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Conceptual Profiles in Outdoor Education

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Abstract
In outdoor experience-based learning there is often a focus on subject learning while the influence of the pupils' prerequisites, their conceptual profiles, is less well studied. In the Swedish curriculum for elementary school, there are several learning outcomes connected to sustainable development. In Biology, one of the learning outcomes relates to "People's dependence on, and the impact on nature, and what this means for sustainable development". Some of the learning outcomes also aims directly at concepts about nature: "Nature as a resource for recreation and experiences and what responsibilities we have when using it".
In this study we analyze the effect of outdoor experiences on conceptions and conceptual profiles for school children in Botkyrka municipality south of Stockholm in Sweden. A questionnaire was answered by 185 pupils, first on the way to the lake, and again on the way back from the lake. The questions asked were: ***Is nature important for us humans? Is nature interesting/boring? Is nature dangerous? Would you spend spare time in nature? Do you like outdoor education?***
The answers were used to construct comprehensive conceptual profiles using ordination techniques. Three main groups could be identified – two groups that differed in finding nature interesting and important, one did and one did not. Those two groups did not change their profile during the field day. One group was intermediate between the two former groups. This group of children was quite indifferent at the start, but changed during the day, finding nature more important and interesting.
Applying linear mixed models we found that the more unimportant the pupils thought nature was for us humans, the more they changed their conception towards important. The same pattern was found also for the other response variables – the field day worked as intended and in line with the curriculum. On the other hand, when we analyze the change in conceptions as explained by the scores from the other questions a more complex pattern arise, e.g. pupils that from the start claimed that they did not want to spend spare time in nature found nature even more boring after the day at the lake.

1. Introduction
In outdoor experience-based learning there is often a focus on subject learning while the influence of the pupils' *prerequisites*, their conceptual profiles, is less well studied. In the Swedish curriculum for elementary school - pupils aged 10-13, there are several learning outcomes connected to sustainable development. In Biology, one of the learning outcomes relates to "People's dependence on, and the impact on nature, and what this means for sustainable development". Some of the learning outcomes also aim directly at conceptions of nature: "Nature as a resource for recreation and experiences and what responsibilities we have when using it". Conceptual profiles have been constructed from different aspects, e.g. [1] constructed profiles to explain understanding of evolution, and [2] construction of more general profiles describing personal approaches to reflection (richness, recursion, relations and rigor). Here we construct profiles from pupil´s conceptions of nature and use them to explain learning outcomes, which actually describes a change in profile, since profiles are constructed to reflect the learning outcomes.

2. Material and methods
In this study we analyze the effect of outdoor experiences among school children on conceptions and conceptual profiles for school children. In Botkyrka municipality south of Stockholm in Sweden, all children in fifth-grade is going on a mandatory field trip visiting a lake. We constructed a questionnaire which was answered by 185 pupils first on the way to the lake, and then again on the way back from the lake. The questions asked were: ***Is nature important for us humans? Is nature interesting/boring? Is nature dangerous? Would you spend spare time in nature? Do you like outdoor education?*** All questions were answered at a ten graded Likert scale. For all questions a high score was negative for the concept: not important/boring/ dangerous/not spending spare time in nature/do not like outdoor education.

Four groups for evaluation as conceptual profiles were constructed from the answers to those questions before the day at the lake. We used the agglomerative clustering procedure “agnes” from the cluster package [3] using the statistical program R [4]. To evaluate the profiles of the groups we made a principle component analysis (PCA) where the scores on the 5 questions were fitted using the procedure “envfit” in the R-package vegan [5]. The change in conception were calculated as score before minus score after the field day, since high score was a negative attitude, high scores in change was towards a more positive conception. The changes in attitude were also fitted to the PCA to evaluate if changes were associated with groups.
More detailed analyses of the association between conceptions and changes in conceptions were performed using linear mixed models from the R-package lme4 [6], with class as a random factor. Results were evaluated using ANOVA type two from R’package car[7], and effects [8].

3. Results

Summary data for the dataset is given in Table 1.
Table 1. Mean values of the answers to questions before the field day, and the change in scores when answering the same questions after the field day. All questions were answered at a 10 graded likert scale with 10 being most negative for the concept.

Question	Mean answer, SE, min and max values	Mean change, SE, min and max values
Is nature important for us humans?	1.67 (0.14, 1, 10)	- 0.02 (0.11, -7, 2)
Is nature interesting/boring?	3.92 (0.25, 1, 10)	0.06 (0.16, -7, 4)
Is nature dangerous?	4.80 (0.20, 1, 9)	0.26 (0.18, -8, 5)
Would you spend spare time in nature?	5.01 (0.31, 1, 10)	0.20 (0.15, -4, 4)
Do you like outdoor education?	4.06 (0.30, 1, 10)	0.08 (0.19, -7, 5)

From the agglomerative clustering of the pupils according to pre-outdoor education day attitudes we chose the level of four clusters, dividing the students into cluster 1: 35 pupils, cluster 2: 3, cluster 3: 26 and cluster 4: 28.

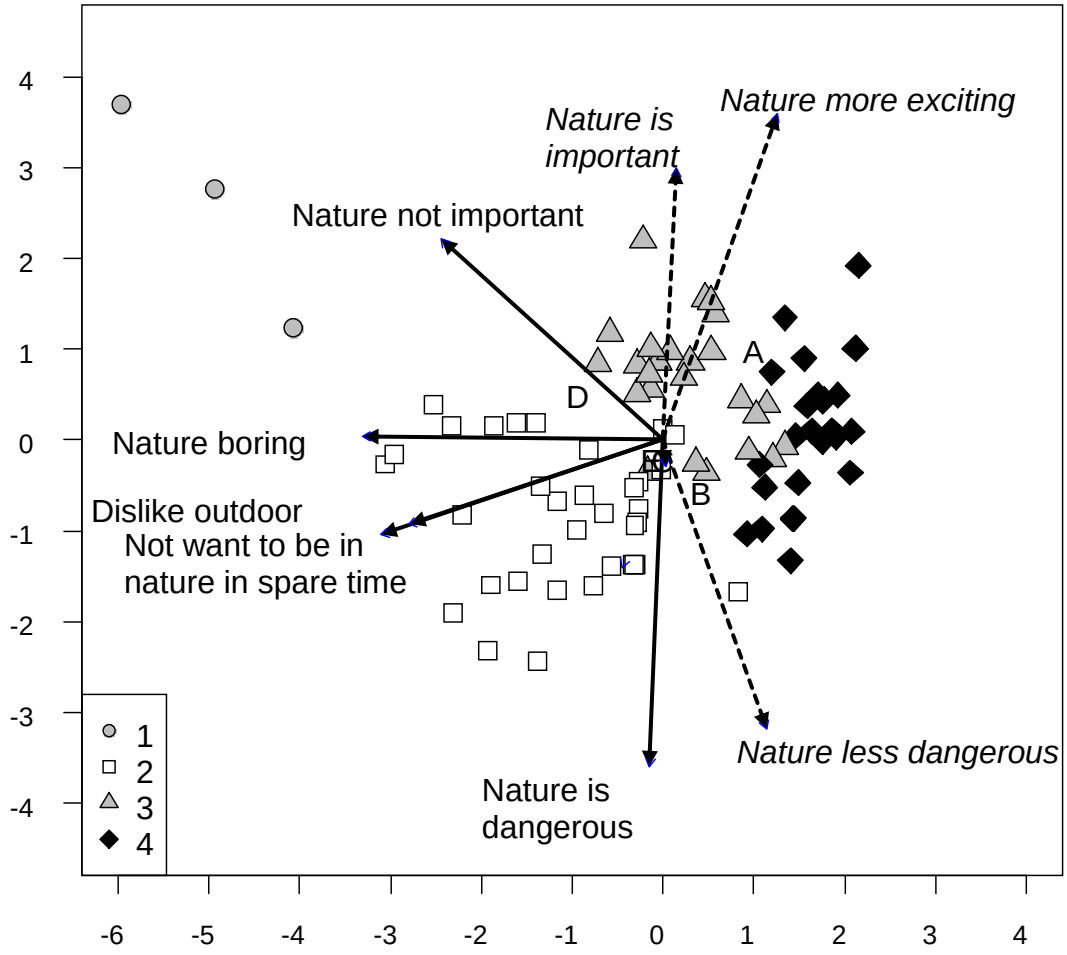

Fig 1. Principal component analysis of pupils´ conceptions of nature. The four groups are constructed from a separate cluster analysis and are indicated by different symbols in the plot. The arrows shows significant association of the attitudes ($P < 0.001$ for all) and changes in attitudes ($P < 0.05$). The letter indicate the 5 different schools that the pupils come from. The association is not significant ($P=0.11$). The filled arrows represents the directions in scores before the field day, i.e. the data used to construct the ordination. The dashed arrows indicate the change in conception during the field day. Three out of five arrows indicating change in conception were significantly associated with the ordination and are the ones plotted. Schools C-E centroids are clumped in the center.

From Fig.1 we can see that the small group 1 consists of pupils that have a conceptual profile where they find nature not important, it is boring and they do not want to be there. They do however not find it dangerous. Group 2 also find nature boring and they do not want to be there, but they do not have any strong opinion on the importance of nature to us humans and the do find nature to some extent dangerous. Group 3 is the group that does not find nature dangerous, they do to some degree find nature exciting and like to be outdoors but they are indifferent to the importance of nature. The last group, 4, finds nature exciting and wants to be there, it is the group that most appreciates the importance of nature and they are less concerned by the dangerousness of nature compared to group 2. The difference between schools is not significant but there is a tendency for school A to be associated with groups 3 and 4.

When it comes to changes in conceptions after the field day it is obvious that group 3 has changed most – the pupils belonging to this group find nature more important and exciting after the day. They may find nature somewhat more dangerous than they thought before. Group 2 finds nature somewhat less dangerous but even more boring. There is a tendency for group 4 to find nature less dangerous and more exciting. The small group 1 seems mostly unaffected.

Table 2. Results from linear mixed models using change in attitude in individual pupils as response variable and initial conception as explanatory variables. The results come from five models (in columns), the significance of effects are indicated by stars (* = P < 0.05, ** = P < 0.01, *** = P < 0.001) and are evaluated using ANOVA type 2, meaning that all effects are evaluated when the effects of the other explanatory variables are taken into account. The original questions are: Is nature important for us humans? Is nature interesting/boring? Is nature dangerous? Would you spend spare time in nature? Do you like outdoor education?

Change Towards / Before	Important	Exciting	Not dangerous	Want to spend time in nature	Like outdoor education
Nature not important	**+** **	N.S.	N.S.	N.S.	N.S.
Nature boring	**-** **	**+** ***	N.S.	**-** ***	**-** ***
Nature dangerous	**-** ***	N.S.	**+** ***	N.S.	N.S.
Do not want to spend time in nature	N.S.	**-** *	N.S.	**+** ***	N.S.
Dislike outdoor education	N.S.	N.S.	N.S.	N.S.	**+** ***

The effect of the initial conceptions before the field day on change in conception is shown in Table 2. For all explanatory variables (in left column) there was a strong significant effect on change towards a more positive conception – the ones most negative at the start of the day change most towards being positive. When this effect is taken into account, additional effects were that considering nature boring before the field day was negatively associated with a change towards finding nature important, and wanting to spend time in nature and outdoor education – the scores were even lower after the day than before, as extracted from effect calculations (not shown). Those who at the start of the day thought nature was dangerous did find nature less important in the end of the day than before. Those who from the beginning did not want to spend time in nature did find nature less exciting after the field day.

4. Discussion

The intention of taking children on a field days is to promote understanding of nature´s importance for humans. The idea is that a field trip should make them appreciate and become interested in nature, creating a fundament for understanding of the importance issue of sustainable development.

From the collected data summarized in Table 1. we can see that before the field day most pupils were in general positive to nature, especially regarding its importance, while the answers on the other questions was closer to the mean scale score (5.5). Changes in concepts are not large but all changes are directed towards being more positive to the sustainality concept.

A more interesting pattern emerges when the pupils are divided into conseptual profiles (Fig. 1). Groups that from the beginning were negative or positive, did not change much. However, pupils in the group (3) which from the beginning did not think of nature as important, but neither very freightening, clearly changed their profiles towards finding nature important and exciting.

Our result showing the effect that pupils preconceptions have on change in score after the field day, indicate that the effect of the field day is dependent on the pupils conceptual profiles. For many of the pupils there is a change to beeing more positive with respect to all concepts in our questionnaire. and a stronger effect the more negative the individuals were from the begining. The exeption was a pupils who from the beginning found nature boring and dangerous, that after the field day found nature less important than before. Those who found nature boring were also after the day less interested in beeing in nature or having outdoor education.

The conclusion is that the learning outcome of outdoor events is dependent on the conceptual profiles of the pupils and that That we should take this into acount when we design outdoor education.

5.References

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