



Inquiry-based Learning in Education of Prospective Chemistry Teachers

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INQUIRY-BASED LEARNING (IBL)

- A teaching approach that can enhance student **learning outcomes**, and develop **inquiry and research skills**.
- Enabling students to follow methods and practices similar to professional scientists in order to construct their own knowledge [1-4].



TYPES OF IBL

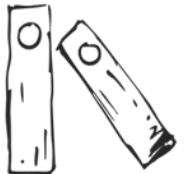
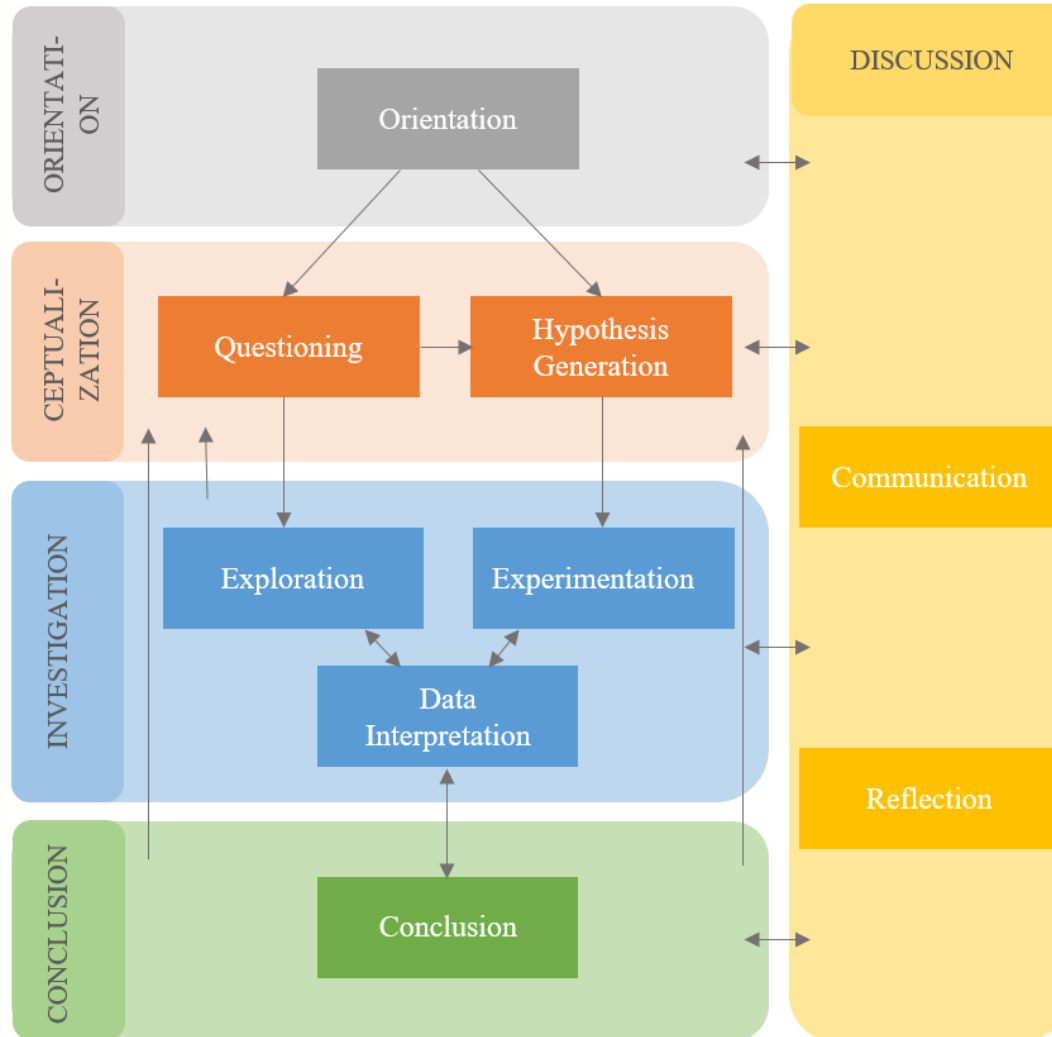
Various types of IBL are discussed in the literature – according to the *level of scaffolding* [5]:

- **structured inquiry** (teacher provides: research problem and outlines inquiry plan);
- **guided inquiry** (teacher provides: research problem and questions);
- **open inquiry** (teacher provides: /).



INQUIRY PHASES AND SUBPHASES

– M. Pedaste et al. [6]



TEACHER'S ROLE

- Being a guide in a self-directed learning environment.
- Crucial for successful IBL[4].



Context: FUTURE TEACHER TRAINING

- With regard to teacher's role in IBL it is beneficial for the prospective teachers to gain experience with IBL implementation involving direct contact with students already during their studies at the university.
- Our research focused on a course at the first Bologna cycle, in which future lower secondary school chemistry teachers, **developed and implemented IBL teaching units** about topics related to chemistry in everyday life.



Context: FUTURE TEACHER TRAINING

Course Project and experimental work:

- 15 weeks (2 hours/week) at the University of Ljubljana, Faculty of Education.
- Prospective chemistry teachers, their 4th year of the first Bologna cycle.
- Development of 90-minutes long IBL teaching units.
- Implementation in a direct contact with students from lower secondary schools - to receive their feedback and experience with implementation of IBL in chemistry teaching.



IBL teaching units

- Based on guided IBL, where groups of 3-4 students were investigating different topics connected with Chemistry in everyday life.
- Phases of the inquiry process were based on model of Pedaste et al. [6].



Method: PROBLEM

- The analysis of students' perceptions regarding the implemented IBL teaching units in the academic year 2017/18 showed that the majority of students mentioned a **perception of positive effects on mental processes** in IBL [7].
- However, it was interesting that higher order thinking skills (HOTs) were **not perceived as frequently** as lower order thinking skills, despite IBL being recognized as an approach to promoting HOTs [8].
- In the two following academic years the change in instructions (more detailed instructions for the development and implementation of IBL teaching units) was introduced in order to facilitate development of HOTs and to overcome the observed deficiencies.
- We would like to evaluate the consequences of this change by monitoring and comparing students' perceptions of learning processes and learning outcomes in IBL teaching units implemented by prospective chemistry teachers.



Method: RESEARCH QUESTIONS

1st RQ: Are there any differences in the students' perceptions of **learning processes** in IBL teaching units in the two academic years?

2nd RQ: Are there any differences in the students' perceptions of their **intended learning outcomes** in IBL teaching units in the two academic years?

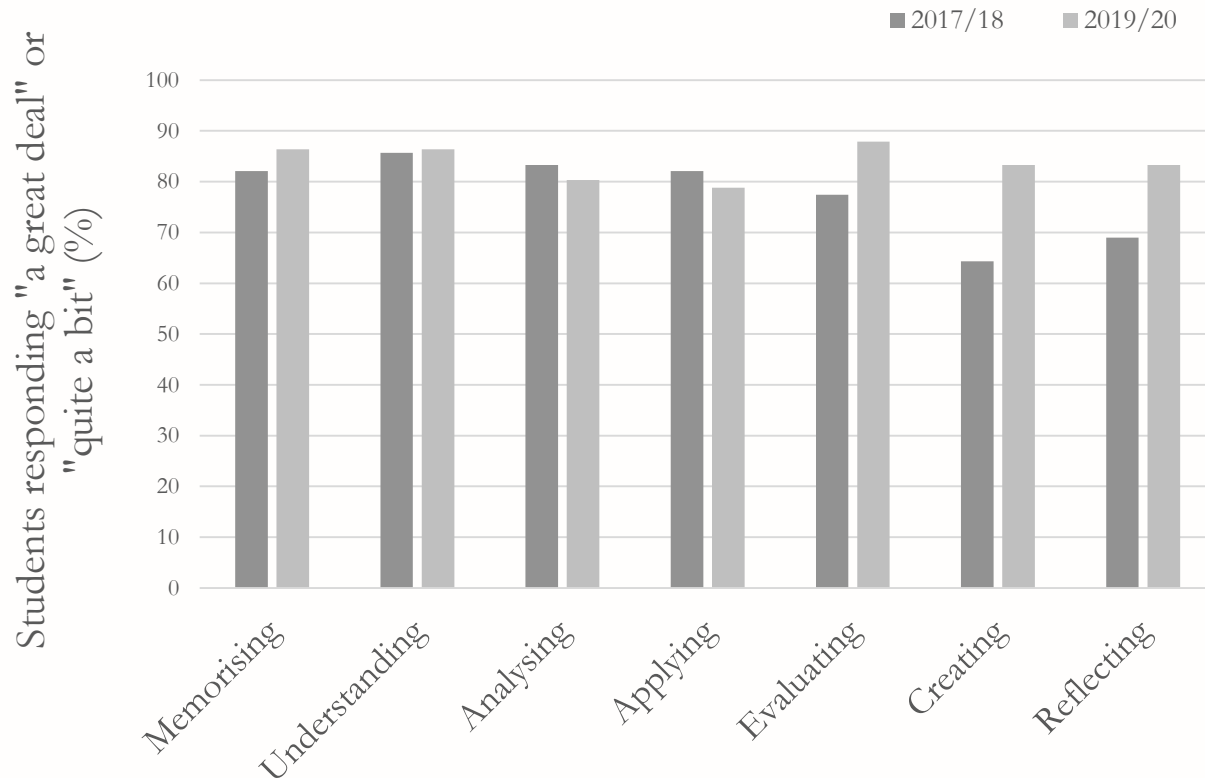


Method: SAMPLE

- 150 students (84 students in 2017/18, 66 students in 2019/20) from lower secondary schools.
- Age: 13 to 15 years.
- They participated in one of the IBL teaching units and completed Spronken-Smith's et al (2012) survey after the participation.



Results: STUDENTS' PERCEPTIONS OF LEARNING PROCESSES (1st RQ)



$\chi^2 (2, N = 150) = 6.75, p = .034.$

Figure 1: Mean scores for students' responses in first section of survey.



Results: STUDENTS' PERCEPTIONS OF INTENDED LEARNING OUTCOMES (2nd RQ)

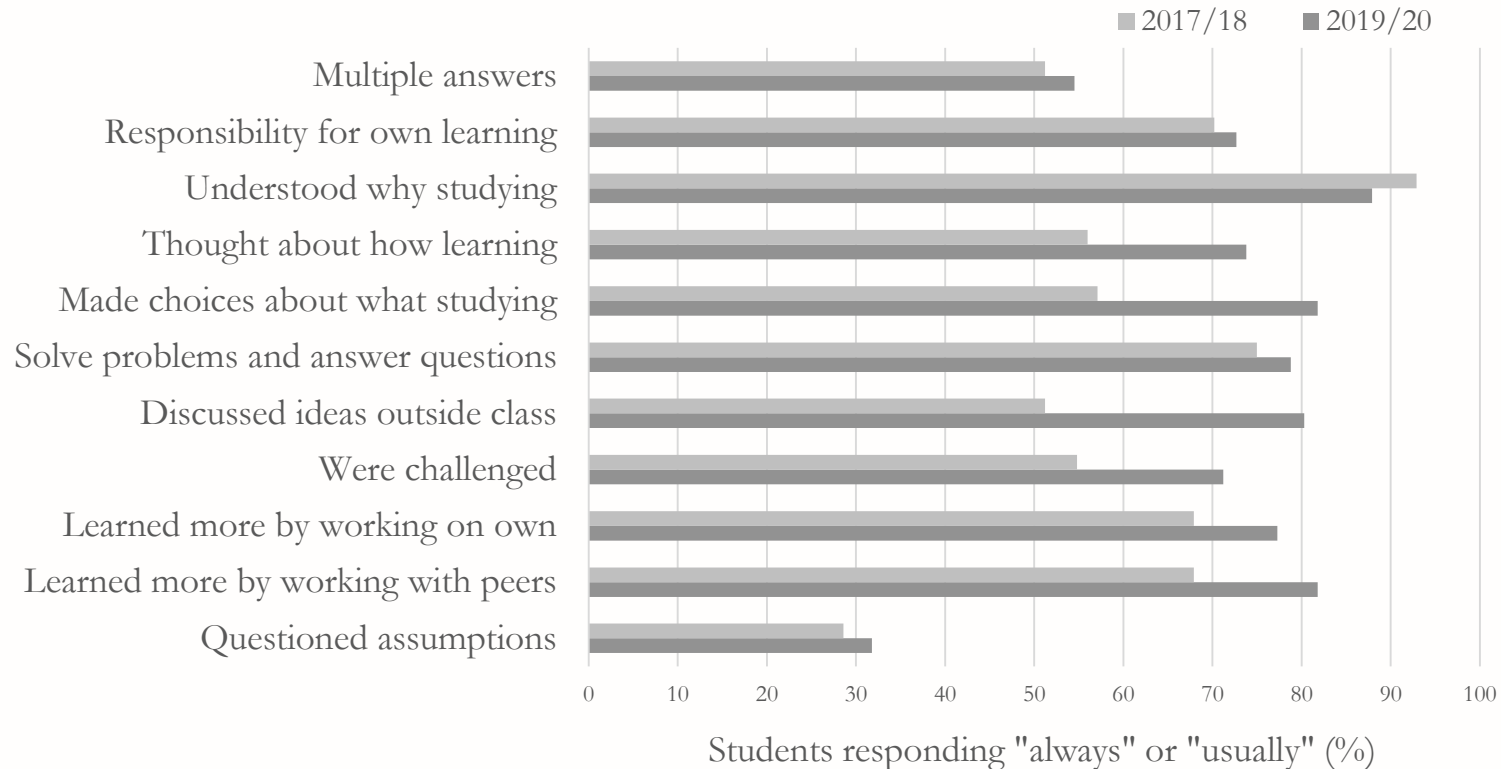
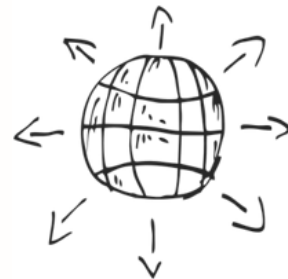


Figure 2: Mean scores for students' responses in second section of survey.



Conclusions

- Developed IBL teaching units can promote HOTs.
- The achievement of this goal depends on various factors, including the focus in the instructions provided to prospective teachers.
- It is important for prospective teachers to be able to practice and evaluate this way of teaching as part of their university education.
- In the future, it would be beneficial to further investigate the role of the teacher in the development and implementation of IBL.





Thank you for your attention.

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