

The situational interest of undergraduate students in zoophysiology

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Dohn NB, Madsen PT, Malte H. The situational interest of undergraduate students in zoophysiology. *Adv Physiol Educ* 33: 196–201, 2009; doi:10.1152/advan.00038.2009.—Situational interest has been identified as an important motivational variable that has an impact on students' academic performances, yet little is known about how the specific variable of the learning environment might trigger students' situational interest. The purpose of this study was to investigate sources that stimulate the interest of students in an undergraduate course in zoophysiology. Observations, informal conversational interviews, and responses to a survey were used to identify sources of interest. Five situational variables and one predominantly individual variable are documented to influence the catching of interest of students. The situational variables are live animals, "Ah-ha!" experiences, meaningfulness, social involvement, and humor, whereas the predominantly individual variable is background knowledge. We conclude that the situational variables are largely under the control of the faculty and should be considered when planning instruction. By focusing on the enhancement of situational interest in physiology lessons, faculty members can find ways to foster students' involvement in specific content areas and increase levels of academic motivation.

academic motivation; sources of interest; instructional strategies

AS EDUCATORS, we are concerned with motivating our students to learn physiology. A key aspect of fostering motivation for learning is to catch the interest of students and to maintain it (12, 25). It is generally accepted that interest plays an important role in the learning process, determining in part what we choose to learn and how well we learn it (22). More specifically, interest affects attention, goal setting, and learning strategies in ways that make it a particularly relevant variable for improving educational practice (16, 17). Thus one may ask "How can one stimulate the interest of most students to facilitate learning?" Unfortunately, theories of interest and motivation provide little specific advice to faculty members about how to stimulate and maintain students' interest in physiology. To alleviate this, we sought to identify situational sources of interest in physiology education.

Interest has been defined in various ways. In recent theories (17, 20, 22), interest is primarily understood as a phenomenon that emerges from an individual's interaction with his or her environment. Interest is a content-specific concept, i.e., it is always related to specific topics, tasks, or activities. The most important characteristics refer to the person's values and feelings. To be interested is to have a subjective feeling for the topic (affect), to be drawn to it (conation), and to have some degree of knowledge about the object or activity in question (cognition) (9, 31, 37, 38).

Two types of interest have been the primary focus of educational research to date: situational interest and individual interest (17, 20, 22). Situational interest is generated by certain conditions and/or stimuli in the environment that focus attention, and it represents an immediate affective reaction that may or may not last over time (16, 20). Individual interest is conceptualized as a relatively stable motivational orientation or personal disposition that develops over time in relation to a particular topic or domain and is associated with increased knowledge, value, and positive feelings (34, 35, 37). Whereas the situational interest approach tends to focus on a response to environmental factors that promote interest in a particular context, the individual interest approach centers on enduring preferences (3, 14, 25).

Individual interest refers to an interest that people bring into the learning environment. For example, undergraduate biology students typically have a long-term individual interest in biology. Some students will come to a physiology lecture already interested in the subject, whereas others may have little individual interest in physiology but have preferences for other biology-related subjects (biotechnology, for example). When a student focuses on something (a personal anecdote told by a faculty member or a spectacular laboratory demonstration, for example), his or her interest has been triggered by the situation. Although situational and individual interests are distinct, they are not dichotomous phenomena, but rather can be expected to interact and influence each others' development. The experience of being interested in a concrete learning situation is the result of an interaction between individual and situational factors (13, 14, 22).

It has been proposed that repeated experiences of situational interest may, over time, have powerful effects on students' individual interest regarding the subject (12, 17, 20, 25, 37). Important with respect to learning and instruction is the question of how to catch interest and hold it for some period of time to stimulate a lasting state of intrinsic motivation. For example, students who were exposed to an exciting lecture in physiology may be stimulated and pay more attention than they did before. For some students, this interest may evaporate as soon as the lecture ends. For others, the interest triggered in this situation persists over time and may develop into an individual interest in physiology. Very little is known about this developmental process even though it carries tremendous educational implications for faculty members, who strive to promote a long-standing interest in topics such as metabolism, respiration, or neurophysiology. Faculty members often think that students either have or do not have an interest in a given topic and may not realize that they could make a significant contribution to the development of students' academic interest. In other words, although faculty members have little influence over the individual interests (or disinterest) students bring into class, they can influence the development of such interests by creating appropriate environmental settings that foster situational inter-

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est. From an educational point of view, situational interest is the real topic of concern because it can be a potentially powerful way to help students who have little or no preexisting interest in a subject (1, 10, 16, 18). By focusing on the enhancement of situational interest in classrooms, faculty members can find ways to foster the involvement of students in specific content areas and increase levels of academic motivation (3, 25).

Although the importance of stimulating situational interest has been acknowledged for some time, it has primarily been investigated within other fields, such as reading. The potential sources of situational interest have rarely been measured in empirical studies of science education. Some instructional strategies that, in general, may create situational interest have been described in the literature (3, 17, 28, 36, 38, 39). These strategies include the following: 1) use of original materials (these materials often have interesting content or details that get left out of more generic texts and therefore can help spark situational interest), 2) creating surprise (presenting material that goes against expectations or background knowledge can create a cognitive disequilibrium for the students; they may then attempt to figure out why their beliefs are discrepant, and then they may become more engaged and involved), 3) use of variety and novelty (introduction of a variety of activities and novel ideas, content, tasks, and activities may facilitate situational interest and prevent boredom), 4) provide some choice of topics based on individual interest (motivation theories suggest that providing some choice and autonomy increases interest and motivation), and 5) integrate students individual interests in designing lessons (when teachers connect the lesson content to individual interests or common interests of the students, it can facilitate attention and situational interest). However, we still have very little idea about the specific variables that might trigger situational interest in physiology lessons. The purpose of this study was to investigate sources that promote interest in a second-year animal physiology course. Although this article does not examine the influence of interest on actual learning, we write under the assumption that interest generally, but not always, promotes learning (13).

METHODS

Description of the course. The Zoophysiology course is a second-year, two-quarter basic course in biology held at the Department of Biological Sciences of Aarhus University (Aarhus, Denmark). A total of 70 undergraduate biology students were enrolled in the course. The first quarter involves 2 h of lectures in 7 wk, 2 h of theoretical exercises in 6 wk, and 4 h of laboratory exercises in 4 wk. The second quarter involves 2 h of lectures in 7 wk, 2 h of theoretical exercises in 7 wk, and 4 h of laboratory exercises in 4 wk. The lectures, theoretical exercises, and laboratory exercises of the course use traditional curriculum and instructional methods.

The course included four comprehensive laboratory exercises involving measurements of 1) human pulmonary ventilation, gas exchange, and ECG at rest and during exercise (treadmill and cycle ergometer); 2) environmental and physiological factors affecting cardiac muscle force development in fish and frogs; 3) extracellular stimulation and measurements of action potentials from neurons in a crab leg; and 4) thermal relations on metabolism in mammals at rest and in toads at rest and during exercise. These laboratory exercises involved the noninvasive use of living specimens of guinea pigs (*Cavia porcellus*) and cane toads (*Bufo marinus*) in addition to fresh prepared legs from crabs (*Carcinus maenas*) and fresh prepared hearts

from rainbow trout (*Oncorhynchus mykiss*) and frogs (*Rana pipiens*). The human exercises were conducted on the students themselves.

Data collection and analysis. The first stage of this study involved a naturalistic inquiry approach (23, 30, 41) based on observations and informal conversational interviews. The intention was to identify students' perceptions of interest within the lessons. The underlying idea of choosing a naturalistic inquiry approach was to study interest in classroom contexts to ensure the "ecological validity" of the results (42, 43). The observations and interviews were conducted in successive intervals by N. B. Dohn and took place in the fourth laboratory exercise in the second quarter. In each observed session, the observer slightly altered the focus of analytic attention compared with the last session, attending to some features of what was occurring and not to others. Field notes were taken and reworked by adding comments and questions to the notes so that they could act as focal points in subsequent interviews. Students were interviewed within their respective working groups (3–4 group members) when they had waiting time in the laboratory schedule. This way, the interviews did not interfere with the flow of the practical itself. Informal conversational interviews, as used here, are a method of interviews where questions emerge from the immediate context and are asked in the natural course of things; there is no predetermination of question topics or wording (30). The 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. A total of 51 students was interviewed across the 3 days of laboratory work (85% of the students present). Students were asked about specific events (for example, the situation where one of the authors explained to a group of students how one, in theory, could make the leg of a crab move to the rhythm of the music by stimulating the nerve with a voltage modulated by the rhythm of music). They were also asked to reflect back to situations of the laboratory lesson where they had been interested and to describe what it was that had interested them. In addition to this, they were encouraged to describe what had caught their interest in previous lessons (lectures, theoretical exercises, and laboratory exercises). The primary goal of the interview data was to explore the diversity in students' perceptions about sources of interest. Students' responses were recorded as notes and categorized.

In the second stage, we developed a survey instrument to access the tenability of the situational interest found through the first stage. The interest questionnaire was designed to measure individual and situational factors that influence situational interest. The questionnaire consisted of 19 Likert-type items plus an open-ended question. The 19 Likert-type items all began with the same phrase: "To what extent...?". Students responded on a 7-point Likert scale ranging from "very much" (7) to "very little" (1). All the items were randomly placed in the scale. At the end of the questionnaire sheet, students were requested to describe the most interesting experience in the physiology course in their own words and declare why it was interesting.

The interest questionnaire was administered for 15 min within the 2-h colloquium on the week after the students were interviewed. Students responded anonymously. A total of 60 questionnaire responses were completed and returned. A total of 41 written responses to the open-ended question were obtained, which represented 68% of the total responses. These written responses were analyzed, and sources of interest were categorized.

The reliability of the instrument was verified by Cronbach's α , which is a reliability coefficient based on the average covariance among items in a scale. Cronbach's α expresses how well a set of items measures a single one-dimensional latent construct (here, "situational interest"). The reliability coefficient was calculated to be 0.7362, which is considered as "acceptable" (8).

RESULTS

Live animals. One of the main sources of interest was the use of living animals in the laboratory. During the interviews, it was evident that the animals had created a lot of interest ($n = 48$). The category of live animals included the guinea pig, cane toad, and crab (not alive, but a fresh prepared leg). This finding was confirmed by two questionnaire items: "To what extent was it interesting to work with living animals? (mean = 6.35, SD = 0.97) and "To what extent was it fun to work with living animals in the laboratory?" (mean = 6.15, SD = 1.08).

"Ah-ha!" experiences. Another main source of interest was "Ah-ha!" experiences. "Ah-ha!" experiences refer to a knowledge-based interest that manifests itself suddenly, such as understanding of how to solve a difficult problem. Written ($n = 10$) and verbal responses ($n = 21$) were coded in this category if they indicated that the students had an immediate insight that prompted interest. For example, a student stated in the open-ended questionnaire item that "it was really fascinating when I suddenly realized how muscles function."

Meaningfulness. Meaningfulness refers to students' perception of the topics under study in their physiology class as meaningful to them in their present life. In the open-ended item, 11 students (18%) stressed the exercise laboratory (pulmonary ventilation, gas exchange, and ECG at rest and during exercise) as the most interesting experience in physiology, because they could relate it to their own body. For example, one of the students wrote the following: "The best way to keep up the interest in the subject is that you can relate it to yourself." Similar comments were obtained from 18 students in the interviews.

Social involvement. This category refers to interest that is stimulated by interpersonal interactions during group work. According to student responses in the interviews, this was a minor source of interest ($n = 6$). Two questionnaire items investigated the correlation between positive feelings, interest, and group work in the laboratory. The item "To what extent did physiology become more fun when you were working in groups?" confirmed the relation between positive feelings and social involvement (mean = 5.21, SD = 1.46). The positive feelings were apparently not correlated with interest since the item "To what extent did the group work influence your interest?" could neither confirm nor deny the relation between interest and social involvement (mean = 3.85, SD = 1.72).

Humor. Humor as a source of interest was not mentioned in the interviews. In the open-ended item, however, eight students (13%) stated the humor of the faculty as the main source of interest in the physiology course. Students commented on humor like this: "that the faculty have humor and use it in the lessons to make it fun and to bring it down to a level we understand and find fun, instead of just talking boring theory" or "interesting lectures, especially because funny stories made the theory easier to understand." The last comment also relates to the category of meaningfulness, since narratives intend to create meaning.

Background knowledge. One of the most common interview responses was related to interest caught by acquiring knowledge in physiological processes and how these processes are expressed in different living animals compared with human beings ($n = 48$). The responses refer to a knowledge-based

interest that is generated due to relevant background knowledge. This category has much in common with the category of "Ah-ha!" experiences but is much more persistent and of more individual character. Background knowledge as a source of interest was confirmed by written responses such as "When you get in depth with a subject and can link topics together" or "The overall understanding where we can link the various topics together." Knowledge as a source of interest was verified by the questionnaire item "To what extent does your interest depend on whether you understand the content of the lesson?" (mean = 5.53, SD = 1.34).

DISCUSSION

The purpose of this study was to investigate situational factors that stimulate students' interest in physiology. The results show that several sources within the course did stimulate the situational interest of the students. During the data-gathering process, some individual factors that influence interest also appeared. These individual sources are not the focus of this article and will not be discussed further. However, background knowledge, which we categorize as an individual factor, will be discussed in this section because the knowledge of the individual is influenced by the situation of instruction. Research shows that interest is not static but changes as a function of the way a task is perceived. Studies have indicated that background knowledge is more closely related to individual rather than situational interest, even though it is significantly related to both (3, 16, 38).

Five sources of situational interest were identified and will be discussed in the following sections. These situational sources are largely under the control of the faculty. The order in which they are listed does not reflect their priority in terms of frequency or relative significance, nor should the list be regarded as a complete taxonomy for instructional use.

Live animals. Live animals was an important source of situational interest in this study. Even though guinea pigs are common pets, students' comments suggested that the animals did represent "real science" in the laboratory for them and were thus not just pets. It was obvious that the living specimen of guinea pigs and cane toads offered the students highly personal hands-on experiences. For example, one of the students stated that "sprinkling the toad with fresh water [at the end of the laboratory] was the most interesting because I'm more interested in zoology than physiology."

Even though the practical concerning extracellular stimulation and measurements of action potentials from neurons in a crab leg did not involve live specimens but only freshly prepared legs from crabs, the students found it exciting and interesting. Almost all of them labeled the practical "exciting" or "cool." Some of the students stated in the interviews that the animal laboratory exercise provided an opportunity for them to find out things they didn't know: for example, "what a nerve bundle really looks like." Another comment was "The lab was great because it visualized something that is hard to understand and you normally can't see." Such comments are also related to the category of "Ah-ha!" experiences.

Although interest research so far has not investigated live animals as a source of interest, hands-on animal laboratory experiences have been suggested as an important factor of engaging students in physiology (7, 32, 44). Hands-on experi-

ences in general (i.e., not necessarily related to live animals) have been reported as important sources of interest, because the manipulation of objects involves perception as well as engagement (24, 25, 26, 29, 45).

"Ah-ha!" experiences. When a person is "stuck" in a problem, he or she sometimes achieves a clear and sudden solution through insight—the so-called "Ah-ha!" experience. The situational category of "Ah-ha!" experience here refers to a knowledge-based interest that is triggered by a sudden and unexpected flash of insight. Our data showed that 85% of the students agreed in having recorded "Ah-ha!" experiences during the physiology course (85% of the students responses were in the range from 4 and 7 in the survey, mean = 5.73, SD = 1.26). Interview data indicated that an "Ah-ha!" experience may trigger interest and have positive effects on the learner's attitudes toward physiology.

"Ah-ha!" experiences have not hitherto been reported as a source of situational interest. The experience of being interested seems to be the consequence, rather than the cause, of the intellectual activity involved in resolving some issue. An explanation of why "Ah-ha!" experiences can trigger interest must be sought in closely related variables like optimal challenge, novelty, and optimal discrepancy between input and cognitive structure (4, 5, 10). Although an "Ah-ha!" experience involves the knowledge of the individual and thus could be classified as an individual factor, we classify the "Ah-ha!" experience as a situational factor because "Ah-ha!" experiences are dependent on instructional strategies. The "Ah-ha!" experience is situated in the context of problem solving. As such, the first step toward promoting the "Ah-ha!" phenomenon is to present students with interesting and challenging problems.

Meaningfulness. Our results confirm the findings of Mitchell (25) showing that situational interest can be sparked by environmental features of personal relevance. In our study, these features are all related to the implications of personal pulmonary ventilation, gas exchange, and ECG measured in the exercise laboratory. It is difficult to overstate the importance of a laboratory activity in which the students are themselves the object of investigation. As Randall and Burkholder (32) reported, the emphasis on personal applications and implications (personal pulmonary ventilation, gas exchange, and ECG) always provides real "take-home" bonuses.

Whereas interest caught by an "Ah-ha!" experience refers to a predominantly knowledge-triggered interest, interest caught by perceived meaningfulness refers to a predominantly value-triggered interest. Value-triggered interests are interests that have the quality of personal significance (20, 33). Value-triggered conditions do not become relevant unless the informational content can have some personal or universal (cultural) meaning to the individual (14).

Social involvement. Social involvement in group work has been reported as a source of interest in the literature (3, 11, 15, 19, 25, 27). To the degree that students perceive that a task or activity will allow them to socialize, they tend to be more interested in the task (3). According to the motivation theory of Self-Determination Theory, humans have a basic need or drive for social contact and that this explains why interpersonal involvement can arouse interest (21, 36). Group work provides a form of social stimulation by encouraging students to talk to one another about subject-related concerns and ideas. For

example, some students noted in the interviews that they were more willing to pose questions among peers than to risk sounding stupid when asking questions of the faculty members in front of the entire class. Group work as a source of interest was mentioned by some students in the interviews, and two items concerning group work were therefore included in the questionnaire. The results suggest that social involvement may have been less important than it was found in the studies of Mitchell (25) and Palmer (27). It should be noted, however, that Mitchell and Palmer's studies were made among K–12 mathematics students and K–9 science students, respectively. It is possible that social involvement has less impact on interest in older students.

Humor. Humor was found to stimulate interest for some students, but our data concerning humor are limited. The comments of the students suggest that humor used by the faculty members helped to develop a positive learning environment and reduced boredom and anxiety related to the perceived difficulty of the learning content.

Humor is useful in facilitating attention and learning motivation (3, 6). It is generally assumed that humorous stimuli draw very intense attention reactions. The intensity of these reactions is to be expected because of the complexity and novelty (i.e., unpredictability) of the stimuli (5). This reasoning predicts that the comparatively inattentive student's exposure to humorous stimuli will increase his or her attention and that this increased attention will facilitate academic motivation of the individual (46).

Background knowledge. Background knowledge was identified as an important source of interest. According to Alexander et al. (2), 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 has suggested that background knowledge is related to both individual and situational interest, even though knowledge appears to be related more strongly to individual interest (2, 3, 38, 40). In the study of Palmer (27), learning (i.e., the acquisition of domain knowledge) was found to be the most important source of situational interest among K–9 science students. For us as physiology educators, the major challenge is how we can help students in the acquisition of domain knowledge and thus interest. Unfortunately, background knowledge is a factor that it is difficult to change, because it is predominantly an individual variable. As Dewey (12) cautioned decades ago, transient (i.e., situational) interest alone will not sustain learning, and such sustained learning is requisite for proficiency in any complex domain. Thus, abstract, demanding exposition will probably need to be carefully anchored to the goals and long-term interest of students (2). Findings from studies of interest have suggested that educators can help students sustain their attention toward tasks even when these tasks are challenging. This could either mean providing support so that students may experience a triggered situational interest or providing feedback that allows them to sustain their attention, generate their own questions, and select resources that promote problem-solving and strategy generation (16, 38, 39).

Using Dewey's (12) definition of "genuine" interest and Mitchell's (25) distinction between catch and hold facets of interest, we assume that sources that only sparked interest but

did not seem to maintain student activity can be classified as “stimulating” sources. Consider, for example, the previous case where students became immediately excited by hearing that it would be possible to make a crab leg move to the rhythms of music. It should be noted that the students only heard about it—they did not try it out. In this case, interest was sparked but did not seem to inspire student activity during the laboratory and thus did not seem to be maintained. On the other hand, sources that appeared to be successful at maintaining student interest may be classified as “empowerment” sources. For example, students experienced the exercise laboratory as meaningful because they could relate the content of learning to their own body. Even when the source of empowerment is removed, the student will likely still find the subject empowering to them. Our findings suggest that the factors of live animals, social involvement, and humor seemed to function mainly as stimulation sources, whereas the two categories of “Ah-ha!” experiences and meaningfulness seemed to function mainly as empowerment sources. The individual factor of background knowledge seemed to act as a strong empowerment source. None of the stimulating sources appeared to serve as an effective way to maintain student interest, but they are important sources with respect to creating a stimulating learning environment. In other words, long-term development of interest seems to be better served by the use of meaningful tasks relating to real life and by student involvement in active learning (here, personal applications and implications of personal electrocardiogram, blood pressure, respiratory quotient, respiratory volumes, etc.) than by using gimmicks like humorous comments to make the class interesting and stimulating.

Conclusions. In conclusion, we identified five situational factors and one predominantly individual factor that influence interest in physiology. The situational factors are live animals, “Ah-ha!” experience, meaningfulness, social involvement, and humor. These situational factors are under the control of the faculty, and they should be considered when planning instruction. The general idea is that faculty members should try to create situational interest in their courses with the hope that this situational interest over time will help students to develop individual interest in the content or topic of the course and thereby facilitate learning. In addition, by attempting to generate situational interest in all students, faculty members do not have to deal with the problem of trying to ascertain all the individual interests of their students (which will vary a great deal) and structuring the course to fit these different individual interests. In this study, we found that hands-on laboratory experiences with live animals and laboratories performed on the students themselves result in remarkable interest and engagement. Such strong sources of situational interest can be expected to arouse and motivate the majority of students in a physiology class, irrespective of their achievement level or previous interest in the subject. By making regular use of such experiences, faculty members can hopefully generate enthusiasm for learning physiology in all or most students.

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