

16 Students' Appropriation of Space in Education Outside the Classroom. Some Aspects on Physical Activity and Health from a Pilot Study with 5th-Graders in Germany

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16.1 Space Appropriation in Educational Settings

The quality of students' space appropriation and the respective influence on their knowledge acquisition, behavior change, PA and health is strongly connected to the properties of the teaching environments and the pedagogical concepts, which has been widely discussed in academic disciplines such as philosophy and aesthetics (Böhme, 2000; 2002), school architecture (Böhme, 2009), education (Nugel, 2014) and public health (Völker, Matros, & Claßen, 2016). Böhme, for instance, understands space in states of aesthetic atmospheres which he describes as standing "between subjects and objects" and create, thus, the emotional experiences of the objective world. Nugel, on the other side, asks from a critical constructivist perspective what kind of knowledge about space is generated in narrative scientific discourses, and what significance such discourses have for pedagogical space theory and practice. Both understand space as a value-loaded concept, which suggests the relevance of space in educational settings. The children's "co-curating of relational spaces" (Thiel, 2018) or concepts compatible with a comprehensive understanding of children's mobility in (urban) open spaces, such as place attachment, affordances, wayfinding and prospect-refuge (Johansson, Mårtensson, Jansson, & Sternudd, 2020) have become the focus of research in order to support children's independent and active mobility. One promising approach to combine meaningful learning opportunities, PA and well-being with an explicit concept of space is the "Education Outside the Classroom" (EOtC) movement. EOtC can be described as regular weekly or bi-weekly compulsory school and curriculum-based education in a natural or cultural setting outside the school building (Bentens et al., 2009). EOtC is mainly based on teaching concepts called udeskole or uteskole from Denmark and Norway and can be considered a grassroots movement initiated by enthusiastic teachers. It has, therefore, by nature, different shades in its meanings and practise.

In this context, EOtC can provide meaningful opportunities for students to explore different natural and cultural places, to learn *about*, *from* and *within* them, and to be physically active in the appropriation of space.

16.2 Education Outside the Classroom – EOtC

During EOtC, lessons are in accordance with the syllabus and regularly take place outside the school building. The focus is on student-centered teaching, interdisciplinary learning, practical learning and the conscious use of natural and cultural places (Bentsen, Mygind, & Randrup, 2009). The meaning of “regularly” differs depending on regional aspects and specific school environments. Especially in Scandinavia and the United Kingdom, different forms of EOtC are widely practised. These forms also include different age groups in relation to different school systems. EOtC or *udeskole* (Denmark)/*uteskole* (Norway) can be described as a grassroots movement and began in the 1990s in Denmark with a handful of motivated teachers. Barfod et al. (2016) conducted a representative, nation-wide survey and conclude that in 2014, 17.9% of all Danish public schools and 19.4% of all independent and private schools practice EOtC with at least one class, which is an increase from 14% of public and independent/private schools in 2007. That describes a potential shift from traditional indoor teaching toward more variety and the use of places outside the classroom. In our systematic literature review (Becker, Lauterbach, Spengler, Dettweiler, & Mess, 2017), we evaluated the possible effects of regular outdoor teaching. We found that EOtC can have positive effects on students’ academic learning, social interaction, PA and mental health. However, the average methodological quality of the 13 evaluated scientific studies was mediocre and, therefore, the scientific evidence was rather limited until spring 2016. Recently published and methodologically more reliable studies indicate that EOtC can lead to an improvement in reading performance (Otte et al., 2019), learning motivation (Bølling, Otte, Elsborg, Nielsen, & Bentsen, 2018), social behavior (Bølling, Niclasen, Bentsen, & Nielsen, 2019), as well as well-being (Jørring, Bølling, Nielsen, Stevenson, & Bentsen, 2019) and, importantly, increased PA among boys (Schneller et al., 2017; Schneller, Schipperijn, Nielsen, & Bentsen, 2017). For students with comparatively low socioeconomic status, an inverse correlation between EOtC and hyperactivity-inattention and peer problems has been reported (Bølling et al., 2019). During outdoor classes, high levels of light PA (LPA) are associated with a health-related reduction of their cortisol level (Becker et al., 2019; Dettweiler, Becker, Auestad, Simon, & Kirsch, 2017), and in addition, breaks and rest periods during outdoor lessons seem to have a positive effect on stress reduction (Mygind, Stevenson, Liebst, Konvalinka, & Bentsen, 2018). These specific findings sit within

a body of research that suggests natural green or blue environments, i.e. landscapes covered by forests, meadows, rivers or lakes, generally provide great potentials to enhance students' health (Mygind et al., 2018; Roberts, Hinds, & Camic, 2019).

Research has found that increasing numbers of teachers see EOtC as of great potential to improve students' learning outcomes and everyday competences (Mygind, Bølling, M., & Barfod, K.S.). From the educational or pedagogical perspective, it facilitates inquiry-based teaching and, therefore, student-centered learning with cognitive challenges (Barfod & Daugbjerg, 2018), and fosters school and teaching development processes in terms of cross-curricular lessons, testing of new methods and extension of multifaceted competencies (Sahrakhiz, 2017).

With respect to the students' strategies to deal with space in EOtC, an early phenomenological study from Norway by Tordsson (2003) described the different ways children and adolescents understand spatial qualities of natural places. Tordsson was especially interested in the *affordance* of natural environmental "objects" as trees or open meadows, in that he portrayed the *objects' qualities or properties that defined their possible uses*. He elucidated how environments and "objects" offer opportunities to children to perform certain actions: the tree affords to be climbed, the meadow to be played on. Tordsson suggests that we (children) have a common understanding to respond to certain spatial properties and qualities. In another Norwegian study, Fiskum and Jacobsen (2013) found that EOtC offered an increased variability of such affordances compared to indoor classes, and that compared to girls, boys more often used natural elements, which *might* indicate that boys are relatively more connected to the specific outdoor environments, thereby predisposing them to more explorative approaches to appropriating the space. Based on interviews with primary school students, Sahrakhiz, Harring, & Witte (2017) argued that EOtC, which most often takes place in natural green environments, provides learning opportunities and challenges and involves students physically, cognitively, perceptually and socially. Space appropriation is especially promoted in play through movement and exploration. Herby, the student-led activities seem to promote motivation and contentment, whereas teacher-led activities were partially perceived with lack of interest or disaffirmation (Armbrüster et al., 2016). In summary, EOtC practice, which is often based in natural green and blue spaces, offers several opportunities for student developments during compulsory school time: it can promote PA, wellbeing and learning motivation.

During EOtC, the characteristics of place and space, as well as the pedagogical concepts, are essential for the aforementioned benefits; the appropriation of space seems to play a crucial part in modeling the benefits of EOtC. In the following section, we provide insights from data collected at a school practicing EOtC in Germany. The data focus on the relevance of students' PA and health with respect to space appropriation.

16.3 Research Example of Education Outside the Classroom from Heidelberg, Germany

In this example, we were interested in comparing the PA levels and students' perceptions of PA, social relations, learning and place of 5th-grade students (ages 10–11) who took part in EOtC classes, with students who took part in regular classroom classes (5th- and 6th-grade students, ages 10–12). The EOtC students studied the subjects of biology, geography, natural phenomena and physical education, in one compulsory school day per week mostly in a nearby forest. Our data collection took place in the school year 2014–2015 and three classes were enrolled in the EOtC class. Students from a regular (non-EOtC) class served as a control group. The EOtC teachers' focus was to facilitate student-centered, hands-on and experimental learning situations and to promote education for sustainable development in the outdoor setting. Different opportunities for problem-solving, co-operation, experimentation and to be physically active on pupils' free choice were enabled by the out-of-classroom setting. Across the entire school year, specific places in the forest were visited on a regular basis.

In order to understand certain aspects of students' health, academic learning and their social relations, we measured students' physical activity via accelerometry during the fall, spring and summer season. We also conducted focus interviews with specific focus regarding students' perceptions of physical activity, social relations, learning and place. We translated the interviews from German to English. For further details regarding the overall study aims, design and results, see our peer-reviewed published articles that are partially based on data sets discussed in this chapter (Becker et al., 2019; Dettweiler et al., 2017).

We analyzed students' PA according to the Compositional Data Analysis approach (Chastin, Palarea-Albaladejo, Dontje, & Skelton, 2015), and our results from this are descriptively presented in ternary plots (Figure 16.1). Ternary plots enable graphic presentation of data from human behavior that is perfectly co-dependent (i.e. interrelated, not independent of each other), such as students' sedentary behavior, LPA and moderate-vigorous PA (MVPA), measured during a school day. A reduction of the amount of time spent in one behavior automatically leads to an increase in at least one of the other behaviors. Therefore, to acknowledge the inherent relationship or co-dependency between sedentary behavior and physical activity is crucial to derive health recommendations.

16.3.1 Findings, Discussion and Future Directions

The analysis shows that the EOtC students exhibited relatively lower relative amounts of sedentary behavior and completed relatively more of LPA and MVPA in comparison to the regular classroom students.

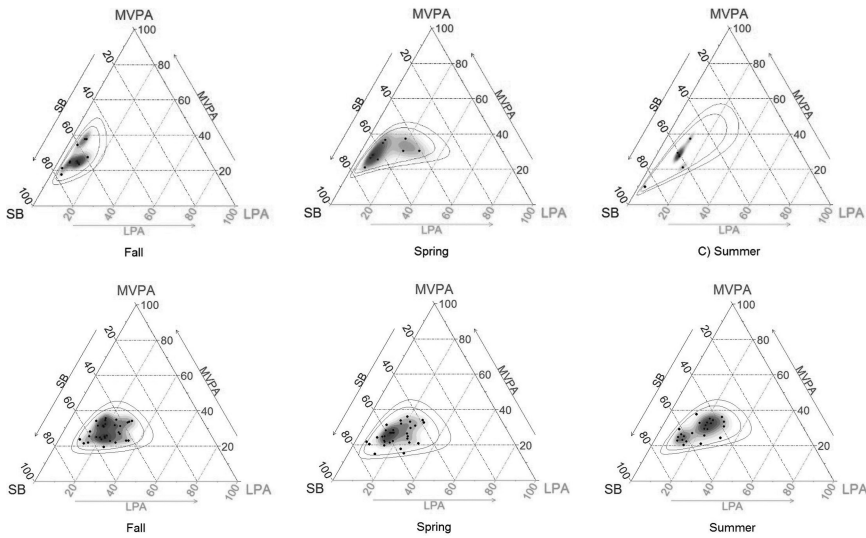


Figure 16.1 Ternary plots of the compositions of students' mean time spent in sedentary behavior (SB), light physical activity (LPA), and moderate-to-vigorous physical activity PA (MVPA). Panel A shows the regular classroom students; panel B shows the EOtC students; both panels are segregated by season (fall; spring; summer). A) Regular classroom students B) EOtC students

Figure 16.1 shows ternary plots of students' sedentary behavior, LPA and MVPA for the regular classroom students (in panel A) and the EOtC students (in panel B), each segregated by season (fall, spring and summer). Ternary plots are used to visually present the distribution of the sample composition and can, therefore, be understood as scatterplots of compositions. The black dots represent the measured behavior of every student in relation to sedentary behavior, LPA and MVPA during one school day. The blue shades indicate the density of similar behaviors within the group; the more intense the color the higher the density. The circles represent the 95% and 99% probability regions of all students. One potential confounder for students' PA during school time is the season of the year. That is because weather conditions such as temperature, precipitation and wind vary in the Heidelberg region and one could hypothesize that students are less active during unpleasant conditions. The 95% and 99% probability regions for the EOtC students are closer to the center of the ternary plot.

Our analysis of students' sedentary behavior and PA indicates that students sit less and are more active during EOtC in comparison to normal indoor classes. This is an important empirical hint that EOtC taking place in natural green and blue environments seems to be beneficial for students' PA and health. We discuss the meaning of students' PA in relation to their appropriation of space by means of the conducted focus interviews. In these interviews, the students described in rich detail what they have

explored at specific places in the forest, how it is connected to the learned content and compare it to similar situations during normal indoor classes. They describe their possibilities to be physically active during lessons of biology, geography and natural phenomena that are traditionally not associated with high levels of PA, as the indoor classroom naturally limits the available space.

And here it is just like this, if we do an experiment then we can really do it. For example, if we do something with water, then it is great with the stream down there and in school, there is no such thing. And then we only do it with such glasses, and with some you can't do it at all, because you really need such a small river.

The student describes an experiment with the aim to measure and understand flow velocity. In the outdoor setting, it has a meaning as a natural phenomenon. From the students' perspective, it would not make sense to transfer the experiment to an indoor setting, as the practical relevance and the phenomenon by itself would get lost. The experiment was closely connected to students' PA, as they needed to walk or run between different stations while developing boats, measurement tools and gathering information by talking to the teachers and classmates.

I'm more immune, I haven't been out in the fresh air that much yet, and now I am. My immune system was strengthened, so I was less ill. And it was really nice once when a man came who knew mushrooms really well and then we looked for mushrooms and then he told us what they were called and what they could do. And in the end we cooked the edible mushrooms and ate them together. And he showed us mushrooms that are poisonous. And if you can see them only on pictures, then you cannot remember that as well as if you see them in real.

The student reflects about his health conditions reasoning that the fresh air during EOtC was beneficial for his immune system, probably recalling some conversations with his parents or teachers. Furthermore, he describes an incident in which an expert helped the students find and identify mushrooms. The combined active process of walking around in the forest searching for mushrooms, comparing edible and poisonous ones, and the group experience of outdoor cooking enables long-term memory. The rather inactive method of working with pictures of mushrooms in a book would hardly be able to provide such rich experiences and to have an – subjectively observed – impact on students' health.

We can even walk during class. In principle, we always move, except when we write something down or talk about something. And you can imagine everything much better.

For some children it is much easier to understand, because here you can explain it well and sometimes when we talk about something, then we also look for animals that look like this. For some children showing thinks helps much more.

Student's report that they are able to be physically active during class. They walk or run to different places within the forest and the nearby environment of the forester's lodge. Seeing and getting in touch with these place and talking about the experiences can be especially helpful to better understand the contents.

The students furthermore spoke about their ability to concentrate in relation to PA and the environment.

But from the concentration I find it better on a forest day, because there we are a lot outside and there you can walk a bit and then you can concentrate again.

I also think you can't concentrate so well in the forest. But the good thing about the forest is, you can see the examples, you can watch them live.

I also think it's a bit harder to concentrate in the forest because you're distracted from other things like birds or ants or something like that, but in the forest you're much freer and I like everything except the forester's lodge.

These examples demonstrate different experiences, as for some students the outdoor environment seems to be better place for concentration, whereas for others it involved many distractions. Students' encounter and interaction with original examples of the world, which are explicit parts of the EOtC concept, seem to be challenging and promoting students' cognitive functions at the same time. From a general perspective, PA in children is associated with positive psychophysiological effects, e.g. more efficient brain activity, better scholastic achievements and higher cognitive performance (Erickson, Hillman, & Kramer, 2015; Mandolesi et al., 2018; Sibley & Etnier, 2003). Rasberry et al.'s (2011) systematic literature review found that 50.5% of studies reported statistically significant positive associations between students' PA and academic achievement (48% reported no statistically significant associations and only 1.5% reported statistically significant negative associations). This indicates the relevance of students' PA in relation to their being able to concentrate during school time. However, students' academic achievement within EOtC needs to be further investigated.

As a conclusive remark, we can say that the relatively more-open learning situation in EOtC invites the children to more physical active compared to "normal" indoor schooling.

The mere lack of classroom walls and the increased opportunity to encounter natural objects seems to inspire students to ask new questions and to solve problems in unconventional and creative ways. That is in concordance with the discussed observations by Fiskum & Jacobsen (2013) and Johansson et al. (2020). Furthermore, many students use the “physical freedom” that comes with open learning spaces to interact with students that they rarely meet in rigid classroom situations and to satisfy their need for movement during complicated understanding processes. Even though we still see a shortage in reliable studies on learning outcomes in EOtC, our strong impression as researchers and practitioners in this field is that children can highly benefit from EOtC in physical as well as in social, methodical and personal dimensions. The presented results from Heidelberg offer insights into one approach in the evolving field of EOtC research. We expect that many different viewpoints will shed further light on the potential benefits and barriers of taking students outside the classroom.

In conclusion, the quality of and variety of students’ appropriation of space in educational settings is highly important for their individual learning experience. EOtC, which often takes place in natural green and blue environments, offers very rich opportunities for appropriation of space. This seems to be beneficial to the students’ social interaction, academic achievement, and physical and psychological health. Yet, future research in EOtC should examine those relationships more solidly with larger longitudinal studies.

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