The affective experience of authentic science education environments: Design and Research

This study explores an authentic learning environment centered on the scanning electron microscope (SEM). It consists of two parts:

**Part A.** The design, implementation, and reflection of an authentic SEM learning environment for two different populations: science teachers and students.

**Part B.** The research and development of models that reflect different aspects of students' affective experience in the SEM learning environment.

The thesis seminar will focus on part B of the study. It involved the evaluating and analyzing students' emotional responses to an authentic environment and how it influenced their perception of the activities' impact, as well as their beliefs about learning science. To evaluate the emotional aspects, a semantic differential emotions questionnaire (SDEQ) was developed, based on an exploratory qualitative analysis of students' open-ended written feedback. The resulting SDEQ items were validated and applied to multiple groups of students who participated in the SEM activity. The results were then combined with the perceived authenticity questionnaires, as well as questionnaires that evaluated students' self-efficacy and science aspirations in order to create several statistical models using the structural equation modeling method. Importantly, these models indicated that students' emotions played a crucial role in mediating between their perception of authenticity and their self-efficacy and perception of the activities' impact. However, although students’ perceived authenticity was found to be a significant predictor of their change in aspirations before and after the activity, their emotions did not mediate this change.

The contributions of this study are twofold: First, the study suggests that the SDEQ approach provided valuable insights into emotions in the SEM learning environment and uncovered unique emotions not previously identified in other learning settings. The study also expanded the range of learning situations that can be subjected to emotion assessment, specifically out-of-school science learning. Second, the study found that the design of an authentic learning environment is linked to a high arousal of emotional scales, mainly positive emotions. It also suggests that an explicit "emotions-on" aspect is an essential contribution of out-of-school learning environments, and that learners' well-being should be acknowledged as a goal during science learning.
 comprise the experimental section, focusing on the design and implementation of an authentic learning environment for students. The study includes two parts: Part A, which involves the design and implementation of an authentic learning environment with the SEMs in two different groups - teachers and students. Part B addresses various aspects of the emotional impact of the learning experience in the SEM environment. The seminar will focus on the second part of the research. In this part, the reactions of students to the authentic environment and the effects of this on their attitudes towards the activity were measured and analyzed. In addition, the students' perceptions of learning and future engagement in science were also studied. To evaluate the emotional dimension, a Special Semantic Questionnaire (SDEQ) was developed. The development was based on the open-ended responses of students about their feelings before and after the activity and on the research literature on academic feelings. After the development stage, students who participated in various activities filled out the questionnaire and reported on their feelings in the context of the SEM activity. This enabled a quantitative assessment of the emotional dimension in the authentic activity. The questionnaire results were statistically analyzed with other questionnaires, including an authenticity questionnaire, a self-confidence questionnaire, and a questionnaire that collected information about the students' aspirations to study and work in sciences in the future. Structural equation modeling was used to create statistical models that revealed the central role of students' feelings in the authenticity of the activity and their self-confidence. In addition, it was found that students' feelings are a mediator between authenticity and the activity's perception as meaningful for the students. Although the authentic experience was found to be a significant predictor of students' aspirations, it was not found to be a mediator of this relationship.

The study has a double contribution to theory. First, the study presents the SDEQ method as a tool that provides meaningful insights into students' emotional perceptions in the SEM environment and in the school environment. The application of the SDEQ questionnaire revealed unique emotions in extracurricular environments that were not identified in other learning environments. The study expanded the range of learning scenarios that can be analyzed regarding emotions according to the literature. The second contribution stems from the fact that the study allowed the identification of the authentic design of the learning environment and the authentic experience of students maintaining a strong emotional connection in their emotional scales towards the positive pole. The study emphasizes the expressive emotional aspect as a strength in extracurricular scientific activities and promotes the enhancement of students' enjoyment and satisfaction as an important goal during learning in science.

The researcher is interested in the notion of the holistic. Based on these, the researcher focused on the emotional and authentic aspects in the SEM and on the emotional and authentic aspects in the past. The researcher thus developed a questionnaire, the Semantic and Authentic Questionnaire (SDEQ), which included open-ended questions about students' feelings before and after the activity and about the researchers' perceptions. The researcher then developed statistical models based on the SDEQ questionnaire, which revealed the central role of students' feelings in the authenticity of the activity and their self-confidence. In addition, it was found that students' feelings are a mediator between the authenticity and the activity's perception as significant for the students. Although the authentic experience was found to be a significant predictor of students' aspirations, it was not found to be a mediator of this relationship.

The study is relevant to several areas. First, it contributes to the understanding of the emotional and authentic aspects in science education, particularly in extracurricular activities. The study highlights the importance of emotional experiences in the learning process and the role of authentic environments in promoting students' enjoyment and satisfaction. Second, the study provides insights into the development of educational programs and policies that aim to enhance students' emotional experiences and engage them in meaningful learning activities. Finally, the study contributes to the theoretical discussion on the role of emotions in education and the importance of authentic learning environments in promoting students' well-being and motivation.