

# What is not taught in mathematics teacher education programs?

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# Goals and Schedules

- Combining experiences
- Preparing some product
- Discussions rather than presentations

# A little bit of history

- Teacher education is a new field!
- Mathematics teacher education is a very new field!
- People have been always unhappy with the education!

## **What is worse now than before?**

- More people are needed
- Tasks are more challenging

# One example



In a letter to David Eugene Smith from 1928 that I have found in the Columbia University Archives, Dmitry Sintsov asked Smith to reply to several questions about American education “which is today very fashionable, so that anything that bears an American stamp is highly prized”, specifically, about Dalton schools. Smith responded that these schools can work only if there are great teachers. And where can one recruit so many great teachers?

# Common Core Standards

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

# One example

1. History of CPSU .....	Excellent
2. Marxist-Leninist Philosophy.....	Excellent
3. Political Economy .....	Excellent
4. Scientific Communism .....	Credit
5. Fundamentals of Scientific Atheism .....	Excellent
6. Foreign Language .....	Excellent
7. Age Physiology and School Hygiene .....	Credit
8. Psychology .....	Excellent
9. Pedagogy.....	Excellent
10. Methodology of Teaching Mathematics .....	Excellent
11. Training in Problem Solving .....	Credit
12. Mathematical Analysis .....	Excellent
13. Algebra and Theory of Numbers .....	Excellent
14. Geometry .....	Excellent
15. Probability Theory .....	Excellent
16. Applied Mathematics and Programming.....	Excellent
17. Specialized course in Modern Mathematics .....	Excellent
18. Specialized Seminar in Modern Mathematics .....	Credit
19. Seminar in the Methodology of Teaching Mathematics .....	Credit
20. Logic .....	Excellent
21. General Physics .....	Good
22. Astronomy .....	Credit
23. Physical Training .....	Credit
24. Term Project in Mathematics .....	Excellent
25. Term Project in the Methodology of Teaching Mathematics, or the Psychological/Pedagogical Cycle.....	Excellent

# Analyzing this plan of study

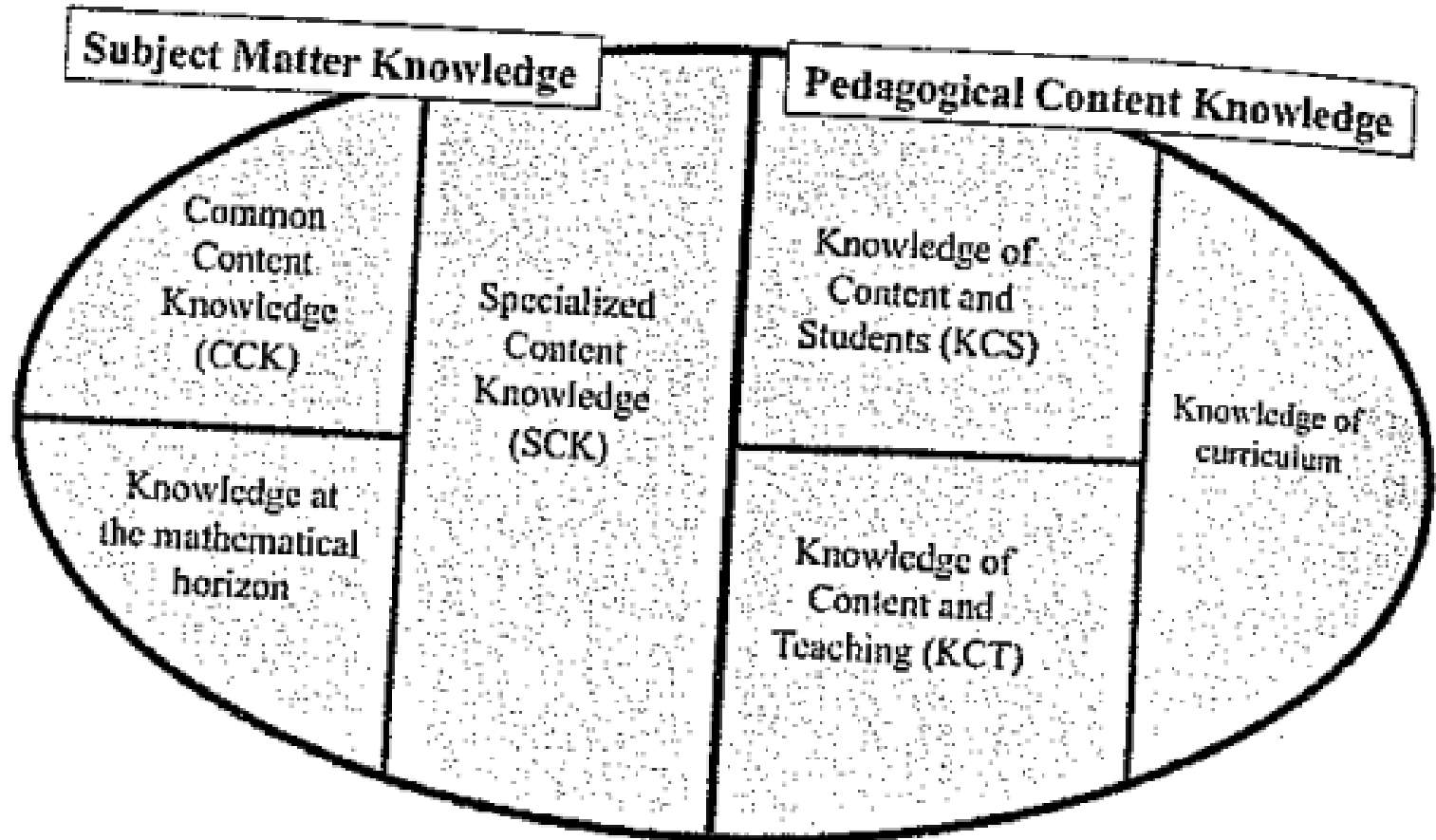
- Ideology (History of CPSU, etc.)
- Psychology and Pedagogy
- Mathematics (Algebra, Analysis, Geometry 4-5 semesters, at least 4 hours per week)
- Methods of Teaching Mathematics and Elementary Mathematics (three semesters, more than 6 hours per week)
- Student Teaching
- Other

# TC CU (Graduate school)

- Mathematics 12 points (4 courses)
- Methods 9 points (two required courses+one elective)
- Broad and Basic 9 points
- Student Teaching 4 points
- Elective 2 points
- TOTAL 36 points



# Debora Ball's scheme



# **“Double discontinuity” and damaging continuity**

Cooney and Wiegel (2003) note that “although secondary preservice teachers’ training in mathematics is typically extensive, their experiences with school mathematics are often limited to their mathematical experiences as teenagers.” (p. 804).

Their mathematical experiences as teenagers are, in turn, quite often limited to the rote memorization of various rules and guidelines for solving what is, once again, a rather limited set of problems. Even & Tirosh (1995) note that “many teachers do not have a solid understanding of the subject-matter they teach” (p.6).

# Why student teaching can't help?

Student teacher learns how to survive in school.

- 1) Typically, student teachers' major concerns are about emotional, psychological and pedagogical issues.
- 2) Cooperating teachers are not prepared to help with methods of teaching.

# Some conclusions

- Diet which lasted 4 hours doesn't count!
- Exercises in Gym once in two months do not help!
- **Developing professional mathematics teachers' skills during 4-6 hours doesn't work either!!!**

# Summary

- School mathematics is not taught
- Pedagogical content knowledge is taught insufficiently

# Ignorance is a demonic force!

Marx

What can be done?

Classics should not die!

Teacher learners should have more experiences!

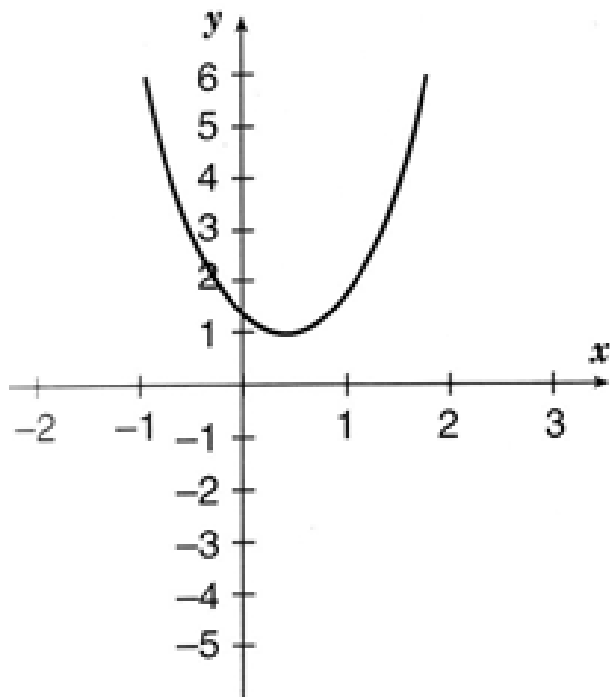
# What should be included?

- Basic topics – linear and quadratic equations/functions vs. exponential and trigonometric;
- Diverse mathematical techniques – prove, calculate, graph, guess, imagine, find an example, generalize, construct...
- Diverse mathematical representations;
- Structure of the set is the most important.

# Possible content

- Computations (including mental computations) based on applications of the properties of operations.
- Proving identities.
- Problems with linear and piecewise linear functions.  
Graphs.
- Quadratic trinomial. Investigation.
- Absolute value.
- Nonstandard equations.
- Proving inequalities.
- Problems in geometry with proofs.
- Compass and straightedge problems.
- Examples of "Olympiad" problems.





(a)  
 $f(x) = ax^2 + bx + c$   
 $a = ?, b = ?, c = ?$