Annex 4 – Assessment of the Potential Impact of the Physical Condition of a Sample of Romanian Schools on Learning Outcomes

1 Introduction

1.1 Research question
This annex was prepared under the Advisory Services Agreement on Informed Decision-making on Investments in Infrastructure between the National Center for Technical and Vocational Education and Training Development (NCTVETD) and the International Bank for Reconstruction and Development, which was signed on March 30, 2016.

Provision of education infrastructure is a means to an end and the end is optimally to support the educational process and, more specifically, pupils’ academic progression in terms of their educational achievements. The HEAD (Holistic Evidence and Design) Project, rooted in a study of English schools, successfully isolated the school design factors that impact the learning rates of primary school children. This is of potential interest in other countries such as Romania, but care is needed to adapt the proven principles from the English context into that of another country to address climatic variations, differences in the school building stock, and the particularities of a country’s culture and related pedagogical practices.

This package of work focuses on an assessment of the school building provision for younger children in Romania (Grades 0–4), with a view to identifying the physical condition of the spaces currently available as learning environments and the issues to be prioritized before remodeling existing schools or building new facilities.

The research question addressed herein is: Using the conceptual framework and measurement systems of the HEAD Project, what is the likely impact of the physical conditions of a sample of Romanian schools on the learning outcomes of the primary school pupils studying in them?

1.2 Key HEAD findings
The HEAD Project focused on isolating the impact of physical school design features on pupils’ learning rates. The Project captured teacher-assessed results for 3,766 pupils in 153 classrooms across 27 English primary schools. Using multilevel statistical analyses, these outcomes were linked to measurements of the variations in the physical features of individual classrooms. The results of these analyses were reported in Barrett et al. (2015b). The main finding was that 16 percent of the variation in pupils’ learning progress could be explained by classrooms’ physical attributes.

The analysis was underpinned by, and confirmed the utility of, a novel neuroscience-informed framework (Barrett and Barrett 2010). Under the heading of “naturalness,” this covered normal internal environment quality (IEQ) aspects, such as heat, light, sound, and air quality, but also added two dimensions: “individualization” and “level of stimulation.” Of the 16 percent impact, naturalness accounted for half and the other two dimensions for another quarter each. These three design principles are also referred to as the SIN (stimulation, individualization, and naturalness) typology. The practical recommendations emerging from these results are spelled out in an illustrated “Clever Classrooms” guide for practicing teachers and designers (Barrett et al. 2015a). The identification of the overall impact of school design and the relative impact of various aspects can inform the education investments of Romanian policy makers.

Although the Clever Classrooms guide focuses on English schools, the underpinning model is person-centric, reflecting the perspective of a primary school pupil. The HEAD Project study confirms that the academic progress of such pupils is strongly influenced by school design features that: provide a good natural (healthy) environment; support individualization of the
space; and provide an appropriate (mid) level of ambient stimulation. These principles were successfully tested in the UK context, but derive from the general characteristics of all young people in the educational context. Thus they can be expected to translate to Romanian children. Aspects related to basic needs, such as light, are sure to be important to all students. Similarly, an appropriate level of ambient stimulation to support learning seems very likely to translate. Individualization is arguably linked to an important human need, especially regarding a feeling of ownership of the classroom, but it is more complicated around the issue of layout where a synergy with the pedagogy being employed is important. These principles can be addressed in a variety of ways in practice. Assessment of Romanian schools’ performance on these dimensions is thus important, as are the particular challenges and opportunities that present themselves.

2 Sample and approach

2.1 Overview of country visit/survey of schools

The methodology adopted was to visit and assess a diverse sample of Romanian primary schools that represented, to the extent possible, the range of educational provision in the country. Common themes and particular issues were identified and will feed into an assessment of the national provision at a later stage. The researchers who carried out the fieldwork for the Clever Classrooms work visited a range of Romanian schools and assessed a wide sample of classrooms using the same techniques as for the UK study. Simultaneously, they closely observed the practices and uses of the spaces and interviewed teachers where possible. This enabled a structured, informed assessment of the physical spaces based on the best scientific evidence available, while revealing the specifics of the Romania context.

2.2 Work plan for country visit/survey

The agreed scope of work was to study the primary provision in five diverse schools. The aim was to look in practical detail at a limited number of schools to complement the broader analyses of existing data that was being carried out by the World Bank. Diversity in coarse parameters such as schools’ age, size, and location was sought at the selection stage. Within each school, diversity in its classrooms was emphasized in terms of factors such as orientation, floor level, and pupils’ age.

In addition, partway through the country visit, the researchers met with representatives of the Romanian Ministry of National Education and Scientific Research (MNESR) and other Romanian education experts. The researchers made a presentation and discussed the UK HEAD study and initial observations about schools in Romania, and were briefed on wider issues and policy aspirations as they impact on primary school education in Romania.

Each school visit was held in the morning to coincide with the presence of younger children. The data gathered were then catalogued and organized offsite. Each school visit involved the following elements:

a) Prior to the visit, any background information available, such as school age, size, etc., was shared by the MNESR.

b) Practical arrangements were made with the school head/administrator in advance by the MNESR, including agreeing on times and obtaining the informed consent of the school. Teachers were forewarned of the visits, and were asked for an informal, but confidential, interview of their views about the teaching spaces they use.

c) On arrival the researchers met with the principal for an initial interview about his/her views and concerns, plus background on the school. Ethical formalities were completed. Schools plans (physical layouts) were generally made available and the classrooms to be studied were selected.

d) Visits were made to approximately six classrooms in each school to assess their physical characteristics. This typically took place while teaching was being carried out.
The visits involved physical measurement of the spaces and furniture and their disposition, the environmental control provided for heat, light and ventilation, and spot measurements of CO₂, sound, and light levels, and humidity and temperature. In addition to these “naturalness” factors, the visual complexity and coloring of the spaces was considered together around the question of the level of ambient “stimulation” provided. Lastly, the “individualization” of the spaces was assessed. All of these factors have been shown to directly impact pupils’ learning. A comprehensive photographic record was taken to provide a record and to illustrate the main themes emerging from the analysis.

e) Interviews of 5–10 minutes were carried out with each class teacher (typically at the end of the classroom visit) concerning their likes, dislikes, and feelings about the learning environment as it worked for them throughout the year and their pedagogical aspirations.

f) Last, the researchers toured and broadly assessed the associated learning and general spaces employed and outdoor provision, all of which are relevant to the studied classes.

2.3 Sample schools/classrooms

Five schools were selected according to the principles set out above. Schools 1–3 are in and around Bucharest. One urban (School 4) and one rural school (School 5) are in and near Brasov. Across these five schools a diverse range of 28 classrooms were studied in depth, together with the general school spaces and external facilities/grounds available. The selection factored in climatic differences and the urban/rural distinction. In particular, the schools in and around Brasov are at a higher altitude and generally experience colder weather than the schools in and around Bucharest. Schools 1 and 2 operate a shift system1 as does one classroom in School 3. The schools in Brasov do not. The broad features of the selected schools, taken from the national database, are given in Table A4.1.

The program for the visits was:

- October 10, 2016 School visit No.1 in Bucharest
- October 11, 2016 School visit No.2 in Bucharest
- October 12, 2016 Meeting with Ministry officials/experts and local World Bank consultants
- October 13, 2016 School visit No.3 in Bucharest area
- October 14, 2016 School visit No.4 in Brasov
- October 17, 2016 School visit No.5 near Brasov

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1 The shift system involves the same classroom being used by primary age pupils in the morning and by gymnasium pupils in the afternoon.
Table A4.1: Broad characteristics of sample schools

<table>
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<tr>
<th>No.</th>
<th>Education level</th>
<th>Year of construction</th>
<th>Capacity (# of pupils)</th>
<th>Built area (square meters)</th>
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<td>1</td>
<td>Preschool; Primary; Gymnasium</td>
<td>Building A – 1896, Building B+C – 1898 (different location)</td>
<td>857</td>
<td>Building A – 3,033, Building B – 121, Building C – 850</td>
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<td>2</td>
<td>Primary; Gymnasium</td>
<td>1967</td>
<td>636</td>
<td>NA</td>
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<td>4</td>
<td>Primary; Gymnasium</td>
<td>1993</td>
<td>579</td>
<td>475</td>
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2.3 Analysis of data
The approach allowed a detailed assessment of a range of teaching spaces within and across the five schools, based on the spaces’ physical characteristics and teachers’ views. The data collected supported a rich, triangulated assessment of the factors impacting learning, linked to the researchers’ intimate knowledge of the results of the UK HEAD Project study. Analysis of the data from the individual classrooms and schools following the country visit thus supported a cross-analysis of the major factors.

The findings, presented below, provide an evidence base off which elements of Romania’s education infrastructure strategy can be built, informed by an investigation rooted in the particularities of Romania’s current situation. The analysis takes stock of practical aspects of current school design and highlights a range of possible actions that could be taken with a good degree of certainty that they will impact positively on pupils’ educational attainment. Section 5 also raises broader questions about possible change for the primary education sector in Romania. These either reflect school design aspects or have implications for the strategic consideration of school infrastructure capacity in Romania.

2.4 Limitations
The HEAD Project is founded on a pupil-centric model, whereby the SIN factors (see below) are driven to a great extent by children’s human needs or the basic mental necessities of learning. The results are not concerned with the absolute level of achievements in English schools, but with the physical environmental factors that explain variations in learning progress. As set out above, it seems highly likely that these aspects will translate from children in one country to another, particularly at the level of design principles.

The HEAD Project extended over three years, with a team of four researchers gathering data about many English classrooms and the academic performance of their pupils. The Romanian project has the advantage of building on these results, but is limited by the amount of data available. Only five schools were visited and data about pupils’ progress were not available. Thus it was not possible to fully replicate the original HEAD analysis. Other things equal, the findings depend on the extent to which the variety in the five sample schools reflect the range of distinctive features of the Romanian primary school sector. To further address the issue of representativeness beyond this small sample, the meeting with officials/experts midway through the visit provided additional confidence that the insights emerging from the five case study schools raised issues relevant across the sector. Judging from the enrolment in the schools
studied, any areas for action identified will possibly be more strongly felt in many of the schools across the rest of the sector in Romania.

3 Survey findings and comparisons
The following subsections address, at the level of the Romanian classroom, each of the 10 design parameters that emerged from the HEAD Project study as significant.

These parameters nest within the three SIN principles of the HEAD Project in reverse order as follows:
- **Naturalness**: light, air quality, temperature, sound, and links to nature
- **Individualization**: flexibility, ownership, and connection
- **Stimulation** (appropriate level of): complexity and color.

Seven of these parameters were found to have strong impacts on learning progress for all pupils and all subjects in the UK HEAD Project study: their relative impact is shown in Figure A4.2. The other three parameters were found to be significant for progress in specific aspects, such as “reading.” So all 10 were included in the Romanian study, but where they are of more focused relevance this is noted in the particular subsection.

Figure A4.1: The SIN research model

Table A4.2 provides a summary of many of the physical “spot” measurements taken in each classroom, presented by school. These raw data inform the following discussion of the 10 design parameters, together with expert assessments of some “softer,” but nonetheless important, factors, as well as interviews with users. Various photographs are included for illustration purposes. Unless otherwise stated, all were taken at the Romanian schools visited.
### Table A4.2 Summary of “spot” measurements by classroom and school

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<th>d8</th>
<th>RH</th>
<th>CO2</th>
<th>A'con</th>
<th>Lux H</th>
<th>Lux L</th>
<th>No. Light</th>
<th>Floor</th>
<th>Room V</th>
<th>Pupil No.</th>
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<td>65</td>
<td>45</td>
<td>2580</td>
<td>N</td>
<td>140</td>
<td>70</td>
<td>2 OK</td>
<td>80</td>
<td>324</td>
<td>30</td>
<td>2.65</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>G</td>
<td></td>
<td>NW*</td>
<td>19.9</td>
<td>48</td>
<td>45</td>
<td>2500</td>
<td>N</td>
<td>150</td>
<td>70</td>
<td>4 Poor</td>
<td>83</td>
<td>323</td>
<td>24</td>
<td>3.45</td>
<td>19</td>
<td>15</td>
<td>3.21</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td></td>
<td>1</td>
<td>0.75x0.5</td>
<td>NW*</td>
<td>21.5</td>
<td>50</td>
<td>45</td>
<td>1970</td>
<td>N</td>
<td>160</td>
<td>70</td>
<td>4 Poor</td>
<td>84</td>
<td>330</td>
<td>22</td>
<td>3.81</td>
<td>19</td>
<td>14</td>
</tr>
</tbody>
</table>

* = dual aspect

### Summary by school

<table>
<thead>
<tr>
<th>School</th>
<th>A/pupil</th>
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<tbody>
<tr>
<td>R1</td>
<td>2.08</td>
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<tr>
<td>R2</td>
<td>2.41</td>
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<tr>
<td>R3</td>
<td>2.26</td>
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<tr>
<td>R4</td>
<td>2.00</td>
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<tr>
<td>R5</td>
<td>2.19</td>
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<td>O'all</td>
<td>2.38</td>
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Summary by school
3.1 Light

Good natural light is generally a positive feature in classroom design, provided it is not associated with problems of glare. Good quality artificial lighting is always needed.

In the schools visited, window area as a percentage of classroom floor area was an average 21 percent, which is reasonable against a rough guide figure of 20 percent.² That said, the newly extended facilities in School 3 had particularly small windows, amounting to only 10 percent of floor area. The classrooms in the sample were oriented evenly around the compass. Those facing east, southeast, and south receive direct sunlight in the morning into the classroom. In fact blinds of only moderate quality were generally found, while some schools used net curtains. In some classrooms the blinds seemed to be used actively, but in many, blinds, and especially net curtains, appeared permanently shut. So despite the generally reasonable window size, the amount of daylight entering classrooms was often severely restricted.

This has led to a reliance on artificial lighting. The luminaires provided are a mix of new in two of the schools and older in the others. Amongst the latter, lights were missing, and these schools had poorer light output generally, linked to the limited number of light fittings provided. In schools with new luminaires, the number was greater and the output stronger, but even here the high ceiling height tended to diminish the impact of the light at the working plane of children.

Some high values of light levels were measured adjacent to windows during the survey (see Lux H for School 1 in Table A4.2 – for subsequent schools the high norm where there actually were desks was recorded instead). In general though, light levels were between 200–500 lux on average, with the lights on. Although the weather was generally quite dull on the visit days, assuming an average of 300 lux for study activity, light levels were generally low in some areas of most classrooms. This was all the more so in some specific classrooms and in all of the classrooms in School 5, which ranged from typical highs of 150 lux and lows of 70 lux.

Investment opportunities around “lighting”

a. Most schools would benefit from new, good-quality, easy-to-operate blinds. Where windows carry a risk of glare, blinds could be external, which would be appropriate in relation to heat gain (see section on Temperature below).

b. Where schools (e.g., School 3) have small windows, additional natural lighting via borrowed lights to corridors, or roof lights, should be considered.

c. Where schools have old luminaires, new, more numerous lights should be provided. These would be more effective if mounted well below the typical high ceiling.

d. Teachers should be trained to maximize glare-free daylighting and sufficient lighting generally for effective study. This should involve the active use of blinds as necessary.

² The calculation of daylight is a specialist area where window size, height, orientation, the reflectivity of walls and depth of room, shading provided, etc. all need to be taken into account for each specific space. That said, a simple “rule of thumb” suggests that if the window area is at least 20 percent of the floor area, a reasonable amount of natural light will exist in the room. This is backed up by some laboratory experiments if 300 lux is aimed for and corresponds to a moderate or good provision of lighting as identified in the UK HEAD data. As a simple measure, it allows for easy, if rough, comparison across schools. Before improvement work is carried out at any specific school, more detailed calculations and design are needed.
3.2 Air quality

Good air quality is essential for effective brain functioning. The schools visited generally had sufficient opening windows in principle. On average the openable window area as a percentage of classroom floor area was 11 percent, close to the rough guide figure of 10 percent. Most schools were better than this, as the average was brought down by a very small value of 5 percent for School 3 given its small windows, installed in a recent refurbishment. In only a few cases were windows on more than one wall, limiting the chance to achieve cross ventilation. Schools 2 and 3 had air conditioning units with an external connection in each classroom and School 1 had them in a couple of classrooms.

Despite a reasonable provision of openable windows, the on-site measurements, albeit at a particular time, display a consistent picture of very poor air quality in practically every classroom (Table A4.1). CO₂ levels are a surrogate measure of air quality, with the threshold of good air quality for schools set at 1,000 ppm, although 1,500 ppm is also suggested by some. The average for all classrooms surveyed was 3,021 ppm of CO₂. In the three Bucharest schools (Schools 1–3), the range was evenly spread from 2300–5300 ppm, with one exception. In the two Brasov schools (Schools 4 and 5), the values were still high, typically around 1,500–2,500 ppm, but lower than in the Bucharest schools.

Various possible reasons exist for the disconnect between the opportunity to open windows and the observed poor air quality:

- The windows were a mixture of older wooden and newer PVC casements. They were generally in good order, but counterintuitively, newer windows can restrict ventilation as they tend to seal tightly.
- In quite a few cases, the handles were removed from windows. This may be driven by a health and safety concern that children may fall out of the windows.
- The schools were often multistory, with few external exits and secure internal corridors, seemingly leading to a stale tank of air within the buildings.
- Where the shift system was employed (typically in the Bucharest schools), the use of spaces was very concentrated, a situation compounded by the generally very short breaks.
- Some of the very worst levels of poor air quality were noted in classrooms where air conditioning was provided, possibly because teachers assumed that the mechanical ventilation meant that air quality had been addressed. School 1 had air conditioning in only two classrooms seen and both had CO₂ levels of 5,000 ppm.

These high levels of CO₂ indicate levels of poor air quality that are sure to severely reduce children’s capacity to concentrate and remain alert, negatively impacting their capacity to learn. Indeed, clear evidence in the literature from controlled experiments shows the direct negative impact of poor air quality on pupils’ picture memory and word recognition (Bakó-Biró et al. 2012) and more general evidence of reduced performance on mental tasks from CO₂ levels of 500 ppm upwards (Allen et al. 2015).

3 As in the above footnote, specialist calculations of ventilation rates from windows are complicated and depend on external wind speeds, whether cross ventilation is available, how far the windows can be opened, etc. The “rule of thumb” that the open-able window area should be 10 percent of the floor area is drawn from UK building regulations for housing. The upper recommendation is taken as school classrooms are intensively used and windows are often restricted. Again, this approach allows easy comparison, but before improvement work is carried out at any specific school, more detailed calculations and design is needed.
For all the detailed possibilities here, there appears to be an overriding disinclination amongst teachers to open windows. This may be cultural, driven by notions of energy saving. However, this influence would be expected to be stronger in Brasov where it is generally colder, but there the air quality was better, albeit not good.

Humidity levels varied from 40–70 percent, reflecting the full range of acceptable levels. However, in classrooms where humidity levels are high and air freshness is low, it is strongly suspected that there could be negative implications for children’s health.

Further investigation is needed, but given the relatively high ceiling levels in Romanian schools (+3.3 meters), it could be feasible to introduce a suspended ceiling to accommodate a ventilation system. The images below are of the system in a Norwegian school. The impact on air quality is profound, while energy saving is actively realized through the process. The air cycles down the tube on the left and through the grills in the ceiling on the right.

**Investment opportunities around “air quality”**

Effectively addressing the issue of poor air quality in existing Romanian schools is probably the single most important aspect that will positively impact on learning.

e. At a minimum, existing openable windows should be rendered workable and easy to operate, while also including opening limiters if there are legitimate health and safety concerns. Means of providing trickle ventilation could ameliorate concerns about energy wastage.

f. Air conditioning units linked to the outside currently appear ineffective and appear to be used for heating and cooling, rather than ventilation. The functional capabilities of these units should be established; if possible they should be employed to increase the air changes in the classrooms (if this cannot be achieved using openable windows).

g. Given the existence of generally reasonable opening windows and some air conditioning, a strong behavioural issue needs to be addressed. This could be attacked via teacher training, stressing the negative consequences of stale air on learning.

h. Linked to above, it could be highly effective to provide air quality meters in each classroom (or at least a few to be shared in each school) as this would make the problem transparent and amplify the need for action. Simple meters cost around US$125 and provide measures of humidity and temperature as well as CO₂ levels. This issue could even become part of the teaching resource, enhancing greater environmental sensitivity amongst pupils.

i. A balanced ventilation system linked to a central heating and ventilation plant is an expensive but ultimately highly effective solution. This could be used in new schools and in existing schools where the above actions are not sufficiently effective.
3.3 Temperature

The schools seen were heated with radiators controlled centrally with no local thermostats. Some local air conditioning units were seen, as noted above, and seemed to supplement the heating. Teachers were generally satisfied with the temperature, although classrooms were quite commonly reported to be hot in the summer and various efforts to address heat gain on south-facing windows were noted. These involved internal shading devices, which are not effective as the solar energy has already passed through the glass into the room.

In general, classrooms with a temperature of 18–20°C are optimal for children to study. The classrooms visited ranged at the time of inspection from 19–24°C, with an average of 21.2°C.

**Investment opportunities around “temperature”**

j. Control could be improved by introduction of individual thermostats for each room, or even on each radiator, which could be simpler.

k. Teacher training would reinforce the value of keeping classrooms a little cooler. This could be supported by the notion of providing meters in each classroom (see h above) and would of course save energy.

l. If, or where, the balanced ventilation system solution was adopted (see i above), this would address the issue.

m. For south-facing windows, heat gain should be addressed through provision of external shading devices. This would also be effective against glare. Eleven (40 percent) of the classrooms surveyed face S, SW, or SE, so this is a pervasive problem.

3.4 Sound

Unwanted sound or noise can disrupt learning. It can come from outside, elsewhere in the school, or classroom activities. The schools studied were generally away from noisy roads (with the exception of School 1). Disruption from playgrounds was not relevant given the minimal break times allowed.

Noise within the classroom is driven to a great extent by the mass of the structure and the finishes provided. Wooden flooring is typical and absorbs sound. Carpets, which absorb sound even more, were not used, but one school had installed sheet flooring, which reduces acoustic performance. Walls were generally plastered, but of solid construction. Ceiling levels were high and acoustic ceiling tiles were employed in one school and in some classrooms in another. The low number of larger items of furniture in the classrooms also meant that rooms were more resonant.

Although it is difficult to take acoustic measures while classrooms are in use, noise levels were recorded during the visits; readings ranged from 50–75 dB. This wide range (decibels are measured in a logarithmic scale, doubling every 10) reflects the variety in classroom designs noted above. As might be expected, readings were quite high in School 4, which had hard flooring and no acoustic ceiling tiles. In larger classrooms (e.g., in Schools 1 and 5) the sound of children was less concentrated, but teachers had to project their voices farther (although see Section 3.6).
3.5 Links to nature

Links to nature was not a major factor overall in the HEAD study, but did emerge as an important factor in progress in the subject of writing.

The Romanian schools visited tended to have plants in the classroom (in contrast to classrooms in the United Kingdom) and many classrooms had some view of trees outside, although often obscured by nets or window blinds. The wooden flooring, and in some cases wooden desks and chairs, added to the “naturalness” of the spaces seen.

That said, access to the outside was generally severely limited. Many classrooms were on upper floors and no classrooms had direct access to the outside. This divide between outside space was reinforced by (or maybe a result of) very limited play breaks, so that going outside was not very feasible; one exception was in School 5, for younger grades. Probably as a result, the outside spaces seemed to be not highly valued. Although generally of a reasonable size, they had no playsets and, at most, lines on tarmac. In several cases, plans to extend the schools threaten their future.

In contrast, direct access to the outside is considered desirable in England, and in fact essential for Grade I and II children (see picture). There, the external space immediately outside the classroom is seen as an extension of the classroom, to be used for learning activities when the weather permits.

3.6 Flexibility

Flexibility is a complex concept focused on the physical shape and layout of the classroom. Taking this in sections, starting with the general provision, classrooms in the Romanian schools seen were split into two categories: large classrooms of 70–80m² in the older schools (1 and 5); and fairly standard 50m² classrooms in the other schools. For a class within the regulation 25 investment opportunities...
pupils for primary schools, even the smaller classrooms are of a reasonable size; for instance, they compare favorably at 2m² floor area per pupil with the HEAD Project English schools, where an area of around 1.84m² per pupil is typical. That said, many classrooms accommodated more than 25 pupils, driving down the area per pupil. This was especially true in Schools 2 and 4, where high demand and smaller classrooms resulted in around 1.63m² per pupil.

Rooms were universally of a simple, rectangular shape. Associated breakout spaces, generally seen as a positive feature as they provide teachers with options to create small groups or to carry out one-to-one coaching, were not provided. There were very limited facilities beyond the classroom, with the exception of some reasonable halls and a few very small libraries, probably aimed at older children as a reference source. This reinforces the importance of amenities available within the classroom. A couple of ICT rooms were noted, but these appeared to be for gymnasium students, were little used, and are a diminishing trend generally (as ICT becomes an intrinsic part of the classroom itself, for example via interactive whiteboards/laptops and computers, which were widely seen being used by teachers in classrooms). These spaces could probably be released for alternative uses.

Storage options are needed for equipment and other items. For the pupils, pegs for coats were typically provided in the classroom and some schools had lockers, but these were not actually used much. Desks quite often included a shelf underneath, but little use was made of these. In fact, the children observed seem to bring their possessions with them in rucksacks or trolleys and take them away at the end of the school day, especially in Bucharest. These bags were seen under desks or hanging on chairs – and were carried around school even by very small children, who have to struggle up and down stairs. This was especially prevalent in schools with shift systems. This arrangement is not good for ownership (see below) or for pupils’ health and safety.

Teachers had limited storage for teaching materials, although the Brasov schools had better provision on this front. The availability of teaching equipment/materials, such as reading books, craft supplies, etc., seemed very low or nonexistent.

Another aspect of flexibility is the availability of wall space to display teaching aids and pupils’ work. Opportunity existed for display in principle in most schools seen but little use was made of this tool, certainly in schools using a shift system, and more generally with a few exceptions. Where classrooms were shared, charts, etc., for older children were commonly found on the walls, mixed up with some material for primary children.

Owing to the shift system, many classrooms were cluttered with more desks than needed, presumably for the gymnasium pupils in the afternoon.

The last aspect of flexibility is the way in which classrooms are set up. As discussed above, the Romanian schools seen generally had more space per pupil in principle than the English HEAD Project schools. In practice, though, higher than regulation numbers (40 in one case) meant that a fair number of classrooms were quite cramped.

Almost without exception, the classrooms seen had desks lined up facing the front. No “learning zones” or sinks/wet areas were provided to support education approaches beyond teaching from the front. This was so even in classrooms with plenty of space. In fact it was quite normal in such spaces for the desks to be moved toward the teaching wall (with, say, the whiteboard),
leaving unused space toward the back. Teachers explained that this was because children at the back could not see the board.

The formal layout of classrooms appears to be a tradition in didactic teaching leading to, and probably reinforced by, a lack of alternative physical options, all within a teaching program compressed into the morning. In addition, several teachers mentioned the need to be fair to pupils by having all oriented to have the sun from their left (presumably assuming they are right-handed). This actually seems to be quite a powerful disincentive to many teachers in moving the desks around, but is less valid given good artificial lighting and the regular use of blinds.

In contrast, the HEAD Project English schools use multiple “learning zones” as a central part of the pupil-centred pedagogy practiced.

The use of multiple learning zones was especially evident in the classrooms for younger children in the United Kingdom, where “play-based learning” is the norm. In the HEAD Project study, effective learning in the earlier years is enhanced by a wide range of learning zones nested naturally within more complex floor plans; for older children, simpler plans and fewer zones are appropriate as the learning becomes more formal. In addition, English classrooms are almost always set out with “islands” of tables to accommodate around six pupils who work individually or in groups when not accessing other learning zones or breakout spaces. This high level of options seems to offer a good range of alternatives to possible variations in pupils’ learning styles. The issues of desk layout and provision of learning zones are closely linked to the pedagogy used, addressed in Section 5.2.
3.7 Ownership
Ownership focuses on the extent to which pupils feel the classroom is their space. This emerged in the HEAD Project study as an important factor generally, and especially with respect to progress in mathematics (Barrett et al. 2016).

In the Romanian schools visited, the layout and decoration of the classrooms was usually not very distinctive. As mentioned above, the use of displays was limited and the inclusion of pupils’ own work rare. An exception was School 4 (see below – right), where classrooms were color-coded through their desks and storage facilities, and more active use was made of the display opportunities. The display of pupils’ work in corridors was noted in a couple of other schools. Pegs, lockers, and classroom storage, where they existed, were not personalized with pupils’ name labels.

As noted above, the lack of age-appropriate classroom furniture was profound and no attempts were made to use furniture to create zones. Desks and chairs predominated and were generally of reasonable quality, but were arranged in rows and not scaled to small children. In schools with shifts this latter feature might arise as bigger furniture is needed for gymnasium students, but the same applied in schools without shifts. The furniture was rarely painted in brighter, “child-friendly” colors. Window sills were generally fairly high for small children to reach.

The combination of plain classrooms in shape, layout and decoration, with a low level of display, little personalization, and a lack of child-friendly furniture, all conspire to create a very
low level of ownership from the perspective of individual children. This was accentuated in classrooms shared with older pupils through the shift system.

**Investment opportunities around “ownership”**

bb. Much of this issue concerns how spaces are used, but the provision of smaller, possibly brighter, furniture appropriate for smaller children would make a big impact on pupils feeling that the space was designed for them, as well as on the health benefits of comfortable seating.

c. In classrooms where the shift system cannot be avoided, adjustable chairs (and possibly desks) could appropriately accommodate the different age groups involved. Fold-away desks could help reduce clutter when lower numbers of smaller primary school children were in residence. This could then allow, say, a library area to fold out.

dd. Linking to items t, u and v above, each classroom should be given a particular personality through provision of individualised storage, creation of zones, use of color, and prominent display of children’s work.

### 3.8 Connection spaces

Although connection spaces did not emerge as significant in the main HEAD Project analysis, they did have positive impacts on progress specifically for the subject of reading, and especially in relation to disadvantaged children.

Barrett et al. (2016) found this result to be connected with the provision of accessible mini-libraries, or “corridor libraries,” in wider corridors (shown here in an English school). This easy access to educational reading material was beneficial to pupils, particularly those who might not have access to such material at home.

None of the Romanian schools visited provided “corridor libraries.” The layout of the corridors was generally quite simple and generous in width, albeit in most schools, over several floor levels. Pupils generally entered the school via a main entrance, so clear routes through the school are important.

**Investment opportunities around “connection spaces”**

ee. Where there are lobbies of sufficient size, the provision of shared “corridor libraries” should be considered and would be expected to particularly benefit more disadvantaged children, who are less likely to have books at home.

ff. The decoration and use of public displays can be used to provide orientating cues, particularly to distinguish the different levels.

### 3.9 Complexity

Visual complexity was found to be optimal for learning at about the midpoint of the variation noted in the English sample. That is, the visual effect should be neither too chaotic nor too bland.
This aspect comprises two components, the first of which is the inherent visual complexity of the room/ceiling shape. As already stated, the classrooms visited were all rectangular and plain, with high, plain ceilings, all of which tend to reduce the feeling of visual complexity. In Brasov schools, the provision of storage added to the visual interest.

The second component is the impact of the use of display materials. Generally this was quite low, particularly in the Bucharest schools. The Brasov schools tended more towards the optimal midpoint, possibly because a shift system was not in use, allowing freer use of the walls (see bottom picture).

Considering the room shape and display materials together, visual complexity in the spaces seen ranged from low to quite low.

<table>
<thead>
<tr>
<th>Investment opportunities around “complexity”</th>
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<tbody>
<tr>
<td>bb. There is a clear opportunity to increase the visual complexity of many of these classrooms for primary school children. This could be linked with bringing the ceiling lower (see item n above).</td>
</tr>
<tr>
<td>cc. This could also be linked to greater use of display material on the walls (see item u above).</td>
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</table>

3.10 Color
This factor was found to have a curvilinear effect in the HEAD Project study: the optimum use of color constituted a calm backdrop with highlights provided by brighter colors on a “teaching wall” or a recess and on the furniture.

The Romanian schools visited tended to be rather monochromatic, with School 3 an extreme example. School 4 (and other isolated examples, e.g., see School 2 below – right) was at the other end of the spectrum, with strong use of varied colors. Walls in two schools were painted white. Floors generally and much of the furniture were made of wood, which provides a warm backdrop. Some color was provided by blinds/curtains, although cream was a common choice of color.
4 Summary of survey

This section first reflects more broadly on the above detailed survey findings, structured using the three main design principles (SIN). Table A4.3 summarizes all of the investment opportunities discussed.

4.1 Naturalness
This design principle is driven by the following parameters: light, air quality, temperature, sound, and links to nature. The Romanian schools seen could be improved in multiple ways across all of these parameters, but the major issue is poor air quality.

4.2 Individualization
This design principle involves the parameters of flexibility, ownership, and connection. It reflects the degree to which users can interact with the spaces provided in a way that suits them personally. The Romanian schools seen generally presented a very low level of individualization. However, given the quite reasonably sized spaces found, particularly if maximum class sizes of 25 are adhered to, but with generous scope in the older Schools 1 and 5, a huge amount could be done to make the classrooms more suited to young children in general and to provide the opportunity for stronger individual ownership more specifically.

4.3 Stimulation
This design principle involves visual complexity and color, and the ambient optimum for studying has been found to be a mid-level of stimulation. The Romanian schools seen were generally rather low in ambient stimulation provided, but the judicious use of additional displays and color could address this.

4.4 Summary of investment opportunities
To improve the physical learning environment, it is important to attack the issues on multiple fronts. A summary of the full range of opportunities is given in Table A4.3. This includes a rough “traffic light” indication in the second column, whereby:

- **Green** indicates physical options that are very easy to implement
- **Orange** indicates those that are quite cheap and easy to implement and
- **Pink** indicates those that would be harder or more expensive to implement across the school system as a whole.
- **Blue**, in addition, indicates options that involve user training.

<table>
<thead>
<tr>
<th>Principle/Parameter</th>
<th>Ref</th>
<th>Investment opportunity</th>
</tr>
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<tbody>
<tr>
<td><strong>Naturalness</strong></td>
<td></td>
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<tr>
<td>Light</td>
<td>a.</td>
<td>Most schools would benefit from new, good-quality, easy-to-operate blinds. Where windows carry a risk of glare, blinds could be external, which would be appropriate in relation to heat gain (see section on Temperature below).</td>
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<td><strong>b.</strong></td>
<td>Where schools (like School 3) have small windows, additional natural lighting via borrowed lights to corridors, or roof lights, should be considered.</td>
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<td><strong>c.</strong></td>
<td>Where schools have old luminaires, new, more numerous lights should be provided. These would be more effective if mounted well below the typical high ceiling.</td>
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<tr>
<td><strong>d.</strong></td>
<td>Teachers should be trained to maximize glare-free day lighting and sufficient lighting generally for effective study. This should involve the active use of blinds as necessary.</td>
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<tr>
<td><strong>Air quality</strong></td>
<td><strong>e.</strong> At a minimum, existing openable windows should be rendered workable and easy to operate, while also including opening limiters if legitimate health and safety concerns exist. Means of providing trickle ventilation could ameliorate concerns about energy wastage.</td>
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<tr>
<td><strong>f.</strong></td>
<td>Air conditioning units linked to the outside currently appear ineffective and appear to be used for heating and cooling, rather than ventilation. The functional capabilities of these units should be established; if possible they should be employed to increase the air changes in the classrooms (if this cannot be achieved using openable windows).</td>
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<td><strong>g.</strong></td>
<td>Given the existence of generally reasonable opening windows and some air conditioning, a strong behavioral issue needs to be addressed. This could be attacked via teacher training, stressing the negative consequences of stale air on learning.</td>
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<td><strong>h.</strong></td>
<td>Linked to above, it could be highly effective to provide air quality meters in each classroom (or at least a few to be shared in each school) as this would make the problem transparent and amplify the need for action. Simple meters cost around US$125 and provide measures of humidity and temperature as well as CO2 levels. This issue could even become part of the teaching resource, enhancing greater environmental sensitivity amongst pupils.</td>
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<tr>
<td><strong>i.</strong></td>
<td>A balanced ventilation system linked to a central heating and ventilation plant is an expensive but ultimately highly effective solution. This could be used in new schools and in existing schools where the above actions are not sufficiently effective. Further investigation would be needed, but given the relatively high ceiling levels in Romanian schools (+3.3 m) it could be feasible to introduce a suspended ceiling to accommodate the system.</td>
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<tr>
<td><strong>Temperature</strong></td>
<td><strong>j.</strong> Control could be improved in specific classrooms by the introduction of individual thermostats for each room, or even on each radiator, which could be simpler.</td>
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<tr>
<td><strong>k.</strong></td>
<td>Teacher training would reinforce the value of keeping classrooms a little cooler. This could be supported by the notion of providing meters in each classroom (see h above) and would of course save energy.</td>
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<td><strong>l.</strong></td>
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<td><strong>m.</strong></td>
<td>For south-facing windows, heat gain should be addressed through provision of external shading devices. This would also be effective against glare. Eleven (40 percent) of the classrooms surveyed face S, SW, or SE, so this is a pervasive problem.</td>
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<td><strong>Sound</strong></td>
<td><strong>n.</strong> Given the high, hard ceilings typically provided, the insertion of suspended ceilings using acoustic tiles would generally enhance the acoustic performance of the classrooms, where this has not already been done. This could be linked to lowering the height of luminaires (see c above).</td>
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<tr>
<td>Links to nature</td>
<td>p.</td>
<td>Create cloakroom spaces for coats and shoes in what are typically wide corridors; this would also declutter the classrooms.</td>
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<tr>
<td>q.</td>
<td>Provide age-specific playsets generally and, where possible, specifically adjacent to the classrooms of younger children.</td>
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<th>Individualization</th>
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<th>There is a clear opportunity to use the existing classroom spaces available to provide a range of learning opportunities to pupils. This is feasible across the board if the regulation maximum of 25 primary school pupils in a class is adhered to, and even more so if the shift system is removed.</th>
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<td>More extensive teaching materials and storage for them would be beneficial.</td>
<td></td>
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<td>Vitally, pupils need effective storage in or adjacent to their classrooms for their own books, so that they do not have to carry them around.</td>
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<td>More display boards could be provided; in schools with a shift system, they could be used to distinguish areas for each class sharing the space.</td>
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<td>New furniture and equipment could create a variety of learning zones in each existing classroom, such as a quiet reading area, play space, wet area to support art (with a water supply and sink), and a carpet/rug area. This could easily extend to flexible desk layouts to support group work. However, it may be difficult to create breakout spaces in existing schools (and maybe infeasible to use them with the typical lone teacher).</td>
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<tr>
<th>Ownership</th>
<th>w.</th>
<th>Much of this issue concerns how spaces are used, but the provision of smaller, possibly brighter, furniture appropriate for smaller children would make a big impact on pupils feeling that the space was designed for them, as well as on the health benefits of comfortable seating.</th>
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<tr>
<td>x.</td>
<td>In classrooms where the shift system cannot be avoided, adjustable chairs (and possibly desks) could appropriately accommodate the different age groups involved. Fold-away desks could help reduce clutter when lower numbers of smaller primary school children were in residence. This could then allow, say, a library area to fold out.</td>
<td></td>
</tr>
<tr>
<td>y.</td>
<td>Linking to items t, u and v above, each classroom should be given a particular personality through provision of individualised storage, creation of zones, use of color, and prominent display of children’s work.</td>
<td></td>
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<tr>
<th>Connection</th>
<th>z.</th>
<th>Where there are lobbies of sufficient size, the provision of shared “corridor libraries” should be considered and would be expected to particularly benefit the more disadvantaged children, who are less likely to have books at home.</th>
</tr>
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<tbody>
<tr>
<td>aa.</td>
<td>The decoration and use of public displays can be used to provide orientating cues, particularly to distinguish the different levels.</td>
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<tr>
<th>Level of Stimulation</th>
<th>bb.</th>
<th>There is a clear opportunity to increase the visual complexity of many of these classrooms for primary school children. This could link to bringing the ceiling lower (see item n above).</th>
</tr>
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<tbody>
<tr>
<td>cc.</td>
<td>... and the greater use of display material on the walls (see item u above).</td>
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</tr>
<tr>
<td>Color</td>
<td>dd.</td>
<td>There is opportunity to work with the generally calm backdrop in many of the schools seen and to provide some focus of color, say on the</td>
</tr>
</tbody>
</table>
teaching wall, or some other area, maybe linked to creation of a learning zone (see item v above).

Where new child-centric furniture is being considered, if it is not made of wood, it could be more brightly colored (see item w above).

5 Wider education system issues

The above sections focused on the characteristics and likely impacts on learning of the physical spaces in the schools surveyed. During the field visits, classrooms’ manner of use was observed and users’ perspectives were gained from principals and teachers via interviews. From these, a range of issues that go beyond the nature of the physical spaces emerged. These are linked to the design of the schools, but also impact the feasibility and desirability of some of the areas identified as opportunities for investment.

5.1 Class size

Romanian regulation states that the maximum class size at primary level is 25 pupils. Of the 28 classrooms visited, only 14 percent were within this “maximum” and some classrooms were decidedly cramped. But if the limit was adhered to, all classrooms would have good capacity to consider more flexible use of the space. Principals generally complained about pressure to increase pupil numbers, but the decision involves different actors.

Various factors conspire to create this situation of overcrowding:

- First and foremost, the shift to per pupil funding incentivizes taking more students.
- Widespread closure of schools in recent times means that teachers could easily feel vulnerable in a volatile market.
- Growing enrolment numbers imply a school’s popularity and success.
- The shift system and the higher maximum of 30 pupils for gymnasium classes means that many classes have 30 desks.
- At county level, agreeing to higher enrolment numbers presumably means cost-savings due to concentration of provision.
- In areas where demand for education exceeds supply, there is social pressure to accept students as no reasonable alternative exists.

But the question remains: Should the maximum of 25 be enforced? If yes, could it be? Doing so would ensure that sole classroom teachers (seen universally) are not overwhelmed and have the capacity to innovate. It would also ensure the availability of physical space to consider innovation.

If the maximum is not enforced, schools will compete strongly with each other in some localities, potentially skewing what could otherwise be a satisfactory provision of places for pupils in the catchment schools/classrooms, and even creating issues associated with unnecessary travel to school.

Real educational benefits can arise from adhering to the 25 maximum class size for primary schools. This would impact the provision of schools/classrooms, which can be modelled using county-level data. Dividing the number of primary pupils by the number of classrooms gives a rough indication of the current average class size. If limiting classrooms to 25 is desirable, the question of how to enforce the maximum in practice still remains. The following options, singly or in combination, have potential:

- Change the funding model to fully fund only the first 25 pupils in a class and then either have a steeply dropping rate of funding, or zero funding over the maximum.
- Use the school inspection system to monitor enrolment and report on classes enrolled over the maximum.
- Include class size as an element in the periodic assessment of principals and any plans they are required to submit.

5.2 Possible developments in pedagogy

The approach to teaching observed was universally that of a lone teacher (no teaching assistants) at the front of the class using a combination of white/blackboard with a computer connected to a projector. Pupils were seated at individual (or sometimes pairs of) desks facing the front. The teaching style appeared to be that of didactic education, whereby teachers impart knowledge to pupils through direct instruction. The pupils had textbooks and exercise books, but very little (nothing) was elsewhere in the classrooms to support any other sort of learning. Even when space was available, teachers moved pupils to the front to be near them and the board. The reasons for this approach to teaching seem to be:

- A strong tradition of a didactic style of teaching. The first Romanian school in Brasov is shown here. Although the desks are now separate, there are strong similarities with current classroom layouts.
- Issues around teacher training and the range of options promoted within this and any follow up in service training.
- A short, intensive school day with a broad national curriculum to cover in the time available.

The didactic style of teaching has its strengths and probably favors academically stronger pupils who can grasp the knowledge being transferred. It may also work better for advantaged pupils who appear to have other educationally enriching activities arranged for them in the afternoon. The approach may not be as suitable for weaker or disadvantaged pupils. As such, it could engender a degree of indirect discrimination. More broadly, as an educational approach a didactic style of teaching emphasizes memorization of facts and can induce a passive approach to learning. Judged against existing international criteria for effective learning environments, the prevalent approach does not seem to: encourage active participation and self-regulation amongst learners, encourage group work/social learning, or display sensitivity to learners’ motivations and individual differences.

Other pedagogical options are available. An approach using a range of interactions and modes of learning appears optimal as it provides a good chance that the varied learning styles and levels of study of individual pupils can be satisfied. This “blended” approach involves some didactic teaching, but also group work, one-to-one support, and possibly learning-through-playing for younger children. This approach augments the teacher, as it includes the “second teacher” (other pupils) and the “third teacher” (the physical spaces/resources). These latter can act as “affordances,” both explicitly, but also as intuitive clues in the environment that indicate a wider range of possibilities for action. The additional resources needed would involve at a minimum: creation of learning zones; provision of desks that could support group work; and the availability of play and reading material. More radical approaches such as open, flexible learning for large classes with teams of teachers would be difficult to accommodate in the existing system. However, the blended approach described is tried and tested and would be entirely feasible for lone teachers in the generally large spaces that exist, provided class size is kept to the maximum of 25.
A move to the blended approach would in fact constitute a significant change in the nature of the educational experience delivered in Romanian primary schools, judged by those visited. It would depend on significant development in the teaching workforce, but change could be phased progressively to increase the chance of success. This evolutionary approach would also encourage children themselves to learn in a more self-directed way. Any change could start with Grade 1 classes and follow them into subsequent primary grades over the following years, until the whole primary system was transformed. As well as engendering a wider range of life skills amongst pupils, the approach should make the whole education process more enjoyable, social, and fun. This in turn would help address the issue of early school leaving and would motivate students to continue on for higher education.

Such a shift in pedagogy is highly consistent with aspects of classroom design. Synergies appear to exist between making changes to the physical set-up of classrooms to support adoption of a blended approach and the injection of greater ambient “individualization” into the spaces occupied by pupils. This involves especially grasping opportunities to personalize the spaces and the rich provision of child-centric furniture, creating more complex and flexible layouts in the classroom, which are evidenced to impact positively on learning rates for young children. This is especially true for success in the subject of mathematics.

It does not make sense to invest in a comprehensive range of practical changes around individualization if the didactic approach to teaching continues. However, it will be virtually impossible to shift to a blended approach without the physical changes mentioned.

5.3 Reconsideration of the school day

Primary school pupils start school around 8 a.m. and finish around noon (or a bit later for some). They have very short breaks within this four hour period, typically 10 minutes every hour or so. They leave before lunch and in most schools do not have time to go outside, so spend the time entirely in their classroom. Even in schools without a shift system, the school day for primary school pupils is still short. This is a fairly intensive, utilitarian approach to the education of quite young children. In a way, the length (or shortness) of the school day drives the pedagogy mentioned above. If more time was available, as in other countries, then wider options could be considered and the opportunity to deliver high-quality education would be greater.

Question arise about the short duration of the school day:
- Is it tradition?
- Are teachers employed full time?
- Does it save money?
- Would parents appreciate a longer day?

Extending the school day by even an hour would create the opportunity for longer breaks and the use of outside facilities. These facilities are currently very basic; investment would be needed in good quality playsets and would raise the issue of provision for coat and shoe storage outside the classroom. It is generally believed that it is good for children to get fresh air and to expend some energy to break up the formal educational activity. This links back to the notion raised above that making the school experience a positive one is very important.

5.4 The shift system

The system whereby a room is used by primary school pupils in the morning and by gymnasium pupils in the afternoon is common in Bucharest. It is not clear how prevalent it is elsewhere. It is clearly “efficient” and can save money, but carries quite a lot of negative consequences.
These mostly relate to the difficulties of setting up the classroom in an age-appropriate way for primary school pupils when older, and maybe more numerous, children use it later. It also undermines the ownership that the primary school class can feel in the space. Further, such intensive use impacts issues such as air quality.

In any development of the education sector in Romania, the shift system may be necessary at times. However, the practice should be avoided and progressively removed over time. This would significantly impact school capacity planning. It could require building new classrooms within existing schools or using “spare space capacity” released by demographic changes to obviate the need for shifts.

Where the shift system cannot be avoided, creative investment in the spaces affected should be made to render them as effectively adaptable as possible.

6 Conclusions
Section 3 explored the physical design features of a sample of five diverse Romanian primary schools through the lens of the UK HEAD Project findings on the impacts on the formal learning progress of primary school children. In general, the physical learning environments of all schools seen seemed quite capable of being brought to a good standard. The investment opportunities to achieve this were summarized in Table A4.3. Section 5 raised a range of issues noted during the visits that concern the wider educational landscape in Romania. These could be seen as contextual, but in many ways they strongly interact with the educational benefit that can be derived from the physical school infrastructure.

6.1 Strategic overview
Figure A4.3 shows the main connections between all of these factors. The wider system issues (on the right) are both interconnected with each other and impact many of the design parameters. This is especially so regarding: keeping class size to a maximum of 25; any move to a blended pedagogy; and the impacts and requirements this would demand in flexibility and ownership. This dynamic plays out slightly differently for the older schools (Schools 1 and 5), where the classroom floor areas are big (Table A4.2). But for the rest, the typical floor area is 50m²; unless the class size is kept to the official maximum, this will seriously constrain any moves to teach differently or to use the space more flexibly. The length of the school day and the shift system, separately and together, impact several parameters. If they could be changed, a range of benefits would ensue.

A range of priority investments are indicated on the left-hand side of Figure A4.3. These draw from the detailed list in Table A4.2, but focus the wide range of items into broader categories. Those linked to more extensive use of outdoor spaces are not prioritized here. This is because the evidence of the impact of external spaces on formal learning was not strong in the HEAD Project study and a move to greater activity here would depend on changes to significant contextual factors, such as lengthening the school day.
The logic behind the priority investments is given in two broad categories, as follows:

- The basic human requirements of the naturalness factors of light, air quality, and temperature are essential to provide a reasonable context for learning. In the HEAD Project study these accounted for half of the impact of the physical environment on learning.
  - Some of the schools/classrooms have already been refurbished, including new windows, lights, and ceilings. Thus planned improvements need to take into account the existing condition of the spaces.
  - For many classrooms it could be enough to ensure that, at a minimum, the following are of good quality (in good condition) and easy to use: blinds, lights, window openings, air conditioning units, and heating controls. If the windows are too small for light and ventilation (e.g., some spaces in School 3), then borrowed light and roof lights could be considered. For south-facing windows (40 percent in the sample seen), external blinds or shading are better to avoid heat gain as well as the inevitable glare.
  - It may be the case that even though the facilities are appropriate, users do not operate them, hence the proposal for air quality/temperature meters for each room (could be shared) to prompt users to address these basic environmental parameters.
  - The acoustic performance of many classrooms could be improved by introduction of acoustic ceiling tiles. This could be linked to the provision of new artificial lighting and could also work with the possibility of balanced ventilation (see below).
  - For various reasons, in some situations the above will not be sufficient to achieve good levels of air quality and temperature. In these cases the more radical (and expensive) approach of introducing a balanced ventilation system could be considered. Generally, ceiling heights in schools are sufficient to accommodate such a system.

- The other half of the impact on learning concerns individualization and an appropriate level of stimulation. These relate to “affordances” to the learning process:
The schools seen almost uniformly presented a low level of individualization and stimulation.

- General investment in flexible, age-appropriate desks and chairs, plus greatly enhanced storage and display options, is a priority.
- Extending this to create a variety of learning zones in classrooms would greatly enhance the flexibility and ownership aspects. It would also enable teachers to consider a blended pedagogy, where at present they are constrained by the limited existing classroom furnishings.
- Many classrooms could readily be decorated, twinned with creative use of the display options called for above, to move the level of stimulation up to a moderate level.

The first category aims at achieving a base level of healthy environments for learning. The second category is concerned with maximizing the positive impact of the classroom as the “third teacher”; i.e., seeing it not as a neutral container, but rather as an active contributor to the learning process.

6.2 Existing/new schools

Given the nature of this study and the data used, the above proposals are directed at existing schools. These reflect the infrastructure as it stands. In the sample seen, many schools appear to have received some “structural investment” to the buildings (and ICT) so that, irrespective of age, they are in reasonable condition. While structural surveys were not conducted, the researchers did not see leaking roofs, for example. However, significant issues remain in terms of making sure the buildings really work, in practical use, to provide healthy environments. Beyond this, a lot of scope exists for “educationally driven investment” that could bring the physical learning environments in existing schools up to a good standard.

Where new schools are planned, the issues above should be taken into account. Indeed, some aspects would be easier to address in a new school, such as: external shading; a balanced ventilation system; interesting spaces and storage within the classroom; provision of breakout spaces adjacent to classrooms; access to the outside; and alternative play options in the playground. That said, except where sheer capacity needs demand it, based on the schools seen, a reasonable level of provision can be achieved by seriously enhancing the existing infrastructure.
References


