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Students' Motivation in Monitoring Butterflies

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Abstract

Within the last decade various efforts have been made to bring science and society closer together and scientists are put on the spot to provide insight to their work. More and more research funding associations worldwide ask scientists to include activities into their research projects to demonstrate broader impacts on science and society [1]. Since 2008 the Austrian Ministry of Research has been running a funding scheme called "Sparkling Science" asking scientist to do research in cooperation with pupils and teachers. Sparkling Science research projects are therefore not only focussing on publishable scientific outcomes but participating pupils should be included in reasonable research tasks. These activities aim to bring real world science to students and teachers, to promote science learning in schools, to increase scientist´s engagement with the wider community, stimulate student´s interest in science as well as broaden their understanding of the variety of science related careers. This paper will provide insight into a currently running Sparkling Science project called "Viel-falter"- Establishing an Austrian Wide Monitoring of Diurnal Butterflies", which was launched in 2013 and will continue until December 2015 (www.viel-falter.at). The project vision is to establish a network of people engaging in monitoring butterflies all over the country. As one of the first steps "Viel-falter" is aiming to establish a lasting purpose driven cooperation between involved partners as well as with school children. Thus it is important to find out whether and how student's motivation to engage in butterfly monitoring develops in course of their first year of participation and which project specific factors might be crucial to support continuous student engagement. 177 students completed the "Short Scale of Intrinsic Motivation Inventory" published by Wilde and colleagues [7] before and after participating in the project. This questionnaire represents the factors interest/enjoyment, perceived competence, perceived choice and pressure/tension with three items each and allows us to apply statistical tests to find out whether significant changes in these items are observable. In addition 19 students were selected to participate in semi-structured interviews conducted at the end of the first project year to get a better insight into students individual development. This paper reports on outcomes visible after the first year and provides insight into how student experience such an authentic research setting as well as which surrounding conditions seem to be important to maintain student engagement.

1. Introduction

Within the last decade various efforts have been made to bring science and society closer together and scientists are put on the spot to provide insight to their work. More and more research funding associations worldwide ask scientists to include activities into their research projects to demonstrate broader impacts on science and society [1].

Since 2008 the Austrian Ministry of Research has been running a funding scheme called "Sparkling Science" asking scientist to do research in cooperation with pupils and teachers. Sparkling Science research projects are therefore not only focussing on publishable scientific outcomes but also participating pupils should be included in reasonable research tasks. These activities aim to bring real world science to students and teachers, to promote science learning in schools, to increase scientist´s engagement with the wider community, stimulate student´s interest in science as well as broaden their understanding of the variety of science related careers.

Science research partnerships are currently very popular not only in Austria but also worldwide. Student participation however is most often a free choice decision and taken by those who are interested in science research already [2]. However this paper will report on a student-scientist partnership in which students did not choose to participate voluntarily because their teacher has signed in their class. Hardly anything do we know about how students' motivation to participate looks like at the beginning and how it develops in course of eight-month project duration.

2. Theoretical Background

2.1 Public participation in scientific research (PPSR)

Various strategies have emerged to encourage young people to participate in science research. Monitoring and analysing natural phenomena is one of these approaches. While acknowledging the convergence and synergies that exits among various strategies such as "citizen-science or science apprenticeship initiatives Haywood [3] suggest to use the umbrella term 'public participation in scientific research' (PPSR) to "facilitate more collaborative research and practice among this broad collection of participatory traditions (Shirk et al., 2012)" (p.65). Four overarching goals emerge from many PPSR projects respectively research studies accompanying them. These are: *expanding the scope and scale of scientific research*, *enhancing science knowledge and understanding via interactive learning experiences for "non-scientists"*, *increasing environmental stewardship,* and *developing more democratic and inclusive science research and policy processes* [3]. In terms of searching for evidence for one or the other impact research has shown that PPSC are most likely to contribute to '*awareness, knowledge, and/or understanding of key-scientific concepts related to the study at hand'*. They increase '*public engagement in scientific activities in the area at which PPSR projects excel*' and are 'excellent for developing science related skills'. In addition a '*few instances where PPSR project participation has affected attitudes toward science have been documented'* [4.p.12]. Thus PPSRs have a great potential to not only help scientist to generate high numbers of data but also contribute to lay participants individual development.
However while many studies report on positive effects others failed to "*demonstrate statistically significant changes in attitudes toward science and the environment ... behaviors … or knowledge about science concepts or the scientific process'*…. *These studies also highlight that the context in which an individual engages in informal science research has substantial implications for the long-term impacts of such engagement* [3,p.68]. Therefore the CAISE Report on Public Participation in Scientific Research published in 2009 argues that there is a need for "*significant research into motivations for members of the public to understand and participate in [scientific] research*" [4.p.48).

2.2 Motivation

According to Deci and Ryan [5] '*To be motivated means to be moved to do something. A person who feels no impetus or inspiration to act is thus characterized as unmotivated, whereas someone who is energized or activated toward an end is considered motivated'*. However, motivation is not a unitary phenomenon but shows various shapes and characteristics that have been studied and discussed in great detail amongst scholars for decades already. While intrinsic and extrinsic types of motivations have been widely studied, this work will focus on intrinsic motivation because intrinsic motivation '*has emerged as an important phenomena for educators — a natural wellspring of learning and achievement that can be systematically catalysed or undermined by parent and teacher practices. … intrinsic motivation results in high-quality learning and creativity* [5,p 55]. However to interpersonal events and structures that conduce towards feelings of competence during action can enhance intrinsic motivation. However the bottom line resulting from Deci and Ryan's assumptions about intrinsic motivation development is that 'experiencing feelings of competence alone will not enhance intrinsic motivation unless they are accompanied with a sense of autonomy' [5,p 59]. In addition not only the school or project work but the home environment may facilitate or forestall the development of intrinsic motivation [5]. We assume that understanding factors that promote intrinsic motivation development in students has the potential to improve student performance and long-term engagement. Thus it is important to find out whether and how student's intrinsic and extrinsic motivation to engage in butterfly monitoring develops in course of their first year of participation and which project specific factors might be crucial to support continuous student engagement.

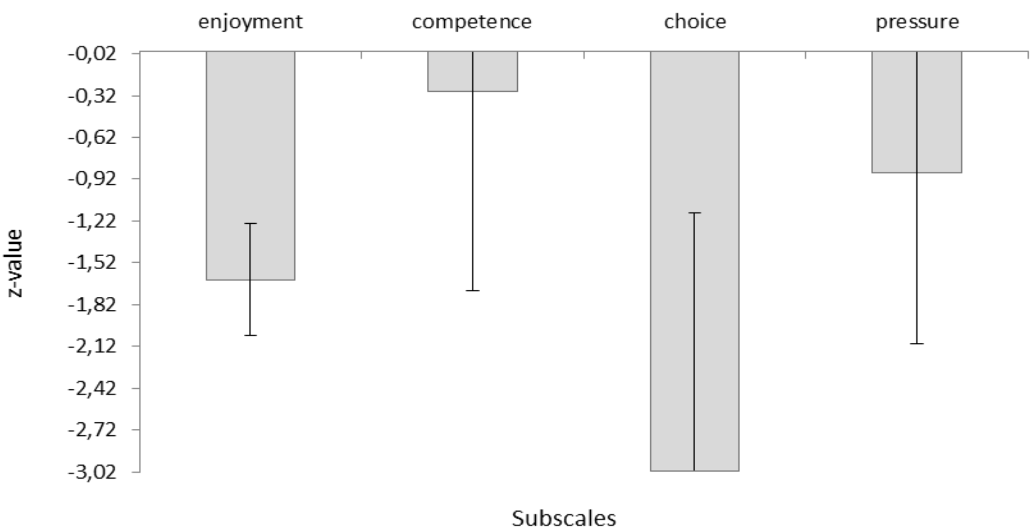
2.3 Methods

The Sparkling Science project "Viel-falter - Establishing an Austrian Wide Monitoring of Diurnal Butterflies" which was launched in 2013 and will continue until December 2015. The project vision is to establish a network of people engaging in monitoring butterflies all over the country. As one of the first steps "Viel-falter" is aiming to establish a lasting purpose driven cooperation between involved partners as well as with school children. 174 students, 95 girls and 79 boys at the average age of 10,4 years (2^{nd} to 12^{th} grade), completed an online version of the "Short Scale of Intrinsic Motivation Inventory" published by Wilde and colleagues [6] before and after 10 month participating in the project. This questionnaire represents the factors interest/enjoyment, perceived competence, perceived choice and pressure/tension with three items each and allows us to apply statistical tests to find out whether significant changes in these items are observable. In addition they completed a set of questions in order to gain more specific information about project specific aspects. In addition the post-questionnaire was extended with seven multiple-choice questions and one open question addressing specific content knowledge required in butterfly monitoring. 30 items were covered by a five-point Likert Scale (4 = strongly agree, 3 = agree, 2 = widely disagree, 1 = strongly disagree, 0 = I don't know) and seven multiple-choice questions and one open question completed the questionnaire. The comprehensibility of the questionnaires was tested by two primary school children, grade three and four, before the questionnaires were put online. In addition 20 primary school children (4^{th} grade) and 4 secondary school students (8^{th} grade) were selected to participate in semi-structured interviews conducted at the end of the first project year to get a better insight into students individual intrinsic as well as extrinsic motivation development. Qualitative content analysis based on Mayring [7] was applied and transcripts were edited with MAXQDA 10.

3. Results

Questionnaire results show that students' interest in participating in the project is decreasing slightly while students' feeling of competence stays the same. However we experience a decrease in how students experience their freedom of choice.

Fig 1. Average of the subscales' items with standard deviation.



The results of the pre- and post-questionnaires were calculated via Excel. For comparison the Wilcoxon singed-rank test was used. The closer the z-value is to zero, the higher the chance that the changes between pre- and post-inquiry are caused by a random statistical distribution. If z-values are < -1,96 or > 1,96 the distribution change between pre- and post-inquiry is certain or likely.
Although students predominately like butterflies and to continue working in a project like the one they did they prefer to focus on different topics after 10 months of engaging in butterflies.
Although botanic topics are not very popular [8] many students said that they are interested in the flowers which are preferred by different butterfly species. Also plants and other insects are topics of choice in respect of participating in a project again. It seems that primary school students enjoy learning details and features they can assign to different groups, whereas older students prefer to understand coherences and identify connections with their lives.

4. Discussion

The project vision is to establish a network of people engaging in monitoring butterflies all over the country. As one of the first steps "Viel-falter" was aiming to establish a lasting purpose driven cooperation between involved partners as well as with school children. However, due to project call requirements and resultant project characteristics students where not asked whether they were interested to participate or not at the start of the project but teachers signed their classes in. However most of the students entered the project with a very high level of situated motivation and engagement and were looking forward to work with scientist and learn about butterflies. Thus it is most likely that this very high level of attainment will not be covered across the whole project duration. Taking our current understanding of motivation development into consideration questionnaire results indicate that because some students experienced less freedom of choice in course of the project they did not

develop an intrinsic motivation to monitor butterflies over an extended period of time [5].
Interviews provide insight into a range of aspects that may count for explanations e.g. that students simply realised that scientists rely on them to collect the data and that these data needs to be reliable. Repeating the same activity a couple of times might not be that as exciting every time. In the contrary it was disappointing if the weather was bad and no monitoring activities could be done even if everybody was awaiting them eagerly. Thus we conclude that if scientists aim for establishing a lasting purpose driven cooperation with their students it is helpful to engage not only in monitoring butterflies but also in monitoring participants' motivational development.

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