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The lexicon project: Examining the consequences for international comparative research of pedagogical naming systems from different cultures

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Use of English as the international language of educational research can mask the nuanced meanings of constructs that researchers working in languages other than English originally employed in framing their practice and their theories. Cross-cultural comparisons are framed in terms of constructs expressed in the language of publication, usually English. Attention has been drawn to the significance of the resulting validity-comparability compromise (Clarke, 2013). The Lexicon Project investigates the pedagogical naming systems used by educators in nine countries (eight languages). Drawing on examples from the Australian, Chinese and Czech lexicons, this paper outlines the project's research design and addresses the implications of distinctive lexical features for comparative classroom research between communities employing different lexicons to describe the phenomena of middle school mathematics classrooms.

Keywords: Professional language, mathematics education, international comparison.

Introduction

The Lexicon Project involves research teams from Australia, Chile, China, Czech Republic, Finland, France, Germany, Japan and the USA. The project aims to document the naming systems (lexicons) employed by different communities speaking different languages to describe the phenomena of the mathematics classroom. Such lexicons consist of words of locally agreed meaning in a single language that collectively accord to lexical norms and conventions characteristic of the language community (mathematics educators) of the particular country.

The theoretical position adopted by this project is that our experience of the world, our engagement in socio-cultural practices, and our reflection on those experiences and practices are mediated and shaped by available language. The Sapir-Whorf hypothesis suggests that our lived experience is mediated significantly by our capacity to name and categorize our world.

We see and hear . . . very largely as we do because the language habits of our community predispose certain choices of interpretation (Sapir, 1949, p. 162).

Marton and Tsui (2004) suggest that categories “not only express the social structure but also create the need for people to conform to the behavior associated with these categories” (p. 28). In this project we examine this normative role of language in relation to classroom practice and research.

While a professional language of teaching practice seems lacking in the USA (Lampert, 2000), such a language seems to be well-established among educators in China and Japan (Fan et al., 2004;

Fernandez & Yoshida, 2004). Our interactions with classroom settings, whether as learners, teachers, or researchers, are significantly mediated by our capacity to name what we see and experience (Clarke et al., 2016). Speakers of one language have access to terms, and therefore to perceptive possibilities, that may not be available to speakers of another language. This has implications for international comparative research.

Any claim that researchers speaking different languages are analyzing “the same classroom,” even when working from the same video records, can be usefully contested. In two published translations of Vygotsky, we find the Russian term, “obuchenie,” represented as “instruction” in one translation and “learning” in another. This is not merely a problem of mistranslation. The term refers to an activity in which teachers and students are jointly participant for which there is *no equivalent term* in English. The term offers a conceptualisation of classroom practice with profound implications for the theorization of classroom teaching/learning. Recognition of these implications is not afforded in English. Educational research increasingly employs English as the primary language through which theory is developed and disseminated. It is essential to recognise the constructs that other cultures have employed in conceptualising their practice and examine the consequences for research and for theory of those distinctive terms (and the designated constructs) that might otherwise be ignored by an international community restricted to communication in English.

Research design

In the Lexicon Project, local teams of researchers and experienced teachers in all nine countries viewed a common set of video records of one eighth-grade mathematics lesson from each participating country. Specific lessons were selected by each country team for the diversity of activities displayed rather than for their representativeness. The purpose of this activity was to stimulate identification of those terms in the local language of each team that constituted the national pedagogical lexicon with respect to the teaching of middle school mathematics (ages 11 to 14). It is via the medium of these terms that teachers plan, engage with, discuss, and reflect upon the mathematics classroom. It was assumed that the vocabulary available to researchers in each country included most terms employed by teachers, but that the researchers’ vocabulary would include other terms not necessarily locally derived, being translations or literal appropriations of terms generated by other educational communities. For that reason, because of the focus on the local language, it was the teachers’ lexicon that was the principal focus of investigation in each country.

The key prompt used by all teams was: “What do you see that you can name?” Once a term was identified and endorsed by the local team, a consensus description was constructed of the specific classroom phenomenon to which the term referred and examples and non-examples identified to maximize effective communication of the term’s meaning and classroom referent. These descriptions, examples and non-examples were crucial to the communication between teams of the meanings of terms that originated in the local (predominantly non-English) language.

But teams were not restricted to only those phenomena visible in the video material. For example, where observation of one type of classroom activity reminded the observer/s of another activity type not evident in any of the video material, that term was included in the lexicon, together with a description, examples and non-examples. It was anticipated that these terms would describe classroom practices, both structures (such as organizational patterns or activity sequences) as well as

specific activities observable in the middle school mathematics classroom. The function of the video material was fundamentally catalytic, stimulating recall of the names of classroom phenomena present and absent in the classrooms filmed. However, the video material also assisted communication within and between the different teams, clarifying the meaning of terms.

Local team consensus was required for the inclusion of a term in the lexicon and in problematic cases authority was accorded to classroom experience and the team members' capacity to argue that the term was in current use by teachers. The essential point was to record single words or short phrases that were consistently and widely used by teachers within that country with a consistent and agreed meaning. Subsequently, a process of local and then national validation was pursued to refine and ratify each lexicon. The means by which this validation process was undertaken varied from country to country, but basically involved inviting a national cross section of mathematics educators to comment on the adequacy, accuracy, and clarity of the constructed lexicon for that country.

Of course, such lexicons are continually evolving and a process of regular updating is anticipated. The international project team takes particular interest in the studying the connections between terms within a given lexicon and the consequent clusters of related terms that provide the structure for each country's lexicon. Both teachers and researchers were involved in the identification of these connections. The Chinese example below illustrates one approach to the identification of such structures. Comparison of the emphases evident within each country's lexicon reveals distinctive features of the different countries' mathematics pedagogy and priorities of classroom practice.

Lexicon selection for the purposes of comparison and contrast

In this paper, one English speaking and two non-English speaking communities have been chosen to provide contrasting examples of the language that educators in Australia, China and the Czech Republic employ to describe the objects and events of the middle school mathematics classrooms in their countries. Structural aspects of the lexicons suggest underlying pedagogical principles or associations that shape the ways in which middle school mathematics teachers function and interact within the mathematics classrooms of that country. The lexicons also offer insight into the language available to researchers in each country, by which they study, classify, analyze, conjecture and theorize about the practices and the affordances of the mathematics classrooms of their country.

The project identified both similarities and differences in the national lexicons, revealing significant differences in the way teachers and researchers from each country perceive the classrooms that are the focus of their professional activity. These differences raise the question of the extent to which the international community of mathematics teachers and researchers can meaningfully and productively share the wisdom of long-established pedagogical traditions of practice, where these are encrypted in the naming systems by which each community identifies those classroom activities that it considers to be significant. Discussion is provided of: (i) the implications for comparison of the lexicons, and (ii) the implications of the lexicons for other comparative classroom research. These two purposes are conceptually distinct but connected.

In this paper, English is used to describe the content and structure of both the Chinese and Czech lexicons. This reflects the underlying purpose and challenge of the Lexicon Project: to identify and make accessible to the international community the pedagogical principles and distinctions encrypted in different lexicons. Examples from the original language are cited for purposes of clarification. For

example, some terms can be approximated in English (e.g., “Teacher Feedback” adequately names 教师反馈 which is “jiào shī fǎn kuì” in Chinese pinyin¹) but there are those that have no simple equivalent English term or phrase but can only be represented in pinyin and an extended English description (e.g., 课堂生成 which in pinyin is “kè táng shēng chéng” and which refers to “when the teacher makes full instructional use of an unexpected event beyond the intended plan for the lesson”). Similarly, the Czech term “S cílem objevit” (literally, “with the aim to discover”) refers to the occasion when “by solving the problem students discover something new.” Examples are used, if needed, in the discussion that follows. The three lexicons: Australian, Chinese and Czech are used to illustrate respectively the methodological processes of Lexicon Identification, Structure and Interpretation.

The Australian lexicon: Generic rather than discipline-specific terms

The Australian National Lexicon consists of 63 terms that are familiar and in widespread use (e.g., *Assigning Homework*, *Rephrasing*, *Worked Example*). A description was constructed for each term, together with both examples and non-examples of the use of the term. Because of the role of video in stimulating the recognition of terms, many terms can also be illustrated with video examples.

In consultation with practicing teachers, the lexical items were organized in five categories: Administration (8 terms); Assessment (11 terms); Classroom Management (6 terms), Learning Strategies (27 terms) and Teaching Strategies (50 terms). A lexical item appeared in more than one category if the Australian team decided on the basis of teacher advice that there was a strong association with each category.

One feature of the Australian National Lexicon is that none of the 63 terms identifies a practice unique to the mathematics classroom. The terms all refer to general pedagogical practices. Also worthy of note is the prevalence of ‘gerunds’ (a verb form that also functions as a noun; “teaching” and “learning” are relevant examples) in the Australian National Lexicon. This duality provides both advantage and disadvantage: “learning” as a noun is explicitly the product of the activity of “learning” in a way that objectified “knowledge” is not, but this duality can also result in less precise communication due to the inherent ambiguity over what is being referred to: process or product. The duality of simultaneously invoking both object and activity is not available in some languages, highlighting the affordances of particular languages and the difficulties of translation.

The generic character of the Australian Lexicon content suggests that the lexicon might also be applicable to other school settings besides the mathematics classroom.

Integrating forms of connection to structure the Chinese lexicon

In the Chinese Lexicon, 126 terms were identified as being used by Chinese middle school mathematics teachers in describing their classrooms. Within the lexicon, every term is related to some other terms, which makes the teacher’s language an organic entirety. The challenge for the Chinese

¹ Pinyin is a phonetic rendering of Chinese characters using the Latin alphabet employed in English and four basic tonal annotations.

team was to clarify the structure of teacher's pedagogical language as encompassed in these 126 terms. A two-step process was employed by the Chinese team to do this.

Step One: Three types of connections were identified between lexical items: Hierarchical, Coincident and Sequential.

Hierarchical

Level One: In the first level, the terms can be divided according to whether the term referred to Teachers, Students or to Teacher-student Interactions.

Level Two: Terms within the category "Teachers" could be divided into: Classroom Management, Demonstration, Questioning, Feedback, Summarizing, Explanation, and Tutoring.

The category "Students" included: Classroom Management, Demonstration, Questioning, Feedback, Summarizing, Doing Exercise, Collaborative Studying, Self-learning and Listening.

The category "Teacher-student Interaction" had no sub-structure at this level.

Level Three (only one example can be shown for reasons of space): "Classroom Management" included: Teaching Affairs Management and Order Management.

Apart from the hierarchical links, it was clear that some activities can happen at the same time while others occur in a sequence. This provided two additional mechanisms for the clustering of terms.

Coincident

This category refers to terms used in a teacher's pedagogical language that refer to activities that can happen at the same time. For example, Group Report and Student Listening — when a group is reporting their findings or answers, the other students must be listening carefully in the class.

Sequential

Teacher Questioning and Student Answering are an example of a pair of tasks that are intrinsically sequential — when the teacher asks a question of the class, this action is typically followed by an individual answering or the class answering together.

Step Two: Using the three types of connections, it was possible to organize the terms in the Chinese Lexicon into a structured array. Experienced teachers were recruited from high achieving schools in different parts of China to identify the connections. In this way, regional variations in interpretation and association could be identified. This illustrates the value of the lexicon in helping to identify regional pedagogical variations in a country as large as China, while also highlighting common pedagogical elements.

Differences between professional language communities: Teachers and researchers in the Czech Republic

As for all the country lexicons, the Czech lexicon does more than simply describe the current pedagogical vocabulary of practising Czech mathematics teachers. It should also be considered as a way to understand the Czech "culture of education" by providing examples that illustrate how it is possible to think about education. The use of pedagogical terms varies according to the groups of users (authors in different fields of pedagogy, teachers, etc.). One purpose of the Czech lexicon at the national level is to provide teacher education with a tool for triggering and framing discussion among pre-service students and practising teachers to facilitate better understanding of lesson structure and classroom practice.

The terms of the Czech Lexicon were classified using the following categories: Classroom Management; Introductory Communication; Explanation of New Topic; Revision of Previously Taught Topic; Solving of a Problem; Checking Individual Work; Institutionalisation; Summary; Non-mathematical Social Interaction; Assessment; Concluding the Lesson; Individual Consultation with a Pupil. The Czech lexicon is highly stratified. There are several sub-categories in each of these themes. One distinctive feature is the prevalence of student-oriented terms that reflect the importance attached within Czech education to the teacher-student relationship. For example, “shrnují na pokyn učitele” (student invited to recapitulate teacher’s instruction) and “vysvětlují na pokyn učitele” (student invited to explain teacher’s instruction) are distinctively student actions.

When constructing the Czech lexicon, the research team identified particular characteristics. One characteristic concerned the difference between how the language was used and understood by different target groups. Practising teachers used few technical pedagogical terms and communicated mostly using words from the language of everyday life. Pre- and in-service teachers were more likely to make use of terms drawn from their lessons on mathematical didactics. For example, “Heuristický rozhovor” is an academic term meaning “heuristic dialogue,” but a practising teacher would be more likely to say, “řízená diskuse” meaning “guided discussion” to refer to the same classroom phenomenon. The Czech team’s concern was how to combine the two ways of using the Czech lexicon – as a tool describing the structure of Czech lessons and highlighting important parts of lessons and as a tool to facilitate discussion between different groups. This dilemma is accentuated by the relative paucity of Czech technical terms not only in the domain of didactics of mathematics but also in pedagogy. The Czech example illustrates the different uses of the lexicon for teachers, student-teachers and educational researchers and identifies the potential for the Czech lexicon to serve as a catalytic focus for discussion between these different communities.

Discussion: Implications for comparison

The key steps in lexicon construction of Identification, Structure and Interpretation have been illustrated with examples from the Australian, Chinese and Czech lexicons respectively. Each step offers insights into the pedagogical history encrypted in each lexicon and the potential value of the lexicon to the teaching and research communities in each country. In this section, we explore the question of comparison. Two forms of comparison warrant discussion: within-project comparison of the separate lexicons for the purpose of gaining insight into the pedagogical principles of each language community encrypted in the professional lexicon of middle school mathematics teachers; and, second, the broader implications for international comparative classroom research of the documented differences in how the phenomena of the middle school mathematics classroom are conceptualized within each language community. Each of these is discussed separately below.

Comparing lexicons: Constructs as boundary objects

The primary consideration in making comparison between any two lexicons is the mediating construct that forms the basis of comparison (Clarke, 2015). For example, comparison might be made between the *agency* accorded in one lexicon to the teacher or to the students. That is, what proportion of lexical terms refer to teacher actions and what to student actions (cf “Level One” in the Chinese lexicon), and what is the nature of the actions in each case: initiating or reactive (for example). The Australian lexicon makes a comparable distinction between Teaching Strategies and Learning

Strategies. In this case, “agency” provides the boundary object by which the two lexicons might be compared. Clearly, “agency” need not be a term situated in either lexicon. Instead, it represents an organizing construct with comparable conceptual legitimacy within each lexicon. As such, it constitutes an acceptable boundary object for the purposes of comparison of the lexicons. Other boundary objects might name categories of lexical items, such as: *assessment* or *management*. The requirement for legitimate comparison would be that the organizing construct (say, assessment) has local validity within each lexicon as designating a cluster of lexical terms and cross-lexicon validity in characterizing conceptually the same shared attribute for each lexical cluster being compared. Comparison of the Australian and Czech lexicons is possible on this basis, with respect to either of the mediating constructs: agency or assessment.

Comparative research: Validity-comparability compromise

The documentation of the separate lexicons has the potential to heighten the legitimacy of comparative classroom research being undertaken across two communities. For example, application of a measure of *participation* to the comparative analysis of classroom data from two countries is problematic, unless it can be demonstrated that “participation” has the same cultural relevance within the pedagogical practices of each community. However, if participation is treated not as the basis for an imposed metric, but as a boundary object, then the question can be asked, “What forms of participation are legitimized within the lexicons of the two countries whose classrooms are being compared?” Analysis of the separate lexicons to identify those terms that characterize forms of participation in classroom practices would reveal both similar and different types of participatory activity. For example, choral response has been documented as a frequent form of participatory activity in mathematics classrooms in China and Korea, but not in classrooms in Australia and Japan. Reciprocally, student-student talk is a common form of participatory activity in mathematics classrooms in Australia and Japan but not in China and Korea (Clarke, Xu & Wan, 2013). Any comparison of student participation in classroom activity in these four countries can be undertaken with much greater validity, where attention is given to important distinctions between forms of participation as these are facilitated and named by teachers in each of the countries whose classroom practices are being compared. Utilization of the lexicons from each country to identify legitimate points of comparison would heighten both validity and comparability (Clarke, 2013).

Conclusion

The construction of national lexicons representing the naming systems employed by educators using different languages to “name what they see” in the middle school mathematics classroom represents the starting point for the deconstruction of pedagogical histories and norms of practice enshrined in the languages by which classroom phenomena are described, studied and theorized in different countries. The documentation of these lexicons has significant practical value to each participating community and to the international community of mathematics education practitioners and teacher educators. The focus of this paper, however, has been on the implications of such lexicons for the legitimacy of international comparative research and on the use of any named construct as a boundary object for the purposes of comparative research analyses. It is intended that the lexicons serve as tools to interrogate, enhance and advance comparative classroom research internationally.

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