

Hands-on amphibians: teachers comparing traditional with hands-on instruction

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Abstract. *In the present paper I report the teachers' views about implementation and evaluation of two types of instruction. One included students working with (experiencing) live amphibian species and the other was in a form of traditional instruction.*

Results from written interview with teachers show that teachers generally approve and are fond of working with live animals in life science instruction. They see the beneficial effects on students developing competences beyond factual understanding of the topic of instruction. At the same time, they perceive many obstacles that are preventing them to effectively introduce students to live animals.

Implications for life science instruction are discussed.

Keywords. Amphibians, Instruction, Live animals, Teachers' views.

1. Introduction

Past decades have seen an extensive research on effectiveness of different teaching approaches with the purpose of improving children's knowledge, attitude and behaviour in life science instruction. Some authors argue, that biology without living organisms in instruction is for students dull and disconnected with nature [1]. If students meet nature in nature or nature is "brought" into the biology classrooms, the quality of instruction increases [2]. Despite that, there are reports about decrease of practical work, experimental work and fieldwork in life science instruction [3]. Although, there are reports that practical work by itself doesn't always have the strongest effect on long-term decisions about pro-science engagements of students in future life, it most certainly has short time effect on students' interest in practical work and motivation to learn [4].

Students are generally fond of working with live organisms. They like to learn about animals over plants [5]. Much too often, we are looking

at the effects of instruction solely on the amount of information students can recall or the level of conceptual understanding they poses about given topics. Other dimensions of students' competences are in most cases neglected. In the year 2006, the European Parliament published a framework of eight key competences for lifelong learning [6]. Each competence is presented as a set of knowledge, skills and attitudes appropriate to the context. Morgan found that only the balanced amount of information and level of involvement leads to forming "appropriate" attitudes [7]. It is therefore necessary to design such instruction that would build on all three components of competences.

Although, amphibians are one of the most endangered animal groups and are facing worldwide extinction [8], there is few empirical data present on how people perceive these organisms. There are several classroom and field activities published about amphibians that teachers can use for their instruction [9, 10]. But there is almost no data how different types of instruction help children to learn about and appreciate amphibian diversity [11, 12]. Children perceive some amphibian species especially toads as disgusting, slimy, non attractive species that are spitting poison onto people and give them warts. In a study conducted by Tomažič, seventh graders rated toad as the most disgusting among 20 animals listed [13]. Direct experience in that study turned out to be the most important factor in forming students' attitude and acquisition of knowledge.

2. Methods

This work is the follow-up study that was conducted in a year 2004/2005, where I investigated the effect of different types of instruction on seventh grade students' knowledge about and attitude toward amphibians [12]. In that research I was also carrying out both instruction types myself.

The present study took place in the end of the year 2009. The study was conducted as a part of the project entitled "*Development of Natural Science Competences*" performed at the Faculty of Natural Sciences of University of Maribor.

2.1. Design of the study

2.1.1. Participants

Teachers who participated in this study, were all biology (science) teachers with at least five years of teaching experiences. They were chosen as evaluators of the provided teaching materials (unit).

Students involved in the study were from sixth and eighth grades of primary school and second grade of secondary school (Gymnasium). On account that research is still in progress, final sample of students is not yet known.

The reasons for choosing students of those grades was, because according to our science-biology curricula, students of sixth grade could met/have learned about amphibians on elementary level, students of eighth grade met/have learned about amphibians in lower sixth and seventh grades and high school students did not learn about amphibians in first year of high school.

All teachers taught both teaching methods to students with the same education level. This way we will be able to compare different instructional types and at the same time assess the level of knowledge and attitude of students before any of our methodology has been incorporated into instruction.

2.2. Teaching unit

This part explains both types of instruction that were used in our research. After invitation, teachers were informed about the topic of our research, but not of our research questions. Teachers were first asked about their most frequently used instruction types. Then they were instructed to prepare teacher-centred instruction by themselves. They were given only detailed instructions, which concepts must they cover during their two school hour unit and one page reminder about the steps of teacher-centred instruction [15].

After they have completed this part of instruction, they met with the researcher (each teacher met with the researcher separately). On that meetings (4 school hours) every teacher was given information on how to carry out hands-on instruction using live animals [14], learned how

to work with individual amphibian species and was informed about the most frequent difficulties that could emerge within such instruction (e.g. expressed fear or disgust and avoidance in students).

Topics of both instructions were:

- amphibian species of Slovenia (the common toad (*Bufo bufo*), the green frog (*Pelophylax sp.*), the European tree frog (*Hyla arborea*), yellow-bellied toad (*Bombina variegata*), the European fire salamander (*Salamandra salamandra*), the alpine salamander (*Salamandra atra*), the alpine newt (*Triturus alpestris*), the Italian crested newt (*Triturus carnifex*) and the cave salamander or olm (*Proteus anguinus*),

- biology of amphibian species of Slovenia,
- understanding the concept 'amphibians',
- conservation biology and worldwide decline of amphibian species.

2.2.1. Teacher-centred instruction

All teachers decided to use overhead transparencies as their main teaching material. In the first school hour they presented several amphibian species of Slovenia and their biology to the students. Second school hour was reserved for generalizing the concept of amphibians, learning about conservation of amphibian species and drawing general conclusions on the learned material. The main focus of that instruction was the teacher, who presented this topic to the students. Students were in the course of instruction allowed to pose questions to the teacher and discuss their experiences with the teacher.

2.2.2. Hands-on (experiential) instruction

In this type of instruction, for the first school hour, teachers' main activity was to give students instructions on what they will be doing and instructed them on how to work with animals. Every teacher included at least four species of live amphibians in the course of instruction. In the first part, students had the opportunity to observe animals in closed containers (each animal for approximately five minutes) and try to find out as much as possible about them. For the purpose of not harming the animals in the next 20 minutes of the first school hour, the students had the opportunity to come with teacher's guidance in direct contact with individual amphibian species. Detailed description on how to work with amphibians can be found in Schneider et al. [10]. The second school hour has been reserved for the same topics as in teacher-

centred instruction. In addition teacher skimmed through species that were used in the first school hour. The rest of the material was the same as in the second school hour of teacher centred instruction.



Figure 1. Observing animals; photo by Romana Čuješ



Figure 2. Handling of an animal (toad); photo by Petra Kavčič



Figure 3. Observing an animal; photo by Petra Kavčič



Figure 4. Observing eating; photo by Petra Kavčič



Figure 5. Sample MSPowerPoint slide

2.3. Students knowledge and attitude assessment

Students were given questionnaires that assessed their knowledge about amphibians and attitude toward toads prior to the instruction and two times after instruction. As mentioned before, analysis of this data is still in progress.

2.4. Teachers evaluations

This part presents the main focus of this paper. Teacher's role was to evaluate provided teaching materials in their classrooms and suggest possible improvements for instruction. A questionnaire was constructed that could help teachers with evaluation. There were 16 open-ended questions included. The questionnaire focused on four main topics:

- (1) comparison of traditional with hands-on instruction.
- (2) advantages and disadvantages of introducing live animals into instruction.
- (3) suitability of the topic for individual grade
- (4) suitability of the questionnaires for the students

Teachers were also offered the following instructions: "As evaluators, you have gained immediate insight into children's acceptance of teaching unit and changing attitudes toward organisms. Now, I would like you to answer the following questions.

Five teachers evaluated their work. For each, the codes were assigned (U1, U2, U3, U4 and U5).

3. Results with discussion

3.1. Comparison of traditional with hands-on instruction

Below is the excerpt from two teacher's answers when comparing traditional with hands-on instruction.

Teacher 1: *"In traditional teaching approach, instruction was focused mainly on my explaining, clarifying and stating facts. For this type of instruction, I have prepared PowerPoint presentation. In that presentation I have included a lot of pictorial material and several movie clips which were displaying feeding and reproductive behaviours of some amphibian species. Some students displayed interest about the topic while other students were not so interested. In hands-on type of instruction I placed students in a circle. All were actively involved in experiencing animals. They had the opportunity to observe each other, their reactions to live animals. After experiencing animals, they listened very carefully to my explanations."*

Next question was asking teachers about motivation/interest of students according to different instruction types.

Teacher 2: *"In hands-on type of instruction students motivation was higher. Some students were expressing fear and revulsion toward amphibians. They didn't want to have any direct contact with them. In contrast to those students, some students didn't want to stay without direct experience with live animals. According to their explanations, the instruction was interesting and the time passed quickly. In traditional type of instruction students were motivated when I showed them movie clips, otherwise it was just an ordinary school hour."*

Also, all teachers were experiencing hands-on instruction more demanding as teacher centred instruction. There was more effort needed to prepare teaching materials and animals for instruction. In their opinion, hands-on instruction itself is more demanding, because it requires greater organizational skills and greater skills of working with students from teachers.

While classical hands-on instruction is not the same as inquiry, teachers still had to first let students experience animals by themselves, posing questions on the basis of gained experiences and communicating their questions with teachers. One such example is observing feeding (*"What does this animal eat? - What do you think? - Insects.- Let us try and feed it."*; Figure 4).

This is in accordance with Crawford, where she stated that teacher in such instruction is confronted with a set of quite different teaching strategies. Instruction like this situates inquiry in

a context, this way teachers embrace inquiry as a content and pedagogy, collaboration between teacher and students enhances inquiry, teacher and student roles become more complex and this type of instruction is demanding greater levels of involvement by teachers than in traditional teaching. In that kind of instruction teachers' roles are versatile, they are motivators, diagnosticians, guides, innovators, experimenters, researchers, modelers, mentors, collaborators and learners [16].

One teacher in our study mentioned that some students were frightened at the beginning and they were avoiding being close to the animals. But when they met live animals and when they saw their peers working with animals, they come closer to the animals and even tried to come in contact with them. According to Bandura, modelling represents one of the main sources of information for self-efficacy appraisal. Students who observe peers who successfully perform a task can be more certain that they too are capable of accomplishing that task. As a consequence, the achievement of those students is higher. Self-efficacy therefore refers to beliefs about one's capabilities to learn or act in a certain way [17]. In our hands-on instruction fearful students were encouraged to come in direct contact with animals by peers (peer - modelling) and teachers (expert-modelling) what in consequence influenced students' behaviour.

Students who participated in teacher centred instruction had to be additionally motivated with different stories and teacher told experiences with animals. One teacher stated that pictorial material alone didn't suffice to enhance students' communication, while the other teacher reported that short movies about animals heightened students' interest. Furthermore, students were expressing the wish to see live animals. All teachers stated that motivation of students was higher in hands-on instruction.

Observation skill is in teachers' opinion one of the most important skills that students were developing. This skill is vital for any naturalist and we should develop it in schoolchildren [18]. Beside that children were to higher extent developing skills of handling animals and building more on the concerns for animal wellbeing thus forming positive attitudes toward animals.

3.2. Advantages and disadvantages of introducing live animals into instruction

Teachers mentioned several drawbacks that limit including live animals in to instruction. The main problems mentioned were: (1) unsuitably equipped facilities. One teacher doesn't have a room for keeping animals and other teaching materials and is keeping them in the classroom. In this classroom, a several teachers teach different subjects, not only science. (2) Teachers mentioned legislation that is very strict and limits the use of live animals from local environments as well as keeping animals bought in pet stores. (3) Teachers mentioned students negative emotions and attitudes that children have toward some animals. This I do not see as limiting factor because that is also the reason why it is so important that children beside gaining knowledge are at the same time building on their attitude. With only teacher-centred instruction, their attitude would not be affected as much as it would be in student centred instruction [12].

Teachers acquire live animals mainly from local environments, pet stores or institutions such as universities.

They also believe that they are well prepared for working with live animals. They all agreed that researcher's advice on how to handle animals and methodology of presenting them to the children was useful for them. Amphibians are organisms that require special care. Their skin is generally very sensitive and can be easily damaged.

One teacher clearly stated that science and biology curricula are demanding much greater knowledge from students that can be gained through hands-on instruction alone. Practical work is in teachers' opinion therefore not quite compatible with curricular demands.

Other teachers believe that sixth and seventh grade Science curricula are suitable for such instruction. They perceive grater difficulties in eighth grades, where they believe that biology curricula is overloaded. That is also the reason why teachers are including taxonomy topics in sixth and seventh grades although it is not obligatory.

In high school there is one additional problem for hands-on instruction. Namely, there are as much as 32 students in each classroom. In this way teacher feels very constrained about practical work and recommend dividing classes to at least two groups in order to achieve quality instruction.

3.3. Suitability of the topic for individual grade

Teachers pointed out two main problems about hands-on instruction with the use of live animals. This type of instruction is more time consuming than it is teacher-centred instruction.

Also, work of a biology (life science) teacher is in their opinion more demanding than any other science subject. Namely, if life science teacher likes to offer students direct experiences with organisms and nature, he or she would need to take students outdoors or "bring nature" to the classroom. For this, much time to find and prepare teaching materials is needed. In case of using animals, teachers also need more time to take care of the animals. Not all teachers especially primary school teachers didn't have assistant. Biology teachers would need assistants who are well prepared to work with and are able to take care of living organisms.

Teachers are convinced that the main goal of science should not be remembering concepts only, but students should be able to explain different phenomena.

3.4. Suitability of the questionnaires for the students

Students generally didn't have much difficulties understanding methodology of the questionnaires. Teachers mentioned the lack of students' knowledge about the topic of the survey and sometimes lack of broader knowledge (e.g. not knowing the names of the Earth's continents from which students had to figure out where is the highest diversity of amphibian species) that prevented students to answer questions correctly. Some students didn't see the reason, why they must answer questionnaires again after instruction, and majority of students were glad that they were not graded on the topic of instruction.

4. Conclusion

Teachers believe that hands-on instruction contributed to higher motivation and higher interest of students than teacher-centred instruction. In first type of instruction, students' attitude changed more than in later type of instruction. Two teachers had to prolong hands-on instruction into third school hour because students showed great interest in experiencing live animals. Teachers reported that students were much more active in that type of instruction and were posing a lot of questions. Teachers believe that students in hands-on instruction

learned more than their counterparts in teacher centred instruction. Teacher generally favour hands-on approach when students are learning about animal diversity. But they are pointing on several limitations of that type of instruction that must be addressed in the future: (1) lack of facilities for keeping live organisms, (2) restrictive legislation, (3) science and biology curricula are overloaded and (4) the need for well educated assistants.

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