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Learning geometry in self-made tutorials: the impact of producing mathematical videos on emotions, motivation and achievement in mathematical learning

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Emotions, motivation and achievement in learning environments

Learning is a complex process, which is influenced by many parameters. “Emotions and motivation are important prerequisites, mediators, and outcomes of learning and achievement” (Schukajlow, Rakoczy & Pekrun, 2017, p. 307). Emotions, which are related to achievement activities and to success and failure outcomes, are achievement emotions (Pekrun, 2006). Accordingly emotions in school are achievement emotions, which effect students’ interest in contents or subjects and motivation to learn (Pekrun, 2006). Interest in mathematics, motivation and as a sequel of these factors a positive effect on grades and test scores can be emerged by positive activating emotions, such as enjoyment, during mathematic lessons (Murayama, Pekrun, Lichtenfeld, vom Hofe, 2013; Schukajlow & Rakoczy, 2016). It is assumed that achievement emotions are influenced by certain appraisals. In the control-value theory of achievement emotions, perceived control over and perceived value of achievement activities and outcomes are in particular relevant for the evocation of achievement emotions (Pekrun, 2006). “From an educational perspective, appraisals are important as well, since they can be assumed to mediate the impact of situational factors, and can be targeted by educational interventions intended to foster positive emotional development” (Pekrun, 2006, p. 317). To influence control, values and emotions positively Pekrun (2006) mentions important factors, like creating learning environments, which support autonomy and cooperation, giving cognitive quality instructions and inducting values, finding a performance-enhancing choice of tasks and fostering students’ self-regulation of emotions. The project, which is presented subsequent, is geared to these factors. It is assumed, that this modelling-related and applied learningconcept is based in a social and learning environment, which fosters students’ emotions, increases interest in mathematic and generates a learning effect on geometric basic competences.

The project

In the project students of a ninth grade (N=68) of a German high school produce in groups mathematical tutorials in the field of space geometry. After an introduction of the tasks and technical equipment, each group works self-contained. The project is conducted after the students already studied the topic of space geometry, so the students have experiences in this mathematical content. In the project it is being investigated whether and to which extent a learning effect and a positive impact on emotions and motivation can be achieved by the participation. First, the students analyze a geometric body. They describe the shape, name and explain the formulas of the surface and volume and put it into an example in the real world. The focus of this working phase is on the process-related competences of mathematical arguing, modeling, using mathematical representation and elements and the mathematical communication. Furthermore the groups develop a concept for

the medial implementation of the compiled mathematical content. Afterwards the groups present their findings and concepts. Thereafter each group starts filming and implementing their mathematical results into a medial setting. Finally the groups present their self-made tutorial. It is assumed that a high degree of individual value inheres in the project. The autonomous and cooperative working, like developing a creative concept, incorporating the mathematical content into this concept and presenting their tutorials and the integration of media reinforce this assumption (Ludwig, 2008). The project-setting constitutes a learning environment like Pekrun (2006) demands.

Research design

To determine the projects influence on stable emotions, motivation and interest in mathematics, a survey of the Project for the Analysis of Learning and Mathematics longitudinal study (Pekrun, Goetz, Jullien, Zirnbibl, vom Hofe & Blum, 2002) is used in a pre-, post- and follow-up scheme. The intrinsic motivation inventory (Deci & Ryan, 2000) is used for researching on unstable situational emotions while the project is processing. For investigating a learning effect of the project a self-developed pre-, post and follow-up test is used. The test is applied to the competence-oriented course of instruction of Nordrhein-Westfalen and comprises tasks on geometrics bodies like describing, reproducing, explaining, representation of mathematical content and appliance, working and solving complex mathematical issues. The evaluation of the findings is in progress.

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