite operational definitions were developed for each term. The set of essential elements of the operational definitions included: the term (in the original language); descriptive detail, and, examples and non-examples from the classroom (in the original language and in English). Where possible and informative, some lexicons also included: a literal translation of the term into English; a closest/best-fit English translation; and, a commentary on the origin of the term.

## Phase two – validation

Throughout the validation phase, from local to national to local, the opinions of the broadest relevant community were sought regarding the extent to which the draft lexicon was seen as reasonable. The question was,

> *Do different communities within a country, who might employ such a lexicon, see its content and structure as reasonable?*

The onus was then on each national team to demonstrate that they had accessed the voice of communities likely to be familiar with or make use of the phenomena referred to in the lexicon and the terms by which those phenomena were identified within the lexicon.

### *Local validation*

The terms of the proposed lexicons, including the composite operational definitions, were subjected to a local validation process by each national team. The intention of this process was to investigate the extent to which the local community of mathematics

education researchers (and, in some cases, their educational colleagues) would endorse the listed terms and any emergent structure, as well as the descriptions, examples, and non-examples. In this case, endorsement was understood as confirmation of the terms as credible and plausible. Each team has outlined their process of local validation, including its membership, in the first of their two chapters within this book.

### *National validation*

Surveys were developed by each research team to collect data about the middle-school mathematics teachers' familiarity with each of the lexicon terms and the extent to which the operational definitions were endorsed. Respondents were invited to comment on the operational definitions with respect to suitability and clarity. The goal of the national survey was to establish that the candidate terms of the draft lexicon were not only familiar to the mathematics teaching community, but also that the meaning of the terms was accepted as being represented appropriately by the mathematics teaching community. The survey included such questions as:

> *How familiar are you with this term?*
> *Do you use this term in conversation with your colleagues?*
> *How might we improve the description of this term?*

The general principle agreed to by all research teams was that a term would be included in a national lexicon if it were familiar to two-thirds or more of national respondents. It was recognised, however, that particular terms might be of sufficient significance for a special case to be made for inclusion outside this rule. Where this occurred, the inclusion of such terms was noted by the relevant national team and justification for the term's inclusion was provided. Following the analysis of responses collected from the national survey the lexicon was re-drafted and subjected to an additional local review.

### Phase three – clarity check

The clarity check was the final phase involved in documenting the lexicon. Each national team had been assigned another country's lexicon for the purpose of reviewing the clarity of the description and examples. Any terms whose descriptions were considered problematic, either for reasons of conceptual clarity or clarity of expression were identified to the originating national team for review.

These national lexicons were documented over a number of years and underwent various stages and phases of development, ratification, and refinement as represented in the illustration (Figure 1.2). This protocol involving the incremental and iterative collaborative documentation and negotiation of key terms, by national research teams with the mathematics teaching community, has resulted in the ten national lexicons that are presented in this book.

## Book structure and character

This book is structured in 20 main chapters, in addition to this introductory chapter, with each of the ten participating country teams contributing two chapters. The first

chapter from each team describes: the process of development and refinement of their lexicon; some analyses of their lexical terms; characteristic features of their lexicon; and, reflections about potential uses for their lexicon. The second team chapter presents each of the terms included in their lexicon; in both original language (including characters where appropriate) and closest English translations, together with accompanying descriptions and classroom examples. Some country teams presented their lexicons together with a structural framework in the second of their two assigned chapters.

As reported earlier, there was an overarching methodological framework used to guide each country team's development of their lexicon. However, there was some flexibility around details of implementation, as well as local analyses conducted, and each international team has a unique story to tell. These unique stories relate to the processes each team used to develop their lexicon, the final 'product' or outcome that is their lexicon, and results of initial analyses of their lexicon.

The generation of the lexicon included four main steps: team members viewing videos from each country and identifying initial lexical terms, descriptions, and classroom examples (the Korean team joined the project at a later stage and only viewed Korean lessons); local reviews and refinements; national review and refinement; and, a final cross-country clarity check. In terms of the processes used by each country team to develop and refine their lexicons, most processes were characterised by strong initial input of a small group of mathematics teachers working together with mathematics education researchers, followed by consultation with the wider teaching community. There were some variations in team composition. For example, the Czech team also included a language teacher and a researcher in pedagogy, and the Korean team included a professor of Korean language education.

With respect to the 'final' lexicons prepared and presented by the country teams, these varied in the number and nature of the terms included. The number of terms included in the lexicons range from 57 to 123 (Czech 57; Australia 61; Germany 65; Japan 70; Chile 74; Finland 99; USA 99; Korea 103; France 116; China 123). Details of the initial numbers of terms identified by each country team and the particular ways that they refined their lexicons to arrive at these final numbers are explicated in each team's chapters.

In regard to the nature of the terms included in the lexicons, country teams described different contextual factors that shaped and influenced the terms they included in their lexicon. These included cultural, historical, educational, and language-based factors. Teams also reported undertaking different analyses of their lexical terms, such as considering how familiar the terms were and how often they were used, and investigating connections and relationships between terms. Country teams also described characteristic features of their lexicons. Some examples of the characteristic features of the different lexicons are outlined below:

*The Australian Lexicon* includes terms that are generic in nature, with few pertaining specifically to the teaching and learning of middle-school mathematics. The categories proposed for organising the terms reflect this generic quality *(Administration, Assessment, Classroom Management, Learning Strategies, Teaching Strategies)*.

*The Chilean Lexicon* has lexical terms with connotations of agency, most referring to actions that are exclusive to teachers. This reflects the prevalence of teacher-led

activities focusing on transmission of knowledge and skills practice with few opportunities for students' contributions.

*The Chinese Lexicon* has an inherent structure that prioritises connections and relationships between terms, and identifies five main "critical pedagogical behaviours": *Teacher-student-interaction*; *Teacher questioning*; *Teacher displaying*; *Student listening;* and, *Student doing exercise*.

*The Czech Lexicon* entries focus mainly on pupils' and teachers' observable activities, the mathematical nature of the activities is less significant. This lexicon reflects the discourse used in practice in classrooms and the discourse used by researchers.

*The Finnish Lexicon* includes terms more focused on teacher-student interaction and lesson organisation than specific aspects of mathematics teaching; this reflects a relative focus on "the act of teaching," with less attention given to student learning, and even less attention to mathematical content.

*The French Lexicon* has a distinct mathematical orientation and a 'didactic' nature that together create the specificities of mathematics classrooms; this is in line with the mathematical orientation of the professional discourse of French mathematics teachers.

*The German Lexicon* includes some terms particular to the German language which have no English word translations that capture their precise meaning; these terms are accompanied by synonymous terms in the lexicon.

*The Japanese Lexicon* is characterised by its evolving nature through its explicit association with the professional practice of 'lesson study'; some terms may be regarded as value-laden, as teachers' aims and intentions are embedded within the description of the terms.

*The Korean Lexicon* includes terms that focus on mathematics instruction-learning theory and teaching practice (including lesson structure and preparation) that teachers learn in pre-service programs; terms influenced by national education policy; and, terms that originated in foreign countries and have been translated into Korean.

*The United States Lexicon* includes a significant number of terms focused on discussion, collaboration, participation and assessment; this reflects relevant research literature findings and policy/standards initiatives.

As can be seen in this brief introduction, country teams differed in the ways they identified, organised, and examined the terms they included in their lexicons, and each lexicon has its own characteristic features. It is anticipated that details presented in the 20 chapters prepared by the country teams will stimulate much discussion and learning within and across the ten participating countries, as well as the global education community more broadly.

## Reflection

In this section, the authors reflect on this first phase of the International Classroom Lexicon Project, in particular, the conceptual and methodological challenges posed by the production of these ten lexicons.

Prior to The International Classroom Lexicon Project, the national research teams observed, to varying degrees, an absence in their language of a well-documented,

pedagogical lexicon for the mathematics teaching profession. This contrasted in many languages and cultures with a great wealth of expressions to describe mathematics classrooms and teaching expertise; a wealth of terminology that the English language, the *lingua franca* of international communication, scarcely expresses. These observations motivated the international partners to commit to this endeavour with much enthusiasm; and they serve to explain the research community's heightened interest. Moreover, these observations confirmed the challenging nature of this undertaking. In order to determine the finer details of our research protocol the research members were required to clarify, as a larger team and within our national teams, our responses to questions such as:

> *What terminology are we seeking to list?*
> *What are our justifications for the inclusion or exclusion of a given word or expression?*
> *How do we decide on its description?*

In addition to the challenge of ten international communities sharing lexicons from nine different languages, the project partners also grappled with communicating the wealth of terminology from these communities with one another. This involved much discussion of their literal translations into English, generating detailed explanations and illustrations from the classroom to ensure accuracy of the terms.

The main chapters in this volume illustrate the difficulties associated with these challenges as well as the process by which these challenges were resolved. Despite similarities, whether culturally or due to common pedagogical and historical influences, each of the ten contexts posed specific problems that required locally-determined decisions. It is strongly recommended that each lexicon chapter and its associated chapter are read as a pair, as individual, cultural contexts and knowledge of the decision-making processes within each, are essential to one's understanding of each lexicon.

The reader may be interested to know that this particular work, producing stabilised and validated lexicons for the nine original countries, took four years to complete. From this point of view, it is encouraging to note that the Korean team, a late admission to the international project team, were able to complete the production of its lexicon much more quickly than the other teams with the support of the accumulated experience of the original nine teams. This suggests that the project may be extended to other countries, and other contexts, all the more easily, since the transmission of its conceptual and methodological foundations will be greatly facilitated by the existence of this book.

The lexicons produced were subjected to a complex process of validation and revision. The project-wide methodology is detailed in The Research Methodology section of this chapter and additional methodological detail is provided in each country chapter. Each of the lexicons are reasonably considered to be shared by mathematics teachers within the given contexts; however, it is also recognised that these are not the only lexicons which could have emerged. These lexicons were naturally influenced by the teams of teachers and researchers who were responsible for their initial documentation. In recognition of this, the validation protocols were both strict and involved, and engaged both members of the local and extended mathematics communities in an iterative process. Readers are encouraged to be mindful that the lexicons themselves are dynamic, subject to change, and by the very nature of language, incomplete.

## Future directions

The lexicons now exist in a temporarily stabilised state. They can be used to contribute to the professionalisation of teaching, to the profession's discourse, and to the status of teaching as a profession. Terms that make up the vocabulary of teachers may be used in a productive and purposeful manner, as opportunities emerge for focussed interaction amongst classroom mathematics teachers as well as with teacher educators and policy makers. Alexander (2008) recognised the power of verbal interaction for learning and by extension the 'things' we have words to talk about: "Of all the tools for cultural and pedagogical intervention in human development and learning, talk is the most pervasive in its use and powerful in its possibilities" (p. 92). Recently, the lexicons have been used with teachers and educators to explore different classification and organisational systems and their effectiveness in the coding of lesson episodes. This initial access to the ten lexicons has stimulated thoughts about new and fascinating perspectives for use.

The lexicons can form the basis of comparative research. Currently underway is research focussed on the exploration of new conceptual and methodological constructions. Research interests of the international research team members include:

- Comparing terms:
  - related to assessment, classroom environment, emotion, beliefs, participation, and discursive actions;
  - considered essential for teacher practice;
  - unique to a lexicon;
  - specifically related to mathematics;
  - similarly named but defined differently;
  - that use metaphor;
  - that are value-laden; and
  - that are present (or absent) or emerging in official documents.
- Using terms:
  - in lesson narratives;
  - for the coding of classroom video; and
  - to inform practice.
- Applying different organisational categories and structures to the entire set of lexicons (categories could include 'teacher questioning' or 'whole class discussion')
- Comparing the teaching lexicons with the language of the mathematics researcher community
- Extending the lexicons to include terms related to teacher preparation, planning, and activity beyond the classroom

This project used innovative video technology to investigate the insights encrypted in different pedagogical naming systems and novel methods of collaborative negotiated analysis to explore how these insights might inform instruction and research in classroom settings around the world. With global trends towards educational uniformity mediated by international measures of student achievement, the international community should now look to investigate the pedagogical terms privileged in some communities but not others, and utilise the insights represented by such terms to interrogate and inform our classroom practice, our classroom research, and our theorising about classroom settings. Differences

and similarities across lexicons might have significant implications for the translation of research findings for practitioner use.

## Concluding remarks

The International Classroom Lexicon Project sought to document professional languages of teachers in order to advance discussion about classroom practice. An empirical identification of lexicons has been the entry point into developing a professional lexicon that is considered familiar and in current use amongst teachers. The lexicons offer the educational community the vocabulary that teachers, from ten communities worldwide, use to talk *about* the middle-school mathematics classroom. The lexicons presented in this book represent robust, coherent, and validated lexicons, both defined and illustrated, and which offer a common point of reference for teachers and teacher educators alike. This project presents an opportunity to evaluate the adequacy of these lexicons to encompass and distinguish the variety of practices and pedagogical and didactical phenomena prioritised by contemporary mathematics education.

If the general aim of an education research community is to support the development of pre-service and in-service teachers, a significant starting point is engaging both groups in a study of the 'terms' that feature in teachers' professional speech when conceptualising the practice of the classroom. Equipped with such lexicons, teachers will be better able to reflect on and improve their practice. The primary intention of this research was to provide insight into the naming system employed by middle-school mathematics teachers in relation to their classroom practice, by documenting and interpreting the constructs that are well-known and more frequently utilised in discussions with others. From this foundation, this research endeavour hopes to inform national and international efforts to provide contemporary mathematics teachers with a sophisticated lexicon to shape their professional practice.

## Acknowledgements

We acknowledge the teachers, teacher educators, and students who welcomed us into their classrooms and participated in discussions and surveys to refine our lexicons; without your generosity this work would not have been possible.
This project has been funded by a Discovery Grant from the Research Council of the Australian Government (ARC-DP140101361).

## Note

1 The package included nine lessons instead of ten as Korea joined the project at a later date and developed their own stimulus package from mathematics lessons of Korean teachers only.

## References

Boroditsky, L. (2001). Does language shape thought?: Mandarin and English speakers' conception of time. *Cognitive Psychology*, 43, 1–22.

Boroditsky, L., Schmidt, L. A., & Phillips, W. (2003). Sex, syntax and semantics. In D. Gentner & S. Goldin-Meadow (Eds.), *Language in mind: Advances in the study of language and thought* (pp. 61–79). Cambridge, MA: MIT Press.

Cao, Y., Clarke, D. J., & Xu, L. (2010). Qifa Shi teaching: Confucian heuristics. In M. M. F. Pinto & T. F. Kawasaki (Eds.), *Proceedings of the 34th Conference of the International Group for the Psychology in Mathematics Education*, (Vol. 1, pp. 232–234). Belo Horizonte, Brazil: PME.

Casasanto, D. (2008). Who's afraid of the big bad Whorf? Crosslinguistic differences in temporal language and thought. *Language Learning*, 58(1), 63–79.

Clarke, D. J. (2001). Teaching/Learning. In D. J. Clarke (Ed.), *Perspectives on practice and meaning in mathematics and science classrooms* (pp. 291–320). Dordrecht, Netherlands: Kluwer Academic Press.

Clarke, D. J. (2006). Using international comparative research to contest prevalent oppositional dichotomies. *ZDM*, 38(5), 376–387.

Clarke, D. J. (2010). The cultural specificity of accomplished practice: Contingent conceptions of excellence. In Y. Shimizu, Y. Sekiguchi, & K. Hino (Eds.), *In search of excellence in mathematics education - Proceedings of the 5th East Asia Regional Conference on Mathematics Education (EARCOME5)* (pp. 14–38). Tokyo, Japan: Japan Society of Mathematical Education.

Clarke, D. J. (2012a). International comparative research into educational interaction: Constructing and concealing difference. In K. Tirri & E. Kuusisto (Eds.), *Interaction in educational domains* (pp. 5–22). Rotterdam, Netherlands: Sense Publishers.

Clarke, D. J. (2012b, November 22–23). *Constructing and concealing difference in international comparative educational research* [Keynote]. *2012 Finnish Educational Research Association (FERA) Conference on Education*, Helsinki, Finland.

Clarke, D. J., Emanuelsson, J., Jablonka, E., & Mok, I. A. C. (Eds.). (2006). *Making connections: Comparing mathematics classrooms around the world*. Rotterdam, Netherlands: Sense Publishers.

Clarke, D. J., Keitel, C., & Shimizu, Y. (Eds.). (2006). *Mathematics classrooms in twelve countries: The insider's perspective*. Rotterdam, Netherlands: Sense Publishers.

Clarke, D. J., Mesiti, C., O'Keefe, C., Xu, L.H., Jablonka, E., Mok, I. A. C., & Shimizu, Y. (2008). Addressing the challenge of legitimate international comparisons of classroom practice. *International Journal of Educational Research*, 46(5), 280–293.

Gelman, S. A., & Roberts, S. O. (2017). How language shapes the cultural inheritance of categories. *PNAS*, 114(30), 7900–7907.

Hammersley, M., & Atkinson, P. (1995). *Ethnography: Principles in practice* (2nd edition). London, UK: Routledge.

Hedegaard, M. (1990). The zone of proximal development as basis for instruction. In L. C. Moll (Ed.), *Vygotsky and education* (pp. 171–195). Cambridge, MA: CUP.

Hiebert, J., Gallimore, R., Garnier, H., Givvin, K., Hollingsworth, H., & Jacobs, J. (2003). Understanding and improving mathematics teaching: Highlights from the TIMSS 1999 Video Study. *Phi Delta Kappan*, 84(10), 768–775.

Hoey, B.A. (2014). A simple introduction to the practice of ethnography and guide to ethnographic fieldnotes. *Marshall University Digital Scholar*, 2014, 1–10.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, MA: Cambridge University Press.

Levinson, S. C. (2003). *Space in language and cognition: Explorations in cognitive diversity*. Cambridge, MA: Cambridge University Press.

Mercier, J. (2019, January 23). Cultural anthropology. *Encyclopædia Britannica*. https://www.britannica.com/science/cultural-anthropology

O'Keefe, C., Xu, Li Hua., & Clarke, D. J. (2006). Kikan-Shido: Between desks instruction. In D. J. Clarke, J. Emanuelsson, E. Jablonka, & I. A. H. Mok (Eds.), *Making connections: Comparing mathematics classrooms around the world* (pp. 73–106). Rotterdam, Netherlands: Sense Publishers.

Sapir, E. (1949). *Selected writings on language, culture and personality*. Berkeley, CA: University of California Press.

Sauter, M. (1998). Narrations de recherche: Une nouvelle pratique pédagogique [Research narrations: A new pedagogical practice]. *Repères-IREM*, 30, 9–21.

Schoenfeld, A. H. (2011). Noticing matters. A lot. Not what? In M. G. Sherin, V. R. Jacobs, & R. A. Philipp (Eds.), *Mathematics teacher noticing: Seeing through teachers' eyes* (pp. 223–238). New York, NY: Routledge.

Sherin, M. G., Jacobs, V. R. & Philipp, R. A. (Eds.). (2011). *Mathematics teacher noticing: Seeing through teachers' eyes*. New York, NY: Routledge.

Shimizu, Y. (2006). How do you conclude today's lesson? The form and functions of 'matome' in mathematics lessons. In D. Clarke, J. Emanuelsson, E. Jablonka & I. A. C. Mok (Eds.), *Making connections: Comparing mathematics classrooms around the world* (pp. 127–145). Rotterdam, Netherlands: Sense Publishers.

Stengers, I. (2011). Comparison as a matter of concern. *Common Knowledge*, 17(1), 48–63.

Stevenson, A. (Ed.). (2015). *Lexicon. Oxford dictionary of English* (3rd edition). Oxford, UK: Oxford University Press. Retrieved from https://en.oxforddictionaries.com/definition/lexicon

Stigler, J. W., & Hiebert, J. (1999). *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. New York, NY: The Free Press.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner & E. Souberman, Eds.) (A. R. Luria, M. Lopez-Morillas & M. Cole [with J. V. Wertsch], Trans.) Cambridge, MA: Harvard University Press. (Original manuscripts [ca. 1930–1934]).

Whorf, B. L. (1956). *Language, thought, and reality: Selected writings of Benjamin Lee Whorf* (J. B. Carroll, Ed.). Cambridge, MA: MIT Press.

Winawer, J., Witthoft, N., Frank, M. C., Wu, L., Wade, A. R., & Boroditsky, L. (2007). Russian blues reveal effects of language on color discrimination. *Proceedings of the National Academy of Sciences*, 104(19), 7780–7785.