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Environmental education excursions and proximity to urban green space – densification in a ‘compact city’

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The value of urban green space for environmental education fieldwork is empirically investigated in a study among all secondary schools in Amsterdam. The article describes how the proximity of schools to green spaces emerges as a new factor in the ‘sustainable city’ and the ‘compact city’ debate. For fieldwork excursions proximity to green spaces is crucial for establishing a pattern of outdoor environmental education. Once established, it shapes teachers’ attitudes on excursions. A linear structural path analysis reveals how this in turn results in more fieldwork excursions to other destinations. Interviews with teachers show how this can be interpreted mainly as a result from iterative positive experiences with excursions close to the school, which are triggered by the availability of nearby green space. Remarkably, beside the effects of green spaces for well-being and health, the significance of green space for environmental education of children remained under-investigated. This argument came prominently to the fore in a case of urban densification within the framework of compact city policies. In the dispute about the elimination of green space, citizens claimed a high educational value would vanish, but they felt this value was not recognized in the decision-making process.

Keywords: Urban green space; Fieldwork; Excursions; Urban densification; Environmental justice; Recognition

1. Introduction

City dwellers value urban green space for multiple reasons, and one underexplored reason is its potential contribution to education. This article describes how in urban densification projects decisions are taken about the preservation versus elimination of green spaces, and why environmental education may become a consideration in such disputes. A case about elimination of green spaces illustrates the recognition of the possibilities for environmental education as a significant element of environmental ‘just sustainability’ (Agyeman 2013) in urban development projects.

In this article the value of green space for environmental education is empirically investigated. The study aims to show that important environmental education activities depend heavily on the proximity of public green spaces to schools. Even though this relation may seem rather obvious (Salazar and Menéndez 2007), it has been nevertheless neglected in the literature on urban densification. The following general research questions are investigated:

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- What is the significance of urban green space for fieldwork in environmental education programmes at schools?
- How is the establishment of environmental education practices affected by proximity to green spaces?

This article starts with a brief introduction on the relation between compact cities and green space, as a framework for the elaboration of the research questions mentioned above. Because these questions have not been described in the literature before, the role of environmental education in a conflict about urban development is described with reference to a case in which the importance of green space for environmental education came to the fore. Then the design of the empirical study is described, with first an analysis of the relation between the distance between schools and green space and the frequency of the school's environmental education excursions, followed by a qualitative and structured analysis of how to interpret this relation with regards teacher's motivations. The article continues with the sections in which the data are analysed, and then ends with the conclusions and discussion.

2. Education, value of green space, and urban densification

The value of green space for environmental education has come to the fore as citizens struggle to secure recognition of this value in decision-making on urban developments within the framework of the compact city. Urban densification is a policy aimed at supporting the concept of compact 'sustainable cities' (Jabareen, 2006). The 'compact city' is characterized by mixed land use and close juxtaposition of buildings, roads, and other infrastructure. Mainly because it would limit transport energy use and urban sprawl, construction of compact settlements is seen as a key element for sustainable cities (Jenks, Burton, and Williams 1996).

The compact city is seen as offering economic and social advantages that foster sustainability, but compact city policies also leave limited space for greenery. Urban residents feel this pressure. Densification projects regularly turn into environmental conflicts (Ruming, Houston, and Amati 2012), and citizens could experience their defence of existing green spaces as an issue of 'environmental justice' or 'just sustainabilities' (Agyeman 2013). Access to green spaces primarily concerns allocative justice, for example the location of parks and who has access to them (Wolch, Byrne, and Newell 2014).

Planners and city governments often legitimize decisions about spatial developments with environmental policy arguments. This applies, for example, to decisions about new infrastructure (Cowell and Owens 2006; Wolsink 2010) and also about more dense housing (Neuman 2005). Charmes and Keil (forthcoming) observed that the policy turn towards urban densification supported with environmental arguments helps to counter the main arguments used by movements opposed to urban growth. In spatial projects in which developers are using environmental legitimization there is often little recognition of the citizen's organizations and their individual stakes that mainly concern environmental values as well. This easily implies the lack of recognition of the residents' potential to change the way people think about the environment and human health in spatial conflicts (Poulos 2015, 15; Wolsink 2012). Hence, this may also be prominent in conflicts on abandoning green space (Ruming, Houston, and Amati 2012).

Clear stakes of citizens concerning green space concern the recognition of the value of parks for liveability of cities (Howley, Scott, and Redmond 2009), for health, respiration, physical exercise, biodiversity (Irvine et al. 2013). Liveability and a healthy environment for children in cities are also valued highly by citizens. Karsten (2011) suggests the decreased urban public space for children in general, including streets, has narrowed the conditions for the development of social capital. This suggests narrowing green space will have similar effects for the value of green space for the development of children and young adults (Baran et al. 2014; Loukaitou-Sideris 2003). A special application of green space for development of children is its use for environmental education.

Environmental education is recognized as an important factor for long-term sustainability, and it is important to use green space as a 'classroom' (Bentsen, Schipperijn, and Jensen 2013). In this article, the relevance of proximity of schools to green space for education is empirically investigated in a study in the conglomeration of Amsterdam (Netherlands). This city is frequently mentioned as a good example of 'sustainability cities' (Kenworthy 2006), and it has a compact city policy for more than three decades. Moreover, Section 3.2 also describes how also Amsterdam has an interesting practice of environmental education.

3. Elaboration of the research questions

3.1. Green space and children's education

Green spaces are essential constituent parts of the landscape for all urban residents, especially children. People enjoy and seek out contact with nature because it provides psychological restoration (Herzog, Maguire, and Nebel 2003), lowers stress levels (Thompson et al. 2012), stimulates physical exercise like walking, and social contacts (Cohen et al. 2007; Roe and Aspinall 2011). Research suggests that green spaces in urban settings also support generally healthier and environmentally friendlier lifestyles (Haines et al. 2007).

Children value green public space as much as adults do, and it is also very important for their physical and mental well-being (Baran et al. 2014; Faber-Taylor, Kuo, and Sullivan 2001). Respiratory health benefits are also attributed to school gardens (Ozer 2007), but schools do not always have a yard, particularly not in compact cities. Moreover, it can be argued that the value of green space in urban settings (such as parks) for sustainability in the long term is also related to the basic knowledge on nature and sustainability, which is fostered by environmental education. Hart (1997) emphasizes that green environments add to children's mental health, because green space plays an important role in their development. Consequently, we take urban green spaces as an essential precondition for the implementation of environmental education. Parks and green space are also used for organized activities (Floyd et al. 2008), and the two come together when schools organize excursions as part of their environmental education curriculum.

Environmental education is sometimes limited to the classroom, but Sandell and Öhman (2008) emphasize the importance of direct encounters with environment and nature. Ozguner, Cukur, and Akten (2011) suggest that for the development of awareness of nature during childhood, direct contact with nature should be encouraged beside formal classroom education. Creating spaces with more nature and natural landscapes in the living environment would encourage the experience of nature in pupils' daily life.

According to the exam material, for example the Dutch standards for geography (Kasbergen and Van de Leemkolk 2005, 143), environmental education may help to foster the understanding of ‘ecosystems services’ (Costanza et al. 1997) – the elements of nature that provide essential value for human society. Within urbanized areas, fieldwork supporting the development of such understanding – particularly on the environmental aspects of biology – requires access to green spaces (Mantle and Heath 1986). According to Aguirre-Bielschowsky, Freeman, and Vass (2012, 109) children suffer from declining access to nature, but schools can help pupils to still recognize the value of nature. Within urban environments ecosystem services are most prominently visible and accessible in urban green spaces (Bolund and Hunhammar 1999; Jansson 2013). How can education take place in urban areas, with an emphasis of the potential role of urban green spaces? The importance of urban form for the physical activity of young adults, particularly the factor ‘distance’, is well known (see Frank et al. 2007; Van Loon and Frank 2011). Nespor (2000) investigates the potential for fieldwork trips, but his research looks at various kinds of longer journeys to public places that require transport, like museums. In contrast, we will focus on any environmental education fieldwork, including excursions that do not require transportation arrangements.

As residents’ valuations of the diverse benefits of urban parks are correlated with proximity (Salazar and Menéndez 2007; Schipperijn et al. 2010), the educational value of parks is also likely to be associated with distance. Based on the literature and anticipated correlations, the research questions as phrased in the introduction about the significance of urban green space for fieldwork and how the establishment of environmental education practices is affected by proximity to green spaces in environmental education programmes at schools, have been formulated.

3.2. *Environmental education fieldwork in Amsterdam*

The investigation was carried out in Amsterdam, a city that already adopted a ‘compact city’ policy in the 1970s. The expressed argument for starting the densification policy was to provide the foundation for urban public transport and foster the urban cycling culture. In fact, it was also aimed at stopping outmigration to satellite towns.

The importance of green space for environmental education was a stake claimed by citizens opposing the elimination of green space. It has come prominently to the fore in a case of urban densification in Amsterdam, which is described in this section. For fieldwork, schools in Amsterdam need green public space, as they do not have schoolyards themselves, except for small fully paved squares. We seek to examine the relationship between the availability of green space in urban settings and the type and time spent on schools’ outdoor environmental education in secondary schools, where environmental education is not a mandatory element in the curriculum, so the choice of fieldwork can be made by the school or even by individual teachers. However, most pupils – as well as their parents – have previous experience with fieldwork, because Amsterdam has a tradition of environmental education in elementary schools for almost one century.

A network of ‘schooltuinen’ (school gardens), spread out across 13 locations next to green spaces, is used for environmental education practice by elementary schools (10–12 year old pupils) (NME 2014). This sophisticated system of environmental education has existed since the 1920s, and since about the 1970-ies most schools in Amsterdam have participated. The programme is managed by the Nature

and Environmental Centre and offers about 95% of all seventh grade pupils the opportunity for educational fieldwork at thousands of small gardens. Each child tends a 20 m² plot, from the end of March till the end of October. This parcel is used for growing vegetables and flowers, which they sow and look after by themselves. Eventually, they harvest their produce and take them home for consumption. The pupils receive specific instructions how to take care of their plants combined with more general education about ecology. Such as how seeds germinate, plants grow, and their metabolism with soil, water, and air. Practical lessons are given at on-site field classrooms, and some theoretical background is provided at the school.

In order to enhance personal identification with and commitment to the gardens, the pupils design and construct a name shield for their garden (Figure 1). In addition to the environmental education objective, the fieldwork in these gardens also contributes to more general well-being and interpersonal relations within the schools (Waliczek, Bradley, and Zajicek 2001). Furthermore, there is a relation between the children's personal school gardens and the increasing significance of food production within the city (Jarosz 2008). In Amsterdam's school gardens the focus is on education, but by growing food crops on a small scale, children can learn about nature and the significance of ecosystem services for sustaining human life, in particular the importance of the soil for food provision (NME 2014). In fact, the initiative to start these school gardens in the 1920s was driven by food scarcity; only in the 1950s were the nature-related educational objectives recognized and defined. As illustrated by the case described below, the commitment to these *schooltuinen* among residents is high, because almost everyone who grew up in Amsterdam had this formative experience.

Urban developments on green spaces where *schooltuin* complexes are located are highly contested, as the example case (Figure 1; location 'A' Figure 2) of decision-making about abandoning green space including *schooltuinen* shows. Figure 1 presents the school gardens in three stages of development, located adjacent to 'Klein Dantzig', a complex of a special kind of private gardens called '*volkstuinten*' (allotments; 'A' Figure 2; Innovatienetwerk 2008). Such complexes of allotments are green spaces with individually rented private gardens, collectively managed by members of the tenants union. The complex 'Klein Dantzig' was saved in urban densification conflicts in the 1980-ies and 1990-ies about four adjacent green spaces. All four have been discussed for densification, and two of these, both parks, have actually been eliminated as parts of densification projects, whereas the other two, a park and the allotments, have been saved because of opposition.

The residents felt that the continuation of environmental education was at stake. In the discussion on the allotment complex the *schooltuinen* were a strong motivation to resist, but the value for environmental education for secondary schools was also emphasized by citizen organizations. A study on the history of densification in this case, including in-depth interviews with people involved in the dispute, revealed that in the dispute about the green spaces adjacent to the allotments and the school gardens, the cooperating residents used the argument of saving these '*schooltuinen*'. One respondent active for several years in the residents' board of the adjacent Frankendael park (the other saved green space) shared,

R2 (m) Officials emphasized environmental policy ... and said we were narrow-minded, only protecting our backyard. They simply refused to recognize the long-term importance of understanding environmental issues among citizens We stressed developing such understanding in secondary schools, but we knew that saving the

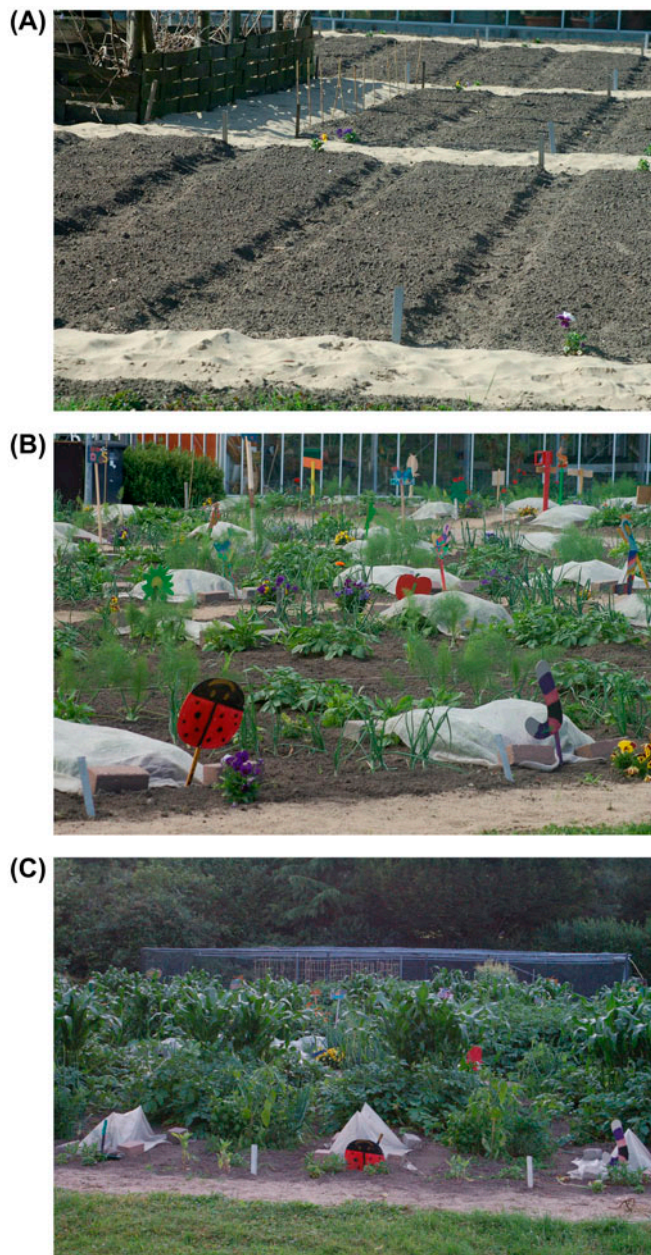


Figure 1. School gardens ('schooltuinen') in three stages of development. (A) Early in April: prepared individual garden plots. (B) Mid-June. (C) Beginning of September.

school gardens was a strong argument. These are very popular among parents – and you know, eventually ... they are voters.

These residential groups claimed that the proximity to green space would be decisive for secondary schools to develop environmental education programmes. This

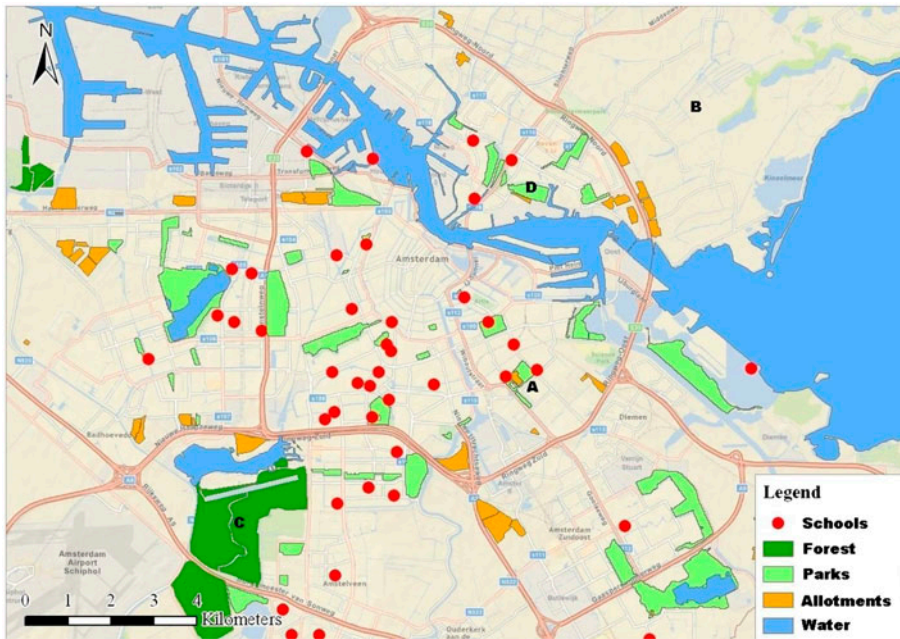


Figure 2. Secondary schools in Amsterdam and available public green spaces.

argument of value of green space for environmental education was put forward by citizen groups. The dismissal by the planning officials and the municipal government (Wolsink 2015) looks similar to what happens in other cases of densification, as for example in a recent study Charmes and Keil (*forthcoming*, 9) observed: ‘the density turn within environmental discourse is especially convenient for promoting projects of growth coalitions ... and often serves to override local resistance It helps to discredit and delegitimize local mobilizations’.

Remarkably, the relation between proximity to green space and intensity of environmental education is not mentioned in the literature, which raises the question whether it really holds empirically. And if it does, how is environmental education practice affected by the existence of nearby green spaces?

Fieldwork outside the school is a voluntary action, decided by the school and its teachers. Schools need green public space for this, as their schoolyards mainly consist of fully paved squares. The assertion is that the number of environmental education events outside school grounds will depend on the proximity of green spaces to the school and the ease of access. It is reasonable to expect that as the distance to the nearest green space increases, such activities will decrease. The hypothesis is that with increasing distances, the complexity of organizing fieldwork increases due to longer travel times and additional effort. Moreover, safety threats, e.g. the need to manoeuvre traffic, street crossings, and air pollution pose further disincentives (Amram et al. 2011). The findings qualitatively establish the relationship between the number of fieldwork events and distance, as well as the frequencies of fieldwork and the attitudes of teachers, whose experiences and motives have also been investigated with in-depth interviews.

4. Method

The hypothesis states a clear relation between proximity to green spaces and the number of environmental education trips taken by school. It is tested and further explored in an embedded case study with structured data collected among all secondary schools as the unit of analysis – a design with a high replication logic, e.g. easy to replicate in other cities (Yin 2009, 50). To answer the research question we empirically investigated the impact of urban green space on environmental education activities at secondary schools ($n = 42$) in the core agglomeration of the greater Amsterdam metropolitan area, including the suburbs of Amstelveen, Badhoevedorp, Diemen and Duivendrecht. These schools for 12–18 year old pupils are located in the municipalities of Amsterdam ($n = 38$) and Amstelveen ($n = 4$). In all these schools, representatives of the teachers involved in disciplines associated with environmental education (biology, geography, chemistry, and physics) have been interviewed. The main questions concerned the existence of practices of environmental education, in particular fieldwork excursions to observe nature and environmental issues, and to which destinations. The figures for the school year 2010/2011 were collected in Amsterdam, with the figures for 2012 and for both years in Amstelveen being added later.

These data were combined with variables indicating location and distances calculated with GIS (geographical information systems). Using the coordinates of the main entrance of all 42 schools and the locations of all green spaces available for visits (including accessible water), the distance to the nearest available green space was calculated (Mean = 292 m; SD = 218 m). These figures were linked to the data about the schools: the number of fieldwork excursions, the destinations, and teachers' attitudes towards environmental education excursions, all collected in semi-structured interviews. Data on the fieldwork were collected over 2 years (Table 1; column 1), and the high correlation between those years ($r_{\text{total}} = .94$; Table 1) indicates a strong continuation of existing patterns. The analysis in Section 5 uses the 2-year averages.

Furthermore, relevant background data were added concerning some possibly confounding variables. The first confounding factor could be the affluence of the schools' surrounding neighbourhoods. The tendency to protect property values – key element in the backyard 'theory' – has been associated with affluence of the neighbourhoods' residents (Crawford et al. 2008; Schively 2007; Taylor 2013). In conflicts about urban development opponents are frequently being accused of being 'residents who want to protect their turf' (Dear 1992, 288) and such opposition is regularly associated with affluence. Moreover, yet another line of thinking could be that availability and quality of parks and open-spaces is related to the affluence of the neighbourhood's residents, and schools that combine pupils with richer parents and close proximity to green spaces might have different curricula (Lee and Buxton 2008;

Table 1. Environmental education fieldwork excursions ($n = 42$).

Number of excursions	Internal 2011–2012 correlation (r)	Mean (2 years)	SD (2 years)
To nearby green space	.82*	1.18	1.01
To other destinations	.94*	1.42	1.58
Total	.94*	2.61	2.10

* $p < .01$.

Monk and Haller 1993). Hence, the affluence of the neighbourhood of schools is an obvious control variable, as it constitutes a possible confounding factor with regards type of school, the quality of schools, and typically with those parts of the curriculum that are often associated with wealthy, middle class parents.

Because within the Dutch context schools are legally obliged to provide similar levels of education, the most obvious distinguishing characterization of schools is whether they are neutral public schools or special schools based on – mostly religious – worldviews (Dronkers 1995). This is a distinction reflecting general values held by the schools government as well as the general values applied in education practice. Hence, the distinction between schools with and without a religious foundation may be a typically Dutch reason not to look solely at neighbourhood affluence as a confounding factor affecting the relation between environmental education fieldwork and proximity to green space.

Affluence has been measured with three variables: average income in large (9) urban districts, beside average property value of households and average household income for spending, both for small (69) neighbourhoods (O&S 2013). These indicators are strongly correlated, and one index has been created with factor analysis (PCA). The remaining factor [Affluence] (Eigenvalue = 2.33) is used as indicator for neighbourhood affluence of the schools. The special character of the schools is a dichotomous variable with (0) being neutral public schools, and (1) special schools with a religious foundation.

The structured data on the schools as units of analysis are analysed with multivariate analysis, such as (curvi-)linear regression and LISREL (linear structural relations modelling; Jöreskog and Sörbom 1996). With the latter, a model of a set of hypothetical paths between several variables, including indirect effects, is tested simultaneously (Freedman 1987). Assumed causality implies relations defined as paths with a clear direction, but the test of the model is based on correlational (co-variance) analysis. Such data cannot provide a real test on the causality (Sobel 1996), as this nomothetic perspective would require an experimental design. Nevertheless, the directions of the relations strongly determine the fit between the model and the data (Pearl 1995). For triangulation and enhanced interpretation of the established relations (Morse 1991), qualitative data retrieved from questions about these relations in the interviews with teachers are used to interpret and explain the nature of the relations.

5. Results: educational excursions and distance to green spaces

5.1. Proximity to nearby green space

All schools and three categories of public green spaces are mapped out in Figure 2. With regard to green space, private gardens are excluded, except for the allotments that usually provide public access to the community spaces, like walking lanes and common grounds (see Section 3.2, orange plots in Figure 2).

To test the hypothesis regarding proximity to green spaces, the distances calculated in GIS were correlated with the number of fieldwork trips. This relationship can be analysed more thoroughly by looking at the shape and by including the background variables of neighbourhood affluence and the special characteristic of schools. The linear correlation of educational excursions with [Distance] is clearly significant ($r = -0.42$; $p < 0.01$), but this linearity obscures the fact that distance

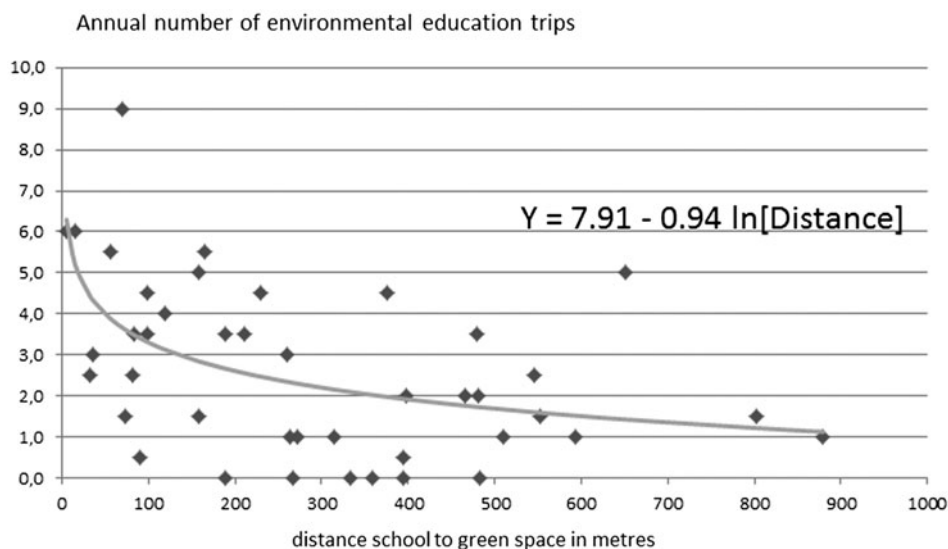


Figure 3. The relation between distance to urban green space and number of environmental education excursions.

soon becomes too large to facilitate educational trips. Figure 3 shows that the number of trips tends to decrease more rapidly at shorter distances, meaning that proximity is a very significant factor for environmental education trips.

The strongest fit to the data is with a logarithmic transformation of the distance ($\ln[\text{Distance}]$) ($r = -.51$; $p < .01$). Addition of the two potentially confounding variables revealed the following result of the explanation of the number of environmental fieldwork excursions:

$$N_{\text{Fieldwork exc.}} = 7.91 - 0.94 \times \ln[\text{Distance}] - 1.21 \times [\text{Special school}_{(0,1)}]$$

$$R^2 = .33; \text{ Standardized : } \beta_{\ln[\text{Distance}]} = -.46; \beta_{[\text{Special school}_{(0,1)}]} = -.26$$

The special character of the school significantly added to the variance, suggesting that it partly shapes the schools' curricula, also for environmental education. This result may also indicate a different pattern or any kind of excursion, not only for environmental education. Neighbourhood affluence did not significantly affect the number of excursions ($t_{[\text{Affluence}]} = 0.80$; $p > .10$), which shows that there is no correlational evidence for the hypothesis that activism for protection of green spaces can be explained by more affluent citizens seeking to protect 'their turf'.

The main finding, as expected, is that the number of trips increases with increasing proximity of green spaces to the school. This expectation was primarily based on the assumption that shorter distances offer better opportunities for small excursions to green spaces and reduce the likelihood of major obstacles. The results confirm that $[\text{Distance}]$ is of major significance, as it provides the strongest explanation for the frequency of fieldwork excursions, but Figure 3 and the regression analysis are both based on an analysis of the total number of all environmental education fieldwork excursions, including those to other destinations than the nearest park. For the latter, a direct relation does not seem to make much sense. To elaborate the

nature of this relation and to explain the reasons behind this correlation, we introduce a breakdown that separates excursions to nearby green spaces from the ones to other destinations. The preliminary analysis (Wolsink 2015) showed that remarkably the pattern of the relation (Figure 3) was similar for excursions to nearby green spaces and for those to other destinations. In order to investigate this unexpected finding, additional data about the destination of the excursions and qualitative data were retrieved from the interviews, and applied in a more sophisticated analysis and interpretation below.

5.2. *Breakdown: destination of excursions*

All trips were divided according to their destination, i.e. to the nearest green space and to other places. Despite the fact that several of the excursions with other destinations were to more remote locations outside the city limits, most still visited destinations in the Amsterdam metropolitan region, sometimes within in the city itself, such as the academic Hortus Botanicus or the Artis Zoo. Popular destinations were also Waterland (Figure 2, area B), the polder agricultural and wetlands landscape north of Amsterdam, and the Amsterdamse Bos, a forest laid out during the economic crisis in the 1930s as an unemployment project (C, Figure 2). About 50% of these destinations required transport by bus, in the other cases the students travelled to the location by themselves, which in the Dutch context mostly means cycling. Most trips took a full day or a significant portion of the day.

The distance to these more remote destinations did not seem to explain the number of excursions, as suggested by Nespor (2000). However, whereas the distance between the school and the nearest green urban space did show a clear and significant correlation, which clearly makes sense, this distance also appeared to be also a good predictor for the number of fieldwork excursions to other locations ($r = -.33$; $p < .05$). This is less obvious, and moreover, it is intriguing that the relation between the number of excursions to other destinations and distance to nearby green spaces has a similar shape (logarithmic transformation, $r = -.41$; $p < .01$). What is the explanation for this similarity? Why are frequencies of fieldwork excursions to other destinations equally related to the school's distance to nearby green space?

To find the answers, we first looked at the motives of the teachers who considered organizing excursions and the arguments used for initiating (or deciding against) the trip. In their interviews several teachers explicitly mentioned barriers and other difficulties when the nearest park was too far:

T7 (f) And when time is short you don't simply go out with a class of 'jumpy' adults. Before you have them together in the park to show something, the time is over. ... No, we did that a few years ago; it just doesn't work.

For excursions within limited timeframes with pupils walking or cycling to the park, several respondents clearly stated that distance in general, and complicated traffic situations in particular, created barriers for establishing a tradition of environmental education. Asked about their excursions to other destinations, several respondents also suggested a causal link between distance to nearby greenery and the number of excursions to more remote places. These answers suggested that schools with such established practices took this step mainly because of good experiences with such fieldwork in the past. For example, concerning the question why they took the excursions, one teacher responded,

T2 (f) After the two fieldwork classes in the park, I always ask them whether they would appreciate a field trip to the Amsterdamse Bos [figure 2, location C]. There is always much enthusiasm, and after the summer recess we go.

This quote suggests causality: the first experience is with excursions close to the school itself – supported by the favourable condition of proximity of green space – and because this is a positive experience, the idea to go to other places for environmental education emerges, and this intention is effectively carried out later. Most teachers involved in educational excursions used arguments related to good past experiences. The reported influence of generally positive fieldwork experiences is in line with the findings of Aguirre-Bielschowsky (2012). When asked, teachers who shared the experiences were often first gained through excursions close to the school. This finding is reinforced by arguments used by teachers from schools with weaker or very weak practice of environmental education fieldwork. Mannion, Fenwick, and Lynch (2013, 798) observed that novice outdoor educators were more concerned with logistics, perceived risks, health and safety. Teachers without experience with actual fieldwork showed limited motivation for environmental education and fieldwork in the first place (Section 5.3), and their arguments expressed concern regarding the complexity of organizing excursions and expected disinterest among pupils. The latter was never mentioned by the teachers who did have experience with fieldwork. They all confirmed that most pupils liked it, and they also often referred to the positive feeling pupils – and also their parents – expressed about their personal experiences with the *schooltuinen* (Section 3.2) during elementary school.

Such qualitative responses seem to underline what Mannion, Fenwick, and Lynch (2013) stressed concerning the importance of place-responsive education, e.g. that positive motivation among teachers is enhanced by positive experience.

T1 (f) When I came here two years ago, I suggested to go to the Vliegenbos [figure 2, location D]. I faced some resistance, but together with ‘H’ [chemistry, biology] we managed to organize a 2-hours practice in April. ... Because of the positive response, we organized a field day in the Amsterdamse Bos [figure 2, C]. A huge success! This year we’ve repeated it with more classes.

Good experiences, also in the domain of pupils’ participation and behaviour (Mygind 2009), seem to enhance positive attitudes among teachers and pupils alike, and this support is underpinning initiatives to expand the element of fieldwork in the schools environmental education curriculum. The significant role of teacher motivation, as described by Mygind (2009), was investigated by means of several interview questions focused on measuring motives, experiences, and argumentation. The potential explanations were further investigated (Section 5.3) in the interviews and by structurally measuring the teachers’ attitudes towards environmental education and fieldwork.

5.3. Teachers’ attitude towards environmental education excursions

In the second round of data collection, the teachers’ motives for environmental education and for including fieldwork excursions were measured through a short structural questionnaire, administered among teachers ($n = 42$) in all schools.

To assess teacher attitudes, three items with five point scales (0–4) were used, as shown in Table 2. These questions were previously developed and tested among a small sample of students (43, from geography, communication, urban planning, and

Table 2. Teachers' attitudes towards environmental education excursions ($n = 42$; Cronbach's $\alpha = .80$; Scale Mean = 4.31; SD = 1.94).

Items 5-point scales: '0' fully disagree – '4' fully agree	Mean	SD
Environmental education excursions are a good experience for the pupils	1.07	0.83
Excursions with outdoor classes in nature are necessary for good environmental education	1.26	0.81
Environmental education is a necessary part of high school curricula	1.96	0.61

ecology studies). The table shows the quality and reliability of the items, and it reveals that they have a clear internal coherence (Cronbach $\alpha = .80$).

The scores of the first item indicate that the importance of environmental education is not necessarily recognized in all schools and by all teachers. One of them responded:

T5 (m) Environmental education is not part of the curriculum, biology is, which should be sufficient. We discussed this, and it was clear to us that discussion about climate change, or the doubtful claims of increasing environmental risk and human agency ... well, it's so political; it should not be part of our lesson.

This quote illustrates the strongest argument used against incorporating environmental education in the curriculum. In most interviews at least some support was given to the idea that integration of some knowledge on biology and notions about (e.g. chemical) pollution, and geographical determinants of both, should be covered, but it was claimed that this was already happening in the current curriculum for biology. Such attitudes can hardly be affected by experiences with fieldwork, when the school does not have this practice.

On the other hand, very positive propositions about environmental education and fieldwork may also exist. Here we will investigate to what extent motivation is affected by the availability of good excursion opportunities due to proximity to green space. These two items in Table 2 show that on average the teachers recognize the necessity of fieldwork within environmental education practices. These items were formulated based on suggestions in the literature that in environmental education the impact of fieldwork transcends the effectiveness of the teachers' lectures: 'The greatest benefits for environmental education will be obtained from the use of experience-based learning strategies in natural environments' (Ballantyne and Packer 2009, 260). Moreover, the experiences – for example in Amsterdam with the 'schooltuinen' in elementary school (Section 3.2) – and the pupils' preferences reinforce the significance of fieldwork (Aguirre-Bielschowsky 2012). In our survey, this idea was only supported by a large minority of the teachers (Table 2), but the low scores were given by teachers who also responded negatively on the significance of environmental education per se (1st item, Table 2). Those who valued it moderately tend to support the suggestion of Ballantyne and Packer (2009) that fieldwork enhances the effectiveness and also that fieldwork is a good experience for the pupils:

T9 (f) Personally, I think in a topic like this, the impression of making your own observations cannot be replaced by a teacher's talk. Moreover, the things they have done and seen in the forest are making my own teaching much more vivid, and it generates topics for discussion that, I think, improve the quality of my lessons.

The resulting 3-item scale was a reliable measurement of teachers' attitude towards environmental education fieldwork. This scale is applied in the next section to investigate to what extent schools implement fieldwork events in their environmental education lessons and the reason behind their choices. With the help of path analysis, the attitude scale is used to find the most likely relationships between distances to green space, the type of school, and the number of fieldwork trips to neighbouring green spaces and other destinations.

5.4. Model explaining frequencies of excursions

The resulting scale was used to test the potential explanatory model (Figure 4) for the number of environmental education excursions. As described in the methods section all indicated relations of this basic model were tested simultaneously in a linear structural equation analysis (LISREL). For relation (3) two options were tested, and the model also included the background variables 'neighbourhood affluence' and 'school's special character' (see Section 4).

As noted in the methods section, the data do not simply allow interpretation of the causal impact a specific change has on behaviour (e.g. organizing fieldwork excursions) or on teachers' attitudes. Causal effect occurs when variation in one phenomenon, an independent variable, leads to or results in variation in another phenomenon, the dependent variable. The conditions necessary for theoretically assuming causality are empirical association, an appropriate time order (cases must have been exposed to variation in the independent variable before variation in the dependent variable) and no spuriousness (the empirical association between two variables should not be due to variation in a third variable).

Because of the ambiguity of relation (3) the diagrams of Figure 4 imply two alternative possible models with similar likelihood (Appendix 1). The models are queried to determine the test assumptions about identification of causal effects from non-experimental data (Pearl 1995). In linear structural relations modelling the diagrams can be used to test expressions for causal effects by means of assumed causal relations simulated in the paths of the LISREL analysis. They are tested with cross-section data like in multiple regression analysis, where independent and dependant variables are defined based on theoretical considerations (Freedman 1987). However, the test of LISREL models is more robust, as all paths are analysed simultaneously

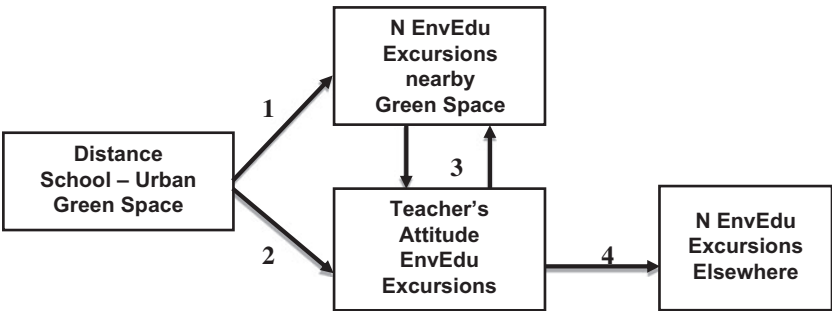


Figure 4. Hypothetical relations explaining number and type of Environmental Education Excursions.

and the direction of the paths also indicates how variables are indirectly affected by mediating variables.

The two possible models (Appendix 1) are combined in one final model with best fit (Figure 5). The variables that characterize the schools – distance to green space (relations 1 and 2 in Figure 4), neighbourhood affluence and the special character of the school – are all independent because of the time order. Assumption that these situational variables could be affected by attitudes or number of excursions would not make any sense. The condition of non-spuriousness is covered by the definition of the paths in the model. In case the hypothetical model in a LISREL test is poorly defined, existing spurious correlation between variables that is not covered by direct and indirect paths will lead to significant stress (decreased goodness of fit) between the model and the data.

The path between the teachers' attitudes to environmental excursions and the two variables of fieldwork excursion is not self-evident, and here the test of different models supports the trend in the qualitative data. Several interview responses indicated that previous experience with fieldwork is affecting the attitudes teachers hold about organizing fieldwork trips. In classic attitude behaviour theory, attitudes are determinants of intention and behaviour (relation 4 in Figure 4), whereas Ajzen's (1991) 'theory of planned behaviour' also states the impact of perceived behavioural control. This means that the intended behaviour – in our case organizing fieldwork – may be impeded by perceived unfavourable conditions. In this case, a lack of perceived behavioural control concerns the idea that the distance to green space may be too large and therefore impedes the choice for organizing fieldwork excursions. The distance factor is assumed to affect the fieldwork excursions to nearby green space, but such a direct effect cannot be assumed between distance to nearby space and

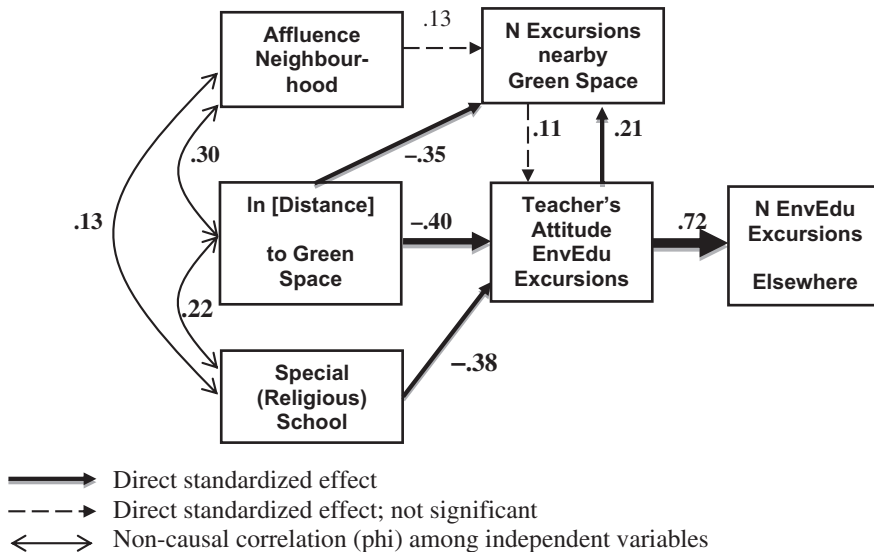


Figure 5. Structural equation model (standardized LISREL path coefficients) for explaining frequency of schools' Environmental Education Excursions.

Notes: Max. Fit Chi-square = .57; $df = 5$; $p = .99$. Adj. Goodness of Fit Index = .98. Root Mean Sq. Residual = .013.

excursions to more remote destinations. Hence, the position of the teacher's attitude in the model may be ambiguous.

In the first tested model (A, Appendix 1) it is expected that the experiences of teachers with fieldwork close their schools results in an increase in positive attitudes that is translated into more excursions elsewhere. In the alternative model (B, Appendix 1), the teacher's attitude is assumed to positively affect the frequencies of excursions to nearby green space as well as to other destinations. Both alternatives show reasonable fit to the data, suggesting that in fact the relation between experience with excursions to green space and the teachers' attitude is reciprocal. Therefore, in the final test the model includes both paths, and indeed, this model shows the best goodness of fit to the data. This model (Figure 5) is discussed below.

The availability of green spaces close to the school apparently creates a strong motivation for excursions elsewhere. There is a clear negative direct impact of $\ln[\text{Distance}]$ on the frequency of excursions – which suggests teachers with positive attitudes towards excursions perceive higher barriers for fieldwork when distances to urban green space are too large. Distance to nearby green space also has a direct impact on the teachers' attitude towards fieldwork excursions, indicating that the perception of this distance seems to affect the attitudes negatively. However, what the model clearly shows is that the relation between the distance and frequency of excursions to other destinations is an indirect correlation. The distance already has a direct influence on the excursions to nearby places, and when schools have established a practice of going outdoors for environmental education, there is also a moderate positive influence of such excursions on the teachers' attitudes. Probably this is due to the good experiences that are mentioned in the interviews.

With regards the central variable, teachers' attitude, there is also a moderate negative influence of the special religious status of schools. The model suggests that special status does not seem to affect excursions to nearby green spaces directly, but it does have a clear effect on the teachers' attitude. This was also illustrated in the interviews, for example:

T11(f) Sensitive stuff ... It would be even more complicated not to mention evolution ... not appreciated in this school, I'm very much aware of that. So in class we experiment with chemicals and talk about pollution.

With the direct impact on teachers' attitude, the school's special religious status also indirectly affects the number of excursions, particularly those further away, because the attitude is indeed a strong explaining variable for the number of excursions to other destinations.

Furthermore, about the other possible confounding variable, once again the affluence of the neighbourhood of the school seems irrelevant. This could be special to the context of Dutch spatial planning. The only impact in the model is statistically insignificant, but we have to recognize that although all schools have been investigated we are still dealing with a limited population ($n = 42$).

The model reveals that proximity to green spaces is crucial for establishing a pattern of outdoor environmental education. Once established, it shapes attitudes through iterative positive experiences. The favourable view of environmental education leads to the institutionalization of outdoor educational excursions in the school's curriculum, and fieldwork excursions to other more distant destinations are introduced.

Some teachers directly indicated that availability of a park was the prime reason they started excursions, but others were not aware that the practice started with easy access to urban green spaces. They simply said they were continuing the practices started by their predecessors, as one teacher shared her reasoning for organizing a field trip to Waterland (B, Figure 2):

T8 (f) I decided to move on with the fieldwork, because indirectly I heard from parents that their kids said at home that it was 'cool'. ... It might not always be 'cool' to admit this in class, but this indirect response is also appreciated. And when we propose another field trip, there is usually little objection.

Apparently good experiences, like positive parent feedback, are reinforcing this pattern of outdoor excursions.

6. Conclusion and discussion

In the introduction two research questions were formulated: What is the significance of urban green space for fieldwork in environmental education programmes at schools? How is the establishment of environmental education practices affected by proximity to green spaces? With the results of the empirical study we can now formulate answers to these questions.

Urban green space close to the school is of high importance to start with environmental education fieldwork. Once the pattern of environmental education excursions starts, the practice continues and is usually expanded to other areas. In line with previous research (Mannion, Fenwick, and Lynch 2013; Mygind 2009) good experiences apparently affect attitudes positively, mainly because they seem to enhance positive motivation among teachers. The teachers' valued the educational contribution of 'being in the field' (Ballantyne and Packer 2009), as well as the participatory engagement of the pupils during the excursions. Mygind's (2009) findings that outdoor contexts afforded less enmity, boredom and disturbances among pupils, were confirmed in the interviews. Interviewed teachers spoke about lessons becoming 'more vivid' and pupils getting 'focussed more easily'.

Crucially these practices were initiated in the first place because it was easy to organize the visit, i.e. easy access and close proximity of green space to the school. This finding reinforces the conclusion drawn by Mannion, Fenwick, and Lynch (2013), who suggests that collaborative planning visits, extended time in natural settings, and opportunity for reflection are all useful ingredients in planning excursions, particularly for the 'novice outdoor' teachers. This effect of the first experience of educational trips, leading to more such excursions to selected destinations further away, suggests that it does not seem to be the quality of urban green space per se that is the most important factor, as close proximity seems to be more important than the environmental quality of green spaces. From a technical aspect, teaching materials can be developed for use on location (Pereira et al. 2006), but the key factor seems to be the availability of an outdoor 'classroom' (Bentsen, Schipperijn, and Jensen 2013). As the schools don't have green schoolyards, they need public green space at small distance and easily accessible from the school. In our study of environmental education in Amsterdam, the findings show that the nearby green spaces strongly stimulate environmental education fieldwork, which in turn indirectly shapes the teachers' attitudes. Visits to neighbouring green spaces spur school staff

to develop a more intensive practice of outdoor environmental education and to organize more excursions that are further away from the school.

This crucial significance of urban green space for broader environmental education underscores the overall importance of green spaces for the physical and psychological well-being of the city's inhabitants (Grahm and Stigsdotter 2010; Irvine et al. 2013; Thompson et al. 2012; Tzoulas et al. 2007; Van den Berg, Hartig, and Staats 2007). Such places can be seen as 'learning gardens' in environmental education programmes, and as 'a bridge between urban settings and the opportunity to engage people with the other-than-human world' (Ardoin, Clark, and Kelsey 2013, 512).

Access to green public spaces in general, and to green infrastructure in particular, can be seen as environmental justice issue (Moore 1997; Wolch, Byrne, and Newell 2014). Easy access to green spaces for schools is a matter of allocation – the first dimension in Schlosberg's (2013) conceptualization of environmental justice. This access is largely determined by the mere availability and proximity of public green spaces to the school. The process of the establishment, location and maintenance of parks contains two essential dimensions of environmental justice, recognition and participation (Schlosberg 2013). The pressure on green spaces is felt by urban residents, whose preferences for urban design are strongly shaped by well-being considerations (Kytta, Kahila, and Broberg 2011). The positive impact of close proximity on fieldwork, on teacher's attitudes, and on excursions to other destinations, confirms the validity of arguments against urban densification projects that threaten green spaces. These are environmental concerns, raised by citizens who felt that their concerns were ignored and their environmental views marginalized (Wolsink 2015), which is congruent experiences in other densification cases (Charmes and Keil *forthcoming*).

In the tense debate on liveability versus sustainability, high density per se may not be the chief source of dissatisfaction. Other environmental quality factors may be paramount – including greenery, but another dimension in such conflicts concerns how these quality of life elements should be treated in specific policies (Howley, Scott, and Redmond 2009). In the described case of elimination of green space feelings of mistrust against decisions and decision-makers emerged. Their environmental education argument was dismissed, leading to perceived of unfairness of process, which is more common in environmental policy that is implemented with top-down decisions (Wolsink and Devilee 2009). This generally concerns place making for infrastructure but also urban developments (Ruming, Houston, and Amati 2012).

Feelings of perceived unfairness, fuelled by a lack of recognition of citizens and their arguments in the dispute, often arise. The actions that activists take to protect green space appear to be connected to ideas about collective engagement to influence decision-making on urban developments. These ideas are reinforced by good experiences, for example children and their parents remembering their personal 'schooltuin'.

For furthering sustainability and more equitable societies, Rigolon (2012) emphasizes an architecture and planning practice that create more natural and designed environments important for environmental education. He specially mentions public places like schools and playgrounds, because these play a fundamental role in enhancing children's 'ecological literacy'. Similarly, Strife and Downey (2009) stress that exposure to nature during childhood is as an important equity issue for city dwellers and relevant within the context of environmental education. This study illustrates the importance of safeguarding easy access to green spaces,

especially for school fieldtrips. Environmental education's approach to see the natural and cultural as intermingled and co-emergent can be emphasized in place-responsive education through fieldwork (Mannion, Fenwick, and Lynch 2013). The socio-cultural component in environmental education is, as illustrated in the case of urban green spaces in Amsterdam, protected by citizen action, a strong environmentally motivating narrative. This storyline should also feature more prominently in urban policy-making on densification. The resident's effort to safeguard access to urban green spaces for schools and children should be recognized as a determined defence of dearly held environmental values – and moreover, it concerns values that are partly based on their experience with environmental education in the past.

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Disclosure statement

No potential conflict of interest was reported by the author.

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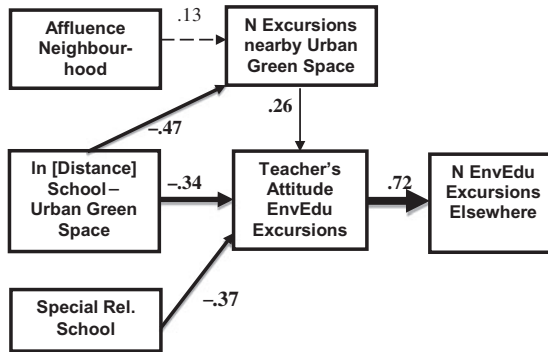
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Appendix 1. Two alternative models (see relation 3, Figure 4) tested

Standardized LISREL path coefficients.

Legend and phi (correlation independent variables): see Figure 5.

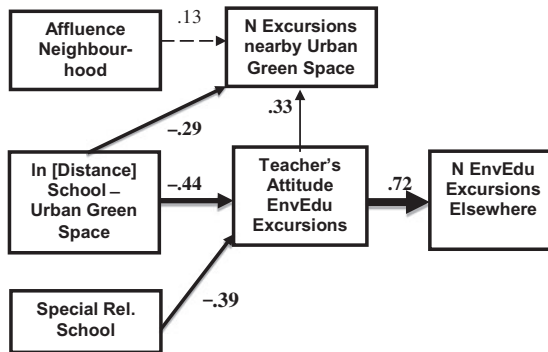


Max. Fit Chi-square = .94; df = 6; $p = .98$

Adj. Goodness of Fit Index = .97

Root Mean Sq. Residual = .023

A: Alternative model with Teacher's attitude dependant from frequencies of excursions nearby green space.



Max. Fit Chi-square = .73; df = 6; $p = .99$

Adj. Goodness of Fit Index = .98

Root Mean Sq. Residual = .017

B: Alternative model with frequencies of excursions nearby green space dependant from teachers' attitude.