

## **PART 9: STRAND 9**

### **Environmental, Health and Outdoor Science Education**

**Co-editors:** *Albert Zeyer & Marianne Achiam*

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# THE COGNITIVE AND NON-COGNITIVE EFFECTS OF OUT-OF-SCHOOL LEARNING

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*The effectiveness of out-of-school learning (OSL) programmes has been shown by several studies with special reference to its beneficial role in raising students' interest in a particular topic, increasing learning motivation and providing a special personal and social experience. In addition, it may also have a significant positive effect on cognitive processes of learning depending on the nature and method of the out-of-school programme. An OSL activity linked to the subject matter, for instance, could encourage a deeper understanding of the topic, help to put the acquired knowledge to practical use and contribute to the long-term storage and easy recall of the studied information thanks to the experience-rich environment. The study discusses the results of one component of a complex online survey (The Effect of the Specific OSL Programmes, Cronbach  $\alpha=0.94$ ), in which primary school students, teachers and principals were asked about their opinions on the usefulness of OSL activities in the achievement of certain cognitive and non-cognitive learning outcomes.*

*Keywords:* outdoor education; education outside the classroom; out-of-school learning

## THEORETICAL BACKGROUND

While the tools and methods of public education are often left out-dated and artificial (Braund & Reiss, 2006; Duran, Ballone-Duran, Haney & Beltyukova, 2009; Eshach, 2007; Hofstein and Rosenfeld, 1996), informal learning spaces just as science centres, open laboratories and museums, for instance, tend to display scientific and technological innovations in line with the expectations of modern audiences in order to fulfil their function of representing science and offering entertainment at the same time. These spaces can be used to pique students' curiosity for science and help them understand abstract concepts that are difficult for them to grasp while at the same time developing individual responsibility for their further studies and academic progress (Gardner, 1991, cited in Eshach, 2007. pp. 171).

### Dimension of out-of-school learning

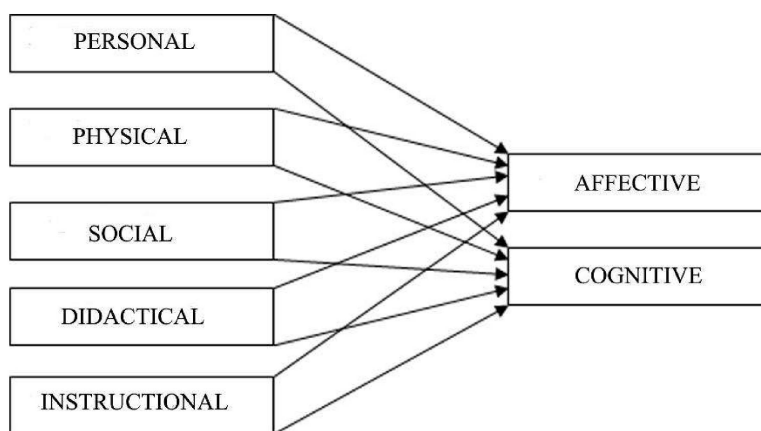
The usefulness of out-of-school learning is affected by several factors such as students' prior knowledge, the physical properties of the environment, the teaching and learning methods employed, the students' social relationships or, for an outdoor programme, even the weather. Each of these factors includes a number of critical features that have a decisive effect on the added pedagogical value of out-of-school classes and programmes.

Combining Orion and Hofstein's (1994) three-factor model of fieldtrip learning with Falk and Dierking's (2000) contextual model of museum learning, Eshach (2007) suggests a model of the effects of out-of-school learning comprising four factors. The four factors may comprise both cognitive and affective components and they are all believed to affect the cognitive and affective aspects of learning processes. The four critical factors identified by Eshach are the following:

1. Physical: e.g., the environment and furnishings of the learning space;
2. Personal: e.g., the student’s prior knowledge about of the subject matter (cognitive) and the student’s attitude towards the subject (affective);
3. Social: e.g., interpersonal interactions between the students (cognitive) and the students’ perception of the instructor’s personality (affective);
4. Instructional: introduction to the scene and topic of the out-of-school activity (cognitive) and the concluding discussion of the experiences of the programme (affective).

This aspect does not, however, comprise the “teaching factors” mentioned by Orion and Hofstein (1994), which include the embeddedness of the activity in the subject matter, the instruction methods employed, the educational objectives, etc. These factors of learning organisation may, however, have a substantial effect on learning outcomes, therefore a fifth factor containing teaching and learning methods and objectives should be added to the out-of-school learning model: the didactical factor. Our extended model is shown in Figure 1.

Although the instructional and the didactical factors may seem to overlap to some extent and instructional features could be assigned to the didactical factor, it is still reasonable to separate the two because the appropriate introduction to and conclusion of an OSL activity is at least as important for the outcome as the other factors mentioned here (Rickinson et al., 2004; Fiennes et al., 2015; James and Williams, 2017; Orion, 1993; Orion and Hofstein, 1994).



**Figure 1. Factors affecting out-of-school learning (based on Eshach’s model, 2007)**

Most studies on OSL fit this model since they tend to investigate outcomes along at least one of these dimensions. Systematic surveys and meta-analyses of the OSL literature (Becker, Lauterbach, Spengler, Dettweiler & Mess, 2017; Fiennes et al., 2015; Hattie, Marsch, Neill & Richards, 1994; Rickinson et al., 2004; Scrutton and Beames, 2015; Waite, Bolling & Bentsen, 2015) typically also use this system of categorisation or one corresponding to this system to organise their results on the effects of OSL, that is, they look at cognitive, affective, social, or personal factors.

## THE SURVEY

### Aims

The present study discusses the results of a selected questionnaire (*The Effect of the Specific OSL Programmes*) of a large-scale online survey with the aim of identifying the educational goals with regard to which primary school principals, teachers and students found OSL activities useful. The study focuses on the added educational value of OSL activities in participating students' learning processes, both in cognitive and in non-cognitive aspects. Further results of the survey have been discussed in other publications (Füz & Korom, 2017; Füz, in press).

### Sample

Data collection was carried out in May and June 2016. Participants included students in Grades 3 to 8 (N=4680), their class teachers (N=112) and principals (N=69). The sample came from the partner institutions of the Szeged Centre for Research on Learning and Instruction. Participation was voluntary with the condition that at least one class in the school participated in at least one out-of-school activity during the school term preceding data collection.

Ninety-six primary schools participated in the survey, 44 per cent of which were located in villages, 25 per cent in towns, 19 per cent in county seats, 9 per cent in townships, 2 per cent in municipalities and 1 per cent in the capital. Schools located in the capital city are underrepresented in the sample:  $t(3880)=-8.29$ ;  $p<0.001$ . Our sample is representative of the country for the remaining settlement types and a set of independent t-tests show no significant difference between the country and the sample distributions.

Looking at the distribution of genders, they were virtually equally distributed among students: of the total of 4,680 students, 2,202 were boys and 2,221 girls. Two-hundred and fourteen students did not specify their gender and 43 students gave an uninterpretable response (marked both options). The different grades are also distributed evenly in the sample: the frequencies and percentages are shown in Table 1.

**Table 1. Student frequencies in the sample by grade**

	Grade					
	3	4	5	6	7	8
N	704	838	894	718	865	661
%	15.0	17.9	19.1	15.3	18.5	14.1

### Method

A complex self-developed online questionnaire entitled *Educational Use of Out-of-School Learning Places Questionnaire* was administered through our Electronic Diagnostic System (eDia, Molnár & Csapó, 2013; Molnár, 2015) in the ICT labs of participating schools.

The survey consists of 5 sub-questionnaires: (1) The Administrative Structure of the School, (2) Characteristics of the Specific OSL Programmes, (3) The Effect of the Specific OSL

Programmes, (4) General Attitudes toward OSL Programmes (adapted from Orion & Hofstein, 1991) and (5) Conditions of Organizing OSL Programmes.

This study discusses the second sub-questionnaire: *The Effect of the Specific OSL Programmes*, which included statements regarding both cognitive and non-cognitive components of OSL. The lists of considerations in the teacher and principal versions were modified and turned into first-person statements in student version as shown in Table 2 in order to assist comprehension. The letters assigned to the statements in the Table will be used in further analyses to help interpret the results. Respondents were asked to rate the statements on a four-point Likert scale, where the level of agreement was: 1 – Strongly Disagree; 2 – Disagree; 3 – Agree; and 4 – Strongly Agree.

**Table 2. The teacher/principal and student versions of the questionnaire entitled Attitudes towards Specific OSL Programmes**

Teacher, Principal			Student
How useful would you say the out-of-school learning activity was with respect to the goals listed below?	Number	Factor *	To what extent do you agree with the following statements? At the out-of-school learning activity....
social experience	1	S	I had a good social experience
learning about cultural heritage	2	C	I learnt about our national heritage
self-regulated learning, development of learning skills	3	C	I received help to organise my studying
foundations of life-long learning	4	S	I realised that we can learn useful things outside the classroom
development of communication skills	5	C	what we did helped me express myself better
acquisition of new information	6	S	I acquired new information
development of social skills	7	S	my participation helped me co-operate with my groupmates
development of critical thinking	8	C	the tasks I did made me think and form my own opinions
development of the ability to filter and process information	9	C	I learnt how to look up information if I want to find out more about a subject
arousing interest in subject matter	10	A	the tasks I did aroused my interest in the subject matter
deepening school knowledge	11	C	the tasks I did helped me understand what we had learnt in the classroom
improvement of subject attitudes	12	A	I became more interested in the school subject related to the programme
development of learning motivation	13	A	my experiences gave me motivation to learn
use of instruments and empirical methods	14	C	we used various instruments and methods
development of manual skill	15	C	I became better at performing tasks with my hands

\*: A: affective, C: cognitive, S: social learning factor

The items of the questionnaire can be divided into two groups: cognitive aspects and non-cognitive aspects of learning. The Kaiser-Meyer-Olkin test for sampling adequacy was used to test the suitability of the theoretical model for principal component analysis, and the resulting value (0.963) proved to be decidedly high indicating that our data were indeed suitable for

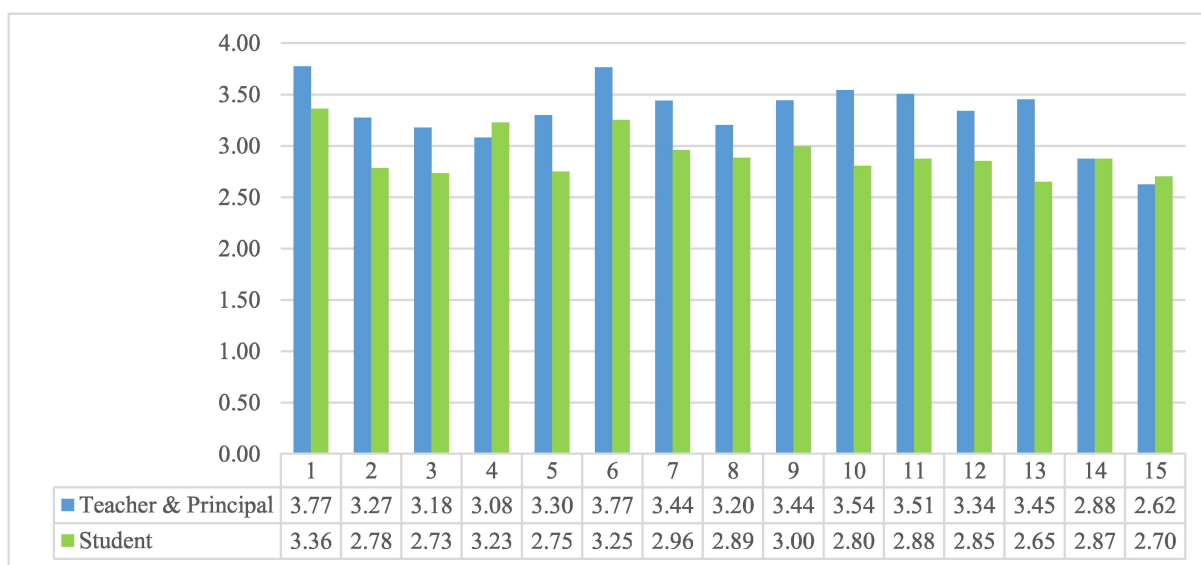
factor analysis. The factor analysis created three factors with 66.63% of the total variance explained by the three together. Table 2 shows the factor structure after a varimax rotation with only values above a factor loading of 0.4 included.

The factors were assigned the following labels: cognitive (C), affective (A) and social learning (S). The reliability of the 8 statements belonging to the cognitive factor measured by Cronbach  $\alpha$  was 0.91, the 3 statements in the affective factor showed a reliability value of 0.87 and the corresponding value for the 4 statements in the social learning factor was 0.78. The combined reliability of the three scales for the whole sample was 0.94. The factors that emerged therefore allow us to group the aspects of learning into cognitive versus non-cognitive categories as suggested in the introduction, and further allow us to distinguish cognitive, affective and social components of the learning taking place during OSL programmes.

## SELECTED RESULTS

### Criteria for assessing OSL programmes

No significant differences were found between the answers of principals and those of teachers. Since their questionnaires used the same format, their responses were combined for the purposes of the analyses reported here (see Figure 2).



**Figure 2. Mean ratings of the usefulness of OSL programmes for the teacher/principal and student subsamples by statement**

As we can see in the Figure, teachers and principals gave more positive ratings for almost all statements than students; the pattern was reversed for only one statement: foundations of life-long learning (teacher version) – the realisation that things can be learnt outside the classroom (student version), where students rated OSL more useful than teachers/principals. For the use of instruments and empirical methods and for the improvement of dexterity, t-tests showed no significant differences between the two subsamples. For the remaining features, however, teachers and principals gave significantly more positive answers than students at the 99 per cent probability level.

Both students and their teachers and principals thought that the social experience ( $M_{\text{student}}=3.36$ ,  $SD=.67$ ;  $M_{\text{teacher/principal}}=3.77$ ,  $SD=.34$ ) and the acquisition of new information ( $M_{\text{student}}=3.25$ ,  $SD=.68$ ;  $M_{\text{teacher/principal}}=3.77$ ,  $SD=.33$ ) were the learning aspects that benefitted most from OSL. For students, the programmes were also highly appreciated for the opportunity to learn things outside the classroom with a mean rating of 3.23 ( $SD=.67$ ), while for teachers and principals, the increased interest in the subject matter ( $M=3.54$ ,  $SD=.46$ ) and the deepening of school knowledge ( $M=3.51$ ,  $S=.5$ ) ranked next.

Looking at all the out-of-school learning spaces combined, the OSL programmes proved to be least effective in enhancing manual skills ( $M_{\text{student}}=2.7$ ,  $SD=.95$ ;  $M_{\text{teacher/principal}}=2.62$ ,  $SD=.83$ ). This is understandable since the educational goal of improving manual skills is typically limited to activities involving arts and crafts. What is a lot more interesting is that the greatest difference between the teachers' and the students' ratings appears for the effects of increasing learning motivation ( $M_{\text{student}}=2.65$ ,  $SD=.89$ ;  $M_{\text{teacher/principal}}=3.45$ ,  $SD=.51$ ) and arousing interest in the subject matter ( $M_{\text{student}}=2.8$ ,  $SD=.82$ ;  $M_{\text{teacher/principal}}=3.54$ ,  $SD=.46$ ): for both of these features, teachers and principals rated the contribution of OSL programmes substantially higher. In fact, students ranked the usefulness of OSL in increasing learning motivation lowest of all aspects, which is unexpected given that several research studies highlight increased learning motivation as a crucial benefit of OSL activities. We should note, however, that our students' ratings fall into a considerably smaller range of values than the teachers' ratings, where the difference between the highest and the lowest average usefulness rating is more than one point on the four-point scale. Also, the average ratings of teachers and principals are greater than 3.00 for 13 statements while the students rated only 3 statements higher than that value. Thus, although the effect on learning motivation was rated lowest, it did not lag far behind the remaining aspects.

No major differences were found between boys and girls in the ratings of the statements either in terms of ranking or in terms of rating values. Only two of the aspects showed significant gender differences: two-sample t-tests ( $p<.01$ ) revealed that girls rated OSL activities as more useful than did boys with respect to social experience ( $M_{\text{girls}}=3.41$ ,  $SD=.64$ ;  $M_{\text{boys}}=3.33$ ,  $SD=.68$ ) and the acquisition of new information outside the classroom ( $M_{\text{girls}}=3.27$ ,  $SD=.67$ ;  $M_{\text{boys}}=3.2$ ,  $SD=.72$ ).

### **Assessing OSL programmes by school grade**

Looking at the average ratings of the programmes by school grade, they showed a monotone decreasing trend with an increase in grade (see Table 3).

If we group the statements into the three factors, the monotone decreasing trend remains: the ratings of cognitive, affective and social learning factors negatively correlate with the number of years spent at school.

An analysis of the individual statements of the questionnaire reveals that students in every school grade without exception gave the highest rating to the social experience accompanying OSL programmes. The lowest ranking statement varied by school grade. It was learning about their national heritage for third graders ( $M=2.95$ ), improved dexterity for fourth graders ( $M=2.81$ ), help with the organisation of studying for fifth graders ( $M=2.81$ ) and increased

learning motivation for sixth, seventh and eighth graders ( $M=2.51$ ,  $2.42$  and  $2.3$  respectively). The highest average rating was therefore given by third grade students for the social experience offered by OSL programmes ( $M=3.58$ ) and the lowest average rating by eighth grade students ( $M=2.3$ ), who did not think that OSL activities made them feel like learning.

**Table 3. Average ratings of OSL programmes by school grade**

<i>Grade</i>	<i>Mean</i>	<i>SD</i>	<i>N</i>
3	3.19	.52	679
4	3.04	.58	805
5	2.98	.58	818
6	2.83	.57	616
7	2.77	.60	822
8	2.63	.58	606

### The three dimensions of the usefulness of OSL programmes

Looking at the learning aspects benefiting from OSL activities grouped into the three factors discussed above, for the student subsample OSL appears to have the greatest effect on social learning with a mean rating of  $3.2$  ( $SD=.56$ ). This is followed by the cognitive dimension ( $M=2.82$ ,  $SD=.66$ ), and the affective aspects come last ( $M=2.77$ ,  $SD=.76$ ).

An analysis of gender differences reveals a similar pattern to that observed before: boys and girls do not differ in their ratings of the cognitive and the affective dimensions but there is a small but statistically significant difference between their ratings of the social learning dimension with girls giving higher values than boys (see Table 4).

**Table 4. Student answers to the questionnaire Attitudes towards Specific OSL Programmes by gender**

<i>Factor</i>	<i>Gender</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Levene</i>		<i>t/d</i>	
					<i>F</i>	<i>p</i>	<i>t/d</i>	<i>p</i>
Social Learning	Boys	2028	3.18	.55	.89	n. s.	-3.49	.00
	Girls	2073	3.24	.54				
Cognitive	Boys	2032	2.83	.66	.01	n. s.	.29	n. s.
	Girls	2074	2.82	.66				
Affective	Boys	2008	2.76	.75	1.59	n. s.	-.69	n. s.
	Girls	2056	2.78	.77				

The teachers' and principals' answers also suggested that the social learning aspects are the greatest benefit of OSL programmes with an outstanding average rating of  $3.52$  ( $SD=.38$ ). In contrast with the students, however, they found its role in achieving affective goals almost as important ( $M=3.45$ ,  $SD=.48$ ). Teachers and principals thought OSL programmes had the weakest effect on the cognitive aspects of learning, but their mean rating remained above 3 even for this dimension ( $M=3.18$ ,  $SD=.47$ ).

## CONCLUSION AND DISCUSSION

Our empirical study looked at the effects of out-of-school learning programmes organised by the school with respect to both cognitive and non-cognitive aspects. We conducted a survey with a sample of 4,681 people from primary schools throughout Hungary. The sample

comprised teachers, principals and students in grades 3 to 8. The survey instrument was a complex online set of questionnaires, of which the results of a four-point Likert scale questionnaire developed by our research group were discussed in the present paper. The questionnaire comprised 15 items, which were grouped into three factors by factor analysis: an affective, a cognitive and a social learning factor. The questionnaire was designed to map students' and teachers' experiences and views on the educational usefulness of OSL programmes.

The results of the study provide further support for the conclusions of meta-analyses and research surveys (Becker et al., 2017; Hattie, Marsh, Neill & Richards, 1994; Rickinson et al., 2004; etc.) indicating that OSL activities can become effective additions to classroom instruction in several areas of learning including its social, affective and cognitive aspects as shown in our study. Of the 15 educational objectives included in the questionnaire, both teachers/principals and students found that the greatest benefit of the OSL programmes in which they participated during the six months preceding data collection was the social experience they provided and the new knowledge they helped to acquire. This result confirms the dual function of OSL spaces: learning as entertainment (Eshach, 2007; Hofstein & Rosenfeld, 1996).

Since learning that takes place in the usual classroom environment tends to become boring to students, it would certainly be worth making efforts to integrate informal learning spaces into formal education since this would help curb the decline in their learning motivation and school subject attitudes. A great number of studies have found that OSL has a positive effect on students' intrinsic motivation and their attitudes towards a school subject or topic (Dettweiler, Ünlü, Lauterbach, Becker & Gschrey, 2015; Fägerstam & Blom, 2013; etc.)

This conclusion is also supported by the answers of the teachers in our survey, who thought that OSL programmes played an especially important role in arousing students' interest in the subject matter and enhancing their learning motivation and subject attitudes. The students' answers, however, appear to contradict this result: they rated an increase in learning motivation as the least likely effect of OSL activities. This may be unexpected given the wide range of studies suggesting the opposite, but we should note that students gave lower ratings than their teachers or principals to almost all aspects included in the questionnaire. Not only did they give lower ratings but the range of ratings they used was also considerably smaller for students than for teachers: the mean student rating for learning motivation, which they found the least noteworthy aspect, did not lag far behind the others. On average, students only rated three statements higher than 3.00, while for teachers 13 aspects crossed this threshold. Furthermore, it is well known that students' learning motivation and subject attitudes linearly and steeply decline with an increase in the number of years spent at school (Braund & Reiss, 2006; Csapó, 2000; Józsa and Fejes, 2012; Holmes, 2011). This decreasing trend also surfaces in our cross-sectional study since the students' attitudes towards OSL programmes negatively correlated with their school years. The last place of learning motivation in the ranking seems justified under these circumstances. Although students rated their learning motivation following an OSL programme rather low, it is quite possible that their attitudes would be even more negative if the same activities had taken place in their usual classroom environments. Most studies arguing

for the positive effects of OSL programmes in the affective dimension provided evidence either by using a control group for comparison or based on a longitudinal study, where the effects of the programme can be clearly isolated. Our large-scale online study did not allow us to exercise that level of control, but our next, smaller-scale, paper and pencil longitudinal study will provide an opportunity to isolate the effects of OSL programmes.

Our analysis of the three factors emerging from the study revealed that both students and teachers/principals found that the greatest contribution of OSL activities was the opportunity it provided for social learning. For students, this was followed by the cognitive dimension with a considerable gap between the two, and the affective factor came last with no lag this time. For teachers, the three factors received similarly high ratings closely following one another in the following order: social learning, affective aspects and cognitive aspects.

On the whole, both students and teachers/principals showed a positive attitude towards the out-of-school programmes in which they had participated during the six-month period preceding data collection. This positive attitude applied to several different aspects of these programmes such as the social experience they provided, their contribution to the acquisition of new knowledge, the deepening of school knowledge, practice in filtering information and co-operation with peers, etc. These results suggest that it is well worth the effort to enrich classroom instruction with the numerous opportunities provided by OSL. Integrating OSL into the school curriculum and educational practice would go a long way in making the learning environment more varied and true to life and thus alleviating the difficulties of public education.

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