

“Quantum Physics is difficult because my teacher says so.”

Secondary School Students’ and Teachers’ Quantum Self-Efficacy

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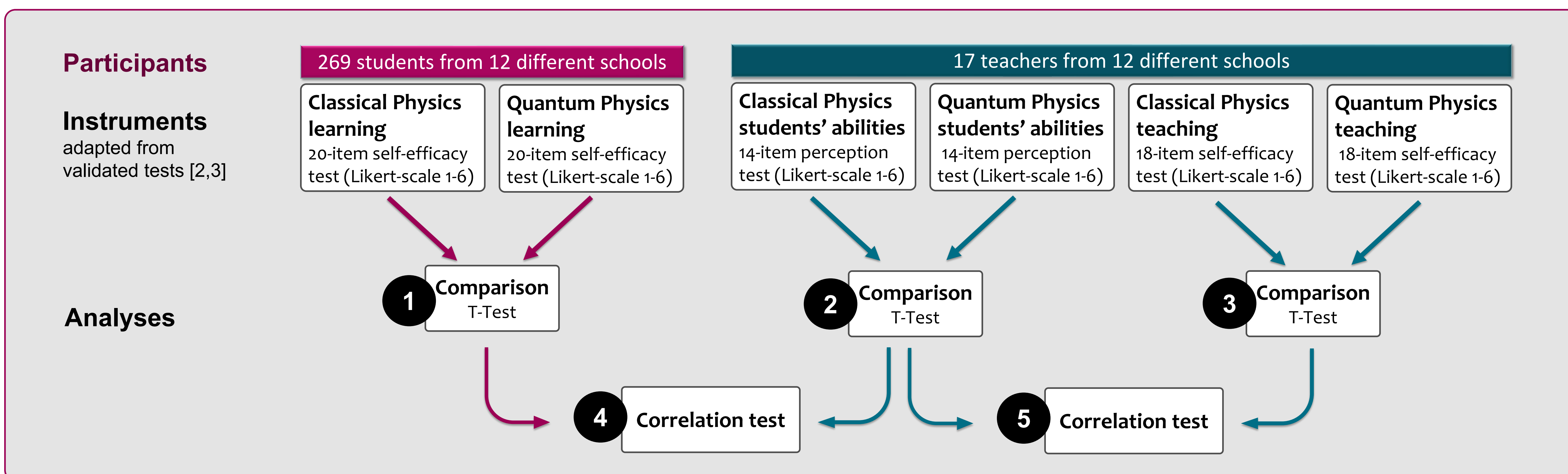
Problem

Quantum physics (QP) has become part of the secondary school physics curriculum in many countries [1]. However, there is little literature on perceptions and opinions about teaching and learning quantum physics in secondary school. In our study, we asked both teachers and students how they perceived the difficulty of learning QP compared to learning classical physics. In addition, we asked teachers how well they rated their own teaching skills for QP and classical physics.

Research Questions

- ❶ Do students perceive learning QP as more difficult compared to learning classical physics?
- ❷ Teaching self-efficacy: Do teachers think differently about their capacities to teach QP or classical physics?
- ❸ Do teachers think differently about their students’ comprehension of QP compared to students’ comprehension of Classical Physics?
- ❹ Do teachers perceive students’ QP comprehension similar to how students themselves perceive their QP comprehension?
- ❺ Is there a correlation between teachers’ QP teaching self-efficacy and how they perceive their students’ QP comprehension?

Method



Likert-scale (1 = low – 6 = high)		Classical Physics	Quantum Physics	Difference t-test
❶	Students’ self-efficacy for learning	4,50	3,83	t = 16,5; p < 0,001
❷	Teachers about their students’ comprehension	4,44	3,83	t = 24,3; p < 0,001
❸	Teachers about their own teaching skills	5,26	4,48	t = 21,1; p < 0,001

Correlations		Classical Physics	Quantum Physics
❹	Teachers’ perception of students’ comprehension vs. students’ QP self-efficacy	r = 0,107; p = 0,040	r = 0,252; p < 0,001
❺	Teachers’ QP teaching self-efficacy vs. teachers’ perception of students’ QP comprehension	r = 0,645; p < 0,001	r = 0,828; p < 0,001

Preliminary results

- ❶ Students perceive learning QP as more difficult than learning classical physics;
- ❷ Teachers believe that learning and understanding QP is more difficult for their students than learning and understanding classical physics;
- ❸ Teachers perceive themselves as more competent in teaching Classical Physics than in teaching QP.
- ❹ Teachers have a realistic idea of how their students perceive QP: Their accounts of student understanding correlate with students’ reported QP self-efficacy.
- ❺ Teachers’ perception of the difficulty of teaching QP is related to their students’ problem to learn and comprehend QP;

Discussion

We surveyed teachers’ confidence in their QP teaching compared to classical physics and students’ perceptions of learning QP and classical physics. The student and teacher surveys show significant differences between the perception of classical physics and QP. Both in learning and teaching, QP was experienced as more difficult.

These perceptions and opinions raise many questions. For example, in other contexts, it has been shown that students’ views about the difficulty of a particular topic are influenced by the way teachers talk about that topic. **If a teacher claims a topic is difficult, students often assume it is** [4]. This can demotivate students from learning and understanding a particular topic [5].

It would be beneficial to investigate **why students and teachers experience QP as difficult**.

Furthermore, there are **remarkable differences between the answers of individual teachers**: For some teachers, there is a big difference between the perception of the difficulty of classical physics and QP, while other teachers gave about the same answers for classical and QP.

It would be interesting to explore **what causes a teacher to find QP to be difficult or not**. There are suggestions that such teachers design their QP lessons with **more contexts, practical exercises, applets, etc.**, whereas teachers who find QP themselves difficult **often rely on the textbook** and give very abstract and theoretical lessons. The influence of the teacher’s attitude towards QP on the students should also be investigated.

References

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