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Insights on Research-Driven Teaching and Learning

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Abstract: The data of a survey in 2021 completed (preliminarily) by 220 teachers is analyzed to shed light on these issues: Which individual experiences for students are seen as essential in the academic setting to foster research-driven learning? What kind of effort do teachers put into their teaching approaches and what activities do they integrate into their teaching methods? Via factor analyses significant distinctions between teaching approaches and expectations of teachers towards students' learning were found. Furthermore, multiple regression models reveal correlations between teachers' activities and attitudes and what students should experience in their course.

Paper:

1. Introduction

Higher education teachers often develop formats of learning independently, partially following conventions, partially according to individual preferences. Trigwell and Prosser (2004) investigated teachers approaches empirically via questionnaire that distinguished student-centred and teacher-centred approaches. Likewise, Visser-Wijnveen et al. (2016) scrutinized how students perceive research integration in their courses. We used a questionnaire with similar items, adjusted to the institutional context, and analyzed general patterns what kind of teaching was used to create which effect in students' learning.

2. Design and methods

Surveys completed by 220 teachers [at university] in 2021 are the basis of our analyses. The study via online questionnaire is still running. Nevertheless, the data already available reveal preliminary results to identify potential for insights into teaching approaches. The questionnaire includes various didactic elements how student-centred or teacher-centred courses are designed and how elements of scientific research and inquiry become part of higher education. Furthermore, expectations towards students' learning and how they benefit from a particular teaching approach were assessed.

2.1. Teachers' responses to what students do or should do

Via explorative factor analysis, five factors could be extrapolated to reveal different strategies to foster students' learning. Table 1 shows the selected items towards students' learning the survey

contained and the results of the rotated factor analysis, which has an explained variance of 67.01 percent.

Table 1. Preliminary five-scale-structure of factor analysis of teachers' strategies to foster students' learning

Factor 1 can be interpreted as **"discovering"** including facets of independent learning. **Factor 2** encompasses **"discussing"** research results and problems as well as "developing" research questions and "exploring" insights into research. **Factor 3** contains items of **"understanding"**. **Factor 4** emphasizes learning as **"problem-solving and practicing"**. **Factor 5** highlights **"basic knowledge"**. Since the survey has not yet expired, the factor analysis is not yet revised. Thus, it is shown that the preliminary results are already useful to excavate relationships in teaching and learning as teachers perceive it in their practice.

2.2. Teachers' responses concerning their own teaching

Via explorative factor analysis, six factors were extrapolated on items concerning teachers' approaches to teaching, which didactic elements they actually used, what they find important, and to what issues they paid attention.

Table 2. six-scale-structure of factor analysis of teachers' approaches to teaching

Factor 1 includes items that highlight teaching as **"showing"** in relation to current research results, examples of research as well as raising attention to current research topics and critical reading. **Factor 2** encompasses teaching activities that relate to encouraging students to be ready to ask questions and to be open to experience **"conceptual change"**. **Factor 3** can be interpreted as a form of **"pinpoint" teaching and learning**. Items focus on formal assessment, textbook knowledge, and teaching as having answers to all of students' questions, of matching content to learning objectives. **Factor 4** includes items that indicate that the teacher pays attention to the **"students' level of knowledge and capacity"** and wants to enthuse them about the subject matter. **Factor 5** revolves around **"basic knowledge"**. **Factor 6** points at **"involving students**" into one's own work of research.

To explore which approach predicts that the teacher wants to foster a certain way of students' experience, multiple linear regression models were analyzed. As the dependent variable the results from the reported principal component factor analysis with its five-scale-structure were used sequentially. In an exemplary way, two separate regression analyses are selected that show the variation of teachers' approaches integral to their teaching.

Starting with the factor 3 that students should experience **"understanding"**, table 3 shows that via multiple regression analysis, the following predictors can be determined: Teachers preferring an **"understanding"-** approach for their students' focus on **"students' level of knowledge and**

capacity", on **"pinpoint" teaching and learning ,** on **"conceptual change"** and on **"showing"**. They also consider "**basic knowledge"**, but they do not involve students into their own research . The explained variance of this model is 53.3 percent (R^2=.533).

Table 3. Results of multiple linear regression analysis related to the factor "understanding" (N = 199)

Table 4. Results of multiple linear regression analysis related to the factor "discovering" (N = 199)

A multiple linear regression analysis of the teaching objective "discovering" was also conducted by analyzing the same factors as predictors (see table 4). A slightly negative significant correlation can be found with the factor "basic knowledge". Teachers prefer their students to discover something, focus mainly on "conceptual change". However, the explained variance of this model is very low with 17.0 percent (R^2=.170).

Equivalent analyses are conducted with data from the parallel students' survey so that students' perspective can be compared to the teachers' point of view.

References: Table 1. Preliminary five-scale-structure of factor analysis of teachers' strategies to foster students' learning

	Factor				
Variable	**1**	**2**	**3**	**4**	**5**
I think that it is important that students discover something independently	.807	.	.	.	.
I think that it is important that students try out something for themselves	.788	.	.	.	.
I think that it is important that students follow own questions	.713	.	.	.	.
I think that it is important that students make conjectures concerning the subject matter	.621	.	.	.	.
I think that it is important that students become familiar with research methods	.601	.	.	.	.
In my class, students discuss research results	.	.817			
In my class, students develop scientific research questions	.	.788	.	.	.

In my class, students discussing problems	.	.719	.	.	.	
In my class, students try out methodical conceptions	.	.599	.	.	.	
In my class, students explore interrelationships of a particular field	.	.584	.	.	.	
I think that it is important that students experience vividly the subject matter	.	.	.738	.	.	
The students understood exactly what I expected from them	.	.	.706	.	.	
I think that it is important that students learn the systematic structure of the subject matter	.	.	.699	.	.	
I think that it is important that students can make sure that they understood the study matter	.	.	.662	.	.	
I think that it is important that students can learn at their own pace	.	.	.426	.	.	
Students receive problem-solving tasks	.	.	.	.858	.	
Students memorize what they have learnt by practising it	.	.	.	.852	.	
Students acquire basic knowledge	.	.	.	.	.823	

Source: own elaboration based on data from 2021.

Table 2. six-scale-structure of factor analysis of teachers' approaches to teaching

	Factor					
Variable	**1**	**2**	**3**	**4**	**5**	**6**
I showed students how to familiarize themselves with research results	.872	.	.	.	.	.
I showed students on what to concentrate when they conduct a research project	.837	.	.	.	.	.

I showed students what was discovered by research	.828	.	.	.	.	.
I referred to current research results	.825	.	.	.	.	.
I used examples of research for an illustration	.808	.	.	.	.	.
I made students pay attention to current research topics	.775	.	.	.	.	.
I encouraged students to read scientific literature critically	.695	.	.	.	.	.
I pointed out what scientists view critically	.681	.	.	.		.
I raised/reinforced students' interest in scientific research	.633	.	.	.	.	.
I classified research approaches historically/systematically	.617	.	.	.	.	.
I involved students into the research culture at my institute	.594	.	.	.	.	.
I encouraged students to ask critical questions referring to our research	.542	.	.	.	.	.
I encouraged students not to be satisfied immediately with one explanation	.	.802	.	.	.	.
I taught students how to begin by asking a lot of questions	.	.668	.	.	.	.
I encouraged students to participate actively in scientific discussions	.	.620	.	.	.	.
I posed questions of thoughts	.	.616	.	.	.	.
I encouraged students to change their conceptions of the content	.	.569	.	.	.	.
I concentrated on content that suits for formal assessment	.	.	.765	.	.	.
I concentrated on content that could be in a good textbook	.	.	.660	.	.	.
I think it is important that I always have an answer to students' questions	.	.	.621	.	.	.
I think it is important that teaching content matches with learning objectives	.	.	.569	.	.	.

I illustrated the subject matter by means of examples from real-life	.	.	.412	.	.	.
I have enough time to support students' learning	.	.	.	.687	.	.
I explained the subject matter very well	.	.	.	.645	.	.
I refer to the current state of research	.	.	.	.602	.	.
I enthused students for my scientific subject	.	.	.	.574	.	.
I worked on students' understanding of basic terms	.	.	.	.	.828	.
I expanded students' basic knowledge	.	.	.	.	.789	.
In my course, I involved students into research projects at the institute/chair	.	.	.	.	.	.560

Source: own elaboration based on data from 2021.

Table 3. Results of multiple linear regression analysis related to the factor "understanding" (N = 199)

Variable	**B**	**SE**	**β**	**t**	**p**
constant	.027	.048	-	.563	.57
"showing"	.125	.049	.123	2.53	.01
"conceptual change"	.278	.048	.278	5.74	.00
"pinpoint" teaching and learning	.389	.048	.394	8.12	.00
"students' level of knowledge and capacity"	.471	.050	.460	9.42	.00
"basic knowledge"	.271	.051	.258	5.28	.00
"involving"	-.038	.048	-.039	-.80	.42

Dependent variable: factor: “understanding” learning expectation.

Source: own elaboration based on data from 2021.

Table 4. Results of multiple linear regression analysis related to the factor “discovering” (N = 199)

Variable	B	SE	β	t	p
constant	.001	.064	-	.021	.98
“showing”	.106	.066	.105	1.61	.10
“conceptual change”	.377	.065	.376	5.84	.00
“pinpoint” teaching and learning	-.039	.064	-.04	-.61	.54
“students’ level of knowledge and capacity”	-.02	.067	-.019	-.29	.76
“basic knowledge”	-.18	.068	-.176	-2.7	.00
“involving”	.072	.064	.072	1.11	.26

Dependent variable factor: “discovering” learning expectation.

Source: own elaboration based on data from 2021.

References

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