This paper is taken from

Innovative Practice and Research Trends in Identity, Citizenship and Education
Selected papers from the sixteenth Conference of the Children's Identity and Citizenship in Europe Academic Network

London: CiCe 2014

edited by Peter Cunningham and Nathan Fretwell, published in London by CiCe,
ISBN 978-1-907675-21-8

Without explicit authorisation from CiCe (the copyright holder)

- only a single copy may be made by any individual or institution for the purposes of private study only

- multiple copies may be made only by
  - members of the CiCe Thematic Network Project or CiCe Association, or
  - a official of the European Commission
  - a member of the European parliament

If this paper is quoted or referred to it must always be acknowledged as:
Katsillis, M. (2014) 'Ethnomathematics, language and immigrant children', in P. Cunningham & N. Fretwell (eds.) *Innovative Practice and Research Trends in Identity, Citizenship and Education*. London: CiCe, pp. 286 – 295.

© CiCe 2014

CiCe
Institute for Policy Studies in Education
London Metropolitan University
166 – 220 Holloway Road
London N7 8DB
UK

This paper does not necessarily represent the views of the CiCe Network.

Education and Culture DG
Lifelong Learning Programme

This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Acknowledgements:

This is taken from the book that is a selection of papers given at the annual CiCe Conference indicated. The CiCe Steering Group and the editor would like to thank

- All those who contributed to the Conference
- The CiCe administrative team at London Metropolitan University
- London Metropolitan University, for financial and other support for the programme, conference and publication
- The Lifelong Learning Programme and the personnel of the Education and Culture DG of the European Commission for their support and encouragement.

Ethnomathematics, language and immigrant children

Michael Katsillis
University of Patras (Greece)

Abstract

Changing demographics bring together diverse people with different experiences and skill sets. As such, issues arise that are related to how to best equip immigrant students to achieve their full potential within their new social environments. These differences often test teachers and certain school subjects are seen as being more challenging for the immigrant children. This poster provides a brief introspection on the phenomenon of fear of mathematics and the puritan ethic permeating the Modern Greek educational paradigm's multicultural classroom. It also contains general elements of instruction in Mathematics as well as the inextricably bound Greek language, to students of Greek as a second or foreign language, as well as to repatriates and immigrants. It briefly presents the deficiencies and some of the techniques applied in both Greek and international approaches to the subject. Furthermore, it notes the positive and negative aspects of the use of the literature for teaching in multilingual and multicultural classrooms. Finally, it analyses the puritanical nature of education systems in regards to the classroom's cultural nature and teaching materials both generally, and in the specific context of this experiment, discussed in the pages of the book.

Keywords*: ethnomathematics, immigrants, minorities, mathematics, language teaching*

Introduction

The existence of the multicultural classroom is, at this point, a part of both the Greek and international reality. It is directly linked to both geopolitical and sociopolitical events leading population masses from monocultural to multicultural communities. Often, these self-same movements act as catalysts for the creation of the very multicultural nature characterising their new communities. However, these new communities are less equipped to provide the teaching approaches that will help the immigrant student maximise their potential while also enabling them to integrate into their new social reality.

In the case of Greece, the influx of a large amount of immigrants in the '90s, as well as the integration of pre-existing populations of a culturally heterogeneous nature presented new challenges for the Greek educational system. By the mid-00s over 10% of the school aged population was and continues to be of non-Greek origin (Palaiologou, 2003; IPODE 2006-07). Despite this, 'intercultural schools have not developed alternative curriculums or materials, instead [they continue] operating with the homogenous curriculum applied in 'regular' schools' (Mitakidou et al, 2008). Thus, we find that the educator is left without

predefined curricula or materials specially prepared to cater to the needs of teaching to students for whom Greek is a second or foreign language.

Difficulties Teaching Multicultural Classrooms

A traditional view of mathematics regards it as an international language comprised of notations, only minimally influenced by the need for natural language (Dale & Cuevas, 1992, Thomas & Collier, 1997). This dominating opinion has led to mathematics being offered as one of the basic courses taught in multicultural classrooms around the world. This approach, while appearing to pay off in the short term, may prove for various reasons, to be unviable in the long run. The symbolic nature of the language of mathematics and its seemingly lower natural language requirements make it more accessible to children of repatriate or immigrant families. Studies have shown that even children themselves express a preference for mathematics over language classes, often citing the relative ease of the course, a greater liking of numbers and operations or even their utilitarian nature, as it could relate to future employment (Tressou & Mitakidou, 1997). However, this feeling of positive association with mathematics may, due to the increased language requirements needed to meet the demands of more advanced mathematical problems, result in a decline in students' performance (Irujo, 2007; Tressou & Mitakidou, 1997). The issue of language difficulties offered by mathematical problems has been presented and exemplified by among others, Short and Spanos (1989). A simple math problem was offered for solution in French to non-French speakers. Through a series of questions asked by the examiners, linguistic, mathematical and even paralinguistic difficulties arose in the course of solving the problem. The presence of unnecessary information, contaminants of absolute and ordinal numbers and the need for awareness of cultural elements that accompany each language were barriers impeding the solution of the problem. Linguistic problems have been apparent for as long as the phenomenon of the multicultural classroom has existed (Irujo, 2007: no page, referencing Ron, 1999) one example is the concept of mathematized language.

Traditional teaching models are insufficient to address the needs of this learning community. Favilli and Tintori (2002) emphasise the sense of lack of teacher preparation to work with immigrant students. Cesar and Favilli (2005) stress that teacher often lack understanding of the potential for richer learning through various techniques, approaches and the experiences these students bring with them. New teaching models, as well as specially designed activities which take into consideration the individual needs of students taught in a language which is not native to them, must be constructed (Short & Spanos, 1989). Such construction is obviously impossible, given the existing teaching infrastructure which does not include interdisciplinary teaching teams or team teaching per se.

Methods to Address the Multicultural Classroom and the Proposal for Teaching through Literature

Despite, or rather explicitly due to, the lack of such interdisciplinary, specialist teams, multicultural classroom teachers are very often forced into one of two alternatives. They either hold to the existing, traditional teaching models, ignoring the multiculturalism and difference of their students or they take the initiative and apply experimental teaching methods on their own. Recent studies support the necessity of teachers' intercultural sensitivity to effectively handle the implementation of such measures (Spinthourakis et al, 2009). This fact has also been observed by teachers themselves, who in turn consistently request additional teaching training on intercultural education and teaching (Spinthourakis & Katsillis, 2003; Tressou & Mitakidou, 1997). The field was pioneered by Cummins (1981, 1994) with studies on the construction of academic language and his noting that Basic Interpersonal Communication Skills (BICS) precede Cognitive Academic Language Proficiency (CALP). Based on Cummins' studies, Kang and Pham (1995), pointed out the need for clarified learning of Academic Language. Davison and Pearce (1988, 1992) have reported improvement of language function and mathematics performance by applying systematic language activities. Other techniques implemented include the use of objects, artifacts and visual tools (Davison, 2005). Irujo (2007), while studying the actual problems and difficulties of children in the multicultural classroom, suggests multiple strategies to facilitate students' teaching and understanding. She proposes the simplification of task and activity language (wording), which often confuses readers with unnecessary information, making the problem more difficult to understand. Cocking and Chipman (1988) reference the usefulness of problems conceived by students themselves. Baluja (2001, p. 85) states that 'A useful strategy that helps to overcome this [obstacle resulting from a lacking understanding of the language of instruction] to some extent is the formation of study groups comprised of pupils of the same language.' Clearly, there are numerous techniques and approaches that can be implemented towards enhancing the teaching and learning of the second and/or foreign language of the immigrant students as well as in the teaching of mathematics (Reyes & Fletcher, 2003).

A Meaning and Utility of Ethnomathematics and Teaching

The term 'ethnomathematics', was first used in 1977 by the Brazilian educator and mathematician Ubiratan D'Ambrosio. He referred to it as 'The mathematics which is practiced among identifiable cultural groups such as national-tribe societies, labour groups, children of certain age brackets and professional classes' (D'Ambrosio, 1985). Later he defined it as 'The codification which allows a cultural group to describe, manage and understand reality' (D'Ambrosio, 1987). Bishop (1988, p. 182 as cited in Harris, 1991) notes that 'Mathematics […] is conceived as a cultural product which has developed as a result of various activities'. Building on the framework of those who came before him as well as the previous definitions, in 1991 (p. 188) Ascher (1991) defined ethnomathematics as 'The study and presentation of mathematical ideas of traditional peoples'. The usefulness of ethnomathematics, as stated previously, springs from the differences that characterize the various ethnic and social groups that may comprise the modern multilingual and multicultural classroom. Recognizing the necessity of ethnomathematics for teaching in

multilingual and multicultural classrooms, various teachers have, over the course of the concept's development, attempted to merge culture and mathematics in such classrooms (Civil, 2008). Examples can be found, among other places, in the works of Bradley (1984), Nelson-Barber & Estrin (1995), Gerdes (1988, 2001), Barton (1996), Malloy (1997) and Flores (1997). Their methods include the use of localized arts and games, manners and customs. Ethnomathematics may be very useful in teaching immigrant children and should be considered as an approach to be taught in teacher education (Presmeg, 1996, 1998).

Using Fairy Tales to Teach Mathematics in the Multilingual, Multicultural (And Even the More Mundane) Classroom

The importance of the use of fairy tales in the integration of traditional heroes into teaching has been generally realized for more than approximately forty years. This is no less relevant today than it was so many years ago. Some of the reasons for this are as Bettelheim (1976) notes, the difficulties in raising children in a modern society. In his work he points out what happens when there are a lack role models, extended family and an integral society. Gilstrap and Evans (1997, p. 1) referencing Manning (1994) manage to communicate the most important reasons for the integration of fairy tales in relation to the increasingly frequent multilingual, multicultural classroom, citing the latter's belief that 'one way to help develop good cultural identity is to recognise and celebrate diverse cultures by using their folktales'. It has been pointed out that, 'Using children's literature to teach mathematics is an approach espoused by the curriculum reform movement' (Friedman, 1997, p. 1). Here we see how Friedman stresses that, through use of stories and fairy tales that contain general principles of mathematics, teachers not only expedite understanding of these principles, but also students' familiarity with the concepts of generalisation and abstraction, which are basic tenets of higher thought.

A Thousand and One Nights – Fairy Tales, Ethnomathematics and Teaching in the Modern, Multilingual, Multicultural Greece

In their case study, Tressou and Mitakidou (2005) instructed an immigrant student reception classroom teacher on the use of ethnomathematics and language teaching using the fairy tale 'Ali-Baba and the Forty Thieves.' Up until this point, the specific teacher followed her own ideas. She was frequently forced to using reading material from regular classes in order to cover gaps between the reception class and the normal classroom. She often met with difficulties fulfilling the requirements of her teaching program due to teaching staff shortages at the school in which she worked. Consequently, students in the immigrant reception class were unable to regularly follow the suggested teaching program with either consistency or chronological continuity. In the absence of specialised training and specific guidance from the relevant authorities and those responsible for the construction of appropriate teaching and training programs in immigrant student reception classes, the teacher in question alternated between following the State proposed teaching program and resorting to favoring traditional,

monocultural teaching models and trying to find different approaches. Students in her class presented many of the problems characteristically found in multilingual, multicultural classrooms (Cocking & Chipman, 1988; Tressou & Mitakidou, 1997; Stathopoulou, 2004; Tressou et al, 2008; Croom, 2008). Almost all the children had a two year gap in their academic career. The exceptions were the two eldest children who had spent one and two years in a repatriate school. Recognising the usefulness of fairy tales in teaching mathematics, in both a traditional monocultural classroom as well as its modern multilingual multicultural counterpart, the teacher tried a different teaching approach blending language and ethnomathematics, and drew upon the story of 'Ali-Baba and the Forty Thieves' for her teaching material.

The fairy tale of 'Ali-Baba and the Forty Thieves' lent itself to teaching purposes due to the multicultural character of the narrative. Supporting the position proposed by Lynch-Brown and Tomlinson (1999), Tressou and Mitakidou (2005) decided to retain the original form of the story which in the end is the one the teacher used with her immigrant students. They chose to offer their students a rehearsal for real life, by way of the most primitive version of the fairy tale. The fictional reality and ephemeral reassurance offered by more commercialised versions were relegated to a secondary position in light of a more complete narrative. Such a narrative would, in any case, be more closely connected to the reality their students experienced and could therefore be better understand. The harsher nature of the original fairytale also created the possibility of engendering concerns in their students. The expression and debate of concerns, in the form of dialogue, would offer students greater familiarity with the Greek Language and a more intimate relationship to its speech patterns beyond the narrow confines of the immigrant adjustment class.

With the story as a reference point, the teacher gave the students opportunities to work word problems that directly related to the fairy tale in question. She also had to deal with issues related to 'logical-mathematical knowledge' (Chatzigeorgiou, 2001, p. 504). An example can be seen in the following dialogue: The distorted logical-mathematical knowledge as well as the application of hidden curriculum becomes apparent in the excerpt, through teaching in the classroom, in the following dialogue (Tressou & Mitakidou, 2005, p. 85):

> Teacher: The forty thieves stood before the cave. Which child will tell or rather you will write, how many legs were standing in front of the cave? Think, how many legs each rider had.
> Peter: He had two legs.
> Maria: Four.
> Peter: There were forty of them.
> Teacher: Forty riders with two legs each. Write that on your papers. How did you find that? Do the operation, if you'd like.

For students with any level of difficulty with the language the class was taught it, the question was fraught with difficulties and possible confusion. After discussion and working

on the question, that the students returned, in various manners, the result sought by the teacher, i.e. 80 legs.

Despite the difficulties she runs into, the teacher's attempts to meet the special needs of the adjustment class clearly help. In order to overcome difficulties in the course of her teaching, she applied alternative teaching programs of her own design, when the one suggested by the Ministry of Education was insufficient. She took advantage of the students in her class, having them explain wording and concepts to their classmates in order to surpass linguistic difficulties some of her students were facing. At the same time, she helped them work through some of their linguistic difficulties by encouraging the use of non-verbal methods including but not constrained to drawing and pantomime (Tressou & Mitakidou, 2005, pp. 78–79, 94). She would also simplify her vocabulary in order to become better understood by her students (Ibid, p. 83).

The simplification of the linguistic level extended to the version of the fairy tale she used to teach the adjustment class – in which she ultimately simplified the language. It offered the 'opportunity [to] learn, recall and use mathematical language and mathematical content as well as the application of mathematical abilities in a context which makes sense to children [and gave] children the ability to negotiate the meaning of mathematical problems which stemmed from the fairy tale and, at the same time, to master linguistic skills through the natural use of the language.' (Tressou & Mitakidou, 2005, pp. 78-79). Thus, she battled students' fear of mathematics using the storytelling method. Students were familiarised with advanced and/or compound mathematical concepts by having them placed inside a conceptually accessible framework. While use of the fairy tale was obviously a step in the right direction, selection of an appropriate fairy tale as well as the specific fairy tale eventually used, were sources of quite a few difficulties to teachers.

Conclusions

The problems faced by students in the multilingual-multicultural classroom are both intricate and complex. Teachers, having recognised the existence of the problem from inside the classroom request new methodologies. They seek further, more specialised, more innovative educational approaches and techniques. They find themselves face to face with circumstances which have not been analysed adequately (and, in the case of previous generations, often not at all) during their education. The teaching of ethnomathematics in the modern multilingual-multicultural classroom seems closely tied to the general education of students in such classes. Research conducted in the last few years, as presented to a limited extent in the present work, have at least empirically concluded that it is both necessary and closely connected to the teaching of language. The common problems encountered while teaching are further exacerbated by the difficulties presented by students' language deficiencies, difficulties adjusting and varied social backgrounds. Common concepts, while sporting different names or, more rarely, even symbols, are a crucial link for immigrant

students and a point of access and approach for their teachers. Mathematics and specifically ethnomathematics stands as a bridge in such cases.

References

Ascher, M. (1991) *Ethnomathematics*. Pacific Grove, CA: Brooks/Cole Publishing Company

Baluja K. (2001) Teachers' perceptions of catering to the mathematical needs of immigrant students. *ACE Papers, Issue 11: Issues in Mathematics Education.* Retrieved from: http://www.education.auckland.ac.nz/en/about/research/research-at-faculty/research-publications/ace-papers/ace-issue11.html . January 2014.

Barton, B. (1996) Making sense of ethnomathematics: Ethnomathematics is making sense. *Educational Studies in Mathematics*, 31, pp. 201-3

Bishop, A. (1988) Mathematics Education in Its Cultural Context. *Educational Studies in Ethnomathematics*, 19, pp. 179-191. Reprinted in Harris, M. (ed) (1991) *Schools, Mathematics and Work*. New York: Academic Press, pp. 29-41

Bradley, C. (1984) Issues in mathematics education for Native Americans and directions for research. *Journal for Research in Mathematics Education*, 15(2), pp. 96-106

César, M. & Favilli, F. (2005) Diversity seen through teachers' eyes: Discourses about multicultural classes, in Bosch, M. (ed) *Proceedings of CERME* 4, Sant Féliu de Gixols. Available at: http://ermeweb.free.fr/CERME4/

Civil, M. (2008) Mathematics teaching and learning of immigrant students: A look at the key themes from recent research. *ICME Survey Team 5: Mathematics and Education in Multicultural and Multilingual Environments*, Monterrey, Mexico, July 2008.

Cocking, R. R. & Chipman, S. (1988) Conceptual Issues Related to Mathematics Achievement of Language Minority Children, in Cocking, R.R. & Maestre, J.P. (eds), *Linguistic and Cultural Influences on Learning Mathematics*. Hillsdale: Erlbaum, pp. 17–46

Croom, L. (1997) Mathematics for all students: Access, excellence, and equity, in Trentacosta, J. & Kenney, M. J. (eds) *Multicultural and gender equity in the mathematics classrooms: The gift of diversity*. Reston, VA: NCTM, p. 1-9

Cummins, J. (1981) The role of primary language development in promoting educational success for language minority students. Από το California State Department of Education (ed) *Schooling and Language Minority Students. A Theoretical Framework*. Los Angeles: California State Department of Education.

Cummins, J. (1994) The Acquisition of English as a second language, in Spangenberg-Urbschat, K. and Pritchard, R. (eds) *Kids Come in All Languages: Reading Instruction for ESL Students*. Newark, DE: International Reading, pp.36-62

D'Ambrosio, U. (1985) Ethnomathematics and its place in the history and pedagogy of mathematics. *For the Learning of Mathematics*, 5, pp. 44-8

D'Ambrosio, U. (1987). Reflections on ethnomathematics. *International Study Group on Ethnomathematics Newsletter*. 3(1), pp. 3-4

Dale, T. C. & Cuevas, G. J. (1992) Integrating mathematics and language learning, in Richard-Amato, P. A. & Snow, M. A. (eds) *The multicultural classroom: Readings for content-area teachers*. New York: Longman, pp. 330-348

Davison, D. M. (2002) An ethnomathematics approach to teaching language minority students, in Hankes, J. E. & Fast, G. R. (eds) *Changing the faces of mathematics: perspectives on indigenous people of North America.* Reston, VA: National Council of Teachers of Mathematics

Davison, D. M. & Pearce, D. L. (1988) Using writing activities to reinforce mathematics instruction. *Arithmetic Teacher*, 35(8), pp. 42-45

Davison, D. M. &- Pearce, D. L. (1992) The influence of writing activities on the mathematics and learning of American Indian students. *The Journal of Educational Issues of Language Minority Students*, 10(2), pp. 147-157

Favilli, F. & Tintori, S. (2002) Teaching mathematics to foreign pupils in Italian compulsory schools: Findings from a European project, in Valero, P. & Skovmose, O. (eds), *Proceedings of the 3rd International Conference on Mathematics Education and Society*, Copenhagen: Centre for research in Learning Mathematics

Flores, A. (197) Si se Puede, "It can be done": Quality mathematics in more than one language, in Trentacosta, J. & Keney, M. (eds) *Multicultural and gender equity in the mathematics classrom: The gift of diversity*. Reston, VA: The National Council of Teachers of Mathematics, pp. 81-91

Friedman, J. E. (1997) What is the Math Moral of the Story? *Childhood Education*, 74(1), pp 33-35

Gerdes, P. (1988) On culture, geometrical thinking, and mathematics education. *Educational Studies in Mathematics*, 1, pp. 3-53

Gerdes, P. (201) Exploring the game of "Julirde": A mathematical educational game played by Fulbe Children in Cameron. *Teaching Children Mathematics*, 7(6), pp. 321-27

Gilstrap, R. L. & Evans, D. (1997) Folktales in the Middle Grades. *Childhood Education*, 73(1), pp. 23-26.

I.P.O.D.E. (2009) Distribution of Foreign and Repatriated students in Public Schools School Year 2006-07. [In Greek] Retrieved from http://www.ipode.gr/default.asp?V_ITEM_ID=904&V_LANG_ID=6 December 9, 2008.

Irujo, S. (2007) Teaching Math to English Language Learners: Can Research Help? *The ELL OUTLOOK* Retrieved from http://www.coursecrafters.com/ELL-Outlook/2007/mar_apr/ELLOutlookITIArticle1.htm

Kang, H. & Pham, K. T. (1995) From 1 to Z: Integrating math and language learning. *29th Annual International Conference Teachers of English to Speakers of other languages*. Long Beach, CA. (Eric Document Reproduction No. ED 384 031).

Maloy, C. E. (1997) Including African American students in the mathematics community, in Trentacosta, J. & Keney, M. (eds), *Multicultural and gender equity in the mathematics classroom: The gift of diversity*. Reston, VA: The National Council of Teachers of Mathematics, Inc, pp.23-3

Mitakidou, S., Tourtouras, C., & Tressou, E. (2008) Performance of students from the former USSR in Greek schools. *Journal of Early Childhood Research*, 6(2), pp. 167-187 Retrieved from http://ecr.sagepub.com December 13, 2008

Nelson-Barber, S. & Estrin, E. (1995) *Culturaly responsive mathematics and science education for native students.* San Francisco, CA: Far West Laboratory

Paleologou, N. (2003) Teaching Greek as a second or foreign language through the development and use of educational software. Paper presented at the *Conference of the Carinthia Technology Institute organized in co-operation with European Distance and E-Learning Network*, 26 - 28 September 2003, Austria. Retrieved from: http://www.eurodl.org/materials/contrib/2005/Paleogou.htm February 22, 2014

Presmeg, C. (1998) Ethnomathematics in Teacher Education. *Journal of Mathematics Teacher Education*, 1(3), pp. 317-339

Presmeg, N. C. (1996) Ethnomathematics and academic mathematics: The didactic interface. *The Teaching of Mathematics in Different Cultures, Eighth International Congress on Mathematical Education*. Seville, Spain

Reyes, P. & Fletcher, C. (2003) Successful migrant students: The case of Mathematics. *Journal of Curriculum and Supervision*, 18(4), pp. 306-333

Short, D. J. & Spanos, G. (1989). Teaching Mathematics to Limited English Proficient Students. *ERIC Digests*. Washington, DC: ERIC/CLL.

Spinthourakis, J-A., Karatzia-Stavlioti, E., & Roussakis, Y. (2009) Pre-service teacher intercultural sensitivity assessment as a basis to address multiculturalism. *Journal of Intercultural Education*, 20(3), pp. 268-276

Stathopoulou, C. (2004) Mathematics Education as an Acculturation Process: The case of a Romany Student Group in Greece. *ICME X*. Rhodes: University of Aegean

Thomas, W. P. & Collier, V. (1997) *School effectiveness for language minority students*. Washington, DC: National Clearinghouse for Bilingual Education

Trentacosta, J. & Kenny, M. (1997). *Multicultural and gender equity in mathematics classrooms: The gift of diversity*. Reston, Va.: National Council of Teachers of Mathematics.

Tressou, E. & Mitakidou, C. (2005) *Language and Mathematics with Literature: A Creative Meeting.* [in Greek]. Thessaloniki: Epikentro, pp. 64–113

Tressou, E. & Mitakidou, C. (1997) Educating Pontian Immigrants in Greece: Successes and Failures. *Early Education and Development*, 8(3), pp. 323–338. Retrieved from http://informaworld.com/smpp/title~content=t775653644 December 13, 2008

Tressou, E., Tourtouras, C., & Mitakidou, C. (2008) Performance of students from the former USSR in Greek schools. *Journal of Early Childhood Research*, 6(2), pp. 163-187