

The influence of direct experience on students' attitudes to, and knowledge about amphibians

Vpliv neposredne izkušnje na odnos in znanje učencev o dvoživkah

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Abstract. In the present study, we investigated how direct experience of certain amphibian species may affect a change in 7th grade science students' attitude to, and knowledge about them. For this purpose, we devised a 45-minute lesson in which we used live amphibian species, and one lesson in which lifeless animals were used. The results show that students with prior direct experiences of amphibians generally report a more positive attitude toward them and, on average, achieve higher pre-test scores. Using live animals in the classroom had a major effect on the students' attitudes to individual species, regardless of whether they had any previous experience with them. Students who have done both practical work with live animals in the classroom and had previous direct experience with them showed the highest level of knowledge and knowledge retention. Implications of the findings are discussed.

Key words: amphibians, direct experience, attitude change, knowledge

Introduction

Slovenian curricula state that, during the course of their formal education, students should acquire as much direct experience as possible of various organisms and their living environments. Only by working with live organisms as the primary teaching objects can students acquire the most vivid experiences and develop strong emotions about given objects. Moreover, students can truly understand living things when they personally make direct contact with them (LOCK 1994, LOCK & ALDERMAN 1996).

The meaning of direct experience in this case involves the actual interaction or manipulation of the object in question. In contrast to direct experience, indirect experience involves only reading or being told about an object. It is known that attitudes based on direct experience are more persistent, stronger, held with greater certainty, more stable over time and more resistant to counter-influence (FAZIO & ZANNA 1981). Through direct contact or experience with live animals, children's attitudes and knowledge improve considerably (YORE & BOYER 1997).

Attitudes have been defined as feelings, based on our beliefs, which predispose our reactions to objects, people and events (MYERS 2007).

According to a tripartite model, attitudes are based on three different sources: cognitive, affective and behavioural, which are not always consistent. As a person's attitude changes, so do his or her actions (SPIELBERGER 2004). An attitude based on a direct experience is more likely to affect an individual's behaviour than an attitude formed on the basis of an indirect experience (FAZIO & ZANNA 1981).

In recent decades there has been considerable emphasis on the significance of researching attitudes toward contemporary environmental issues which also includes attitude toward organisms (KELLERT

1985, 1996, LEMING & al. 1995, BOGNER 1998). KILLERMAN (1998) points out research conducted among 6th graders in which in one case live invertebrates (earthworm, darkling beetle and spider) were used in the classroom and, in the other, only visual materials and models were presented. The results showed that the students who were taught using live animals developed a much better attitude to the organisms than those who had not been in direct contact with the animals. The former also exhibited a greater increase in their knowledge.

In research by TOMKINS and TUNNICLIFFE (2001) 12-year-old pupils observed a bottle ecosystem of brine shrimps without any prior instruction. Their results indicate that pupils, while observing animals notice their salient anatomical and behavioural features, and those observations may provide a base for clearer hypothesis making when formal teaching and investigations begin.

In addition to one's attitude, one's knowledge also affects one's behaviour toward organisms. A person's positive attitude does not necessarily mean that once they are in contact with an organism, they would treat it in a way which would not harm it. BARNEY & al. (2005) find, for example, that only well-educated college students who have benefited from direct instruction exhibited the most knowledge about and appropriate attitudes toward dolphins.

It is the level of involvement (LOI) and amount of information (AOI) which help to build a balance between one's attitude and knowledge (MORGAN 1992).

Biology teachers have the responsibility of creating conditions in which students meet various organisms (YORE & BOYER 1997). They should, however, take note that intrapersonal barriers, which significantly affect the quality of experience, play an important role in an individual becoming acquainted with an organism (BIXLER & FLOYD 1999). Negative feelings, such as fear and disgust, also affect the transformation of attitudes towards these animals.

Expressed fear of animals mostly functions as a response to perceived or immediate threat of physical injury. Disgust toward animals, on the other hand, may act as a protective agent against possible contamination (DAVEY & al. 1998, DAVEY & al. 2003).

Studies of people's attitudes toward and knowledge (familiarity) of different organisms often focuses on larger and/or 'charismatic' animals, such as sharks (THOMPSON & MINTZES 2002), dolphins BARNEY & al. (2005) and primates (LUKAS & ROSS 2005, ROSS & al. 2008), but also invertebrates (KILLERMANN 1998, LOOY & WOOD 2006). However, the effects of the use of animals such as amphibians are rarely studied as part of educational research (RANDLER & al. 2005, YEN & al. 2005).

It is well known that amphibians are endangered, and that their numbers have been declining in recent years. There are many possible causes for this, including human actions, which work in a synergistic way (BLAUSTEIN & KIESECKER 2002, BEEBEE & GRIFFITH 2005).

As for the effects that the use of live amphibians in a pedagogical process has on students' attitude and knowledge are relatively poorly researched, and in view of the rising awareness of amphibian species decline, we set out to find:

1. how many 7th graders have already had direct experience with any common local amphibian species,
2. how they perceive their attitudes toward individual amphibian species before and after a classroom lesson, depending on whether they have had direct experience (before instruction) with live amphibians or not, and
3. how instruction with or without live animals affects their knowledge.

Method

The research was conducted in the school year 2004/2005. It included 21 7th grade classes (n = 487) from 10 Slovenian primary schools. The final sample included only students who attended a pre-test, participated in classroom lessons and attended all three post-tests (n = 392). In the school year 2004/2005, all respondents changed from an 8-year to a reformed 9-year primary school programme,

which meant that they progressed from the 5th to 7th grade. The reason 7th graders were included in the research is because they had not been taught about animals in science classes in the 5th grade, whose curriculum focuses mainly on plants. They would, however, have met live amphibians outside school or in the first four years of their elementary education. The age of respondents was 11 to 12 years. This age, according to KELLERT (1985), marks a period when pupils acquire knowledge in the form of information, which follows their development of emotional concern and sympathy for animals. As a result, the research included testing the students' attitude toward and knowledge about amphibians before and, three times, after instruction.

Instruction

The following animals were used for instruction: the common toad (*Bufo bufo*), the green frog (*Pelophylax sp.*; formerly *Rana*), the European treefrog (*Hyla arborea*), the European fire salamander (*Salamandra salamandra*), the alpine newt (*Triturus alpestris*), the Italian crested newt (*Triturus carnifex*), and the cave salamander or olm (*Proteus anguinus*). With the last species, we did not use live animals, as the olm is a strictly protected species.

Two types of instruction were used. The first (**Kla**; $n = 127$), used in the control group, was frontal instruction, which involved presenting amphibians to students with the use of tertiary teaching objects (transparencies and pictures). By talking with the students about animals and giving them information about animals, we sought to change their attitudes to the species in question and provide a correct picture of them.

The second type of instruction (**Exp**; $n = 265$) involved live animals. After reassuring the students of their and animal well-being, they could first experience an animal (observe its behaviour and appearance, and touch them). Next, we talked about the animals, their characteristic features and the fact that they are endangered. We actively encouraged the students to hold an animal. If they were very reluctant to do so, we encouraged them to at least gently touch it. In neither case, however, did we force any student to make physical contact with an animal. The Exp-type instruction included two teaching forms. The first involved students forming a circle in which the teacher presented them with one amphibian species at the time. The second involved students in groups of three, with a maximum of two animal species per group. They would rotate every 8–10min, moving from one designated point to another. The first group of students was given on the spot instructions on what to do with the animals, while the second also received written instructions. As both methods involved handling live animals and we sought to find a connection with direct experience, we combined both groups in our statistical analysis of results. Neither of the two groups undergoing Exp-type instruction had shown any statistically significant differences pertaining to their attitude toward and knowledge about amphibians either before or after the lesson (Mann-Whitney U; all $p > 0,05$).

The influence of different teachers was considered, so all 21 classes were taught and supervised during evaluations by the author, who is a biology teacher by profession. The lesson was of standard duration (45 min).

Instrument

The tests were administered one week before instruction (pre-test) and three times after instruction (post-tests 1, 2, 3). The first post-test was administered one week, the second two months and the third four months after the lesson.

The pre-test consisted of two parts. The first required students to answer two open-ended questions about which animals they are afraid of, and which four they like the most (affection). They also had to explain their answers. The follow-up consisted of 10 questions testing the students' knowledge about

amphibians. Seven were multiple choice, two required them to provide missing information, and one required that they identify animals in a picture.

The second part of the pre-test included a self-report scale, which required students to rate their attitude toward three amphibian species (green frog, toad and salamander) on a five-point scale and state whether or not they had had any direct experience with these animals (yes/no statements). We had presumed that the students at least knew the species names of the selected animals before the lesson, as they are quite common locally. Students rated their fondness for individual amphibian species according to the following scale: 1 = 'I don't want anything to do with this animal'; 2 = 'I don't like this animal'; 3 = 'I do not have any special feelings toward this animal'; 4 = 'I like this animal'; 5 = 'I like this animal very much'.

In this part of the questionnaire students also assessed their fear of and disgust toward a selection of 20 animals, which also included the green frog, the toad and the salamander (*considered for publication elsewhere*). Here students had to list for the second time whether they had any direct experience with amphibians. Students' answers on prior direct experience with three amphibian species from this section of the questionnaire were used to test the reliability of their answers. Test-retest reliability for the green frog was modest ($r = 0,614$; $p < 0,001$). Reliabilities for the toad ($r = 0,918$; $p < 0,001$) and the salamander ($r = 0,834$; $p < 0,001$) were high.

Statistical Analysis

Basic descriptive statistics was used to obtain the average values and frequencies of each data component or group. Nonparametric tests were used to determine statistically significant differences between and within the experimental and control groups on attitude ratings and knowledge test scores. All the data was analysed with the SPSS statistical programme, version 15.0.0.

Results

Direct experience

Before the lesson, few pupils stated that they had had previous experience with the selected animals (Tab. 1). In comparison with the experimental group (Exp), more students in the control group (Kla) stated that they had had previous direct experience with the green frog ($\text{Chi}^2 (1, n = 383) = 3,674$; $p = 0,055$). In both groups, it was the toad that the fewest pupils had previous direct contact with ($\text{Chi}^2 (1, n = 377) = 0,231$; $p = 0,631$), while the most knew the salamander first hand ($\text{Chi}^2 (1, n = 379) = 0,775$; $p = 0,379$).

Table 1: Descriptive statistics on students' prior direct experience with amphibians according to type of instruction.
Tabela 1: Deskriptivna statistika predhodne neposredne izkušnje učencev z dvoživkami glede na način pouka.

ANIMAL	Instr.	DIRECT EXPERIENCE					
		No		yes		no answer	
		n	f (%)	n	f (%)	n	f (%)
Green frog	Exp	184	69,4	73	27,5	8	3,0
	Kla	78	61,4	48	37,8	1	0,8
Toad	Exp	205	77,4	48	18,1	12	4,5
	Kla	103	81,1	21	16,5	3	2,4
Salamander	Exp	146	55,1	110	41,5	9	3,4
	Kla	76	59,8	47	37,0	4	3,1

Direct experience and attitude

Before the lesson, there were no statistically significant differences between the two groups (Exp and Kla) in rating their attitudes toward an individual amphibian species. (Mann-Whitney U; all $p > 0,01$).

Fig. 1 shows the average ratings of the students' attitudes towards the three amphibian species before and after both lessons, i.e. the one that included live animals and the one that did not. The ratings are shown in relation to students' previous direct experience with individual amphibian species. Statistically significant differences occurred only in ratings pertaining to the salamander, with students who had had previous direct experience with the animal. (Figure 1c; Kla1-Exp1; Mann Whitney U, $Z = -2,902$; $p = 0,004$). All graphs show that, on average, pupils with no prior direct experience with individual animals rated their attitude lower, which means that it was more negative. In contrast, pupils who had had previous direct experience with the animals on average rated their attitude higher. After the lesson which included the use of live animals (Exp), students with both higher and lower rated initial attitudes (Exp0 and Exp1) significantly changed their attitude toward the animals. In the Exp0 group, the differences between the initial and final ratings for individual animals were statistically significant (Wilcoxon Signed Ranks Test; all $p < 0,001$). The same holds true for the Exp1 group (Wilcoxon Signed Ranks Test; all $p < 0,001$).

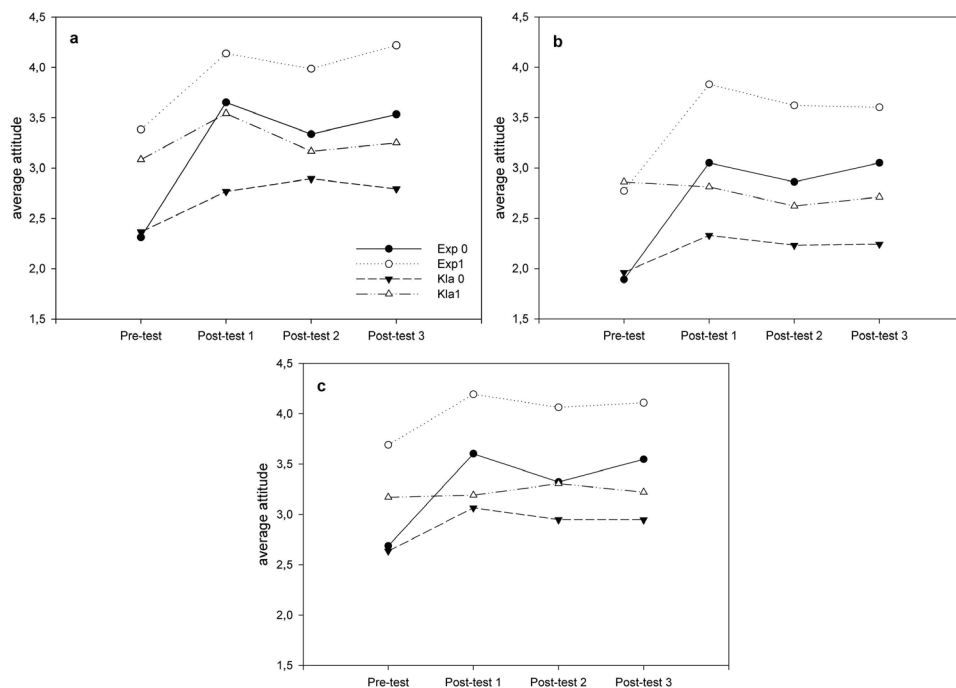


Figure 1: Average students' attitude ratings for individual amphibian species before and after instruction, according to prior direct experience and instruction type. Chart order: (a) green frog, (b) toad and (c) salamander. Exp0 and Kla0: students without prior direct experience with animals. Exp1 and Kla1: students with prior direct experience with animals.

Slika 1: Povprečna ocena odnosa učencev za posamezno vrsto dvoživk pred in po pouku glede na predhodno neposredno izkušnjo in način pouka. Vrstni red: (a) zelena žaba, (b) krastača in (c) močerad. Exp0 in Kla0: učenci brez predhodne neposredne izkušnje z živalmi; Exp1 in Kla1: učenci s predhodno neposredno izkušnjo z živalmi.

With the control group students who had had prior direct experience with the animals (Kla1), there were no statistically significant differences between their initial and final ratings concerning individual animals (Wilcoxon Signed Ranks Test; all $p > 0,05$). The rating of their attitude toward the toad (Fig. 1, b) fell somewhat, but not statistically significantly. The lesson which did not include live animals (Kla), on the other hand, had a positive effect on the attitude of pupils without prior direct experience (Kla0) of the animals. Differences in attitudes toward the toad and the green frog between the initial and final ratings in the Kla0 group were statistically significant (Wilcoxon Signed Ranks Test; both $p < 0,01$), while the attitudes toward the salamander were marginally significant (Wilcoxon Signed Ranks Test; $p = 0,055$).

Direct experience and knowledge

Students' knowledge about amphibians before and after the lesson did not differ significantly between the two groups (Tab. 2). The differences in achievement scores before and after instruction were rather small.

Table 2: Descriptive and inference statistics of average students' test scores before and after instruction, according to type of instruction.

Tabela 2: Deskriptivna in inferenčna statistika povprečnih rezultatov testov znanja učencev pred in po pouku glede na način pouka.

test	Instruction				sig.	
	Exp (n = 265)		Kla (n = 127)		Z	p
	Mean score (%)	SD	Mean score (%)	SD		
Pre-test	43,4	15,6	43,3	14,5	-0,491	0,623
Post-test 1	63,8	13,1	65,4	13,2	-1,135	0,256
Post-test 2	61,4	14,2	58,1	19,0	-0,798	0,425
Post-test 3	60,7	14,7	57,7	15,8	-1,724	0,085

Note: sig.: Mann-Whitney test.

After analysing the data about direct experiences with individual amphibian species before instruction, differences in knowledge between students became evident and statistically significant (Fig. 2). On average, pupils who attended a lesson which did not involve live animals (Kla) scored similarly on the first post-test as the Exp1 pupils. However, knowledge of the Kla0 and Kla1 pupils showed a more rapid decrease in subsequent testing in comparison to the pupils from Exp0 and Exp1 groups. In the first post-test, the Exp0 pupils achieved the lowest scores in the part which tested their knowledge; however, in subsequent tests, their knowledge showed a steadier decline than in the Kla group. In final testing, there were no statistically significant differences between the Kla0, Kla1 and Exp0 groups (Kruskal-Wallis test; all $p > 0,05$). Pupils who displayed the most knowledge were those who had direct contact with the animals before and during the lesson.

Discussion

Slovenian science curricula stipulate that at the beginning of their compulsory education students should encounter various living organisms. The results of our survey show that amphibians are rarely among them, as much as 55% or more of students had had no direct contact with individual amphibian species (Tab. 1). Moreover, the results suggest that students seldom encounter live amphibians outside the school environment (e.g. family influence).

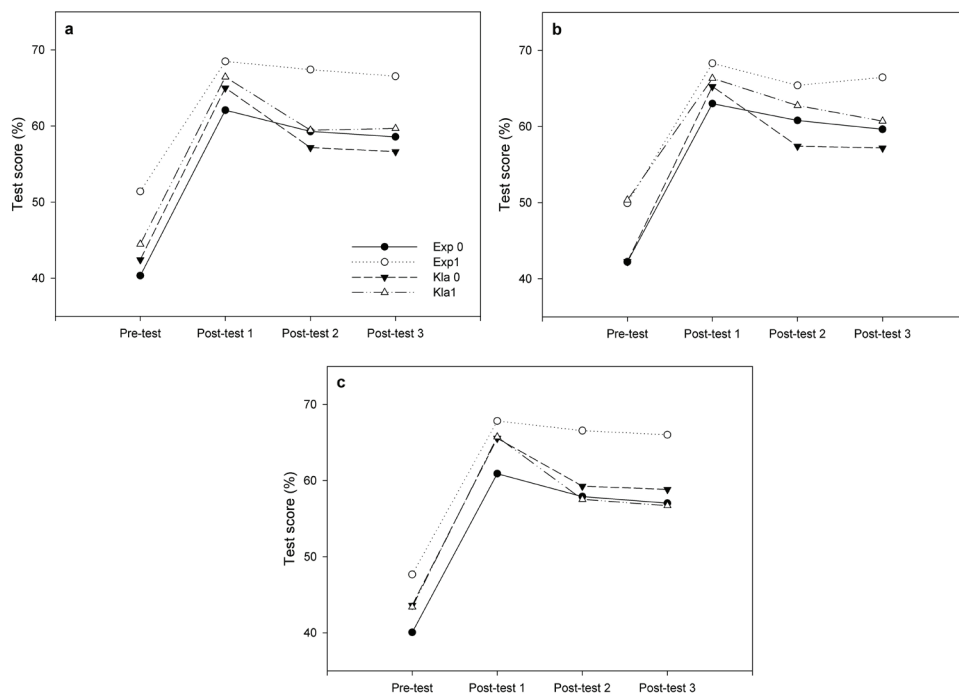


Figure 2: Average students' test scores before and after instruction in relation to students' prior experience of individual amphibian species. Chart order: (a) green frog, (b) toad and (c) salamander. Exp0 and Kla0: students without prior direct experience of animals. Exp1 and Kla1: students with prior direct experience of animals.

Slika 2: Povprečni rezultati testov znanja učencev pred in po pouku v povezavi z njihovimi predhodnimi izkušnjami s posamezno vrsto dvoživk. Vrstni red: (a) zelena žaba, (b) krastača in (c) močerad. Exp0 in Kla0: učenci brez predhodne neposredne izkušnje z živalmi; Exp1 in Kla1: učenci s predhodno neposredno izkušnjo z živalmi.

The pedagogical literature suggests several ways in which students could work with amphibians (MURPHY & FORTNER 2001, GREEN & GREEN 2005, TOMASEK & al. 2005). However, there is little information about how this influences their attitudes toward and knowledge about these animals.

The pupils included in our survey who had had prior direct experience of amphibians showed better attitudes toward these animals before the lesson than pupils who had had no such experience (Fig. 1).

KELLERT (1985) makes a similar point in his research, stressing that the focus with young students should be firstly on developing the emotional component of experiencing animals. This stage should be followed by acquiring information about them. Only when students are familiar with animals and have developed appropriate attitudes towards them (experiencing animals through direct contact and acquiring enough factual information) can they, according to Kellert, develop their own understanding of ecology and their ethical concerns for the welfare of animals (aged 13 or older).

Pupils who had neither been in contact with amphibians before the lesson nor encountered them during the lesson (Kla0) changed their attitudes more significantly than those who did not encounter amphibians during the lesson, but had previous direct experiences with them (Kla1, Fig. 1). With the Kla0 pupils, the teacher's role was probably greater, as he presented his own view of and experience with

the animals. Pupils who had no prior experience (Kla0) found it much easier, through information passed on to them by the teacher, to form a positive attitude towards the animals than the Kla1 pupils. Kla1 pupils' prior experience with the animals probably affected the change in their attitudes, since an attitude arising from direct experience shows more resistance to external influences (FAZIO & ZANNA 1981).

The students who gained the most were those who attended the lesson where live animals were used (Exp; Figure 1). Both those who had no prior direct experience (Exp0) and those who had prior direct experience (Exp1) rated their attitudes toward the animals higher than their peers who did not see live animals during the lesson (Kla). We believe that the teacher's guidance played a vital part in this, as the teacher would notice and immediately correct any false ideas pupils may have had about the animals. After the lesson, the attitude of the Exp0 pupils was at roughly the same level as that of the Exp1 students before the lesson. The latter, however, changed their attitudes so much that, on average, these could be rated as "I like this animal".

The two groups (Exp and Kla) also differed in terms of their knowledge (Fig. 2). The Kla0, Kla1 and Exp0 pupils achieved similar scores in the final test, while the Exp1 group, which had prior direct experience of the animals and worked with live animals during the lesson, achieved a better score. The latter also showed better knowledge retention. One week after the lesson, the Exp0 students showed the weakest knowledge, which decreased evenly by the time of the final test. It is possible that these students scored poorer than the Exp1 group as a result of their emotional involvement during the lesson, for which reason they required more time to switch from emotionally experiencing an animal to becoming rationally involved in the lesson.

Although Slovenian curricula maintain that students should develop their relationship toward nature and the living organisms, there are often no clear guidelines about how teachers are supposed to achieve this. In their work teachers focus greatly and spend considerable amounts of time on passing information to their pupils about animals and their endangerment. A question arises here: will students who have never encountered a living organism be prepared to do something for them? LINDEMANN – MATHIES (2005) finds that students who are in contact with organisms (even the more inconspicuous ones, such as plants) develop more sensitivity toward them. Moreover, they develop a liking for them and quite a special attitude. Furthermore, these students show greater knowledge of these organisms.

As STRGAR (2007) notes, when students work with plants their interest in them increases and even more so after teacher intervention. Our experience about the interest and motivation of students in our survey is almost the same. Students who attended the lesson which used live animals were highly motivated at the end and ready to learn more about them (they did not wish to leave the classroom and they asked many questions).

Based on our research, we believe that prior direct experience with animals outside the classroom and relatively short exposure (45min) to live animals in the classroom have a positive effect on pupils' attitude toward amphibians.

If the educational process provided 'the right' experiences with living organisms, there would probably be fewer questions raised about potentially harmful behaviour toward animals as noted by BARNEY & al. (2005).

Conclusion

The results of our research show that:

1. enabling pupils brief direct experience significantly changes their attitude toward living organisms, which helps to reduce their intrapersonal barriers on contact with living organisms,
2. higher grade teachers could compensate for pupils' 'forgotten' or missed opportunities to emotionally experience animals in elementary classes,

3. students who gained the most knowledge and had the best attitude were those who had prior direct experience with animals and attended the lesson in which live animals were used; therefore, it would be sensible that, during the course of their education, students were given several opportunities to experience the same living organisms (e.g. in elementary school, secondary school).

Worth researching in the future would be the attitude of both future teachers and teachers of life science topics toward living organisms, as they have an important role and the responsibility to create such learning environment in which students can further develop their knowledge and attitudes.

In addition, it would be beneficial to study the extent to which a teacher's attitude toward living organisms can affect the attitude of students.

The lesson which involved live amphibians would make a good starting point for students' subsequent work, as once they were in direct contact with the animals, they also asked questions to which they could later find answers on their own.

Povzetek

V raziskavi, ki je potekala v šolskem letu 2004/2005, smo preverjali, kako neposredna izkušnja učencev z nekaterimi dvoživkami vpliva na spremembo njihovega odnosa do in znanja o dvoživkah. V raziskavo je bilo vključenih 392 učencev 21 sedmih razredov devetletne osnovne šole. Sodelujoči učenci so bili stari od 11 – 12 let. Po KELLERTU (1985) je to obdobje, v katerem učenci intenzivno pridobivajo podatkovna znanja. To obdobje naj bi sledilo obdobju izgradnje čustvene skrbi in navezanosti otrok do živali. Zato smo raziskavo zasnovali tako, da smo pri učencih preverili njihov odnos do in znanje o dvoživkah pred poukom in izvedli tri zaporedna preverjanja po pouku. Statistična obdelava podatkov je upoštevala predhodne neposredne izkušnje učencev z dvoživkami. Da bi v raziskavi preprečili vpliv različnih učiteljev, je vsa preverjanja in pouk izvedel raziskovalec. Učenci so eno šolsko uro spoznavali dvoživke. Pouk je bil izveden na dva načina. Pri prvem načinu so učenci spoznavali dvoživke preko pogovora, razlage in uporabe terciarnih učnih virov (slikovnega materiala). Ta način pouka je služil kot kontrola. Pri drugem načinu pouka pa smo uporabili žive živali, kjer smo učence spodbujali k vzpostavitvi neposrednega stika z živalmi. Rezultati so pokazali, da večina učencev pred poukom še ni imela neposrednih izkušenj z dvoživkami. Učenci, ki niso imeli predhodne neposredne izkušnje s posamezno živaljo, so živalim v povprečju pripisali nižje ocene odnosa, kar pomeni, da je bil njihov odnos 'slabši' od učencev, ki so pred poukom že imeli neposredno izkušnjo. Po pouku so najboljši odnos izrazili učenci, ki so se pri pouku srečali z živimi živalmi. Pri pouku, kjer žive živali niso bile uporabljene, pa so v manjši meri spremenili odnos samo tisti učenci, ki niso imeli predhodnih neposrednih izkušenj. Pri slednji skupini učencev je bila verjetno prisotna večja moč informacij, ki jih je posredoval učitelj. Pri zadnjem preverjanju znanja se je izkazalo, da so učenci s predhodno neposredno izkušnjo in uporabljenimi živimi živalmi pri pouku izkazali najvišje znanje. Raziskava je pokazala, da s kratkotrajno neposredno izkušnjo pri učencih pomembno spremenimo njihov odnos do organizmov in tako pozitivno vplivamo na znižanje intrapersonalnih ovir, s katerimi se učenci srečajo ob stiku z organizmi. Z uporabo živali lahko nadoknadimo "pozabljeno" doživljanje le-teh v nižjih razredih šolanja. Na znanju so največ pridobili in imeli najboljši odnos učenci, ki so imeli predhodne neposredne izkušnje z živalmi in so doživeli živali pri pouku. Zato bi bilo smiselno, da bi se učenci v času šolanja večkrat srečali z istimi skupinami organizmov, začnši že v nižjih razredih šolanja otrok. V nadaljevanju bi bilo pomembno ugotoviti, ali so učitelji in bodoči učitelji usposobljeni za delo z živimi organizmi pri pouku, saj imajo učitelji pomembno vlogo in odgovornost, da ustvarjajo učno okolje, kjer lahko učenci pridobijo največ na znanju in odnosu.

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