Sekilas ttg Penelitian dalam Pendidikan Matematika

Pengertian Penelitian

- Cara ilmiah untuk mendapatkan data dengan tujuan dan kegunaan tertentu.
- Ilmiah mengandung arti mengandung ciri-ciri keilmuan, yakni Rasional, Empirik, dan Sistematis.
- RASIONAL artinya kegiatan penelitian dilakukan dengan cara yang masuk akal sehingga terjangkau nalar manusia

- EMPIRIS artinya cara-cara yang digunakan dalam penelitian itu teramati oleh indera manusia sehingga orang lain dapat mengamati dan mengetahui cara-cara yang digunakan.
- SISTEMATIS mengandung arti menggunakan langkah-langkah tertentu yang bersifat logis

Pertanyaan yang berkaitan dengan riset pendidikan matematika

- Apa objek yang secara khusus dapat diteliti pada riset pendidikan matematika?
- Apa tujuan riset pendidikan matematika ?
- Apa pertanyaan penelitian spesifik dalam penelitian pendidikan matematika?
- Apa hasil yang diperoleh dalam penelitian pendidikan matematika?

Objek Penelitian Pendidikan Matematika

- pengajaran matematika,
- belajar matematika,
- situasi kegiatan belajar-mengajar,
- situasi didaktis; kaitan antara pengajaran, pembelajaran, dan pengetahuan matematika;
- realitas kelas matematika, pandangan masyarakat terhadap matematika dan pengajarannya,
- atau system pendidikan itu sendiri.
- Dll.

Menurut ROMBERG

- *Mathematical learning from an association framework*
- *Mathematical learning an activity learning framework*
- *Mathematical problem solving and creative behavior*
- *Mathematics teaching*
- *The effectiveness of instructional programs*
- *The association of learning characteristics with mathematical achievement*
- *Attitudes toward mathematics, and*
- *The evaluation and measurement of mathematics achievement.*

Apa tujuan riset pendidikan matematika?

- TUJUAN PRAGMATIS. Diantara beberapa tujuan pragmatis adalah peningkatan praktek pengajaran, dalam upaya meningkatkan pemahaman dan ketrampilan siswa.
- TUJUAN UTAMA KEILMUAN. Penelitian yang dikembangkan oleh para ahli pendidikan matematika secara akademik sebagai suatu pengembangan keilmuan.

Research in mathematics education has two main purposes, one pure and one applied:

- *Pure (Basic Science) : To understand the nature of mathematical thinking, teaching, and learning;*
- *Applied (Engineering) : To use such understandings to improve mathematics instruction.* (ALAN SCHOENFELD)

Apa pertanyaan penelitian yang khusus dalam penelitian pendidikan matematika?

Pendidikan matematika terbentang melintasi berbagai disiplin ilmu, seperti matematika murni, psikologi, pedagogi, sosiologi, epistemology, teori kognitif, semiotic, dan ekonomi.

Pendidikan matematika mempunyai problematika sendiri yang tidak dapat dipandang secara kasus dan aplikasi khusus dari domain-domain disiplin ilmu tersebut.

Pertanyaan yang perlu diperhatikan adalah Jenis/macam problematik dalam pendidikan matematika. APA????

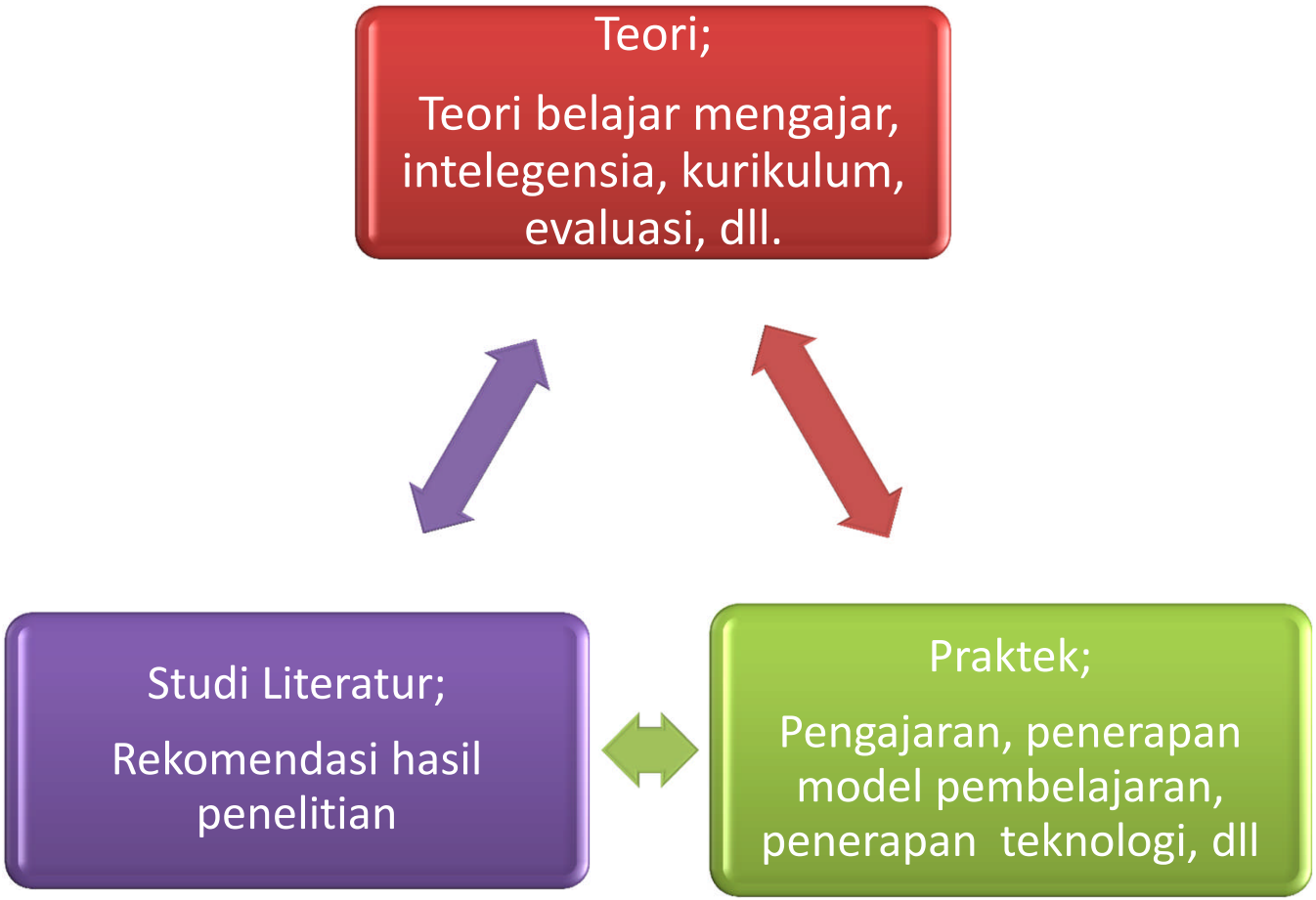
Pertanyaan penelitian pendidikan matematika diperoleh dari

Praktek Pengajaran

Misalnya:

- Bagaimana memotivasi siswa untuk belajar matematika, atau
- Bagaimana kesulitan siswa dalam mempelajari matematika
- Bagaimana Desain Didaktis pembelajaran Segitiga (sebagai contoh)

Sumber masalah penelitian menurut Ruseffendi (1998)



Creswell (1994)

- *Is the topic researchable, given time, resources, and availability of data?*
- *Is there a personal interest in the topic in order to sustain attention?*
- *Will the result from the study be of interest to others (e.g., in the state, region, nation, etc)?*
- *Is the topic likely to be publishable in a scholarly journal? (or attractive to a doctoral committee)?*
- *Does the study (a) fill a void, (b) replicate, (c) extend, or (d) develop new ideas in the scholarly literature?*
- *Will the project contribute to career goals?*

Trending topic in math ed research

Some ME research organisations

- ICMI = International Congress for Mathematis Instruction
- IGPME / PME = The International Group for Psychology of Mathematics Education
- ERME = European Researchers of Mathematics Education
- NoRME=Umbrella organization for Nordic and Baltic ME research associations
- SME = Sociology of Mathematics Education
- Etc.

Conferences to go to

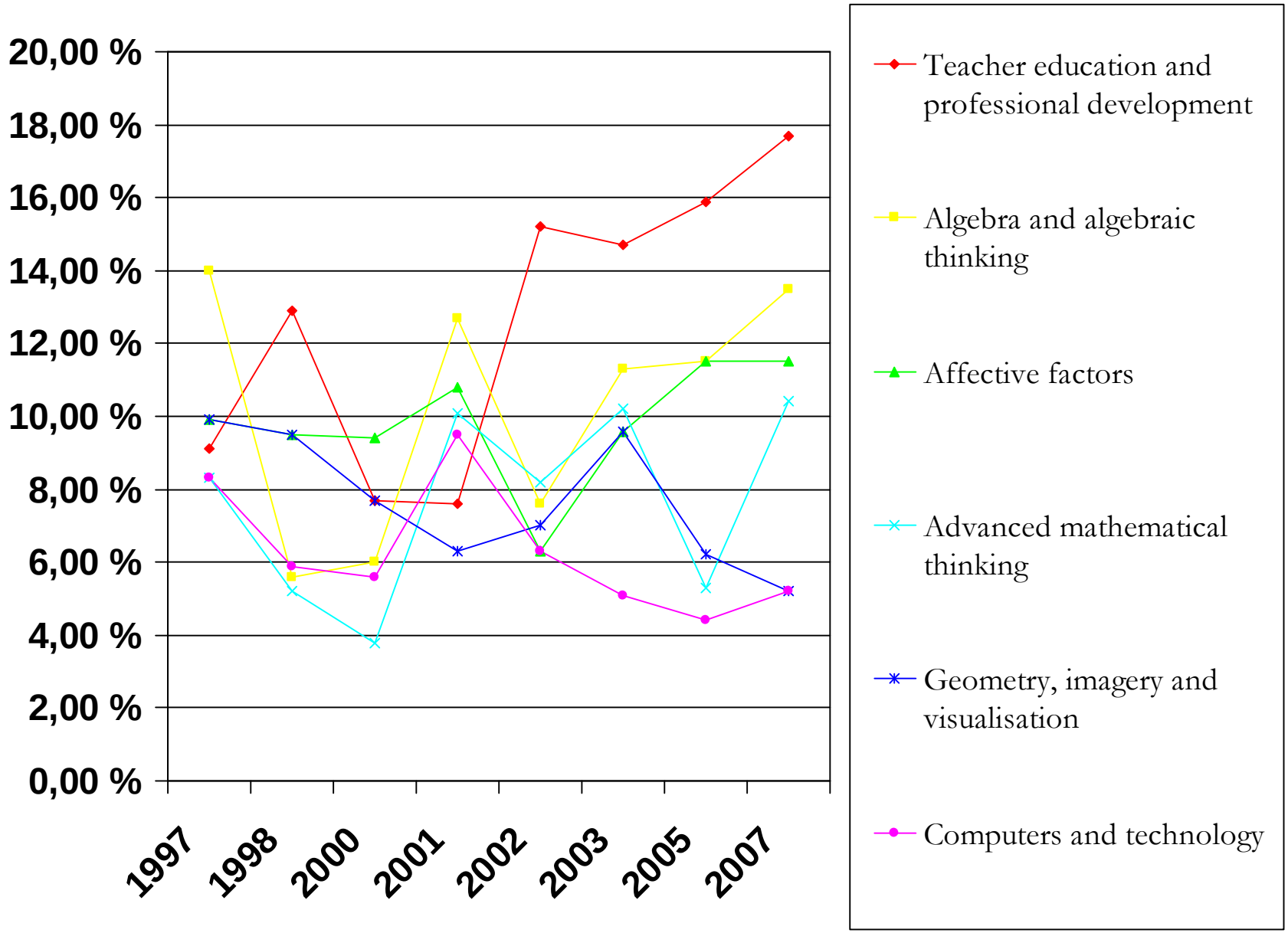
- PME (yearly in July)
- ICME (every 4 years, 2008 in Mexico)
- CERME (biannually in Europe; Jan - Feb)
- Norma (2008)
- Baltic conference
- [German mathematics conference]
- Adults Learning Mathematic
- International Research Forum on Statistical Reasoning, Thinking, and Literacy
- International Conference on Technology in Mathematics Teaching.
- EARLI
- Etc.

Journals

- **Scholarly journals: print**
- Educational Studies in Mathematics
- For the Learning of Mathematics
- Journal for Research in Mathematics Education
- Journal of Mathematics Teacher Education
- Journal of Mathematical Behaviour
- Mathematical Thinking and Learning
- Nomad
- Etc.
- **Scholarly journals: on-line**
- The Philosophy of Mathematics Education Journal
- The Mathematics Educator
- The Montana Mathematics Enthusiast
- International Journal for Mathematics Teaching and Learning
- Etc.

Trends in research topics

- Based on PME proceedings
- Author-selected categories of research
- Some changes in categories over years
- Some small categories were united with more popular ones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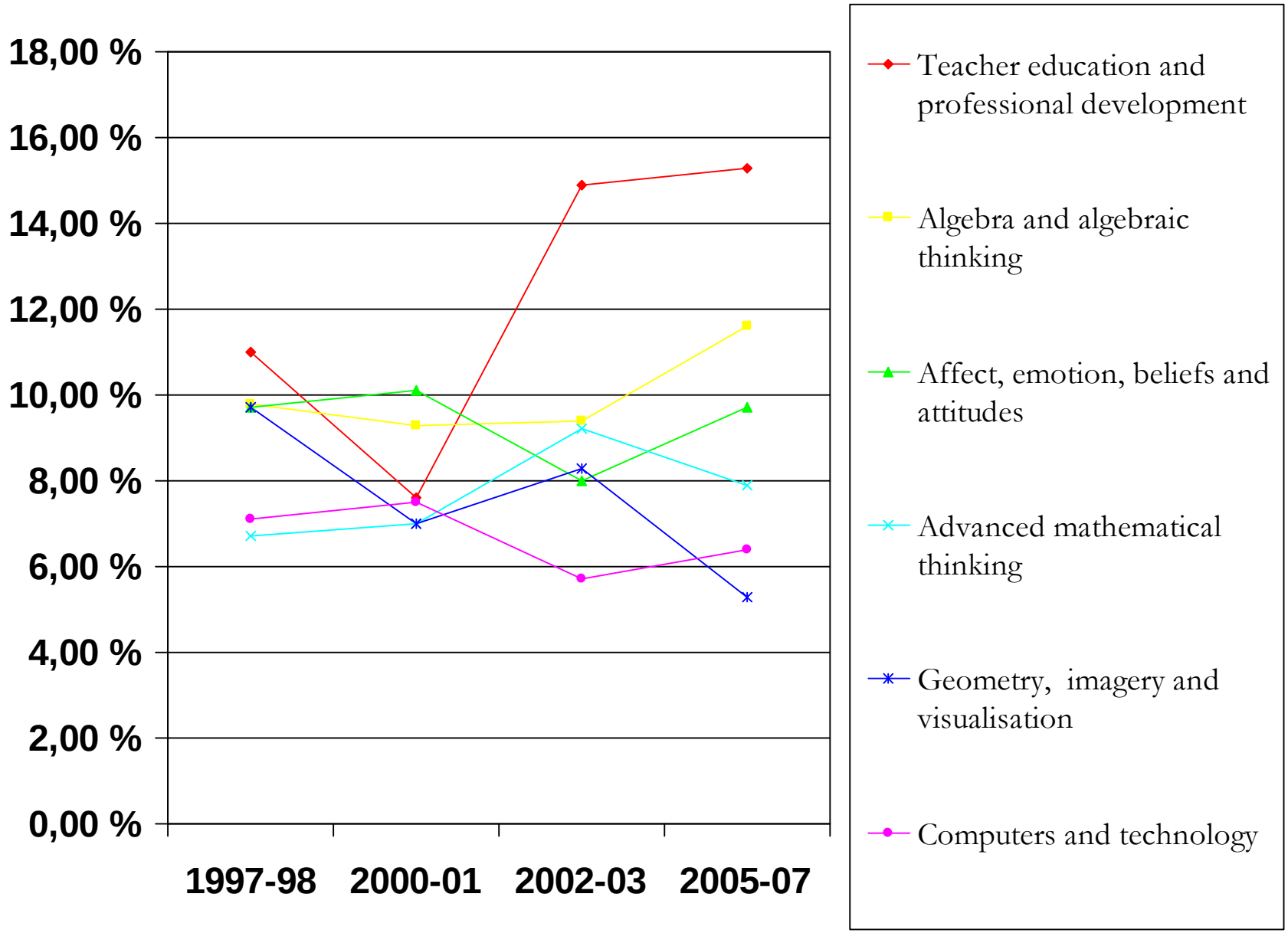
Teacher education and professional development
Algebra and algebraic thinking
Affective factors
Advanced mathematical thinking
Geometry, imagery and visualisation
Computers and technology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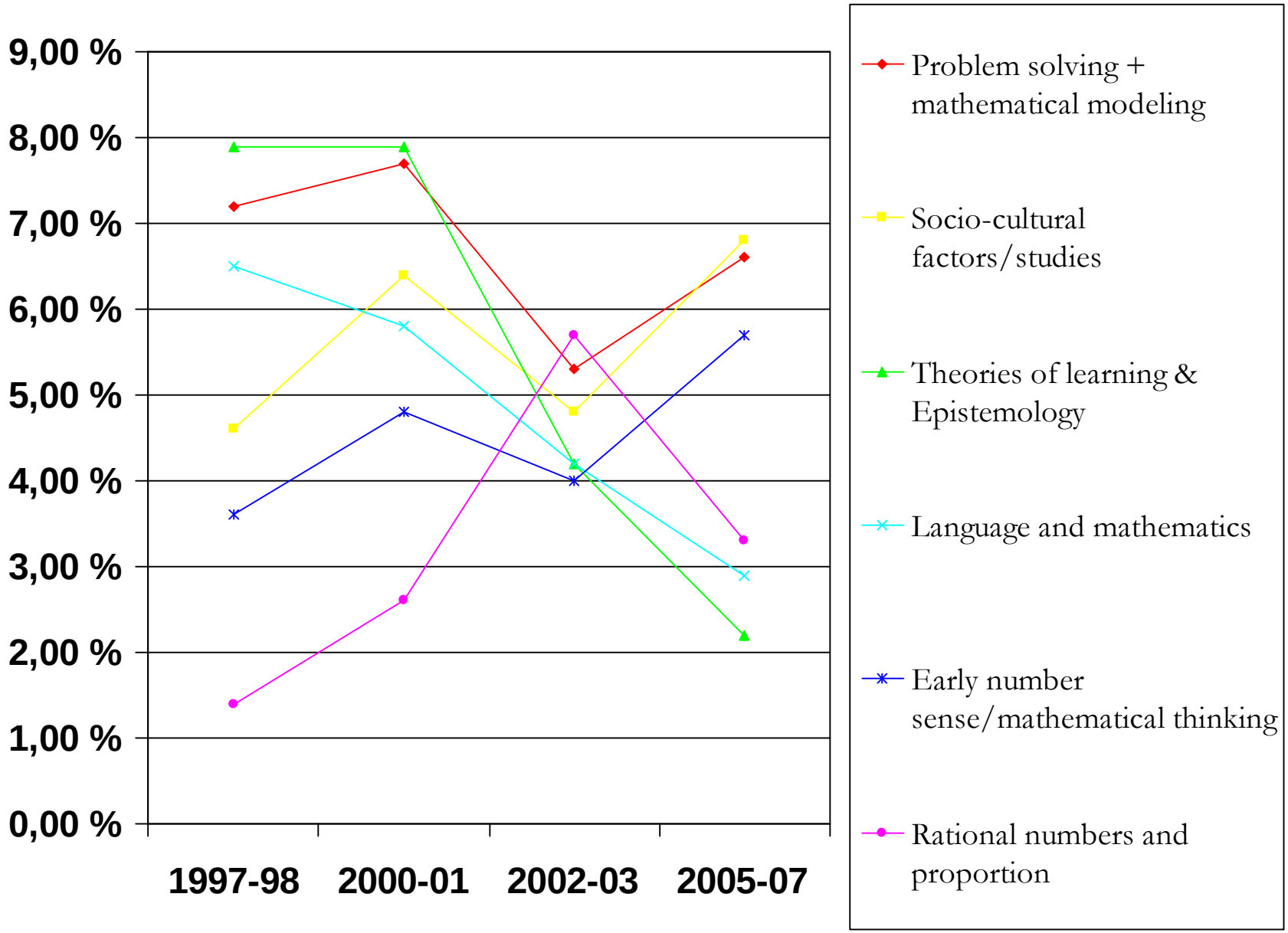
Teacher education and professional development
Algebra and algebraic thinking
Affect, emotion, beliefs and attitudes
Advanced mathematical thinking
Geometry, imagery and visualisation
Computers and technology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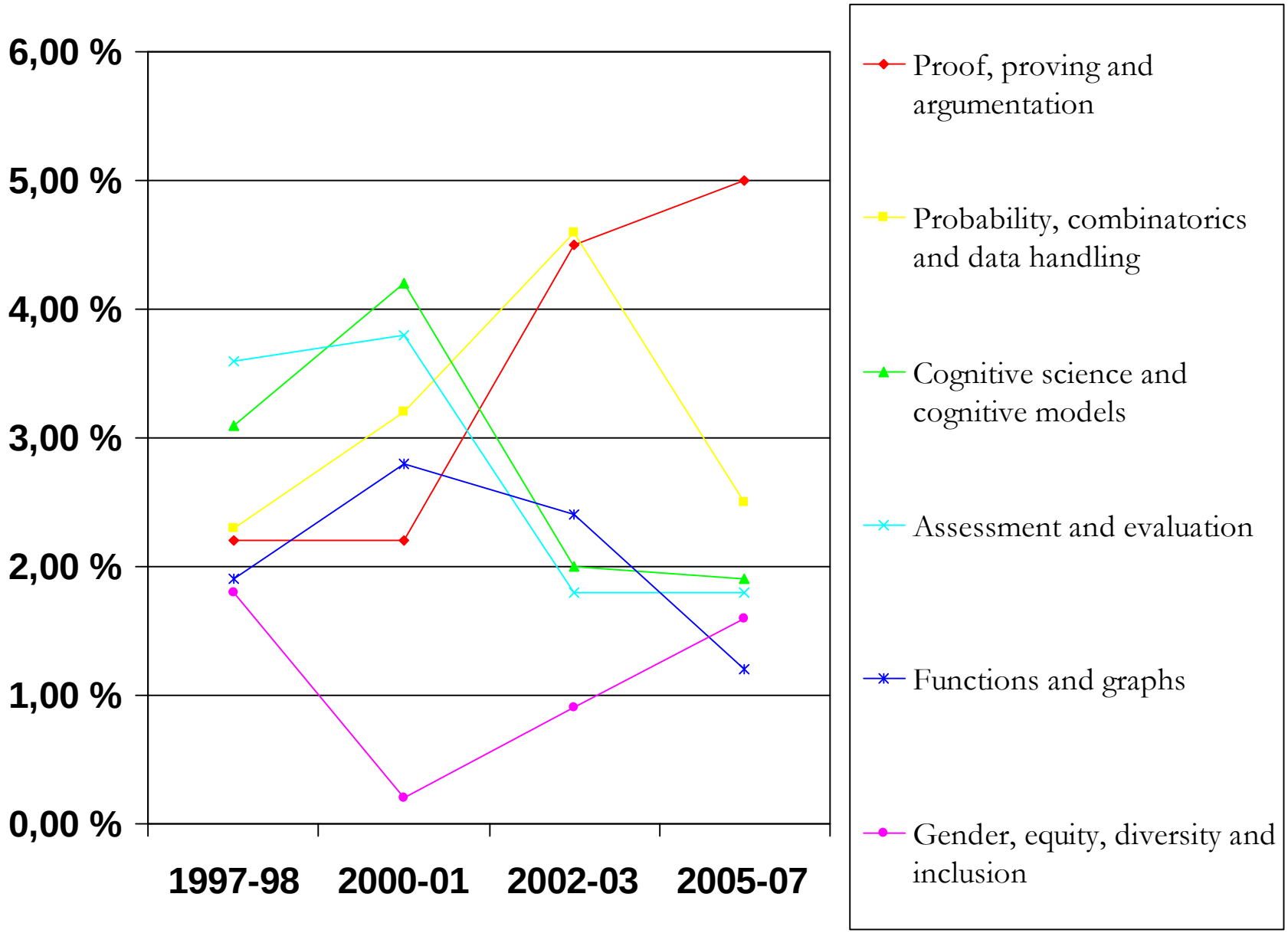
Problem solving + mathematical modeling
Socio-cultural factors/studies
Theories of learning & Epistemology
Language and mathematics
Early number sense/mathematical thinking
Rational numbers and proportion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1997-98
2000-01
2002-03
2005-07
Proof, proving and argumentation
Probability, combinatorics and data handling
Cognitive science and cognitive models
Assessment and evaluation
Functions and graphs
Gender, equity, diversity and inclusion

Topics of research, summary

- Always popular
  - Algebra, affect, and advanced mathematical thinking have remained as popular topics, each covering 8-12 % of yearly reports.
- Trendy topics
  - teaching, teachers and teacher education
  - computer tools and their influence on learning; e.g. visualization.
    - focus has shifted from students' use of technology into design of tasks and teaching sequences.
    - mainstreaming
- Retro popular
  - Proof and proving
    - as an essential part of mathematics knowledge building for all.
  - Early mathematical development.
    - focus has shifted from arithmetic and counting to teaching wider scope of contents as part of early numeracy.

Methods of research

- Emphasis in PME is in qualitative methods.
- For example, 66 % of submitted proposals in 2009 were qualitative, 23 % quantitative and 11 % theoretical.
- A notable recent change in methods is the emergence of design studies.

Design studies

- To design teaching sequence, tasks, software, …
- Research-based design
- Research of design process

The World of Mathematics Education Research

- European (diversity)
  - France: didactical engineering
  - The Netherlands: Realistic Mathematics Education
  - Eastern Europe turning to west ?
- Australia
- Canada (qualitative)
- US (math war)
- Japan (lesson studies, Problem Solving)
- South Africa (equity, language)
- Israel (strong ME community)
- Other established: Brazil, Mexico, China (American Chinese)
- Rising: Turkey, Taiwan, Korea

? Russia, Asia (India), Africa, South America

Topic-Topi lainnya yang hampir sama

Topic	Affiliation - Faculty and Dept
Mathematics and Language	FoS (Mathematics)
Undergraduate Teaching and Learning in the Mathematical Sciences	FoS (Mathematics)
Senior Secondary Teacher Development	FoS (Mathematics)
The use of technology in the teaching and learning of mathematics	FoS (Mathematics)
Transition from secondary to undergraduate mathematics	FoS (Mathematics)
Peer tutoring and cooperative learning in undergraduate mathematics	FoS (Mathematics)
Teaching and learning of undergraduate mathematics	FoS (Mathematics)
Content-based professional development	FoS (Mathematics)
Enhancing connections between university lecturers and school teachers	FoS (Mathematics)
Lecturer practice and its relationship to research interests	FoS (Mathematics)
The use of Team-Based Learning in the quantitative sciences	FoS (Mathematics)
Technology in teaching and learning mathematics	FoS (Mathematics)
Mathematical thinking and calculus	FoS (Mathematics)
Designing mathematical modelling activities	FoS (Mathematics)
Mapping mathematical conceptual growth	FoS (Mathematics)
Mathematical creativity	FoS (Mathematics)

Top

Keragaman Penelitian Pendidikan

Diversity of Educational Research

Keragaman Penelitian Pendidikan

Perspektif Penelitian

- Type is not as important as understanding the implications of a study's most distinctive feature.
- Whatever distinctive features must answer the research question
- The seven distinctions described here are as follows:

Kuantitatif VS Kualitatif

- Penelitian kuantitatif bertujuan menguji sejumlah hipotesis melalui nilai-nilai numerik (angka) daripada penjelasan phenomena yang kompleks melalui dekripsi verbal.
- Penelitian kualitatif bertujuan menjelaskan phenomena yang kompleks melalui deskripsi verbal daripada menguji hipotesis melalui nilai-nilai numerik

- Metode-metode untuk menguji teori-teori tertentu dengan cara meneliti hubungan antarvariabel (penelitian kuantitatif).
- Metode-metode untuk mengeksplorasi dan memahami makna yang - oleh sejumlah individu atau kelompok orang – dianggap berasal dari masalah sosial atau kemanusiaan (penelitian kualitatif).
- Pendekatan penelitian yang mengkombinasikan atau mengasosiasikan bentuk kualitatif dan bentuk kuantitatif (penelitian metode campuran)

- Jelasnya……(Numbers VS Words)

  Penelitian kuantitatif (*numbers*) biasanya fokus pada MANUVER STATISTIK untuk menjangkau kesimpulan, sedangkan penelitian kualititatif (*words*) biasanya fokus pada DESKRIPSI DAN POLA SECARA NARATIF dalam menjangkau kesimpulan.

Perhatikan pernyataan Teaching is a science and an art. Penelitian tentang teaching is a science merupakan kuantitatif, tetapi penelitian tentang teaching is an art cenderung kualitatif.

Deskriptif VS Inferential

- Bertujuan untuk memberikan gambaran karakteristik dari populasi tanpa pengujian hipotesis secara statistik

- Bertujuan memperoleh generalisasi untuk populasi yang luas dengan data yang dikumpulkan dari sampel populasinya.
- Ada pengujian hipotesis secara statistik

True Experimental VS Quasi Experimental

- *Research involving the use of a manipulated independent variable (an intervention) coupled of subject to groups. Such design* ***with random assignment*** *are strong for testing cause-and – effect relationship.*
- *Random Assignment: assignment of research participants to groups such that all members have an equal and independent chance of being assigned to each group*

- Research involving the use of a manipulated independent variable (an intervention) **without random assignment** of participants to groups, weakening the researcher's ability to ferret out cause – and - effect relationship.

Time Series Quasi Experiment

- Study uses an intervention or treatment without random assignment.
- Examine patterns and trends by repeated observation or measure over time. Why are such design prone to difficulties in establishing cause – and – effect connections and to rival explanations?

Causal Comparative VS Correlational

Causal Comparative

- Nonintervention research aimed at uncovering relationships by comparing groups of people who already differ on variable of interest. It uses designs that search for causes or effects of a preexisting factor of interest.
- The preexisting factor differentiates groups and permits a meaningful comparison

Correlational

- A type of non experimental research using one of several designs that measure individual differences in an attempt to uncover relationships between variable.
- Correlational findings do not imply cause-and-effect relationship, though they often uncover relationship that might be tested experimentally.

Contoh 1:

- pengujian kemampuan (achievement) matematika antara anak-anak pada keluarga *single-parent* dengan *two-parent*.
- penelitian mengukur perbandingan kemampuan penalaran matematis siswa yang bersekolah di SSN dengan siswa pada kelas yang sama yang tidak besekolah di Non SSN.
- Penelitian perbandingan berat badan siswa di sekolah yang memberikan pelajaran olah raga dengan yang tidak ada pelajaran olah raga.

Contoh 2:

- pengujian hubungan antara *pshysical exercise* dengan *grade point avarage* pada siswa SMA.
- Penelitian tentang *self esteem* siswa dikaitkan dengan skor daya pikat fisiknya.
- Penelitian tentang kaitan antara kecepatan siswa dalam menyelesaikan soal dengan skor yang dicapainya.

Single Subject VS Group

- Single research aimed at studying a single individual (or very small group) to learn more about relationship among variables or trends over time.
- Group Research aimed at studying on or more large group to learn more about relationships among variables or trends over.
- Both single-subject and group-subject investigate relationship of interest to researchers in education. Group research often yields more generalizable findings, yet single-subject research may yield very useful findings without widespread application.

Teacher VS Traditional

Teacher

- Self reflective inquiry whereby teachers study their own practice, collect data, and attempt to solve a problem or improve learning in their classroom
- Teacher research can be viewed as a type of action research (CAT)

Traditional

- Formal scientific research using accepted guidelines and integrated process aimed at testing hypothesis
- Strived toward theory building and generalized knowledge
- Relative free from bias

Contoh Teacher research

- Mrs. Rahmy wondered whether cooperative learning strategies would help students learn about division fractions. She arranged for her third math class to complete the exercise sheets while working together in group of four or five students. She compared their final test scores with those of her fourth period “control” group that worked on the exercises individually. Because the cooperative group did so well, She took “action” and used cooperative learning strategies in her other math class.

Contoh traditional research

- In order to test the effectiveness of computer-assisted instruction in physics (develop from generative models of learning), 60 schools were selected to use the courseware for 1 year. A randomized control group of 60 schools which used traditional “talk and chalk” methods was used as a comparison.

Large-Scale Policy VS Small-Scale Evaluation

Large-Scale Policy

- Research using large data sets (often standardized measured) with the intention of shaping public policy and influencing reform
- The type of research is associated with organizations designed for this task and requires ample funding.
- The data collection is massive, the analysis is complex, and the public policy implications are often dramatic

Small-Scale Evaluation

- Research aimed a evaluation local programs or procedures for the purpose of improvement or decision making

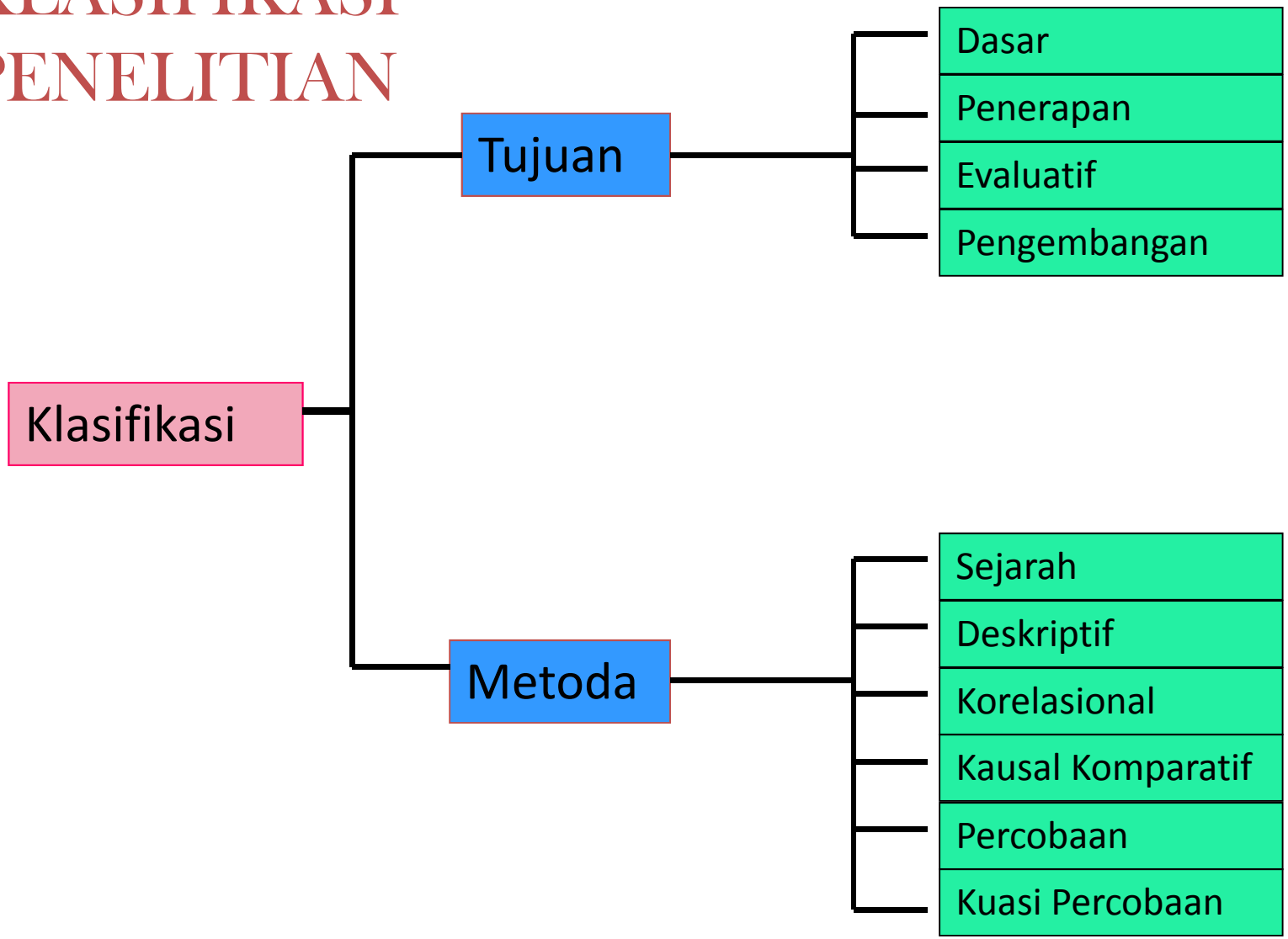
Contoh Large-Scale Policy

- Researchers used National Assessment of Educational Progress (NAEP) data to compare the white-minority gap in achievement over the past years in 20 large urban districts
- Researchers sampled 400 charter schools (and 12,000 students) in seven western states and compared their reading achievement gain to a matched sample in non charter public schools

Contoh Small-Scale Evaluation

- Researchers at a local high school compared students going –to-college rate before and after implementing a new program that centered on students visiting local colleges during their senior year.
- Researchers at a local middle school surveyed students to learn more about their reactions to a longer day but shorter week school schedule

KLASIFIKASI PENELITIAN



Apa hasil yang diperoleh dalam penelitian pendidikan matematika?

- Hasil penelitian adalah relatif thd permasalahan dan kerangka teoritis yang mendasari, serta thd metodologi yang digunakan.
- Ada dua tipe 'temuan' dalam pendidikan matematika, yakni temuan yang didasarkan pada pengamatan dan pengalaman jangka panjang, dan temuan yang diperoleh dari hasil penelitian (survey).

Kriteria yang digunakan untuk mengevaluasi hasil penelitian pendidikan matematika.

- ✓ Klarifikasi makna dari istilah-istilah seperti kebenaran, keilmiahan, validitas, metodologi, dan relevansi dalam konteks pendidikan matematika.
- ✓ Masalah lain yang berkaitan dengan pengetahuan (dalil) yang diperoleh.

Karakteristik Tesis

- Berfokus pd kajian satu isu sentral dalam ilmu pendidikan atau dalam satu disiplin ilmu, sesuai dengan program studi yang ditempuh mhs.
- Merupakan pengujian empirik terhadap posisi teoritik ttt dalam ilmu pendidikan atau dalam disiplin ilmu yg dipelajari.
- Menggunakan data primer sebagai data utama dan ditunjang oleh data sekunder, untuk penelitian bibliografi, digunakan sumber yg otentik.
- Ditulis dlm bhs Indonesia, EYD.
- Bobot SKS 8

Perbandingan Karya Ilmiah

PERBANDINGAN JENIS KARYA ILMIAH

NO	KARAKTERISTIK	JENIS KARYA ILMIAH			
		MAKALAH	SKRIPSI	TESIS	DISERTASI
1	Bagian Studi	Mungkin ya	ya	ya	Mungkin tidak
2	Keketatan Bimbingan	Tidak ada	ya	Mungkin tidak	Mungkin ya
3	Tebalnya Isi	Bias beberapa halaman	50 – 100 halaman	50 – 150 halaman	50 – berseri
4	Karya Ilmiah	Mungkin ya	ya	ya	Ya
5	Karya Penelitian	Mungkin ya	ya	ya	Ya
6	Kontribusi thdp Pengembangan Ilmu	Mungkin tidak	ada	besar	Besar sekali
7	Kedalaman Pemecahan Masalah	Mungkin dalam	Dangkal	Sedang	Dalam
8	Karakteristik Populasi	Tidak ada	Cukup jelas	Jelas	Akurat
9	Pemilihan sampel dan ukurannya	Tidak ada	Sempit	Cukup mewakili	Akurat & besar
10	Studi Literatur dan Banyaknya Sumber	Mungkin ada	Sederhana & beberapa	Teliti & cukup Banyak	Teliti & banyak
11	Instrumentasi	Tidak ada	Agak teliti	teliti	Teliti sekali
12	Kondisi Distribusi Populasi	Tidak ada	Sebagian asumsi	Sebagain besar diuji	Semua diuji
13	Ukuran Statistik	Tidak ada	Cukup tepat	tepat	Sangat tepat
14	Validitas Internal	Tidak ada	Asumsi dikontrol	Sebagian dikontrol	Dikontrol
15	Validitas Eksternal	Tidak ada	Asumsi dikontrol	Sebagian dikontrol	Dikontrol
16	Generalisasi	Tidak ada	Sempit	Sedang	Luas
17	Penemuan Teori/Dalil Baru	Tidak	Tidak perlu	Tidak wajib	Wajib ada
18	Pembimbing/Penasehat	Tidak ada	Paling rendah Lektor, magister, dan ahli dalam bidangnya	Paling rendah Lektor, Doktor, dan ahli dalam Bidangnya	Penasehat Guru Besar, Doktor, dan ahli dalam bidangnya

Sumber : Ruseffendi (1998)

Semoga bermanfaat

Terima kasih