

Inquiry based chemistry learning in a non-formal educational setting for gifted students

DiSSI-partners

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Theoretical background

Inquiry based learning (IBL) is a student-centered method (Reid & Ali, 2020). The method of IBL is based on a constructivist approach to learning, which contends that learners create their understanding by taking an active part in the learning process (Driver & Oldham, 1986). Students seek an answer to a research question by conducting experiments, followed by phases of the scientific inquiry that scientists use to collect and analyse data and draw conclusions. In chemistry education, these activities lead students to acquire new knowledge and skills (Pedaste et. al., 2015). Students have positive attitude towards inquiry activities in science classes and therefore show more interest in learning science. Toth and Borbas (2021) concluded that if IBL is not guided by teacher to some level, it does not significantly positively influence lower secondary students' chemistry knowledge and skills development. It is reasonable to assume that individual interest in chemistry learning may influence how students perceive learning and how IBL activities influence students' situational interest and attitudes towards the IBL approach. Students often show better performance, greater confidence in their ability to complete science tasks and more enjoyment in learning science (OECD, 2012).

The aim of the project is to develop educational strategies in the field of chemistry in a non-formal learning environment for diverse students. Project focused on four dimensions of students' diversity: (1) students from lower socio-economic statuses, (2) students who are part of an ethnic or a cultural minority, (3) students with lower linguistic skills and (4) gifted students.

Gifted students were the subject of research by the Slovenian team. It is important to emphasise that IBL can positively influence gifted students' chemistry learning (Juriševič & Devetak, 2018).

Aim of the study

The aim of this study is to illustrate the development of learning modules and their adaptations for teaching chemistry in the context of inquiry-based learning in a non-formal educational setting and to find out whether the original DiSSI modules and the adapted modules have significantly different impacts on students' situational interest in chemistry learning and on their views about inquiry-based learning in a non-formal educational setting.

Method

A pre-post educational research approach was used in this research. A total of 136 Grade 8 and 9 students from 11 lower secondary schools across Slovenia participated in this study. 68 students participated in the non-adapted DiSSI module application and 68 in the adapted DiSSI module application. Students had to fill in a questionnaire regarding their individual interest in chemistry learning and provide some additional data about their identified giftedness before the lab work. After the lab work, students had to fill in a second questionnaire about their situational interest and perception of the IBL approach in the chemistry laboratory.

Results

Results show that there are no significant differences between gifted and non-gifted students and their situational interest after the non-adapted DiSSI module application. This indicates, that the lab work is suitable for both gifted and non-gifted students in terms of their interest.



When comparing situational interest between gifted and non-gifted students after the adapted DiSSI module was applied, it was found that there were significant differences between the two groups ($U = 218,5; p = .001$). That means, that more guided instructions led to higher situational interest among non-gifted students.

When situational interest between gifted students before and after the application of adapted DiSSI modules was compared, no significant differences were found. Gifted students who participated in the workshop before DiSSI module adaptations, showed higher interest, than those who participated after the adaptation. It can be assumed that more guided instructions make the workshop less interesting for gifted students. As opposed to gifted students, non-gifted students showed higher situational interest after application of adapted DiSSI module. However no significant differences were shown when comparing situational interest between non-gifted students who participated before and those who participated after DiSSI module adaptations.

When comparing how gifted students perceive IBL there was a significant difference ($U = 302,5; p = .017$), between those who participated in the lab work before DiSSI module adaptations and those who participated after. Gifted students who participated after adaptations had a more positive attitude towards IBL, than those who participated before adaptations. When comparing how non-gifted students perceive IBL, there were no significant differences between those who participated in the lab work before the adaptations and those who participated after. The adaptations that were made to the modules did not improve non-gifted students' perception of IBL, therefore this remains an open question and can serve as a guideline for further research and improvement.

Literature

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