



BIODIVERZITETA - Vretenčarji

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Strategija (metoda): klasičen pouk, izkustveno učenje (experiential learning HANDS-ON), neformalne oblike pouka (živalski vrt)

Starostna skupina, razred: 7. razred OŠ

Kompetence, ki se razvijajo:

a) generične:

- **Gk1.** sposobnost zbiranja informacij,
- **Gk2.** sposobnost analize in organizacija informacij,
- **Gk3.** sposobnost interpretacije,
- **Gk4.** sposobnost sinteze zaključkov,
- **Gk5.** sposobnost učenja in reševanja problemov,
- Gk6. prenos teorije v prakso,
- **Gk7.** uporaba matematičnih idej in tehnik,
- **Gk8.** prilagajanje novim situacijam,
- **Gk9.** skrb za kakovost,
- **Gk10.** sposobnost samostojnega in timskega dela,
- **Gk11.** organiziranje in načrtovanje dela,
- **Gk12.** verbalna in pisna komunikacija,
- **Gk13.** medosebna interakcija,
- **Gk14.** varnost.

b) predmetno-specifične: odnos do organizmov, okoljske vrednote, pro-okoljsko delovanje ter

c) procesna znanja in spretnosti: opazovanje, sklepanje, predvidevanje, sporazumevanje, primerjanje, uporaba časovno-prostorskih dimenzij, oblikovanje hipoteze, določanje in kontrola spremenljivk, eksperimentiranje, raziskovanje

Medpredmetne povezave: fizika, okoljska vzgoja, likovni pouk,

Umestitev v učni načrt/Nova vsebina:

- ekosistemi (7. razred);
- povezava s sistematiko in ekologijo (8. razred);
- primerjava strukture in funkcije ter ekologija in biodiverziteta (predlagani učni načrti)

Predviden način evalvacije: pred/po-test; čustva/odnos/znanje, mnenje učencev / dijakov



Izdelava gradiva temelji na izkušnjah in analizi dela s študenti, bodočimi dvopredmetnimi učitelji, katerih en predmet študija je biologija. V študijskem letu 2009/2010 smo v sklopu predmetov Biološki praktikum 2 in Biološki praktikum 3 s študenti organizirali delavnice v Živalskem vrtu Ljubljana. Tema letošnjih delavnic so bile zveri in dvoživke. Študenti so se v sklopu vaj udeležili predavanj o zvereh, v živalskem vrtu so se srečali z zvermi in deli živali iz trajnih zbirk, na fakulteti so spoznali in se srečali z dvoživkami, samostojno so se pripravili za nastop v živalskem vrtu in izdelali plakate za svoje predstavitve. Kot končni prispevek tega sklopa so študenti v obliki delavnic predstavljali živali širši javnosti (Priloga 3).

Gradivo v pripravi

1. Utemeljitev priprave gradiva

Tema gradiva se navezuje na trenutni učni načrt Naravoslovje 7 (sklop GOZD). V sklopu gozda se obravnava več vretenčarskih skupin (dvoživke, ptiči, plazilci in sesalci). Učenci spoznavajo lastnosti posameznih vrst živali. Živali primerjajo med seboj in povezujejo lastnosti živali z okoljem, kjer te živali živijo. Spoznajo najbolj ogrožene živalske vrste ter razloge za njihovo ogroženost.

V učnem načrtu je zapisano, da naj učenci pridobivajo neposredne izkušnje z organizmi in njihovimi okolji. Vretenčarske skupine, še posebej avtohtone vrste plazilcev, ptičev in sesalcev učitelj težko prinese v razred ali učencem omogoči neposreden stik z živalmi. Izjema so le morebitne trajne zbirke (lobanje, kože in drugi telesni deli živali), ki se nahajajo na šolah in bi lahko še bile uporabne za delo v razredu.

Znano je, da le slike in elektronski viri v manjši meri pripomorejo k kvaliteti znanja in v manjši meri k oblikovanju pozitivnih stališč in spretnosti kot delo s konkretnimi materiali in celo z živimi organizmi. V primeru, da šole nimajo takih materialov, lahko učenci obiščejo izvenšolske ustanove, ki lahko omogočijo učencem pridobivanje neposrednih izkušenj in nadgradnji šolskega znanja.

Ciljno naravnane učne enote, ki bi jih ponudile izvenšolske ustanove bi lahko predstavljale močne podporne elemente učnim načrtom.

2. Cilj gradiva

a) Izvedba v šoli

Učenci spoznajo:

- gozdne vretenčarje.
- načine prehranjevanja.
- strukturo in funkcijo raznih telesnih delov živali.
- znotraj vrstne in medvrstne odnose izbranih vrst vretenčarjev.
- nekaj zavarovanih in ogroženih vrst vretenčarjev ter ukrepe za varovanje le- teh.
- razloge za ogroženost izbranih živalskih vrst.

b) Izvedba v živalskem vrtu

- uporabijo znanje pridobljeno v šoli in ga nadgradijo z,
- delom z živimi živalmi in živalmi ter deli živali iz trajnih zbirk,



- spoznajo vlogo živalskih vrtov pri ohranjanju biodiverzitete.

--- sesalci (noge - parklji in kopita, rogovi, namestitev oči, prehrana - zobovja, plen/plenilec, dlaka, stalna telesna temperatura; razmnoževanje; živali: jelen, volk, veverica, miš, kuna, kozorog, ...

--- ptiči (noge/krempļji - luske, oblika kljuna, namestitev oči, prehrana, plen/plenilec, perje, stalna telesna temperatura; razmnoževanje; živali: sova, golob / grlica, kanja, žolna, zlatovranka, divji petelin, ...

--- plazilci (koža - levitev, kuščar/kača/želva, oblika telesa, prehrana - zobje, skelet, plen/plenilec, nestalna telesna temperatura; razmnoževanje; živali: rdečevratka / sklednica, kuščarica, gož, modras, slepec-blavor, ...

--- dvoživke (koža - levitev - strup, oblika telesa, prehrana, plen/plenilec, nestalna telesna temperatura; razmnoževanje; živali: krastača, močerad, sekulja, urh, ...



Priloga 3

Priložen prispevek je rezultat gradiva, ki sem ga pripravil in evalviral v prejšnjem obdobju. Zaradi obsežnosti, ga nisem mogel vključiti v prejšnje poročilo. Prispevek je bil sprejet v objavo na mednarodni konferenci, ki jo organizira CŠOD (Center šolskih in obšolskih dejavnosti) v sodelovanju z European Institute for Outdoor Education. Tema konference je "Encountering, Experiencing and Exploring Nature in Education". Konferenca bo potekala v Planici od 22. do 25. septembra 2010.

Educating pre-service biology teachers in informal teaching environments - a case of a local zoo

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Abstract

Educating good science teachers is the main goal of all science teacher programmes. Teachers today should be trained to carry out both classroom and outdoor activities for children. In addition, they should be able to convey modern socio-scientific issues to the general public. Informal environments such as zoos, botanical gardens and various other nature centres present an ideal opportunity for pre-service teachers to learn about different teaching activities, gain pedagogical and scientific (biological) knowledge, and develop attitudes and skills necessary for teaching. This paper presents students' self-evaluation and the evaluation of the workshops that they organised in the spring of 2010 at the local zoo (ZOO Ljubljana). The workshops focused on endangered large carnivores and amphibians of Slovenia. Students were generally eager to carry out workshops and are willing to participate in the similar activities in the future. Implications for teacher education programmes and co-operation with other nature education centres are discussed.

Introduction

According to the IUCN Red List of Threatened Species (*The IUCN Red List of Threatened Species*, 2010), in the past century many animals, plants and other species have undergone severe decline or are facing worldwide extinction. The main reason for such declines can be contributed to human actions. Habitat destruction and exploitation, climate change, increasing levels of ultraviolet radiation, environmental contamination, disease, and the introduction of non-native species are all possible causes for which species numbers are in decline. To address these issues and to raise awareness about loss of biodiversity, the year 2010 has been declared by the United Nations as the ☐ *International year of biodiversity* ☐ (*United Nations*, 2010).

In the year 2004, the Society for Conservation Biology published Conservation literacy guidelines (Trombulak et al., 2004). In their opinion, education plays



an important role through which biologists can present novel environmental problems to the general public. Through education people can be informed about those problems and motivated to take actions for preserving healthy environments. Their main arguments are that educators should seek to develop a deeper understanding of the importance and tools of conservation biology in people; they propose that education is the most effective when people develop knowledge, skills, and attitudes through direct experience and that conservation biologists have a unique set of knowledge, skills, and concerns to share with others.

We have found ourselves in a position, where we found that biology (environmental) education often does not provide knowledge according to which people would be willing to act pro-environmentally. Slingsby and Barker (2004) therefore believe that we must design teaching methods that will be more efficient. Teaching must go beyond achieving only factual understanding of subject matter.

Learning through fieldwork seems to be a promising method to educate environmentally responsible people (for literature review of see, Barker, Slingsby & Tilling, 2002; Bogner, 1999; Lock, 1998). In spite of mentioned fact, there are reports that fieldwork is in decline (Tilling, 2004). Also, the trend for a decline in fieldwork is evident in initial teacher training (Kendall et al., 2006).

There are many reasons for the decline but that should be reversed by:
□making fieldwork a requirement rather than an option in the biology curriculum; developing and presenting a strong case for biology fieldwork; supporting innovative curriculum development; providing support for trainee and experienced teachers; encouraging scientists to take a much broader view of the world around them□ (Barker, Slingsby & Tilling, 2002).

Zoological gardens can be treated as one form of fieldwork (informal education setting), with a lot of learning possibilities (Lock, 1998). They are the place where students can for example learn about animal behaviour (Tunnicliffe, 1996) and can directly experience indigenous and endangered species (see Lock, 1998). Emphasis on students acquiring experience through direct contact with nature and organisms is also one of the basic innovations of the science and biology curricula of the reformed Slovenian school system (Verčkovnik, 2000). But for that, teachers must be equipped with proper knowledge, skills and attitudes with which they are able to convey biology topics appropriately to the students.

For that purpose I have prepared a half semester activities for pre-service student teachers, where they gained knowledge in a form of lectures about several endangered animal groups, experienced animals at the local ZOO, where they have been learning from live animals and preserved parts of animals. Following their own learning, workshops at the local ZOO were organised, where students had the opportunity to present animals to the general public with the purpose to raise awareness of people about those animals. All of the above activities were followed by students' evaluation of the programme.



Methods

Slovenian school system

Slovenian education system has in the past two decades gone through an extensive reform. Primary school was prolonged from eight to nine years and the whole primary schooling is divided into three parts called triads. Science is taught from the beginning of primary school, but is not standalone subject until eighth grade. In the eighth and ninth grade it is divided into three separate subjects, biology, chemistry and physics. Teachers that can teach science are usually two subject primary school teachers or one subject teachers that were further qualified in one or two missing subjects. Only teachers with background in science are allowed to teach science.

The biological content structure of science and biology curricula is as follows. In sixth grade the students are learning about anthropogenic ecosystems in order to get familiar with their everyday surroundings and meet as many organisms and interactions between them and environment as possible. In the seventh grade, students get to know natural ecosystems and organisms living in them. Both in sixth and seventh grade students are also learning about basic structure and function of organisms. In eighth grade, students are learning about systematics, ecology and evolution and in ninth grade about human biology with basic genetics.

Participants

Participants of the activities were two-subject biology-chemistry and biology-home economics student teachers (N=85). The majority (N=71; 84%) of the students participated in the evaluation part of the activities (Table 1).

Table 1: Structure of the research sample

| Biology- | INITIAL SAMPLE (f) | | FINAL SAMPLE (f) | |
|----------------------|--------------------|----------------|------------------|----------------|
| | Chemistry | Home economics | Chemistry | Home economics |
| Second year students | 17 | 21 | 16 | 20 |
| Third year students | 19 | 28 | 15 | 20 |

The programme

The programme consisted of six steps which were organized at the first several weeks of the semester.

(1) Lectures about several endangered animal groups (Figure 1; a)

Several experts were invited to prepare lectures for the students. A professor from Ecology department introduced carnivore species of Slovenia, their biology and their endangerment to the students. Three teaching assistants from the same department presented their research activities on carnivore biology and ecology and socio-biological aspects of carnivore protection to the students. Because carnivores are many times publicly controversial topic, students had to be informed about possible reactions of the ZOO visitors. And finally, from the Ministry of the Environment and Spatial Planning, The Environmental Agency of the Republic of Slovenia, I invited a colleague who is involved in state protection of large carnivores.



Figure 1: Student activities

(2) Learning about carnivores at the ZOO (Figure 1; b,c,d)
Students had the opportunity to come very close to the animals and were informed about individual animal history at the ZOO, about animal enclosures and animal care. Later on, students were learning from preserved parts of animals. They also had to be prepared for working with such materials.

(3) Learning about local amphibians at the Faculty
In this part students were learning about amphibians of Slovenia and had a chance to work with live animals kept at the Faculty. They gained experiences of handling live amphibian species.

(4) Work of students in teams - preparing for the workshops and making posters



Students were organised in teams of two to three students. They agreed that animals that they will be presenting at the ZOO workshops should be assigned to them by a lot (one to two carnivore species and one to two amphibian species). Then they were delivered literature about selected animals. In a form of a lecture, they were also informed about benefits and drawbacks of conducting fieldwork in biology (science) teaching (see the cited literature in the introduction).

(5) Workshops at the local ZOO

Workshops were organised for the purpose to participate in the EAZA (European Association of Zoos and Aquaria) yearly campaign. In this part of the programme, students were presenting animals to the general public with the purpose to raise awareness of people about those animals.

(6) Evaluations of the programme - *Instrument*

After the workshops, students had to evaluate the programme. A mixed methods approach was employed to collect both qualitative and quantitative data from written questionnaires and a written assignment (Creswell, 2008). The analysis of the data is still in progress, so only preliminary results are presented. Quantitative data were obtained by 5-point Likert type questionnaire that contained 36 questions. The meaning of the scale was as follows: 1 = "I completely disagree", 2 = "I disagree", 3 = "Undecided", 4 = "I agree" and 5 = "I agree completely". Students were asked about (1) their work with live animals and preserved materials; (2) their work with ZOO visitors; (3) usefulness of the individual step of their preparation for the workshops; (4) interest in workshops and (5) behaviour of ZOO visitors at the workstations.

Qualitative part of the survey consisted of 14 open-ended questions grouped in four categories: (1) comparison of teaching in classroom with teaching at the ZOO; (2) using animals in instruction (3) suitability of workshop theme for primary school students and (4) students' positive and negative experiences with ZOO workshops.

Students were also asked to grade their own presentations at the ZOO workshops. They graded their presentations of carnivores separately from amphibians.

Results with discussion

For the purpose of this article, the results from the Likert scale about students' interest in the workshops are presented. Additionally, answers on open-ended questions of two students about their positive and negative experiences with ZOO workshops are included.

Students interest in ZOO workshops

After items S3, S4 and S5 were reversed, factor and reliability (Cronbach's alpha) analysis were conducted. Cronbach's alpha for five items was 0.72, what is satisfactory for such a small sample and number of items. Factor

analysis with varimax rotation produced only one factor when eigenvalue was set as greater than 1.1 and loadings above 0.40.

Third year students had already participated at the workshops the year before. So their experiences with such activities were not new. Students of both study years stated that they liked carrying out workshops at the ZOO and that they were interesting (Figure 2, S1 and S2). Students of the second study year liked workshops more (S2) and were less bored (S4) than their counterparts. That was probably because repeated activities didn't pose such a novelty for the third year students as they did for the second year students. The same reason might apply for the third statement (S3), where third year students felt more confident (but not statistically significant) in conducting workshops than did their counterparts. Students were generally not angry that they had to attend workshops at the ZOO (S5) what also shows that they were motivated to participate.

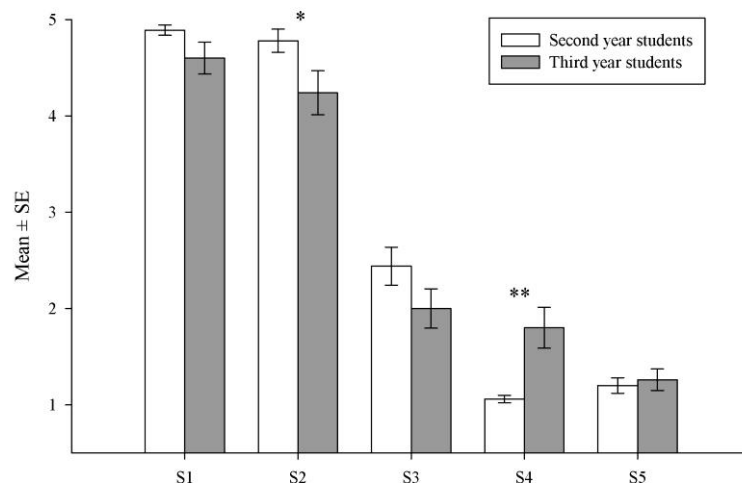


Figure 2: Students ratings of interest statements.

S1 - □Conducting workshops was interesting□; S2 - □I liked conducting workshops□; S3 - □I didn't fill confident before conducting workshops□; S4 - □Conducting workshops is boring□; S5 - □I was angry because I had to conduct workshops□. Meaning of asterisks: * $p < 0.05$; ** $p < 0.01$.

Students experiences at the ZOO

Describe any negative experiences that you might gained from the workshop at the ZOO

Student 1 (first time workshop): □I don't have any unpleasant experiences. I admit that I wasn't so keen to sacrifice one Sunday to attend workshops at the ZOO, but I have changed my mind as soon as we started working. I was a little disappointed on account of older visitors, because I didn't expect that they wouldn't know many basic things about animals...

... It was also a little cold and we were freezing by the end of the workshop, but they were worth the effort.□

Student 2 (second time workshop): □Last year, it was more unpleasant because it was raining and there were only a few visitors. It was very difficult to motivate people to come to our place of presentation. This year it was



different. People just kept coming and were gathering around our table. There are no other unpleasant things for me to mention.□

Both students focused mainly on the logistical aspect of the workshop, i.e. weekend and possible bad weather. It is necessary to organize workshops at the weekend that students have the opportunity to encounter as many visitors as possible (different ages, prior knowledge, attitudes and values, ... of ZOO visitors).

Several students mentioned that knowledge of visitors is scarce and that many times visitors view animals in anthropomorphic or anthropocentric way.

Describe ANY positive experiences that you might gained from the workshop at the ZOO

Student 1 (first time workshop): □For me, everything was positive. I was in a very good mood, when I came home. I gathered a lot of new experiences. Children alone give me a lot of energy. I liked that they were listening to me and were with enthusiasm working with live animals (most of the time). Even an elephant on the other side of a path was no match for my animals. I got some kind of confirmation that I chose a right path, of my study I mean. I can draw attention of complete strangers and keep them as long as 10 minutes or more and what I do was interesting for them. I am also pleased that I knew the answers to all questions that visitors have been asking. Truly a great day and excellent experiences.□

Student 2 (second time workshop): □It was positive that this year there were a lot more visitors than in the last year and that there were not only children but visitors of different ages. You are forced to communicate with all of them (it is not that it is hard, but you are reluctant to and you have to, which is good). In this way we got skills in communicating with people, and in working with organisms. And we are in fresh air. It is a change; we are not in a classroom all the time. The main thing is, that it is fun.□

The first student was in her description focusing more on working with people and was glad that her insecurity about her decision for the teaching profession was not wrong. She was also satisfied with her knowledge about the topic of the workshop. On the other hand, second student was not so eager to work with people, but realizes that it is a "need to" for her future profession. She also sees benefits of activities beyond classroom. This student focused more on the didactic value of the workshops.

Conclusion

Cooperation with institution such as ZOO proved to be a promising way of preparing pre-service biology teachers. Students reported that they liked to work at local ZOO and gained several positive experiences, e.g. communication with people of different ages, working with teaching materials. Students not only gained experiences they will need as teachers but they also got knowledge about certain endangered animal species and



experiences of introducing such topics to the general public. Because they participated in every step of preparing the workshops, they were gaining knowledge and skills in organising informal learning activities. Later on as teachers, they should be able to prepare learning environments where their students will gain knowledge, form positive attitudes toward organisms and nature and develop a plethora of necessary skills.

Acknowledgements

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Literature

1. Barker, S., Slingsby, D., and Tilling, S. (2002). Teaching Biology outside the classroom: is it heading for extinction? Field Studies Council. Occasional Publication, Shrewsbury.
2. Bogner, F. X. (1999). Empirical evaluation of an educational conservation programme introduced in Swiss secondary schools. *International Journal of Science Education*, 21(11), 1169-1185.
3. Creswell, J.W., (2008). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. (3.ed.). SAGE Publications, Inc.
4. Kendall, S., Murfield J., Dillon J., and Wilkin A. (2006). Education Outside the Classroom: Research to Identify What Training is Offered by Initial Teacher Training Institutions. *National Foundation for Educational Research*. Research report No 802; Available at: <http://www.education.gov.uk/research/data/uploadfiles/RR802.pdf>
5. Lock, R. (1998). Fieldwork in the Life Sciences. *International Journal of Science Education* 20(6): 633-642.
6. Slingsby, D., and Barker, S. (2003, Winter2004). Making connections: biology, environmental education and education for sustainable development. *Journal of Biological Education*, pp. 4-6.
7. Tilling, S. (2004). Fieldwork in UK secondary schools: influences and provision. *Journal of Biological Education*, 38(2), 54-58.
8. Trombulak, S.C., Omland, K.S., Robinson, J.A., Lusk, J.J., Fleischner, T.L., Brown, G., and Domroese, M. (2004). Principles of conservation biology: Recommended guidelines for conservation literacy from the Education Committee of the Society for Conservation Biology. *Conservation biology*, 18(5), 1180-1190.
9. Tunnicliffe, S. D. (1996). Conversations within primary school parties visiting animal specimens in a museum and zoo. *Journal of Biological Education*, 30(2), 130-141.
10. Verčkovnik, T. (2000). Biologija v prenovljeni šoli (Biology in the redeveloped school). *Acta biologica Slovenica*, 43, 21-32.
11. Web sources:
12. The IUCN Red List of Threatened Species, (2010). Available at: <http://www.iucnredlist.org/> [20.8.2010]



13. *United Nations, 2010*; Available at: <http://www.cbd.int/2010/welcome/>
[20.8.2010]