

MU Report #3 on the PROFILES Students Gains Evaluation – Insights into the Analyses of the Total Treatment Sample

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Aim and Purpose

Aim and purpose of this the 3rd MU report (Total Sample) on the Students' Gains Analyses is to present an overview about the insights the PROFILES group at MU gained by analysing the MoLE data collected in the regarding the evaluation of the impact of the PROFILES interventions in the frame of Work package 7: "Evaluation of Students Gains".

General Question of Interest regarding this report

The general question regarding this report is: How does the PROFILES intervention carried out by the working group at MU impact students gains in general and the participating students' (intrinsic) motivation to learn science the PROFILES way in particular?

Design of the Students Gains Evaluation for the MU Report #3

In order to answer the general question mentioned above, the working group at MU chose a (treatment-) pre-post-test design developed by FUB. Therefore, data has been collected in the PROFILES intervention classes before the PROFILES treatment took place and at the end of the implementation of the PROFILES specific IBSE strategy. What is special about the PROFILES treatment carried out by the working group at MU is that our approach is aimed to students' experimentation, development of teacher creativity and education of students with special educational needs (gifted, disabled).

Specific Questions of Interest and Research regarding Report #3

In the context of the pre-post test, the students first assess their regular science (physics, chemistry or biology) education in retrospect, so we can specify the general question asked above.

1. *How do students (who take part in the PROFILES intervention of the MU group) retrospectively assess their previous science education?*

Furthermore, the chosen research design allows a focussed look at the assessment of the interventions, which were conducted by the MU team, through the polling of the students directly after the interventions using the MoLE questionnaire in its REAL version and ask:

- 2. How the students of the PROFILES interventions of the MU team perceived and assess the motivational learning environment of the „PROFILES lessons“?*

A normative element is integrated into the PROFILES Students' Gains Evaluation through the survey of students on their priorities and wishes regarding science education. Thus the concretizing question is:

- 3. Which wishes and priorities do students link to their science education?*

The data obtained in our research design (the pre-post-test and REAL- and IDEAL-version surveys) allows for deepening analyses and makes differentiated results appear possible. First, the calculation of the so-called wish-reality-differences (WRD) is to be named. Wish-reality-differences can of course be calculated a) at the first point of measurement (on the basis of the pre-test data) and also at the second point of measurement (based on the post-test data). Hence, the correspondent and concretizing question is:

- 4. Which wish-reality-differences can be identified a) in the pre-test survey and b) in the post-test survey?*

Since data is collected at two (statistically) independent points of measurement, before/after comparisons are possible. In our analyses we will conduct these comparisons from two perspectives; namely with regard to the changes in the REAL-assessments of the students, and on the other hand with regard to the calculated wish-reality-differences. These two options for comparing the pre-test-data with the data from the post-test surveys lead to the next concretizing question, which is:

- 5. Which (statistically significant) changes can be identified in the students' feedback of the pre-post-test in the treatment s a) regarding the possibly different REAL-assessments of the students and b) which (statistically significant) changes can be discovered regarding the (calculated) wish-reality-differences (of the pre-test and the post-test analyses)?*

These 5 research questions outlined in this context are supposed to help structuring the reporting of results achieved in the frame of the MU Students Gains Evaluations.

Total Sample of MU Treatment Evaluation

The total treatment sample of the MU research and evaluation consists of 1.008 students from 56 different classes.

Table 1. Total Treatment Sample of Students' Gains Evaluation of MU PROFILES team

Sample	No. of Students			No. of Classes
	REAL (Pre-Test treatment group)	IDEAL	REAL (Post-Test treatment group)	
Physics, Chemistry and Biology Classes	1.008	1.008	1.008	56

Results and Findings of the MU Total Treatment Sample

Figure 1 provides the mean scores of the MoLE scales – differentiated by the pre- and the post-test treatment group analyses of the students' REAL-assessments and IDEAL-assessments of the total treatment sample.

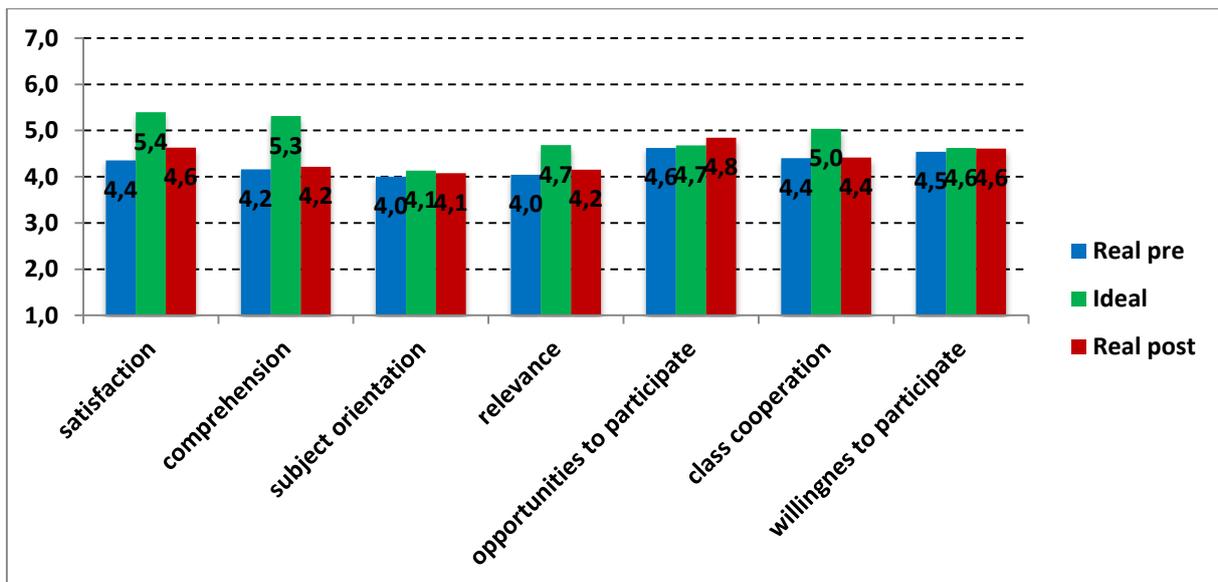


Fig. 1. Mean scores of the seven MoLE scales differentiated by pre- and post-test treatment group analyses – here of the MU total treatment sample (1.008 students).

Focusing on the students' priorities and wishes regarding science lessons – Analyses of the students' feedback on the MoLE IDEAL-version:

Analysis of the wishes of students, which are expected in teaching/learning science, finds out distribution of students' ideas into the three groups. The highest priority of the students are in the areas of: "satisfaction" (M=5.4), "comprehension" (M=5.3) and "class cooperation" (M=5.0). This first group wishes confirms our assumptions. Students require a positive atmosphere, knowledge understanding and cooperation.

These priorities also correspond to the fundamental needs of today's young people to science education. Medium priority is given to the following items: “relevance” (M = 4.7), “willingness to participate” (M = 4.7) and “opportunities to participate” (M = 4.6). An explanation for this level of desire is probably hidden in the lack of student sufficient motivation for their active involvement. The lowest priority had “subject orientation” (M = 4.1), which was apparently caused (in our opinion) by no sufficient understanding of the relevant test questions.

Focusing on the students' assessments regarding their regular science lessons (before the PROFILES intervention) - Analyses of the students' feedback on the MoLE REAL-version in the pre-test of treatment group:

Students expressed on most items almost neutral view. Higher values have satisfaction, which corresponds to a positive atmosphere in classes. This finding confirms that science education requires innovation – PROFILES intervention.

Focusing on the students' assessments regarding their PROFILES science lessons of the PROFILES intervention - Analyses of the students' feedback on the MoLE REAL-version in the post-test of the treatment group:

The results of the post-test analyses offer a little different picture: we can see that all MoLE-scales are assessed as positive because all mean scores of the post-test analyses are higher than 4.0. The highest score is the mean of the scale “opportunities to participate” (M=4.8), followed by “willingness to participate” (M=4.6) and “satisfaction” (M=4.6). This result close correspond with student wishes for IDEAL education. Except “comprehension” and “class cooperation” all rest of items demonstrate a growing trend. This trend is not so pronounced as we expected. In our opinion, the cause are: one-off PROFILES intervention and good quality of teachers who use innovative teaching methods.

Comparing the students' assessments regarding the PROFILES science lessons before and after the PROFILES intervention – Analyses of the pre- and post-test-data sources:

The differences between the pre- and post-test mean values are not enough statistically significant. But we can follow a clear trend to approximate the IDEAL state in the items because most of calculated WRD differences of scores of the post-test are lower than WDR scores of the pre-test (see Fig. 2).

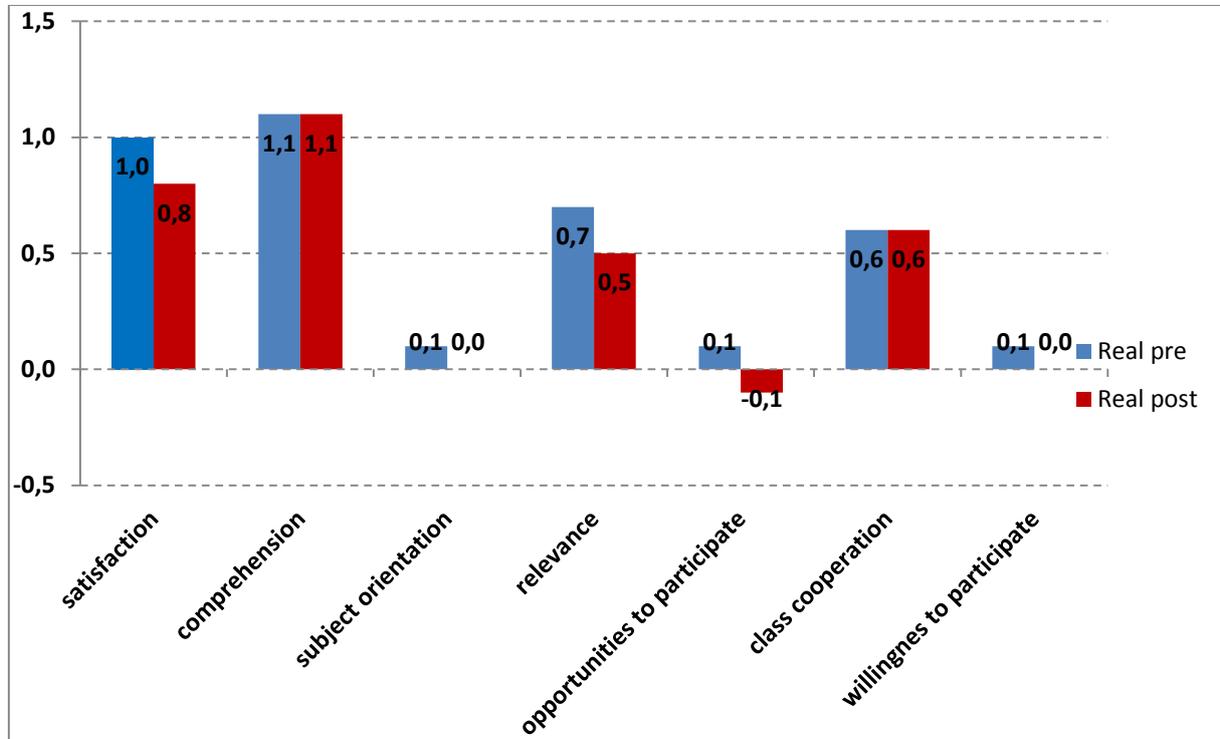


Fig. 2. Calculated wish-to-reality-differences regarding the seven MoLE scales differentiated by pre- and post-test analyses by treatment group analyses of the students' assessments (IDEAL-minus-pre-treatment - group REAL- assessments and IDEAL-minus-post-treatment-group- REAL-assessments) – here of the MU total treatment sample (1.008 students).

Conclusions regarding the MoLE analyses of the MU total treatment sample

By means of all three rounds (1st, 2nd and 3rd; school years 2011/2012, 2012/2013 and 2013/2014) of students' gains data analyses the MU PROFILES working group we are able to conclude that the PROFILES treatments and interventions carried out lead to success. By means of this study we are able to show evidence how the students' motivation to learn science tends to increase when the students are taught by the PROFILES IBSE technology.

The mean scores of the students' motivational learning environment assessment are in the most items higher in the post-test than they were in the pre-test. So we can conclude that the PROFILES interventions at MU tend to increase of the students' intrinsic motivation to learn science.

We can assume that the students prefer PROFILES lessons more than they appreciate their regular lessons. Here we found that the gap between the students' wishes and how they perceive and assess regular science classes got smaller. Because most of changes are not statistically significant ($\Delta=0.2$ or less), we have to combine this diagnostics tool with others - interviews and case study (a research triangulation) for verification of evaluation. We realised these interviews with students and teachers under PROFILES treatment. Results of this



research confirm increasing of intrinsic motivational level not only at students, but also at teachers.

We tried to explain not high differences in test results in MU evaluation. Our additional research and experience have revealed these important factors:

- One-off implementation of PROFILES treatment
- Teacher-participants were mostly able teachers-innovators who IBSE partially applied, and therefore it is not enough new for their students
- Students and teachers encounter more educational innovation and are often skeptical to them

The above findings led to the conclusion that it is necessary to implement PROFILES innovations in teaching/learning science consistently, systematically and efficiently. For this method of teaching/learning is needed to educate and prepare teachers, students and appropriate curricular materials.

Outlook

In this (the 3rd) report of the MU Students Gains Evaluation we have focussed on the PROFILES treatment sample as a whole. Because of our specific interest of PROFILES strategy education of gifted and disabled students, we will take a more detailed analysis of these two groups of students. These data and research results we will implement in our PROFILES publications.