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## "Why do we learn mathematics? Because it organizes our minds" An encounter between Former Soviet Union and Israeli cultures of mathematics education

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### Introduction:

The title, believed to be taken from the famous mathematician and scientist, Michael Lomonosov (1711-1765) was hung in Lena's math class in Ukraine, before she immigrated to Israel in 1995. She repeats the expression with much pride and with a certain yearning for order, clarity and a sense of belonging.

The resonating message of Lomonosov and others goes far beyond mathematics itself. The importance of "order" in life being derived from math, is part of an ongoing legacy.

Mathematics was endowed with great importance by the Soviet government. Teachers and educators considered mathematics and the sciences as a necessary tool in developing the *vospitanie* (upbringing) (Muckle, 1988), and they saw themselves as agents of mathematical culture in the Soviet Union.

Lena and many others immigrated to Israel and found themselves immediately facing a new culture based on completely different value systems. Within the Israeli math education community there was already a built-in consensus about the inseparable link between mathematics, values, society and culture (Bishop, 1988; Amit, 2000). However, in society in general, math is perceived as neutral, as without cultural affinity; and therefore it is believed that math education should be easily replicated or immigrated from one country to another, or from one culture to another, without expecting any crises or conflicts. This perception was found to be far from the truth.

An encounter between two mathematics education cultures was experienced by math teachers who moved from a Soviet culture to an Israeli one. This encounter accelerated changes in the culture of mathematics education in Israel, that for the first time were not motivated by politicians, market forces, industrialists or researchers, but by teachers, through the teaching practice (Amit & Fried, 2002).

Following is a study carried out with immigrant math teachers in the Israeli public educational system. All of them had been students as well as teachers in their former culture. We describe four case studies in detail, and expound on them with findings collected from other immigrant teachers and by immigrant and non immigrant students. We do not presume that our description utilizes all the situations and problems in a cultural encounter, but the case-studies below may reflect quite precisely some aspects of mathematics education during a period in which societies are undergoing change.

### Background:

During the 1990's, about 900,000 new immigrants from the FSU, many sciences, engineering, medicine and music professionals, arrived in Israel, which had a population of about 6 million people. Israel was prepared to invest tremendous efforts to make this wave of highly professional immigration effective and productive. Whereas other countries may not hold a positive approach to immigrants, the approach in Israel was most positive (Izikovitch & Buck, 1991).



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On the assumption that math was “neutral as without value or cultural affinity”, thousands of immigrant teachers, as well as engineers successfully underwent teacher retraining for their easier adjustment to the new society and school system.” The halo of the Soviet mathematicians’ reputation contributed to the tremendous self-confidence of immigrant teachers, the expectation being their clearly immediate, successful integration. This expectation was found to be partially erroneous.

Today, over a decade later, we are able to observe and reflect on the **process of absorption** from a perspective of **mutual** influences on mathematics education in Israel. According to Berger (2003): “A large part of the immigrants’ difficulties...is a result of not knowing and not understanding the codes of the culture they are trying to settle in. Research shows that it is only after the immigrant can understand these codes, that he/she can evaluate the new culture; and only later can he/she arrive at the stage of internalizing and fitting in.” Berger’s process includes four phases of absorption that seem sequential, chronological and one-directional: understanding, evaluating, internalizing and integrating. We challenge this, as it becomes apparent in this study that there is a two-directional, interactive, non-sequential absorption process of the immigrant teacher, far more complex than that of other professionals. In the enculturation system, the teacher is by definition the keeper of the culture and the instiller of values. And herein lies the dramatic conflict of the immigrant teacher. Which culture and values is the teacher to transmit – the old ones that he/she lived and honored? Or the new ones that are not an integral part of him/her? And how will this dichotomy play out? Research literature about immigrant teachers is “rare...perhaps because the phenomenon itself tends to go against the grain: teachers are seen, at least partially, as representatives of the culture” (Elbaz-Luwisch, 2002).

In the conflict of math teachers from the FSU, there is a huge dissonance between the confidence in universal mathematic knowledge in the proved, successful pedagogical tradition they came from, and the need to prove such success and integrate into the new mathematical culture that has variations in many elements. This dissonance created cracks not only in the immigrant culture, but also in the mathematical-educational culture in Israel.

The authors of this study have been following up on this immigrant teacher absorption process during 10 years, from two aspects: One as a veteran Israeli teacher in a school where FSU immigrant teachers and students were absorbed and where her role was math department coordinator; the other as the national math supervisor in the Ministry of Education, who visited countless classes with teachers from both of the cultures in question.

**The Research:**

The aim of this research is to identify differences between two cultures of math education as they had been perceived by new immigrant mathematics teachers. The cultures are that of the FSU up to the early ‘90’s and the Israeli one during the 90’s to 2004.

Data was collected through deep semi-structured personal interviews with four teachers from the FSU, class observations, open discussions with native Israeli teachers and students, and videotaped sessions. The teachers were interviewed for about 2 hours each, fully aware that the purpose of the interview was this research.

Four interviewees’ profiles: Lena: B.Sc in Mathematics and Physics, 15 years as mathematics and physics teacher in Ukraine, teaching in Israel since 1997; Olga: B.Sc in Math and Computer Science, 2 years teaching experience in Ukraine and teaching in Israel since 1993; Bronka: M.A in Mathematics, about 15 years experience teaching in a technological college in Kyrgyzstan and



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teaching in Israel since 1995; Sasha: M.A in Mathematics and Computer Sciences, 8 years teaching experience in Moscow, immigrated to Israel in 1990, teaching in Israel since 1999. All four of the interviewees had undergone one-year teachers' retraining and certification.

### **Some Outcomes – Two Cultures**

From the analysis of the interviews and other findings, two cultures of mathematic education, differing in the most basic of elements, clearly arise. These are derived from a general culture of each of the countries – FSU and Israel – and rest on the educational-pedagogical perception in each of the applied societies differently in the math instruction process in each of the cultures.

In the country of origin, there was a strong centrality in everyday life, especially in the educational system, from the state level to that of the school and the classroom. The approach was rigid and authoritative, striving towards uniformity to the point of utter lack of choice, with an emphasis on order and discipline, and strict supervision and constant follow-up, great respect for the government, which made educational processes clear and explicit. "We knew exactly what was permitted and what was forbidden; there was order." Competitive and excellent groups were encouraged, and the teacher had a status of respect, especially the math and science teachers. Both the state and the culture placed math, sciences and technology in the highest priority, and even provided resources to attain this priority.

The immigrant teachers in Israel view their new culture as over-flexible and not centralized enough, too many choices open to students, with emphasis on great individuality and autonomy, a willing atmosphere of cooperation (as opposed to competitiveness), for providing equal opportunity for math studies for all, and to challenge and advance wide-ranging populations of all levels. Still, while the state and agents of culture significantly proclaim priority for math and science, this is not expressed in any centrality as in the FSU nor in any special resources.

Both cultures have impact in all fields of education, particularly in math. Of course, this determines the structure of schools and the grouping of study levels, teachers' rights and professional duties, as well as teachers' status. In the FSU, all elements of the curriculums were determined absolutely by the state, while in Israel there is more of a "free market" approach. Regarding learning materials, the choices and temptations are widely varied, and this poses difficulty in coping for the immigrant teacher.

An interesting example is the methods of achievement evaluation which, in the FSU, had been done every year by external bodies with pre-determined content, distributed to the teachers at the beginning of the school year. These exams presented no element of choice, and the test results determined how well both students and teachers withstood the tasks. In Israel, on the other hand, achievement evaluation seemed rather lax, in the hands of the teacher and of the school, done in writing, with large elements of choice "in order to help the students succeed in the tests." External testing was not to be carried out until high school completion, in pre-matriculation (Bagrut) exams and then, too, the students were given choices of three performance levels.

Cultural disparity was expressed also in discord or conflict right into the study topics and methods of instruction. For example, statistics as a subject was not included in the math curriculum in the FSU because math is "deterministic and explicit."

Another example, for teachers who came from authoritative approaches, was the difficulty in accepting conceptual autonomy, an investigative approach and the constructivist theory as a basis for math education, a theory so widespread in Israel during the '90's. From discussions with immigrant teachers, statements arose such as: "There we knew and succeeded at it (teaching) the right way; we know what's best for them (the students)"; "A student can not discover rules of math on his/her own;" "Why does the student have to construct concepts and procedures on his/her own?"



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We can teach them the correct ones;” “It is the role of the student to learn in any situation; he/she must practice a lot, do a lot of homework, be very organized (including in his/her notebook) and then he/she will have order in his/her mind.” “Why should a student invent... what is WRONG with a GOOD explanation?”

Immigrant teachers found it hard and even insulting to accept involvement and sometimes criticism about instruction from the students and parents, acceptable practice in many western, more open cultures. Some were forced to change basic, routine teaching methods due to language difficulties. For example, teachers who had been very verbal in their native language, to giving in-depth explanations, completely gave up on this aspect in the multi-cultural Israeli classroom, and succumbed to technique and procedures, using graphs or symbols instead. The (very erroneous) impression given was that “Russian’ teachers are strict, and prefer only mathematical symbols and technique to explanation.”

This is only the tip of the iceberg of the two differing math education cultures that clashed with each other; and we have not even begun to discuss the students (More details in the appendix, on videotaped discussions). The important question is what, if any, have been the affects of this encounter on each of the mathematics educational cultures?

### **Changes Immigrant Teachers Have Undergone:**

The final question presented in the interview was: "Based on your teaching experience in Israel, has there been any change in your views concerning the aims of mathematics education and of the ways of teaching it? The answers varied:

Sasha claimed that there had been no change in his personal views about math. However, he had trouble defining his goals in teaching math – had the notion of “order of the mind” vanished? Bronka, who confidently came from the "top of the pyramid" of mathematics education in the FSU, claimed that there had been no change in her personal view regarding the purposes of mathematics education. Lena went through a real conceptual change. She expressed her feelings, difficultly, by saying: "over there everything was clear, over here everything is unclear." She was confused about how she viewed the attitude of society towards mathematics and said: "Now I see it as being (there, in FSU) a bit exaggerated. A child that didn't do too well in mathematics was considered worthless..." Her former strong belief regarding the social importance of mathematics has begun to crack. Olga was the only one who claimed to have gone through a change of “180 degrees.” She perceived the purpose of teaching math as the opportunity to provide a useful and approachable tool for everyone. Although she grew up in the perception that math is meant for the “the bright and the very best,” she is now devoting much time and effort to finding teaching methods that simplify and make mathematics accessible to all.

Discussions with other immigrant teachers show that they are beginning to honor the social democratization of mathematical education, the ability to choose and logically conclude that everyday culture and mathematic-educational culture can no longer be separated. Some of them are even enjoying the direct relationship with the students, but all find difficulty with the *exaggerated* autonomy in the learning process, the lack of their own authority as teachers, and with the poor discipline of the students

### **Immigrant Teacher Influence on Mathematics Education Culture in Israel**

As noted before, a massive number of math teachers from the FSU were absorbed into the Israeli educational system. While many veteran teachers move on to administrative positions, most immigrant teachers remain in teaching roles and continue to contribute their abilities till today. A minority of them tended towards detachment and attempted to create parallel frameworks conducive



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to the culture of the FSU, which hardly survived, but succeeded in exposing a glimpse into the FSU mathematical culture.

There are a number of remarkable changes associated with the FSU cultural influence on mathematical education in Israel, firstly the centralizing of the achievement evaluation process, in favor of the centralized government. This started earlier in Israel than in the US and other countries, fostered in great part by the immigrant FSU cultural values perceived to be successful.

A welcome influence of the immigrant culture on the mathematic-educational culture in Israel has been the legitimization and massive encouragement of aspiring towards mathematical excellence, at high and challenging levels. Groups of “math speakers” in many schools have been formed, with the guidance of well experienced FSU immigrant teachers.

The most successful “encouragement for excellence” program in Israel is a math club called “Kidumatica – For the Advancement of Mathematics Excellence in the Negev” has been established at Ben-Gurion University of the Negev, at the initiative of one of this study’s authors. It is designed for young students with cognitive potential, many from the lower socio-economic strata. Its main aim is to build mathematical reasoning, logic skills and scientific positioning, and to develop creativity and multi-direction in solving unusual problems. Most of the club teachers are immigrant mathematicians who find this work highly gratifying, “like being here with some air from there.” Indeed the Kidumatics has pooled important elements from both the Israeli and Soviet cultures of math education and illustrates an ideological integration of both. On the one hand, Kidumatics addresses the Israeli social need to provide equal opportunity to diverse populations; on the other hand, it advances excellence in mathematics in the spirit of the FSU.

### **Conclusions and Closing Remark**

The purpose of this research was to identify differences between two cultures of math education as perceived by Israeli new immigrant math teachers from the FSU. The differences found are related to the characteristics of the two societies as well as to their educational systems. The teachers moved from a society based on hierarchy, uniformity and discipline; to a society that encourages equality, diversity, choice and autonomy; from teaching in a centralized educational system that promotes the teacher’s status, encourages personal excellence, competitiveness and dedicates many resources to education, to an educational system which allows much autonomy for teachers as well as pupils, appreciates diversity in teaching methods, while it invests much less in the field of mathematics education.

Looking back at the process of absorption (Berger, 2003), we can conclude that the teachers in this study now understand the codes of the Israeli educational culture. They are able to evaluate and, to a certain degree, even internalize it. However, these teachers are not fitting in per se, but are negotiating new codes and creating a math-education sub-culture. The nature of this new culture requires much further research.

With populations migrating from country to country in changing societies, Israel may be a case study of building a model of math education in a multi-cultural society made up of immigrants. Such a model must have some underlying principles: Respect for differences and for diversity; the aspiration for expanding cooperation and responsibility; striving for cross-cultural dialogue and creating mutual and systematical patterns of exposure to the culture *of the other*.

This last principle has extra significance in the cultural encounter. In such a situation where the absorbing group is dominant, the less dominant group should have the opportunity to present, raise and explain its values and be allowed to create a joint synthesis of the two cultures.





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Teachers of mathematics and science may further reduce authoritativeness and dogmatism by implementing a humanistic approach in teaching, by educating for openness and conceptual flexibility and through the development of human rationalism and critical reasoning.

These points of view were the motivation for this study and a reason for further research concerning resettlement of immigrant mathematics teachers.

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