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Students' interest in a zoo

Upper secondary students' situational interest: a case study of the role of a zoo visit in a biology class

Abstract

This paper comprises a presentation of the findings of a case study that investigated how situational factors triggered 12th grade students' interest during a field trip to a zoo. The purpose was to identify sources of interest and to investigate the attributes that make them interesting. Students' interest was investigated by a descriptive interpretive approach, based on data from classroom and field trip observations, video recording, interviews, and students' work. The findings provided evidence that substantial situational interest can be generated during a fieldtrip to a zoo. Students' interest was triggered by variables such as active involvement (hands-on activities), novelty, surprise, and knowledge acquisition (activities and provided information), and social involvement (opportunities for socialisation). The results show that strong interest is stimulated when several variables are in play simultaneously. The study implies that zoo visits can provide students with affective experiences, which can be a powerful way to stimulate students' learning motivation.

Keywords

Situational interest, sources of interest, biology education, field trip, zoo education

Introduction

Over the years a number of studies have shown that field trips to zoos can play an important role for students' science learning. A great deal of research has been devoted to the clarification of the cognitive processes involved in visitors' learning from zoos (for a literature review, see Dierking, Burtnyk, Buchner, & Falk, 2002). While these efforts have come a long way to explain the unique nature of student learning outside school, they have also demonstrated how little is known about the influence of affective variables in these settings. Affective variables are central for learning, since they guide cognition, select among beliefs, arrange priorities among goals, determine access to memories, and provide heuristics that influence reasoning, judgment, and planning (Oatley, 2001).

Interest is an important affective variable that involves feelings of arousal, alertness, attention and concentration. Interest has motivational and cognitive properties, and is therefore a key variable in the motivation of learning and achievement (S. Hidi & Harackiewicz, 2000). From the perspective of positive psychology, experiences of positive affect prompt individuals to engage with their environments and partake in activities, many of which are adaptive for the individual. The experience of being interested has been characterized as an optimal state that combines positive affective qualities (e.g. feelings of immediate enjoyment, good moods etc.) and positive cognitive qualities (e.g. striving for meaningful goals, relevance etc.) (Rathunde & Csikszentmihalyi, 1993). Interest has been found to be associated with focused attention, higher cognitive functioning, and learning (Ainley, Hidi, & Berndorff, 2002), which makes it an important variable for learning in field trip settings (J. H. Falk & Dierking, 2000).

Although the importance of stimulating interest in science education has been acknowledged for more than twenty years, interest has mostly been investigated within other fields, e.g. reading. The potential sources of situational interest have only rarely been measured in empirical studies of

science education. While there is a growing amount of research into students' learning from museum visits, very little previous research has considered the specific variables that might trigger situational interest in these settings. To alleviate that, this study was set up to identify situational sources of interest in a zoo.

Conceptualising student interest

Interest is defined as a positively charged cognitive and affective experience that directs attention to, and focuses it on, the activity or task at hand (Rheinberg, 2008). An interest is content specific, i.e. it is always directed towards an object, activity, field of knowledge, or goal. When persons experience interest, their actions acquire an intrinsic quality; they are driven by enjoyment rather than external reasons (Krapp, 2002). However, it is important to note that interest cannot be equated with 'enjoyment while learning'. Enjoyment can occur for many reasons, and interest is only one of these. Interest creates the urge to explore, take in new information and experiences, and expand the self in the process. It is commonly assumed that promoting interest increases students' intrinsic motivation to learn and the number of learning strategies they use to do so (S. Hidi & Renninger, 2006).

In recognising the strong affective component of interest, many researchers went so far as to argue that interest is a basic emotion (Fredrickson, 1998; Izard, 1977; Silvia, 2006). Hidi (2006) suggest that if we only consider the moment in which the psychological state of interest is triggered, interest may be appropriately considered as an emotion. However, as interest develops and is maintained, both affect and cognition contribute to the experience. Furthermore, the relative strength of the two components of affect and cognition change over time, cognition having an increasing presence as interest develops (S. Hidi & Renninger, 2006).

In educational research, two types of interest, 'situational' and 'individual' (also referred to as personal interest), have been the focus of research (Krapp, 2002). 'Situational interest' refers to focused attention and the affective reaction that is triggered in the moment by environmental stimuli, whereas 'individual interest' refers to a persons' continued predisposition to engage in particular content over time (S. Hidi & Renninger, 2006). Situational interest consists of both an attentional and affective reaction to the situation, which can be differentiated into two forms: triggered situational interest and maintained situational interest. Triggered interest involves improving the affective experiences individuals associate with the environment. Maintained situational interest is a more involved, deeper form of situational interest, in which individuals begin to forge a meaningful connection with the content of the material and realize its deeper significance (Dewey, 1913). Although situational and individual interests are distinct constructs, they may be expected to interact and influence each others' development (Krapp, 2002).

Situational interest appears to be particularly important in catching students' attention, whereas individual interest may be more important in holding it (Mitchell, 1993). The question is how to catch students' interest and hold it for a prolonged time in order to stimulate a lasting state of intrinsic motivation. Consider a group of students who attend an otter training session during a zoo excursion. Animal training sessions may effectively capture people's attention and arouse an interest in the zoo visitor (U. S. Anderson, Kelling, Pressley-Keough, Bloomsmith, & Maple, 2003). During training session, the students may be stimulated and pay more attention than they did before; the contextual stimuli provide a 'hook' to capture students' attention (Csikszentmihalyi & Hermanson, 1995). Triggering interest activates a system that generates positive feelings, directs attention to the object or information that triggered the interest, and in the absence of stronger competing motives will prompt cognitive activity (Ainley, 2006). For some students, the triggered interest may evaporate the moment they leave the otter exhibit. For others, the triggered interest

persists and may develop into a genuine situational interest. From an educational point of view, situational interest can be a powerful way to motivate students who have little or no prior interest in a subject (Ainley, et al., 2002; S. Hidi & Harackiewicz, 2000).

Although zoos' stimulation of interest has been said to be of significant importance (cf. J. H. Falk, Reinhard, E.M., Vernon, C.L., Bronnenkant, K., Heimlich, J.E. & Deans, N.L., 2007), only very few studies of variables that stimulate interest in zoos have been conducted. Empirical evidence has primarily been generated through visitor studies and self-report surveys on attitudes (e.g. Bitgood, 1992) or analysis of visitor behaviour and engagement (e.g. Moss & Esson, 2010), i.e. not specifically directed at students on field trips. The research that does exist has rarely been informed by current psychological literature about interest (c.f. National Research Council, 2009). Some research has been done on how general contextual factors, such as the classroom environment or instructional strategies, can promote students' interest in a particular domain, but investigation of specific conditions that stimulate students' interest in zoos is almost absent. The purpose of the present study was, therefore, to investigate the role which a field trip to a zoo played in triggering 12th grade students' interest in biology. The focus of this paper is consequently on the zoo visit itself and on the activities in which the students participated prior to and after the visit, in preparing for and reflecting on the visit, respectively.

Methodology

Situational interest refers to a transitory state, i.e. the focused attention and the immediate feelings stimulated by the situation. Research in situational interest has traditionally been based on survey approaches: questionnaires and self-rating scales administered after a learning task. However, an exclusive use of survey research may cause us to overlook aspects of interest that are important to students (Pekrun, Goetz, Titz, & Perry, 2002) and do not permit an in-depth exploration of how

individuals come to construct their understanding within a learning environment or the role of the contextual factors. Survey approaches provide a retrospective view of the event, which is not necessarily the same as the state experienced while doing the task (Ainley, 2006). Survey approaches has resulted in rather limited information about how interest is triggered (Alexander, Kulikowich, & Jetton, 1994). Neglecting the complexity of the social contexts in which interests develop can result in missed opportunities to understand the processes involved. To understand students' focused attention and immediate feelings *in situ*, the tools of assessment must therefore extend beyond the commonplace multiple-choice item or the often-administered Likert scale.

Students' interest can be recorded by interview techniques. However, it can be difficult to assess exactly what a student means by 'interest', due to the embeddedness of the concept in the everyday language (Valsiner, 1992). Nothing is revealed about the student's level of commitment to this object or activity when a student speaks positively about an interesting object or activity. Careful consideration is required to assess how interested a student is in particular objects or activities of interest.

To address this issue, a descriptive interpretive approach (Tobin, 2000) was adopted for this study. Such an approach calls for collection of open-ended information about the population and phenomena of interest from a variety of sources. Thus, a qualitative methodology was deemed the most appropriate means to achieve the research objectives of this study. The basic aim was to understand the context in which interest was created and thus to ensure the 'ecological validity' (Bracht & Glass, 1968) of the results. In this study, multiple methods were used, including content analyses of interview protocols and ethnographic observations of learning activities in zoo and classroom. The case study was framed by the following research question:

How are situational interests of 12th-grade students triggered during a field trip to a zoo?

The purpose of the present study was to investigate how a field trip to a zoo promotes interest of 12th grade students. Specifically, the purpose was to identify sources of interest and to investigate the attributes that make them interesting.

The participants

The 21 students (16 girls and 5 boys, age 17-19 years old) in the present study attended a Year 12 biology class in a public gymnasium (Danish upper secondary school), taught by Mr. Olsen¹. The gymnasium is situated in a major town in an urban area of Jutland, Denmark. The school has 60 teachers and some 530 students, divided into 21 classes (Year 10, 11, and 12).

Mr. Olsen taught the biology class 4 or 6 lessons per week. The biology lessons were dominated by traditional curriculum and instructional methods, i.e. teacher talk, blackboard, textbooks, and laboratory exercises.

The zoo trip was planned by the teacher to be an integral part of the school curriculum in evolution, focusing on the concepts of variation, adaptation, and speciation. The teacher had not previously made trips to the zoo. The visit included two guided tours, planned and led by the zoo educator, and a laboratory exercise on protein profiling that comply with national educational objectives in Year 12 biology. The teacher directed the laboratory activities, assisted by the zoo educator and the researcher.

The zoo

Odense Zoo, founded in 1930, is a public Danish zoo. Odense Zoos' exhibits can be classified as third-generation, i.e. they display animals in their species-natural groups in exhibits that contain vegetation and land formations that simulate the animal's home region (Shettel-Neuber, 1988).

¹ All names used in this paper are pseudonyms to protect the anonymity of the participants.

Odense Zoo's purpose is to inform about animals and preservation and to preserve endangered animals through national and international collaboration. The zoo plays an important role in education, and provides many opportunities for learning for both general visitors and school groups. The zoo's school service offers a number of traditional programs, including guided tours and instruction which typically includes group work with worksheets and hands-on materials like fur, skulls and eggs. Some 7,000 students, mostly primary school classes (0-3rd grade), annually attend the school programs.

Data collection

Data were collected for 7 weeks. Biology lessons were observed from 4 weeks before the zoo visit. During this pre-visit period, students were taught molecular genetics and evolution. The class prepared for the zoo visit in the end of Week 4. The zoo visit itself took place in the beginning of Week 5 and lasted an entire school day, from 9.30am – 3pm. The post-visit period lasted about 2 weeks long (Week 5-7), and involved in-class evaluation of the zoo trip and post-visit lab activities.

Three forms of data collection methods were employed in the study: participant observations of the classroom and zoo trip, video recording, and interviews.

Classroom and field trip observations. Classroom and field trip observations were 'naturalistic observations', i.e. embedded in the settings that are being studied without interfering with the activities under observation (Angrosino, 2005). Situations where students seemed attentive and emotionally engaged (committed talk, emotional exclamation, or laughter that indicated attention and/or engagement in discussions or spontaneous debates on a topical issue) were recorded in field notes and later reviewed and expanded for preliminary analysis to help inform subsequent classroom observations.

Video recording. The entire 7-week period was videotaped. The camera was placed on a stand in the biology classroom and filmed the entire class. The aim was to capture student action and dialogues in the classroom. Video recording was performed in two ways in the zoo: a) the laboratory activities were recorded with the camera placed on a stand, b) the guided tour was recorded by hand-held camera. In both cases, the entire class was filmed in order to capture student action and dialogues.

Video recordings were reviewed for preliminary analysis and compared to field notes.

Transcriptions were made from video sequences of student talk in which students verbally expressed affect, such as "That's pretty boring".

Interviews. The use of interviews as data source was a choice based on their utility in exploring and illustrating situational interest. In this study, two approaches to interviews were used: The informal conversational interview and the formal semi-structured research interview.

In studies of situational interest, it is preferable to use a very fast procedure to gather data, in order to capture the short-lived fluctuations in interest levels as they occur (Palmer, 2009). To access students' triggered interest calls for a method that directly monitors interest *in situ* since there is a risk that the significance and meaning for the individual and the feelings associated with the interesting object or activity might change over time. Situational interest was identified in informal interviews. The informal interview is a method of interview where questions emerge from the immediate context and are asked in the natural course of things; there is no predetermined topic or wording. One advantage is that the salience and relevance of questions increases, because interviews are built on and emerge from observations; the interview can be matched to individuals and circumstances (Patton, 2002). On the other hand, informal interviews have limitations:

interviewing small groups of individuals involves group-dynamic aspects that might influence individual's interest and beliefs.

Informal interviews were conducted in the classroom (Week 1-7) and during the field trips to the zoo (Week 5) and involved all the students. Students were interviewed alone or in small groups of 2-3 individuals when the situations made it possible. They were asked questions, such as following:

- How did you experience the situation?; why?
- Did you experience interest?; how/why/not?

The informal interviews typically lasted 3-5 minutes. Students' responses were recorded as notes.

Formal post-trip interview was conducted as semi-structured qualitative research interviews (Kvale, 1996), which lasted between 35 and 45 minutes. This type of interview is designed to obtain qualitative descriptions of the interviewees' life-world in order to interpret the meaning of the described phenomena, and thus to understand the interviewees' life-world. 6 students volunteered and were formally interviewed during the 3 days following the zoo visit (Week 5). The interviews were based on field notes and responses from the *in situ* informal interviews. The interviews concerned what the students experienced as "interesting", "exciting", and "fun". The interviews took place in the biology classroom at the end of the school day, and were conducted using the following interview guide:

- Immediate comments about the trip?
- Was the trip like what you expected?
- How did you experience the visit?

- What did you like most at the visit?
- Was the visit interesting?; how/why/not?
- Were the laboratory activities interesting?; how/why/not?
- Were the guided tours interesting?; how/why/not?
- Did you find the topic (evolution) interesting?

The teacher was formally interviewed on the day after the trip about his aims, rationale, and expectations for the students and his general educational philosophy and approaches to field trips.

All formal interviews were recorded on video, and full transcripts were made of all resulting video tapes.

These three sources of data were deemed necessary to allow triangulation and to provide a valid interpretation of what students experienced as interesting during the zoo visit. These sources combined together provided a rich, holistic interpretation of students' interests in the zoo context.

Data analysis

The actual data driven analysis felt in two phases. In the first phase of the analysis, students' different kinds of descriptions of their situational interest were identified. The interview transcripts were first informally reviewed to identify common themes. Interview transcripts were then coded line-by-line for emerging themes reveal and report students' voices. Through this process, justifications for what the students found interesting were classified. Codes emerging from individual transcripts were compared, and codes that represented similar factors were combined.

After several repeated coding sessions, five coding categories were formulated based on the dialectics of data and theory (Miles & Huberman, 1994). The categories were: ‘hands-on’, ‘social involvement’, ‘surprise’, ‘novelty’, and ‘knowledge acquisition’. The list of codes is listed in Table 1. In the second phase, a more detailed qualitative analysis was conducted and students’ responses were coded and assigned to the five categories formulated in the earlier phase. Because the interviews were semi-structured and students were able to discuss several topics in the same response, some responses included elements from more than one category. These responses were coded in every relevant category.

[Insert table 1. around here]

Results and interpretation

The zoo visit

The teacher intended the trip to be an integral part of the biology curriculum unit taught in the lessons 4 weeks’ before the trip (Week 1-5), and nearly 2 weeks afterwards (Week 5-7). During Week 4-5, the class read a textbook chapter on methods to infer a phylogeny from molecular data, and they made a written assignment. On the day preceding the visit the teacher gave a 15-minute presentation in preparation for the field trip. The presentation included the schedule of activities for the visit and a brief review of the laboratory exercise.

Mr. Olsen had explicit learning goals for the class: To learn about the concepts *variation*, *adaptation*, and *speciation*. Judging from classroom observation and informal talk, Mr. Olsen was typical in his view of learning and teaching. This was reflected by his teacher-directed instruction (i.e. teacher monologues), as he believed that students would learn by reading textbook and listening. Students were typically not given choices in their work, which for example was reflected

by extensive use of cookbook-style laboratory work. As consequence, the students considered the lessons monotonous and boring. Mr. Olsen expected the zoo trip to be a motivating event, as students should be working within an ‘authentic’ context for the theme of evolution. Besides, he viewed the laboratory work a highly relevant part of the school curriculum. One specific goal for the trip itself was to give students the chance to “try a cool exercise and to see the results of speciation”. Mr. Olsen said he felt this experience was important for students to actually see animals and give them a more “real experience of evolution” than just finding information in books or on the Internet.

The students' expectations were less learning-oriented. They expected to “have a nice day together” and “see some animals”. Their expectations were influenced by a shared belief that zoos are not appropriate learning environments for upper secondary biology, but places for entertainment where families go on Sundays. On the surface, students’ expectations may suggest that they were not highly motivated to learn. However, further questioning indicated that the learning experience they expected to find was one of exploration and adventure, which Packer (2006) refers to as “learning for fun”. The phrase refers to the phenomenon in which visitors engage in a learning experience because they value and enjoy the process of learning itself, rather than for any instrumental reasons, such as the attainment of specific learning outcomes.

When they arrived at the zoo, the class was greeted by the zoo educator and the director of the school service. The class was guided to the zoo classroom, which was fitted out by animals in caves and terrariums, and laboratory equipment for the laboratory exercise, which was based on the educational kit ‘Comparative Proteomics’ (Bio-Rad Laboratories, Inc. #166-2700EDU). The kit is designed to show how a specific protein from different fish species differs as a result of an evolutionary history in which the corresponding genes have mutated from a shared point of origin at

some point in the distant past. The closer related two fish are the more similarities between their DNA. The exercise allows students to use SDS-polyacrylamide gel electrophoresis (or SDS-PAGE), one of the most widely used techniques in life science research, to study protein structure and function, and to create cladograms (phylogenetic trees) in order to determine evolutionary relatedness between species. The kit is developed for classroom use. The class could, in principle, perform the laboratory exercise in school but due to lack of sophisticated equipment (vertical electrophoresis chamber, for example) the exercise could in practice not be done in this school.

The students worked in groups of 2 or 3 individuals. They spent 2 hours on fish dissection, protein extraction and gel loading. After this group time, the students were allowed to form their own peer groups to walk around the zoo on their own for about 30 minutes while the electrophoresis was running. After lunch, the class was led on a guided tour around the zoo, where the education officer talked about evolution and adaptation of tapirs, penguins, and manatees. The students returned to the zoo classroom and prepared the gels. The zoo educator guided the class to the chimpanzees where he talked about evolution and adaptation of chimpanzees for 30 minutes. After this second guided tour, the students finished the laboratory exercise and packed the gels for analysis the following day. In the subsequent biology lessons (the day after the visit) the visit was evaluated. Post-trip activities were observed for about 2 more weeks, during which students determined molecular masses of the extracted proteins, created cladograms (“fish evolutionary tree”) and wrote their reports.

In his post-visit interview, Mr. Olsen said he was very pleased with the outcome. He felt that the students enjoyed the trip and that they learned from the hands-on experiences with professional life science laboratory equipment.

The students enjoyed the laboratory hands-on experiences, but they felt that the underlying theory was hard to understand. They also enjoyed the guided tour by the zoo educator, who told ‘good stories’ about the specific features or characteristics of individual animals (like how chimpanzees catch termites using a stick). In informal interviews performed during the zoo visit all students, however, reported that, while they did enjoy the trip, they felt they learned very little. Statements like: “I think it was exciting, but we didn’t learn much” is representative of many students’ comments. When asked what they learned, most students cited facts they had heard, such as “there are 17 penguin species world-wide” or “manatee descended from elephants”. During the post-visit laboratory activities, students were excited about learning how to create a cladogram based on molecular evidence. Students' comments indicated that interest was triggered during the post-visit laboratory activities.

Sources of situational interest

In this study, an inductive approach (Miles & Huberman, 1994) was used in order to identify the sources that arouse situational interest. Based on students’ answers, five different categories – ‘hands-on’, ‘social involvement’, ‘surprise’, ‘novelty’, and ‘knowledge acquisition’ were composed indicating several variables triggered situational interest among the students during the visit. It was in some instances difficult to isolate the significance of the individual variables, since there were often several variables in play at once. The order in which they are listed does therefore not reflect their priority in terms of frequency or relative significance.

Hands-on. Hands-on was an important source of situational interest in this study (n = 21). It was obvious that the laboratory exercise offered the students hands-on experiences that created interest. All students found the exercise work fun, fascinating, exciting and interesting but also somewhat challenging. For example, Sarah expressed it this way:

“It is an exciting but also demanding job, I really like being careful and concentrated in this way”
(informal interview, Week 5).

Students’ informal comments suggest that they enjoyed working with authentic material and professional laboratory equipment.

Social involvement. The category social involvement refers to interest that was stimulated by interpersonal interactions. Social involvement was among the most commonly referred source of interest by the students (n = 19). Group dynamic conditions showed up frequently in the data, primarily when the students worked together on the laboratory exercise. For example, when students loaded the SDS- polyacrylamide gels by pipetting 10 µL samples into the wells, they negotiated gel loading as a competition in allocating samples as accurately as possible. David put it this way:

“Pipetting was a very difficult step, it required a lot of precision, but it was also very exciting and fun because we competed to load the samples as precisely as we could” (interview, Week 5).

The students enjoyed being together, and the field trip made them socialize under more liberal conditions than in school. Many students indicated that they got to know each other a little better at the trip. The following interview quotes are representative of the many student comments about the social significance of zoo trip:

“It was really nice, this also makes it [the topic] more fun and interesting” (Sophia, informal interview Week 5)

“We shared some exciting experiences and we talked a lot together; this creates a better classroom atmosphere” (Olivia, interview, Week 5).

Surprise. This category refers to unexpected or discrepant information, i.e. a knowledge-based interest that is triggered by sudden and unexpected information. Verbal responses were coded in this category if they indicated that the students had an immediate feeling of surprise that prompted interest (n = 17). It was obvious that the zoo educators' 'good stories' created surprise, as the information contained surprising details about animals that went against students' expectations. For example, Alexander stated that:

"It was really fascinating when he [the zoo educator] explained how manatees descend from elephants, I didn't know that" (informal interview, Week 5)

Likewise, Isabella stated that:

"It was exciting that there is such a wide variety among penguin species!" (informal interview, Week 5)

The realization that there are several penguin species and not only the Emperor Penguin as she thought, triggered her interest.

Novelty. Responses were placed in this category if they indicated that interest had been aroused by something new or unusual. Novelty and variety were a significant source of interest during the zoo visit (n = 16), mainly because the zoo provided the students with experiences different from school. Even though the teacher conducted the laboratory exercise during the zoo visit, students still rated the lab experience as new and exciting and thus interesting:

"Although we could have done it [the laboratory exercise] at school, it becomes a special event when you do it in zoo. It was a great experience and I may remember the exercise a little better, I think" (Emily, interview, Week 5).

The contrast between the daily biology lessons and the zoo trip was reinforced by the students' experience that the biology lessons were monotonous, as evidenced by the following student statement:

"It was great to get away [from school], it does give us different learning experiences because normally we just sit in the classroom and listen, it can be very monotonous, when you just sit here and do assignments and listen, and do assignments and listen... so [the zoo visit] was great just because of the variation" (Amanda, interview, Week 5)

Similar comments during the trip suggest that variety had significant impact on students' interest. The six in-depth interviewed students said that going out of school meant they were more attentive and open to new impressions.

Knowledge acquisition. Some students reported interest sparked by acquiring knowledge (n = 6). The responses refer to a knowledge-based interest which was generated by acquisition of knowledge. This category has much in common with the category 'surprise', but seemed to be of more persistent and thus individual character. Knowledge acquisition as a source of interest was confirmed by responses such as:

"It became interesting when I understood the theory [of the exercise]" (Olivia, interview, Week 5).

"It was really fascinating when I made the phylogenetic tree based on our own data" (Sophia, interview, Week 5).

"Great to learn about fish evolution" (Matthew, interview, Week 5).

Knowledge acquisition was only reported in relation to the post-trip laboratory activities in school (analysis and interpretation of SDS gels), and thus not directly tied to the zoo environment.

Discussion

A substantial body of research on field trips has accumulated over the past years, much of which has attempted to identify to what degree field trips contribute to school-based instruction and learning, including teachers' variety of reasons for arranging field trips: as an enrichment experience, as a supplement to school curriculum, or as a reward, as illustrated by Davidson, Passmore and Anderson (2010) and Tofield, Coll, Vyle and Bolstad (2003). Sørensen and Kofoed (2003) has classified school field trips in four categories: a) the 'day out' tour, with no preparation and no follow-up; b) the 'classroom' tour, where students follow a docent or teacher around the venue and often do a worksheet; c) the 'inspiration' tour, where students explore the exhibits on their own to obtain ideas for post-trip activities back at school; and d) the 'learning resource' tour, where the visit is part of the work at school with pre- and post-trip activities. In the present case study, the field trip belongs to the category 'learning resource': The zoo served as an out-of-school laboratory; the field trip learning goals were tightly aligned with school curriculum; and the visit was structured according to recent ideas on field trips to science museums, i.e. advance content preparation, active participation in structured science activities, and follow-up activities (National Research Council, 2009). Recent research has shown that advance field trip preparation gives students a framework which guides what they should pay attention to during the visit and how they should interpret what they see (D. Anderson, Kisiel, & Storksdieck, 2006; D. Anderson, Lucas, Ginns, & Dierking, 2000; Griffin & Symington, 1997). During a field trip, active participation in structured museum activities (hands-on activities, inquiry-based problem solving, discussion with peers, etc.) promotes student motivation (S. Hidi, Weiss, Berndorff, & Nolan, 1998; Paris, Yambor, &

Packard, 1998) and learning (Cox-Petersen, Marsh, Kisiel, & Melber, 2003; Mortensen & Smart, 2007; Tofield, et al., 2003). Educational impact is increased by post-visit activities (D. Anderson, et al., 2000; Davidson, et al., 2010; Griffin, 1994). In the present study, the students participated in pre-trip preparation activities supplied by their teacher and were engaged in field trip laboratory work. The latter was continued in post-trip classroom activities. All students reported that they found the zoo activities highly meaningful and thus interesting. They reason they reported for this was that the activities tied the field trip and school work close together.

Whereas much field trip related research has focused on the cognitive learning potential of out-of-school environments or contrasted out-of-school learning opportunities with in-school instruction, very little research has been undertaken on the influence of affective variables in these settings. The purpose of the present study was therefore to investigate how a field trip to a zoo promotes interest among upper secondary students. Specifically, the purpose was to identify sources of interest and investigate the attributes that make them interesting. The results provide evidence of factors influencing students' interest; how hands-on, social involvement, surprise, novelty, and knowledge acquisition can trigger situational interest.

Hands-on. This was by far the most common source of interest overall. The students reported the laboratory exercise to be the most important source of interest, much more important than touching fur, bones or skulls. The findings suggest that hands-on may have allowed a number of other sources of interest to come into play. For example, when the students were dissecting fish, several also reported of 'novelty' and 'social involvement', as well as excitement caused by using professional laboratory equipment. Likewise, when the students handled a manatee skull and heard of its relation to elephants, most also reported of 'surprise'. Each source seemed to influence and/or

be influenced by other sources. The findings suggest that the significance of hands-on was mediated by these allied factors, which is in agreement with the research reported by Palmer (2009).

Hands-on experiences have been reported as important sources of interest, and the main reason is manipulation of objects involves perception as well as engagement (Holstermann, Grube, & Bögeholz, 2010; Middleton, 1995; Mitchell, 1993; Palmer, 2009). However, hands-on activity is not always in itself sufficient to capture interest. This can be illustrated by students' lack of interest when the zoo educator talked about evolution. Positioned in front of the manatees' exhibit, the zoo educator passed an ostrich egg and lion fur around for the students to touch. Even though the students enjoyed touching egg and fur fun, they did not experience interest, primarily because of lack of relevance to manatees. This example suggests that a hands-on activity that does not involve themes that student can identify (i.e. meaningfulness) or a high intensity level seems not to have influence on interest (Holstermann, et al., 2010; Mitchell, 1993).

For well over a century, hands-on laboratory experiences have been purported to promote key science education goals including the enhancement of students' interest and motivation (Hodson, 1993; Hofstein & Lunetta, 2004). For whilst students in general do like practical work, Abrahams (2009) has recently shown that their reasons for doing so might appear to be primarily that they see it as preferable to non-practical teaching techniques, such as more writing or teacher talk (Hodson, 1990). This issue point to variety as a source of motivation.

Social involvement. Social involvement is known to be an important source of interest (Dohn, 2011; Isaac, Sansone, & Smith, 1999; Mitchell, 1993). According to the Self-Determination Theory, people have a basic need for social contact, and this is why interpersonal involvement can arouse interest (Deci, 1992; Krapp, 2005). The framework suggests that social environments can facilitate intrinsic motivation by supporting individuals' innate psychological needs. In this study, group

work by itself appeared to trigger interest. Group work provided a form of social stimulation by encouraging students to talk to one another about subject-related concerns and ideas.

The interview data suggest that the students redefined gel loading into something more positive to perform through collective transformations of the hands-on activity. Sansone, Weir, Harpster, & Morgan (1992) suggest that strategies that regulate interest can help people maintain their motivation to perform the task. Individuals often attempt to regulate their motivation for important activities by using the social context of the activity to make their experience more interesting. To the extent that individuals approach an activity with interpersonal goals, they will experience greater interest if the activity and surrounding context facilitates those goals (Sansone & Thoman, 2005).

Surprise. The zoo educators' 'good stories' created surprise in most students, as the information contained surprising details about animals that went against the students' expectations. Iran-Nejad (1987) has emphasized the role of intellectual activity in response to such stimuli by suggesting that the degree to which information is interesting is related to its *post-dictability* – that is, how well the information can be related meaningfully to expectations or prior knowledge. Surprising stories are interesting because the resolution of post-surprise incongruity intensifies intellectual activity. Thus, creating surprise by presenting information that goes against expectations or background knowledge can create a cognitive disequilibrium for students; they may then attempt to figure out why their beliefs are wrong, and then they may become more engaged and involved (Bergin, 1999).

Surprise is closely related to certain variables; optimal challenge, novelty, and optimal discrepancy between input and cognitive structure (Berlyne, 1949, 1960; Deci, 1992). Although surprise involves knowledge of the individual and thus could be classified as an individual factor, surprise is classified here as a situational factor, because surprise depends on situational conditions, too.

Novelty. In the present study, novelty (i.e. new or unusual) was categorized together with variety (i.e. unfamiliar), because of the problem of reliably coding them. Even though novelty and variety may be slightly different constructs, they are categorized here as novelty. Palmer (2009) argues that variety, which involves teaching activities that are different or unusual, is also a type of novelty.

Variety came out as an important aspect of novelty in this study. Evidence for variety as a source of interest was provided by the students' comments regarding the field trip; the trip was perceived as an *event*, i.e. the field trip provided the students with significant differently experiences than daily instruction. Before the zoo trip, informal conversations revealed that all of the students experienced the biology lessons as "uniform" and "boring", and only a few took part in discussions on class. Maria, for example, commented on the biology lessons as follows: "Whew, it's very boring, there is no one who is enthusiastic about it" (informal interview, Week 3). Common sense tells us that if students do the same activity day in and day out, boredom will inevitably set in. Research reminds us that novelty and variation are very important variables, not only to capture interest, but also to stimulate intrinsic learning motivation. Providing novelty and variety in tasks and activities in the structures of instruction at the daily level results in higher levels of interest and intrinsic motivation in students (Pintrich, 2003).

Knowledge acquisition. Only few students reported interest sparked by acquiring knowledge in the present study. Interest generated by knowledge acquisition was related to the post-trip classroom laboratory activities. Verbal responses were only coded in this category if they indicated that the students had a feeling of learning something that prompted interest. It was obvious that the zoo educators' 'good stories' presented students with surprising information, but the students primarily reported acquisition of this surprising information as related to surprise. Thus, acquiring

information like “there are 17 penguin species world-wide” was not categorized as knowledge acquisition.

Acquisition of domain knowledge is known to be a source of interest. Palmer (2009), for example, report learning (i.e. the acquisition of domain knowledge) to be the most important source of situational interest among K-9 students in an inquiry-based science course. There appears to be a reciprocal relationship between knowledge of a domain and interest in the domain. That is, we pursue learning about things we are interested in, and the more we know about something, the more we become interested in it. Previous research suggests that knowledge is related to both individual and situational interest, even though knowledge appears to be related more strongly to individual interest (Alexander, et al., 1994; Bergin, 1999; Tobias, 1994). As mentioned earlier, the category ‘knowledge acquisition’ is similar to the category ‘surprise’ in that they both rely more on individuals’ cognition than other variables. The category ‘knowledge acquisition’ seemed, however, to be of a more persistent nature than ‘surprise’.

The presented findings imply that the upper secondary students experienced a great deal of positive task-related and social emotions during the zoo trip. When the trip was evaluated in class (Week 5), students commented the trip with a range of affective terms to describe how they felt. These included terms like ‘motivating’, ‘liking’, ‘fascinating’, ‘interesting’, ‘fun’, ‘pleasure’, ‘happiness’, ‘enjoyment’, and ‘delight’ (obtained from classroom video recording). The students’ use of these words suggests that not only interest, but also a whole range of other positive experiences of affect had been activated through the zoo trip, resulting in positive feelings toward evolution that lasted through the post-visit biology lessons (Week 5-7). During the post-visit period, all 21 students said they found biology more interesting than before the trip, and all reported more motivation than before. Thus, the results suggest that positive emotions such as enjoyment and content appear to be

important outcomes of school field trips, and it is likely that the experiences of positive affect prompt individuals to engage in post-trip activities which might develop the individual. The broaden-and-build model of positive emotions (Frederickson, 2001; Fredrickson, 2004) proposes that interest, like positive emotions, serves long-term developmental goals: curiosity about the new and the possible expands experiences and attracts people to new possibilities. The model suggests that interest cultivates diverse experience by orienting people to new learning events and facilitates the growth of competence by motivating sustained activity in a specific area. However, understanding of positive emotions has been limited by the prevailing prototype of emotion established from the study of negative emotions (c.f. Frederickson, 2001). To date, research on students' affective life in science education has primarily focused on the decline of students' interest in science (e.g. Gardner, 1998) and has generally been biased toward negative emotions such as boredom. To obtain a more complete picture of students' affect, it would seem necessary to analyze students positive experiences as well, as suggested by Pekrun, Goets, Titz & Perry (2002). So, whether directing attention to students who are excited about learning, or, students who are bored and demotivated, questions concerning the place of affect in the psychological processes that support learning need to be addressed. Such an analysis may be of specific importance for designing field trips in such ways that they foster students' psychological well-being and learning beyond perspectives of preventing and modifying negative emotions. Going beyond the decline of students' interest in science, the study of affect should thus address the full range of students' affective experiences in science education, negative as well as positive.

Conclusion and limitations

Before we present the conclusions, it is important to acknowledge the limitations of the current study.

First, the interview transcripts suggested that students often equated 'interesting' with 'fun', 'fascinating', 'liking', or 'motivating' which possibly represented different constructs. In everyday language, the word 'interest' may refer anything that a person likes or feels attracted to. What people mean when they express their interest is therefore not obvious. While this lack of clarity is understandable given the flexible use of the word 'interest' in everyday language (Valsiner, 1992), it nonetheless points out the need to conceptualize 'interest' in studies of students' outcome of field trips.

A second limitation concerns to the generalization of the results. The exercise was based on an advanced educational kit; Comparative Proteomics (Bio-Rad Laboratories, Inc. #166-2700EDU), which was developed for upper secondary and tertiary level biotechnology education. The exercise involves a study of protein structure and function in order to identify evidence for biological evolution. The students reported the laboratory activities as very intense and stimulating experiences that triggered a lot of interest. It is difficult to assess how much influence the laboratory activities have had on students' overall experiences during the zoo field trip. It is conceivable that a zoo field trip without this advanced laboratory exercise will promote less exciting experiences and thus less interest. Thus, using this case as a representative example of how interest can be generated in a zoo should be done with care. This issue leads to more general perspectives on the generalization of the findings. The results are based on a single case study, involving participants from the same biology class. To establish the results' generalisability, the findings observed in the present study need to be replicated in more heterogeneous samples, and at different points in student development. Replication of the present results in samples of different ages and cultural backgrounds would support the findings that hands-on, social involvement, surprise, novelty, and knowledge acquisition is universally interest stimulating for all individuals, in schools as well as on organized field trips.

While the limitations of this study limit the generalisability of the findings, there are nonetheless some noteworthy implications of this study. Students in this study experienced situational interest through the use of active involvement (by challenging hands-on activities), novelty, surprise, and knowledge acquisition (by discrepant events activities and providing surprising information), and social involvement (by providing opportunities for socialisation). The results show that strong interest is stimulated when several variables are in play simultaneously. The sources of situational interest (hands-on, social involvement, surprise, novelty, and knowledge acquisition) correlated quite well with those described for other field trip settings (Dohn, 2011) as well as for other learning domains such as reading (Schraw & Lehman, 2001), mathematics (Mitchell, 1993), and science education (Palmer, 2009). The study implies that zoos can provide students with positive emotional experiences that are rich and varied, as suggested by Myers, Saunders and Birjulin (2004).

Table 1

Categories of the sources of situational interest in inquiry-based science education

Category of the sources of situational interest	Description of the source
Designing inventions	Design process, inventing, developing new methods, being creative
Trial-and-error experimentation	Trial-and-error,
Achieved functionality of invention	Successful test,
Collaboration	Being together as a group, social interaction among peers, the atmosphere in the group

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