

Research methods in educational science

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Content

- Characteristic of educational science research
- Some research designs
- Quantitative or qualitative methods or mixed-methods?
- Collecting (qualitative) data
- How to analyze qualitative data?
- Quality in qualitative research

Some characteristic of educational science research

- Object of the study:
 - students' understanding/perception of X, performance in the class, actions students take to get a passing grade, curriculum
- Aim of the study:
 - To have e.g. social or institutional impact, understand phenomena, test new ideas, add to the knowledge base, predict ...
- Aims at looking at the object of the study in its context, as a part of its environment.
 - Thinks that people have to be studied in their natural settings → experimental studies (in lab environment) do not work (but quasi-experiment designs might!)
 - Context may change over in the course of time

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- Different interpretations of the situation are possible
 - Since studies involve people, ethical aspects are extremely important
 - Attending the study must be voluntary for subjects
 - Subject are treated with respect
 - It is possible/sometimes desirable that subjects take part in the study (e.g. Action research)

Some research designs

Group 1:	O_1	X	O_2
Group 2:	O_1		O_2
Group 3:			O_2

Group 1:		X	O_2
Group 2:			O_2

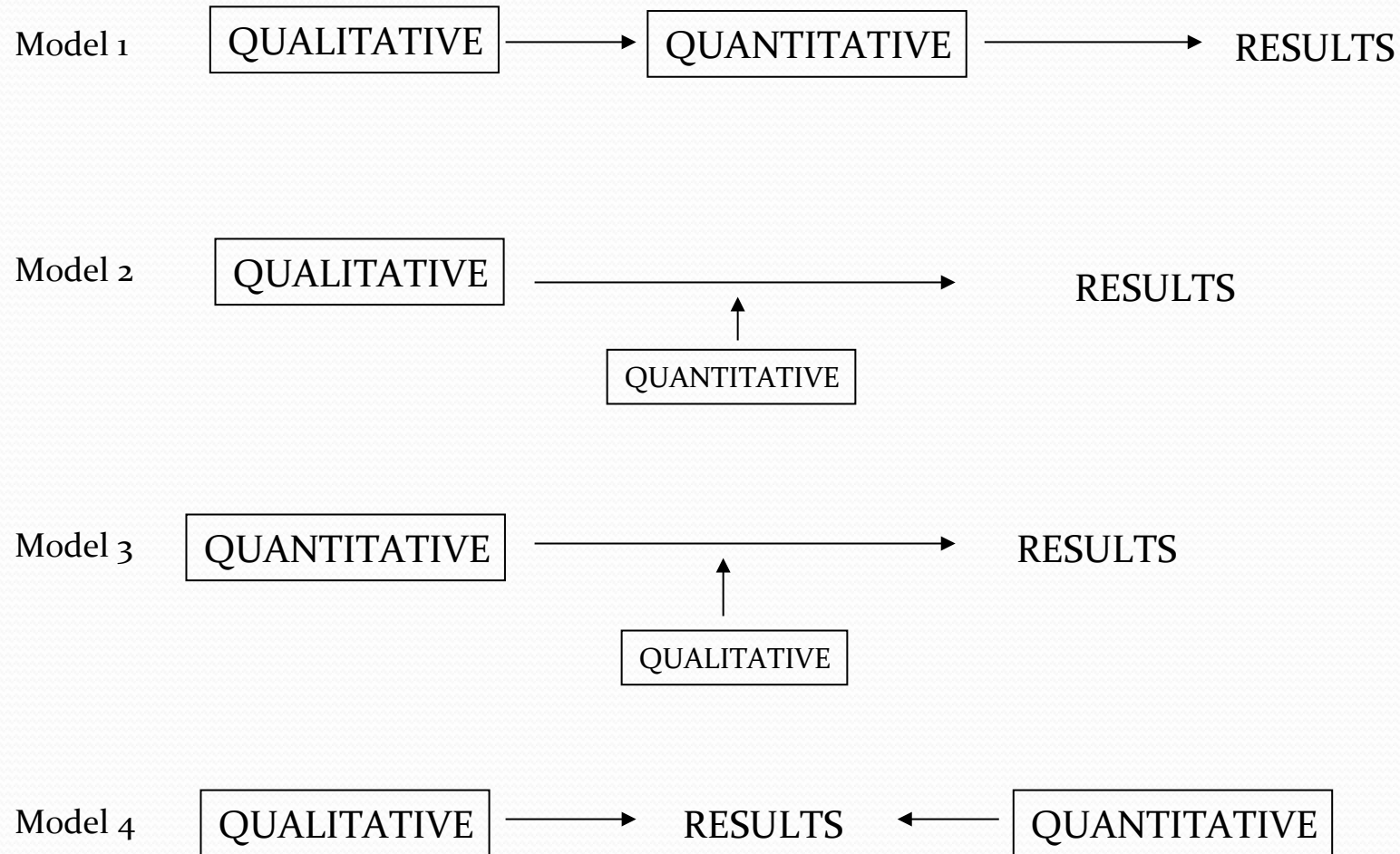
Group 1:		O_2
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Group 1:	O_1	O_2	O_3	X	O_4	O_5	O_6
Group 2:	O_1	O_2	O_3		O_4	O_5	O_6

Quantitative or qualitative methods?

- Your research question will give you some idea, which approach could help you to find the answers
 - Do you want to:
 - Find a causal law
 - Get a rich insight into how students understand/experience something
 - Find a concrete solution to some problem at your class/university
 - ...
- Has your topic been studied a lot previously?

Different kinds of mixed-methods procedures



Three examples of mixed research

Meisalo, V., Sutinen, E. & Torvinen, S.: Choosing Appropriate Methods for Evaluating And Improving the Learning Process in Distance Programming Courses. The 33rd ASEE/IEEE Frontiers in Education Conference, FIE 2003, November 5-8, 2003, Boulder, CO, USA.

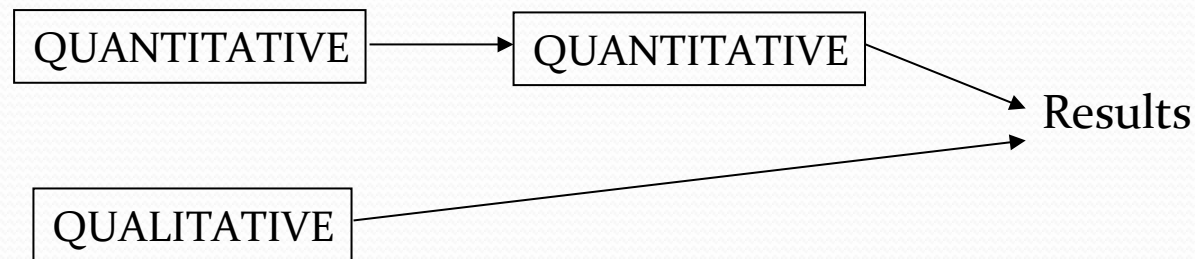
Setting: High school students study first-year university level studies in CS over the web. There are some problems at the course and some student drop out.

Aim of the study: Ascertain the difficulties in learning programming in a virtual learning setting. Evaluate the study process in the course and improve the course



Methods that were used:

- Quantitative:
 - Statistical analysis of submitted exercise
 - Exam scores
 - Analysis of closed questions in questionnaires
- Qualitative:
 - Analysis of open questions in questionnaires
 - Interviews, observations, tape recordings and field notes
 - Analysis of the feedback given by students and tutor teachers
 - Written products: quality of submitted exercises
 - Result of examinations



Meisalo et al. conclude that qualitative methods were essential when it came to explain the quantitative findings:

- data collected by questionnaires posed new questions that required qualitative methods



Example 2

P. Kinnunen, L. Malmi, Problems in Problem-Based Learning - Experiences, Analysis and Lessons Learned on an Introductory Programming Course. *Informatics in Education*, 4 (2), 2005, pp. 193-214.

Setting: University students study programming (CS1) in a tutorless PBL group. Some groups work well and gain good result and others have difficulties.

Aim of the study: To find out what makes some groups work well and other not. What could be done to help all groups to work efficiently.



closing session

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	6	2	0	2	2	0	0	0	0	0	47	0	2
2	4	6	2	0	18	0	0	0	0	4	14	6	4
3	0	2	0	2	102	2	30	2	0	12	18	4	8
4	0	2	2	0	2	0	0	0	0	0	0	0	0
5	0	22	108	0	55	2	14	0	4	0	57	2	8
6	0	0	6	0	0	4	0	0	0	0	0	0	0
7	0	0	8	0	8	0	18	49	0	2	4	0	0
8	0	0	26	0	12	0	10	8	2	0	6	2	4
9	0	2	0	0	0	0	4	0	0	0	0	0	0
10	0	4	10	0	0	0	2	2	0	0	4	0	4
11	47	14	18	0	57	0	4	6	0	4	0	0	0
12	0	0	0	2	6	0	6	0	0	2	0	24	2
13	4	4	2	0	10	2	2	2	0	2	0	4	2
	61	57	181	6	272	10	89	69	6	26	150	41	33



ranking	Group	CCR	PE	IT	ITC	sum
1	A	1	1	2	4	8
2	B	4	2	3	2	11
3	C	3	8	1	1	13
4	D	2	7	4	3	16
5	E	5	3	5	5	18
6	F	6	4	6	6	22
7	G	9	5	7	7	28
8	H	7	6	9	9	31
9	I	8	9	8	8	33

Questionnaires

Grades


Interpretation

Example 3

Kinnunen, P. & Malmi, L. (2008). CS Minors in a CS1 Course. *Proceedings of the fourth international workshop on Computing education research (ICER'o8)*, September 6–7, 2008, Sydney, Australia. Pp. 79-90.

Kinnunen, P., & Malmi, L. (2006). Why Students Drop Out CS1 Course? *Proceedings of the second international workshop on Computing education research (ICER'o6)*. Canterbury, UK. Pp. 97-108.

- Setting: Around 40% of the students who enrolled in an introductory programming course (CS1) dropped out of the course.
- RQ: Why do students decide to drop out of the CS1 course?



Approach	QUANTITATIVE →	QUALITATIVE →	QUANTITATIVE + qualitative
Data collection method	Questionnaire	Interview	Questionnaire with some open questions
Goal	To get an overview, to map out some possible reasons for dropping out	To get an insight into some students' experiences at the course	To see if the reasons for dropping out apply to a larger

” → ” stands for sequential, “+” stands for concurrent, capital letters denote high priority and lower letters denote lower priority.

Collecting (qualitative) data

- Good quality data → there is a possibility to do a high quality study.
 - Bad quality data → you will suffer at each phase of your research project.
- Pay attention: prepare and conduct data collection with care
- Learn how to interview, observe, construct surveys before collecting your data
 - Test your interview protocol, observation sheet, questionnaire



Interviews

- Interviewing one person – group interview
- Interviewing the person once – interviewing the same person several times on the same/varying topics
- Structured interview – semi-structured interview
open interview
- Do you use material that might help the interviewee to remember the situation better (e.g. Videos of the class, submitted assignments ...)

Observation

- Observer does not attend the activities – observer attends the activities
- Do the people who are being observed know that somebody observes them? – ethical issues!
- What do you observe?
 - What to include/exclude
 - Structured/semi-structured/open observation sheets
 - What is your observation unit




How to analyze qualitative data?

- Qualitative data is often very rich and there tends to be a lot of it
1. Look at your research question. What do you want to ask from your data? → decide on the the analysis procedure
 2. Prepare the data for analysis (transcribe audio files into a text, re-write your various field notes ...)
 3. Get to know your data well = read through your data several times, write down initial observations

Content analysis as an example of an analysis

- Qualitative(/quantitative) content analysis
- Three options: Theory based – data based – theory and data based
 - Theory based
 - previous studies and theories provide you categories

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- Data based (if no previous studies/theories are available):
 - Read data several times
 - Prominent themes emerge from the data → preliminary categories
 - Continue reading your data again and again → add new categories/add dimensions to the existing ones
 - Test your categories against the data. Look for cases that contradict your categories.
 - Make the connections between the categories (concept maps, tables ...)

Categorizing, looking for themes and types

- Categorizing data
 - male- female, positive-negative answers ...
- Looking for themes
 - what are the common themes that emerge from the data (e.g. Which aspects of phenomena X many interviewees talk about)
- Looking for types
 - Authentic type
 - Type that combines elements from several cases
 - Wide-ranging type

An example: a study on people who eat at the university canteine

Categorization

- Positive/negative responses
- Male/female responses
- Student/personnell
- You can get:
 - Frequences of responses/category
 - Trees with main and sub-categories
 - Mind maps

Themes

- What themes the interviewees brought up when they talked about their experiences?
- E.g. Taste of the food, price, cleanliness of the canteine, variety of the menu, number of options on the menu ...

Types

- Looking for canteine user – types?
- Culinarist: taste of the food is the most important, variety of the menu also plays an important role
- Social eater: appreciates cozy environment and big tables, wants to spent time at the canteine, taste of the food is not so important
- Picky eater: has several restrictions on her diet, appreciates clear notations on the menu (contains what, nuts...)

Some aspects of quality of a qualitative research

Correspondence

- Results and conclusions correspond/are related to the original phenomena.

Transferability

- Results can be used to understand slightly different kind of phenomena if the context is similar enough with the original context.

Stability of the results ("reliability")

- Have researcher's data collection and analysis skills evolved during the research process (e.g. Did you conduct the first observation the same way you conducted the last one?)
- Has the situation/phenomenon/context changed considerably during the time of data collection? What was the context like when you did your first/last observation?

Transparency:

- The research process has been described in detail. The reader can get a picture of the context and can follow the authors' reasoning.

Evocativeness

- Results make the reader to think about the phenomena differently/from a new viewpoint.

Theoretical validity

- Are the theoretical inferences you make based on your data?

Workability

- Can you use the results for something? How results are being used by readers?

Thank you for your interest!

Some useful readings:

- Johnson, R. B. & Onwuegbuzie, A. J. (2007). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, Vol. 33, No. 7, pp. 14–26.
- Heikkinen, H., Huttunen, R. & Syrjälä, L. (2007). Action research as narrative: five principles for validation. *Educational Action Research*, 15(1), 5–19. Doi: 10.1080/09650790601150709
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- Johnson, B., and Christensen, L. (2004). "Educational Research. Quantitative, qualitative, and mixed approaches." 33(7), 14-26. Jungert, T. (2008). "A longitudinal study of engineering
- Cohen, L., Manion, L., and Morrison, K. (2000). *Research Methods in Education*, London: Routledge Farmer.