

The Birth and Development of Polish Mathematical Didactics in the Interbellum and World War II Eras: Challenges and Opportunities for Inclusion in a Modern Multi-Ethnic Classroom

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Abstract

What makes the history of learning and teaching mathematics in Poland unique? Main contributors include the pre-World War II deliberate attempt by a group of mathematicians to construct a distinctively Polish *School of Mathematics*, thus promoting the importance of mathematics to the nation; several instances of highly organized underground teaching and learning, especially during World War II; the relationships between mathematicians and mathematics educators; and Anna Zofia Krygowska's pioneering work on establishing the didactics of mathematics as a scientific discipline. Here, we examine these threads, consider some places for inclusion of the ideas into our curricula (and why we should include them), describe some challenges to pursuing our goals, and, finally, argue for preserving an important place for Polish scholars and educators in the history of mathematical didactics.

Introduction

Because we make the claim that the history of teaching and learning mathematics in Poland is important to the history of mathematics generally, we offer not only reasons for this assertion, but questions that allow us to understand the inclusion of this history from both humanistic and pedagogical points of view. First of all, what exactly do we mean by 'the history of Polish mathematics'? Although there were sporadic contributions by a handful of mathematicians prior to World War I, and the nation is now full of mathematical activity by serious mathematicians and mathematics educators, what we think of as the Polish *school* of mathematics usually refers to the period immediately before World War II. Also, what makes Poland's history of teaching and learning mathematics distinctive? Poland has a long tradition of clandestine education. Further, one of the primary proponents of the didactics of mathematics as a scientific discipline was the redoubtable Zofia Krygowska, whose influence on mathematics education, the community of mathematicians and mathematics educators, and the popularization of mathematics was, perhaps, *non pareil*. In addition, one can say that the relationship between mathematicians and mathematics educators in the early twentieth century was strong. We must ask, as well, about the social, cultural, and political milieu in which Polish mathematics developed, and how these contexts influenced the developments we describe. Finally, it is necessary to ponder why the history of mathematics is important pedagogically, whether teaching it influences the learning of mathematics, and what learning opportunities can be presented to students and in what ways so as to maximize the potential for inspiring students to learn more both about mathematics and about its history. This

question may be the most difficult to address. Note that in all that follows, the term 'the history of Polish mathematics' is intended as an umbrella term that includes the history of mathematics didactics in Poland, since, at the time of interest, there was a great deal of cross-fertilization between mathematicians and many mathematics educators.

The Polish School of Mathematics

In 1911, Waclaw Sierpinski noticed that when mathematicians gathered, they enjoyed many discussions, but none concerning their research, since their fields did not overlap. He asked: why not somehow get a group of mathematicians to become involved in one field? In 1918, *Nauka Polska: jej potrzeby, organizacja i rozwój* (*Science and letters in Poland: its needs, organization and progress*) published two influential articles, one by Stanislaw Zareba, who suggested sending secondary school teachers abroad to find out about current research, and then having them return to Polish universities to teach what they had discovered, and another by Zygmunt Januszewski, who urged finding people who are talented in mathematics and having them all focus on one branch of the subject. In the following year, *Nauka Polska* published an article by Stefan Mazurkiewicz, who reviewed the 1918 articles, called for two mathematics centers in Poland, and proposed that Poland needed to recruit new talent, figure out good ways to disseminate research, and create mathematics libraries. That same year, Sierpinski, Januszewski, and Mazurkiewicz decided at the University of Warsaw that they would create a set theory research center. The next year, they established *Fundamenta Mathematicae*, the world's first specialized mathematics journal.

In Lwow, the main focus was functional analysis, and the journal established there in 1929 was *Studia Mathematica*. Although lesser known as centers of mathematical activity, other universities in cities such as Krakow, Wilno, and Poznan were not without their contributions. Additional means of developing a School of Polish Mathematics included the establishment of the Polish Mathematical Society (1919; started as the Mathematical Society of Krakow in 1917). In 1927, 1931, and 1937, the Polish Mathematical Congress was held. In this era, many distinguished foreign mathematicians visited Poland.

All was going as envisioned by Sierpinski, Januszewski, and Mazurkiewicz.

World War II

On September 1, 1939, the Nazis invaded Poland, and everything changed in the most dreadful of ways for the entire country. For the community of mathematicians, the effects were devastating: Poland lost about half of her mathematicians, to death, to sickness, to emigration, and despite the valiant efforts of clandestine educators, she lost an entire generation of *future* mathematicians and mathematics educators, either to death or lack of access to secret education. Universities, research centers, entire cities were lost. The grand future plans were, of course, abandoned. There was too much devastation, too much fear of death to continue toward implementing the great vision for Polish mathematics.

Clandestine Education in Poland

Poland has a long history of respecting the value of education, notably establishing what is believed to be the world's first ministry of education in 1773. Although the *Komisja Edukacji Narodowej* (KEN) was in existence for a mere twenty years, its focus on enlightenment thought, the openness of education to masses of people including peasants, training of teachers, and the publication of books and manuals in Polish had a lasting impression, and, indeed, one can say guided Poland through 123 years of the Partitions, six years of Nazi occupation, and 50 years of Soviet interference in Polish life and learning. Perhaps the most astonishing implementation of clandestine education was that which arose during the Nazi occupation. In 1939, the *Tajna Organizacja Nauczycielstwa* (TON), a secret organization of teachers, was formed. Clandestine education was embraced at all levels. About half of Poland's professoriate was involved in "conspiratorial instruction." Eventually, there were more than 10,000 students in clandestine universities and between 1,000,000 and 1,500,000 secret high school students; there even were underground medical, pharmacy, law, and seminary students.

Didactics of Mathematics as a Scientific Discipline

Anna Zofia (nee Czarkowska) Krygowska was an important figure in the underground who started out intending to become a professional mathematician. Her doctoral work, although started during the war, was not completed until 1950, after she had taught for twenty-three years. Her early inspiration was Wilkosz; he was interested not only in mathematics but in mathematics education. Wilkosz and as well as Otton Nikodym believed in presenting the new ideas arising in Europe as precisely and as rigorously as possible, but everything must be absolutely clear to the student. Krygowska listened intently to their message, and wanted to know the best ways of bringing so-called "school mathematics" closer to professional mathematics. During the war, not only did Krygowska study clandestinely, she organized other teachers. She traveled around Poland under the auspices of TON in order to teach mathematics and to help coordinate these secret classes. After the war, Krygowska realized Poland's desperate post-war need for schoolteachers if the nation was ever to rise from the devastation wrought by the Nazis. So many teachers were killed during the war or else unable to access whatever education was offered in secret that the education system, in addition to everything else in Poland, was in a shambles.

As time went on, Krygowska strongly believed in mathematical didactics as a scientific discipline. Many argue that she essentially created a new field of scientific questioning—the *didactics of mathematics*, which brought together mathematics, education, the methodology of science, and psychology. According to the prevailing view, mathematics can be understood by only a few bright students who will learn no matter how they are taught. Krygowska disagreed, and went on to study exactly how each student could be taught successfully. She is known particularly for this contribution, but she also was an active proponent of the popularization of mathematics, served on many

committees and journal editorial boards, and was an involved participant in national and international discussions.

Why Include the History of Polish Mathematics in Our Curricula

Let us consider the question, Why teach the history of Polish mathematics beyond Poland's borders? In a modern multi-ethnic classroom, the more contributions of various groups that we bring to students, the more they are likely to view the subject as a living human endeavor involving a multitude of nationalities. Moreover, students would be able to see clearly that mathematics is a social activity. Especially at this delicate time in American and European history, it is critical for students to understand the contributions of immigrants to their nations. Poland, in particular, lost a host of her mathematicians to emigration, especially to the United States. But what Poland lost, other nations gained. Many students may view doing mathematics as a solitary activity, and for some mathematicians, it usually is, but for many, there is a strong component of community interaction. The manner in which Sierpinski, Januszewski, and Mazurkiewicz went about building an entire school of mathematics makes clear the nature and possibility of mathematics as a community activity and the very idea of a community of mathematicians.

Most important, the development of mathematics in the period between World Wars I and II, the role of clandestine education in preserving a nation, and the development of the didactics of mathematics as a scientific discipline in the aftermath of World War II together represent a unique and uniquely inspiring episode in the history of mathematics. For this reason alone, these developments deserve at least to be mentioned if not examined in great detail.

Challenges

For a non-Polish student or scholar, many challenges stand in the way of incorporating the history of Polish mathematics into a curriculum; e.g., a lack of ability of many historians to read Polish, as well as a lack of translations of extant documents. More troubling and more difficult to fix are missing documents, not enough documentation in or for existing documents, perhaps unreliable accounts, and conflicting accounts. Especially in the United States, there is clearly a lack of attention, probably because of ethnic biases. The particular mathematics itself is very difficult, especially for students. If we intersperse this history in discussions of individual branches of mathematics, we lose the flavor of the entire Polish enterprise of building a School of Mathematics.

Finally, how do we convince writers of English language textbooks to include the history of Polish mathematics? In the United States, this writer has been unable to discover a single history of mathematics textbook that mentions the Polish School of Mathematics, the history of clandestine education in Poland, *and* the foundation by Krygowska of mathematical didactics as a scientific discipline. Perhaps at this juncture we can offer to our students only public lectures, departmental colloquia, papers and talks at conferences and meetings, papers in refereed journals and proceedings, and magazine and

newspaper articles. All are valuable, but all are extracurricular, it seems, rather than housed in a curriculum proper.

Conclusion

There are many excellent reasons to encourage the exposure of both Polish and non-Polish students to the history of Polish mathematics. These reasons include introducing students to the successful purposeful construction of an intellectual movement, enabling them to understand the history of World War II from a broader perspective than is currently offered to them, enlarging their vision of what it means for a nation to be a haven for immigrants and refugees, and helping them face and correct any biases they may harbor or may have encountered. In addition, it is possible that knowledge of this history can help students become better students of mathematics, since the cultural, social, and political aspects of the subject that frame its history can bring it to life in a way that inspires and encourages pursuit of further knowledge of that subject. Certainly, there exist obstacles to implementing any plan for the inclusion of the history of mathematics into a non-Polish curriculum. Many of these impediments, however, can be overcome with creativity, good will, continued scholarship, and more awareness in the mathematics community as well as in the general public of the singular contributions of Poles to the disciplines of mathematics and the didactics of mathematics.

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World War II was the largest and most destructive conflict in history. Learn more in this outline of key WWII dates and events. The mass murder of Europe's Jews took place in the context of World War II. As German troops invaded and occupied more and more territory in Europe, the Soviet Union, and North Africa, the regime's racial and antisemitic policies became more radical, moving from persecution to genocide. The Birth and Development of Polish Mathematical Didactics in the Interbellum and World War II Eras: Challenges and Opportunities for Inclusion in a Modern Multi-Ethnic Classroom. Emelie Kenney. Modern Mathematics: The Genesis of a School in Poland. Sr Mary Kuzawa. Grace. Personal correspondence with the author. Grzegorz Åysik. Polish Women in Mathematics. Polskie Towarzystwo Kobiet W Matematyce. 1. persons who flee for safety in time of war Holocaust 2 2. mass destruction of European Jews by Nazis during World War II refugees 1 3. a country that claims to be independent but is actually under control of another. 1. the confinement of a hostile force within existing geographical boundaries containment 1 2. a temporary alliance for some special purpose guerrilla 3 3. Spanish word meaning little war; warfare of harassment by ambushes and sudden attacks coalition 2. 1. led by Mao Tse-tung Tiananmen Square 3 2. led by Chiang Kai-shek Chinese Communists 1 3. location of government pr... This set is often saved in the same folder as World War II was a global war that lasted from 1939 to 1945. Rising to power in an unstable Germany, Adolf Hitler and his National Socialist (Nazi Party) rearmed the nation and signed treaties with Italy and Japan to further his ambitions of world domination. Hitler's invasion of Poland drove Great Britain and France to declare war on Germany, and World War II had begun. Heavy casualties sustained in the campaigns at Iwo Jima (February 1945) and Okinawa (April-June 1945), and fears of the even costlier land invasion of Japan led Truman to authorize the use of a new and devastating weapon. Developed during a top secret operation code-named The Manhattan Project, the atomic bomb was unleashed on the Japanese cities of Hiroshima and Nagasaki in early August. Against this background, in the field of research on didactics, learning and teaching it is important to overcome fragmentation and to find common ground. In this book the editors demonstrate how far we have come over recent years in advancing research in the field which has the ultimate aim of improving learning and teaching. However, in a rapidly changing society in relation to technological development, these cultures have influenced each other and we are now facing learning contexts that integrate these traditions, taking advantage of each of their strengths. This concept of integration is often described as blended learning (Garrison & Kanuka 2004). On this basis a definition of subject didactics in a modern sense is given and two of its constitutive tensions are defined.