

HEAD for Norway Knowledge Transfer Project for School Design for Learning

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May 2016

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Acknowledgements

The HEAD for Norway work was the result of collaboration between the authors of this report and Siv Marit Stavem of Norconsult AS in Oslo. Her support was crucial to the initiation of the project, arranging the site visits, organizing a stakeholder workshop and distributing this resulting report. Without her involvement the project would not have happened. Another key individual was Trond Storaker of the Norwegian Directorate for Education and Training who funded and supported the project throughout.

The work could not have been completed without the cooperation of the three schools visited and we would like to thank the Principals and staff of these schools for their open and welcoming response. In addition a range of stakeholders attended a workshop to consider the emerging findings and their honest and objective feedback was much appreciated.

As ever, any errors of interpretation, etc remain our responsibility.

Professor Peter Barrett and Dr Lucinda Barrett, Buxton, UK, 2016.

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First published by Nutbox Consultancy, Buxton, UK, in 2016.

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Executive summary

The HEAD Project, rooted in a study of English schools, has successfully isolated the factors about school design that impact on the learning rates of primary school children (~5-11 years old). This is the focus for investigation and is of great potential interest in other countries such as Norway, but care is needed to take the proven principles from the English context and to interpret them into the particularities of another country. This translation process is at the core of this report.

The assessment involved case studies of three diverse, but representative Norwegian schools, including site visits and measurements in individual classrooms, interviews with Principals and a range of teachers and the collection of a photographic record. This was augmented with a half-day workshop involving a broader range of teachers, together with designers and policy-makers, at which the initial findings were presented, tested and discussed. The sample is clearly on a relatively small scale and data on individual pupils' progress was not available. That said, the HEAD project does provide a robust initial foundation from which to work. However, the findings and suggestions need to be intelligently integrated with the provision and practices of specific Norwegian schools.

Some general observations of similarities and differences between Norwegian and English schools are noted, but a major similarity is that pupils spend the great majority of their time in one classroom and enter and leave it locally. This suggests that the dominance of the physical classroom design, over whole school level factors, found in the HEAD study can be assumed to be similar in Norway. Hence the investigation focuses at the classroom level of analysis.

Based on the survey findings, and then the “testing” of the issues and possible responses raised through the workshop, the following conclusions for Norwegian primary schools can be drawn. These apply to new school designs, but also to maximising the positive effects of existing schools. The conclusions fall naturally into a strategic SWOT format.

Strengths: The “naturalness”, comfort factors are generally being addressed well. Air quality and glare control were especially good in the schools visited.

Weaknesses: There is a question mark about the acoustic environment provided in some schools and further investigation with specialist testing is recommended to assess the size and scope of the issue. Carpeted areas, using low allergy options, like gym mats or similar, could be considered as part of the solution of any problem identified. Some consideration could also be given to possible patches of slightly low artificial light levels, as these were commonly observed.

Opportunities: Classrooms are generally generously sized, but from a physical learning environment perspective there seems to be a missed opportunity in traditional cellular classrooms to provide pupils with a wide range of learning options to meet diversity in their learning styles. In the newer “flexible” schools, the same issue arises, but on a different scale. The, typically, quite anonymous flexible spaces offer the opportunity to create a range of grouped, distinctive learning spaces. Other opportunities to consider are: the provision of “corridor libraries” subject to the availability of sufficiently broad areas within the circulation routes; and the more active use of the outside space next to the classroom as a teaching facility.

Threats: The level of stimulation in the schools seen was generally quite low. However, in the newer, flexible school it was *extremely* low. To the extent that the HEAD results for English schools show that a mid-level of stimulation is optimal for learning, and that the new school visited represents likely future designs in Norway, it can be seen why this issue is typified as a threat. The challenge is not about the choice of flexible learning spaces and glass partitions *per se*, but it is about how spaces such as this can be delivered into use in a way that provides a midlevel of stimulation. At the same time it should also be possible to enjoy flexibility without driving out distinctiveness and so ownership of the spaces.

This study of Norwegian schools, in the context of the HEAD results of English primary schools, has highlighted a range of issues. It is hoped that this fresh external perspective will help those with responsibilities for school design and the delivery of education within them to make the most of their physical learning environments.

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1 Introduction

1.1 Brief

The HEAD Project, rooted in a study of English schools, has successfully isolated the factors about school design that impact on the learning rates of primary school children. This is of great potential interest in other countries such as Norway, but care is needed to take the proven principles from the English context and to interpret them into the particularities of another country. This is to address aspects such as: climatic variations, differences in the school building stock and the particularities of the Norwegian culture and its related pedagogical practices. This translation process is at the core of this report.

1.2 Headline HEAD findings

The HEAD (holistic evidence and design) project focused on the issues of isolating the impact of physical school design features on pupils' learning rates. The project captured Teacher Assessed results for 3766 pupils in 153 classrooms across 27 English primary schools. Then via multi-level statistical analyses these outcomes were linked to measurements of the variations in the physical features of individual classrooms. The results of these analyses have been reported in Barrett et al (2015). The headline findings are that 16% of the variation in pupils' learning *progress* can be explained by the physical attributes of the classrooms.

The analysis was underpinned by, and confirmed the utility of, a novel neuroscience-informed framework (Barrett P and Barrett L 2010). Under the heading of "naturalness", this covered the normal Internal Environment Quality (IEQ) aspects, such as heat, light, sound and air quality", but also added two other dimensions, namely: "individualization" and "level of stimulation". Of the 16% impact, broadly speaking naturalness accounted for half and the other two dimensions for another quarter each. These three factors have more memorably been styled the SIN (stimulation, individualization and naturalness) typology.

The practical recommendations running from these results are spelt out in an illustrated "Clever Classrooms" guide for practicing teachers and designers (Barrett P S, Zhang Y et al. 2015).

Clearly this identification of the overall impact of school design and the relative impact of various aspects has great potential to inform the practices of designers and teachers and the imperatives / investments of policy-makers. The question addressed here is: with how much confidence can the HEAD results be taken up in the Norwegian context?

2 Sample and approach

2.1 Overview

Given the HEAD study's focus on the primary school stage (~5-11 years old), this is the focus for investigation in Norway so that, amongst the complexity addressed, at least this aspect is consistent between the countries.

To achieve the necessary translation a mechanism was designed that had the following features. Thus, the project:

- Involved the UK researchers with both explicit knowledge and tacit understanding of the HEAD findings;
- Involved a Norwegian expert in school design;

- Engaged with a range of representative real life schools;
- Engaged with a broader range of teaching practitioners; and
- Engaged with school designers and policy-makers.

2.2 Programme of activities

In order to progressively move from the English knowledge base to advice and guidance that can be used with some confidence in Norway, the following programme of activities was followed:

- *Three case studies* of diverse, but representative Norwegian schools, including site visits and measurements in individual classrooms, interviews with Principals and a range of teachers and the collection of a photographic record.
 - The output from this was an assessment of the significant similarities and differences between the English and the Norwegian situation, in the context of the HEAD factors and around the dimensions of: climatic variations, differences in the school building stock and the particularities of the Norwegian culture and its related pedagogical practices.
- *A half-day workshop* involving a broader range of teachers, together with designers and policy-makers, at which the initial findings were presented, tested and discussed.
 - The output after this workshop is this report setting out the extent to which the HEAD results can safely be applied in the Norwegian context and identifying areas where additional interpretation is needed.

2.3 Limitations

The HEAD project is founded on a pupil-centric model, where the SIN factors are driven to a great extent by their 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. It seems likely that many of these aspects will translate from children in one country to another, but this cannot be assumed, hence the need for this project.

The HEAD project extended over three years with a team of four researchers gathering data about many English classrooms and the academic performance of the pupils in them. The HEAD for Norway project has the advantage of building on these results, but is limited by the amount of data it was possible to gather. Only three schools were visited and data about pupils' progress was not available.

Thus, it is not possible to replicate the original HEAD analysis and, other things being equal, the findings are dependent on the extent to which the variety in the three sample schools picks up the range of distinctive features of the Norwegian primary school sector. The schools were selected to be varied, which strengthens the approach and, to further address the issue of representativeness beyond this small sample, the workshop involved a wider range of teachers / schools and others with a broad interest and experience of this sector. Their feedback provided additional confidence that the insights from the three case study schools do raise issues that are relevant across the sector.

2.4 The sample schools

The three schools are to be kept anonymous, but some broad descriptive details are now given to indicate the diversity of aspects they provide.

School 1

This school differs most markedly from both the English schools studied in the HEAD research and the other schools in the sample. It is very new and can be said to broadly represent the type of school now being built in Norway. It has children from 6-16 years of age, with an overall roll of over 550 pupils. Academic achievement is said not to be the highest and many pupils have Norwegian as their second language.

School 2

This school has buildings from two eras (nearly one hundred years old and twenty years), but they combine well on the site. It has children from 6-11 years of age. The vast majority of the 550+ pupils on the roll have Norwegian as their first language. The school's reputation is for high academic attainment.

School 3

This school is in the countryside and is about 15 years old, with less than 400 pupils on roll. About 30% of the pupils have Special Needs. Most pupils have Norwegian as their first language and academic achievement is high. Population growth within the locality has meant adjustments are starting to be made to the use of space, with three smaller classes of pupils in the earlier years that coalesce later to two larger classes.



2.5 Survey methodology

During each school visit the study team replicated the data gathering techniques used in the English HEAD study, in order to capture a rich picture of the physical characteristics of the classrooms. First a discussion was had with the Principal or Vice-principal to gather general information about the school and to identify which diverse range of classrooms could be visited. Then within each of the three schools four or five such classrooms were investigated in detail, giving a total sample of 14 classrooms and associated spaces.

In each classroom:

- Architectural measures were taken, such as: room dimensions and learning zone layouts, plus an extensive photographic record.
- A range of further factors assessed included: how much control there was of the classroom environment via heating controls and layout flexibility; and the colour and visual complexity of the space.
- In addition five spot meter readings (temperature, light, humidity, CO2 levels, acoustics) were taken in each of the rooms to assess the environmental conditions at the time of the visit, in order to provide possible prompts regarding problem areas.
- Lastly, a questionnaire-based interview with each teacher was carried out, investigating their experience of their classroom, over the whole of the year.

The analysis then involved identifying similarities and differences between the sample classrooms and schools, and with English practice, all within the SIN framework.

3 Survey findings and comparisons

First, to provide some context, a number of general similarities and differences between English and Norwegian practices were noted and these are summarised briefly here.

Practices in Norway and England that seem similar are:

- Pupils spend most of the day in their own classroom generally
- Entry to classrooms at the start and end of the day through multiple entrance doors associated with specific classrooms, rather than via a main school entrance.
- Having to accommodate growth in school roll numbers, through expansion of class sizes or provision of new or converted classrooms.
- Provision of personal storage space for pupils.
- Use of technology in the classroom, with smart boards and laptops used to support lessons.

Practices that seem to vary somewhat are:

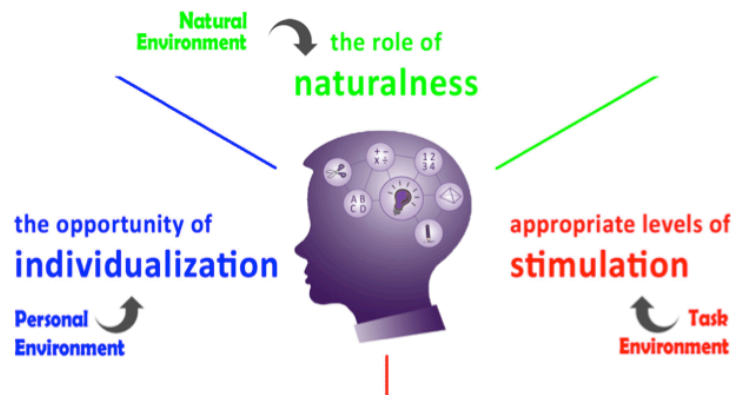
- Parents usually send children to their local school in Norway, with much less reliance on school buses or car transportation than in England.
- Security of the school perimeter is much more relaxed than in England.
- The Norwegian school day starts a little earlier and finishes quite a bit earlier, resulting in a shorter time at school for pupils, especially younger children, compared with England.
- Breaks are quite long and pupils appear to bring packed lunches, whereas school dinners and dining halls are generally a feature in English schools.
- A tendency towards smaller class sizes compared with the almost universal class of 30 (and sometimes over) in England.
- More separate, specialist rooms available, extending to woodwork and metalwork, however, seemingly less art and craft activity in the classrooms themselves, than is typical in English schools.
- Spaces provided for after school care, and these spaces not typically used during the school day.
- Greater use of team teaching and more qualified teachers seem to be available. In England there would commonly be one qualified teacher with a teaching assistant per class.
- Teachers have personal office space, normally alongside those they teach with, whereas in England teachers just have a space in their classroom.
- The schools all had large play areas with different zones and activities available. In England this would vary much more, with some city schools on cramped sites having very little provision.



Nothing noted above suggests that the focus mainly on the classroom level, found to dominate in the HEAD results, would be any different in Norway. In particular the fact that the pupils enter and leave by entrances near their classroom and spend the great majority of their time in the same space aligns strongly with the English experience. So, within these general observations, the following sub-sections address, at the level of the Norwegian classroom, each of the ten design parameters that emerged from the HEAD study as being significant.

These parameters nest within the three SIN principles of the HEAD project, as follows:

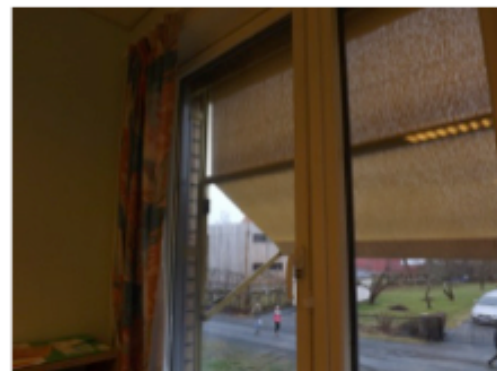
- *Naturalness*: light, air quality, temperature, sound and links to nature;
- *Individualisation*: flexibility, ownership and connection;
- *Stimulation* (appropriate level of): complexity and colour.



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 various orientations were noted, but mainly to the South-East, which would mean direct sunlight into the classroom. However, good quality external shading was generally provided, either permanently or via manual or electric blinds. The last were noted to be rather slow to operate and too limited to exclude all glare. Two of the schools also employed internal curtains to provide an extra option, not something seen in English schools. Only a small amount of occlusion of the windows by furniture or display material was noted. In all classrooms modern light fittings were noted.

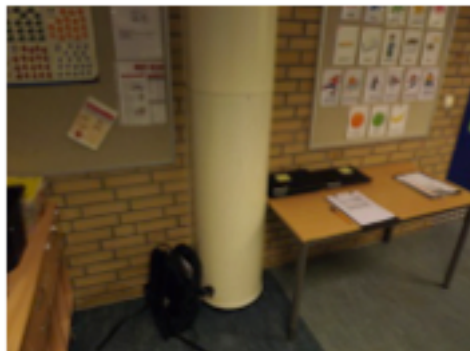


Two of the schools displayed lighting levels of 250-500 lux in the classrooms with the lights on. In the other school the levels were 400-750 with the lights on. The weather was dull on the visit days, however, taking a datum of 300 lux for study activity, it would seem that the light levels are generally reasonable, if a bit low in some areas of the classrooms.

3.2 Air quality

Good air quality is essential for effective brain functioning. The schools visited generally had quite small opening windows, but employed balanced ventilation systems. The result was that CO₂ levels (as a surrogate measure of air quality) were generally very good. In two

schools they consistently fell between 530-780 ppm and in one case were a bit higher at 850-1000 ppm. This last instance is approaching the threshold of good air quality for schools of 1000 ppm, although 1500 ppm is also suggested by some. Maybe as a result of the systems being used, humidity levels were at the lower end of the acceptable range, typically at 35-40%.



To emphasise how good the air quality is found, in the HEAD English school sample, much greater variation in CO₂ levels was noted with many instances well above 1500 ppm. This was the outcome of a reliance on the use of opening windows by occupants, where sometimes the openings were only small and on other occasions the windows were hard to reach or operate. It was also compounded by generally smaller classrooms and bigger classes of children. The Norwegian balanced ventilation systems seen appeared to work very well, although if they failed there is typically an inadequate provision of opening windows.

3.3 Temperature

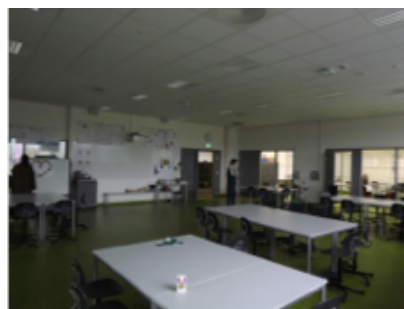
Generally cooler classrooms are optimal for study. The classrooms visited were remarkably consistent at around 21°C, albeit a bit cooler in one school (down to 18°C) and a bit hotter in another (up to 23°C). The visits were in the Spring and so not the hottest part of the year, but there would appear to be effective systems in operation to maintain individual classrooms at target temperatures on a local basis. Active control by occupants is not obviously encouraged, but only in one instance was a complaint noted by the teacher in a classroom. The temperatures are maybe slightly high for children, for whom around 18-19°C is thought to be ideal, but are ideal for teachers. Over and above the control of heating, classrooms were provided with external shading where necessary so avoiding heat gain from direct sunlight.

In the English schools local control of heating was found to be desirable, but in fact the approach of centralised control targeted at the local spaces, found in the Norwegian schools, seems to achieve the desired result.

3.4 Sound

Unwanted sound or noise can disrupt learning and can come from outside or elsewhere in the school, or within from classroom activities. The schools studied were generally isolated well away from noisy roads etc and disruption from playgrounds etc was only mentioned in one school, where of necessity, play / meal times had to be staggered.

In terms of noise within the classroom, this is hard to assess with them in use, however, noise levels were recorded and, despite quiet children and even then a lot of “hushing”, readings were quite high (up to 65-70 dB with just quiet talking). It seems likely that this is a result of extensive hard surfaces, with sheet flooring in all schools and un-plastered walls in one schools and extensive glass walling in another, as shown here.



In the HEAD English schools, acoustics was not found to be problematic, but there carpet tiles on the majority of the floor area is normal, with plastered walls, quite a lot of furniture breaking up the space and generally smaller classrooms anyway. There would seem to be a prime facia case for a fuller assessment of the acoustic performance of Norwegian schools, especially if there is a trend towards more hard surfaces and maybe considering the issue of carpeting, albeit with health implications.

3.5 Links to Nature

This was another factor that was expected to be important in the HEAD study, but in fact did not emerge as a major factor overall, but did emerge as important just in relation to the subject of writing. The Norwegian schools seen generally had reasonable views of nature through windows with low sills. In two schools wood was used in the classrooms for furniture and windows. Direct access to the outside was mediated via cloak / boot rooms.

In England access direct to the outside is sought, especially for younger children (Grade 1 and 2). It may be that there is a difference in perspective here, with practical access to the playgrounds throughout the year being emphasised in Norway. Whilst in English practice (shown here) the external space immediately outside the classroom is potentially seen as an extension of the classroom, to be used for learning activities when the weather permits.



3.6 Flexibility

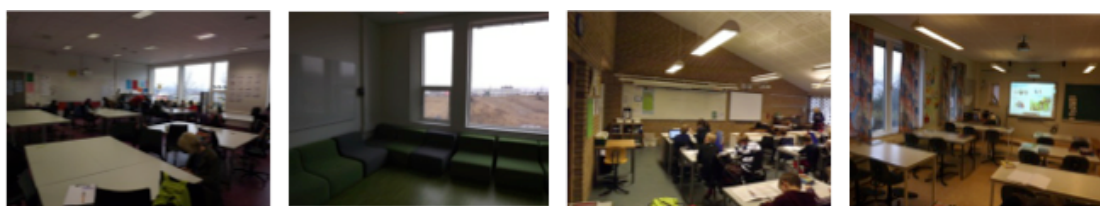
This is a complex area focused on the physical shape and layout of the classroom. Taking this in sections, starting with the general provision, classrooms in the Norwegian schools seen were really quite big. Apparently the design target is 2m^2 of floor area /pupil. This is exceeded in the two older schools at around $2.15\text{-}2.5\text{m}^2$, whilst in the newest school the provision is more around 3m^2 . The rooms are generally of a rectangular, simple plan shape, albeit in the newer school with grouped ranges of related spaces. This compares very favourably with the HEAD English schools where an area of around 1.84m^2 per pupil would be typical.

Access to break-out spaces is generally a positive feature as it provides the teacher with options to create small groups or to carry out one-to-one coaching. Two of the schools generally had a classic provision of a shared smaller room between pairs of classrooms and this appeared to working well, although in one of these schools with relatively smaller classrooms, groups sitting in corridors were common too, which is not ideal. The newer school had very extensive options for using spaces of a variety of sizes, albeit otherwise quite undifferentiated. In the English schools studied no examples of such extensive

provision of spaces as this last case were seen, but the immediately accessible, often shared, break out room, or purpose built areas in widened corridors immediately outside the classroom, were seen to be beneficial.

Storage options are needed for equipment, etc. For the pupils, cloakroom and locker provision seems generally good in the Norwegian schools seen. In addition drawers are provided for their work in the classrooms. For the teachers and teaching equipment / materials there was some call from those spoken to for more provision in two of the schools. In one of these the extensive use of glass partitions did limit the options. This is all a similar pattern as in England, except for a major distinction and this is that it would be very unusual for English primary school teachers to have their own office space, away from the classroom. They would very typically just have a small area in their classroom, sometimes a desk, often not. The provision in Norway of team teaching offices, grouped in pods away from the classrooms and adjacent to the staff room is a significant difference. It must change the dynamic amongst the teachers of course, but it must also take some pressure off the floor space and storage needs in the classroom itself.

Another aspect of flexibility is the availability of wall space to display teaching aids and pupils' work. In one school seen in Norway there were plenty of options and the teachers were using them extensively. In the other two schools, options were limited, in one case by a combination of un-plastered walls and folding partitions, and in the other case by a near universal use of glass partitions. The outcome was that in both cases there was relatively little display material on show and where it was it was often in inappropriate positions, such as too high up for children to see. Norwegian teachers spoken to clearly would have liked more options and this was most noted in the newest school where some small clip strips were all that seemed available. Thus, it is apparent that this is a pedagogical tool that is sought and, where available, is used. In the English schools studied extensive use of displays on the walls is very much the norm, but cases here were noted where a combination of glazing and storage could result in situations where options were limited and this was seen as a problem.



The last aspect of flexibility is the way in which the classroom is set up. It can be seen from above that the Norwegian schools seen, compared with the English schools studied, generally have more space per pupil and less pressure on that space owing to the teachers having their own separate offices. Thus, Norwegian schools would appear to have opportunities to use the space they have in a variety of ways. That said the plan shape is generally quite simple and so different “zones” are not automatically suggested, except in the newer school where there are various contiguous spaces. In practice, the Norwegian schools seen displayed a low level of differentiation in the use of the classroom spaces. In the newer school there would be one smaller space with some soft seating, but nothing else and there was a basin for washing hands, but not a “wet area” for art etc. In the other two schools, within their single classroom spaces, there was some use of zones: maybe a sink (but not much storage etc associated) and possibly a reading area. In nearly all the classrooms visited in Norway the normal disposition of desks was in rows, or pairs, facing

towards the front of the classroom. This quite often results in a clear area to the front or back of the room.

In contrast, in the HEAD English schools, multiple “learning zones” were clearly a central part of the pupil-centred pedagogy practiced. This was especially evident in the classrooms for the younger children, where “play-based learning” is the norm. In the HEAD study results the indications for effective learning in the earlier years are a wide range of learning zones nested naturally within more complex floor plans, whilst 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 will work there individually or in groups, when not accessing one or other of the learning zones or breakout spaces. This high level of options does seem to offer a good range of alternatives to possible variations in pupils’ learning styles. In smaller English classrooms it could also result in a certain amount of congestion.

3.7 Ownership

Here the focus is on the extent to which the pupil can feel the classroom is *their* space. This emerged in the HEAD study as an important factor generally, and especially in respect to progress in mathematics.

In the schools visited in Norway most rooms were of quite a simple layout, although one with a rising ceiling and un-plastered walls did have a stronger character. In the newer school the only distinguishing feature was some colour coding of the floor finish. Limitations in two of the schools in the display areas available on walls have been discussed above, and this had a knock-on effect on the extent to which pupils’ own work, or group work, was evident on classroom walls. However, opportunities had been grasped in the two older schools to display pupils’ work in the corridors. Pegs, lockers, and classroom storage had generally been personalised, with pupils’ name labels provided. The room furniture was of good quality and adjustable chairs were provided generally, allowing pupils of different heights to sit comfortably. The desks were quite bland and generally larger for older children, but in one school this was not the case. There was little use of classroom furniture to create distinctive spaces within the classroom.



Of the English schools studied, more complex / distinctive room shapes were more common, accentuated by the use of furniture to create zones (see above). Pupils’ work as individuals and from group work was very commonly displayed on the walls. Furniture tended to be more “childish”, quite often in bright colours. However rise and fall chairs were nowhere evident in the English schools. Personalisation of hooks and trays with pupils’ names was similar to the Norwegian practice.

3.8 Connection

This factor concerning way-finding around schools, did not emerge as significant in the main HEAD analysis, but did figure in a sub-analysis with positive impacts specifically for reading, and especially in relation to disadvantaged children. This would appear, on further consideration, to be connected



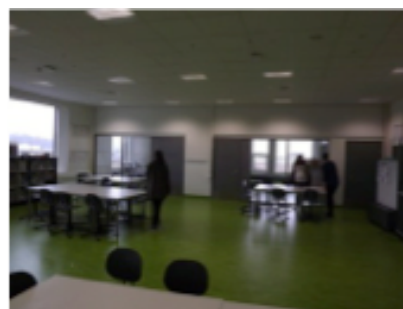
with the provision in wider corridors of accessible mini-libraries, or “corridor libraries” as shown above in an English school.

In the Norwegian schools visited, corridors were generally quite generous in width and, in two of the schools, pupils’ artwork was used to aid orientation. In one case a few impressive “public art” pieces provided orientation where they were found. None of the schools had provided “corridor libraries”.

In the English schools studied it was felt the impact of routes through the school was muted in its effect because pupils typically entered the school adjacent to, or directly into, their classroom, where they spent most of the day, and so the classroom was reinforced as the centre of their existence within the school. This same practice was noted in the Norwegian schools. That said, it was very unusual for the English schools to be anything other than single-storey, whereas the Norwegian schools were all on at least two levels, albeit mitigated in two of the schools seen by building into slopes.

3.9 Complexity

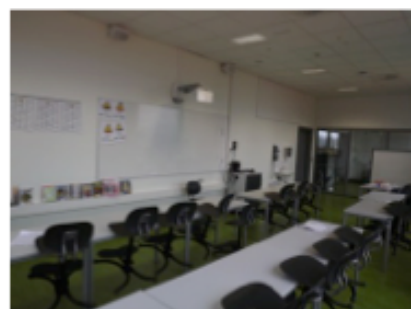
Visual complexity was found to be optimal for learning at about the mid-point of the variation noted in the English sample. That is the effect should not be either too chaotic or too bland. This aspect is made up of two components, the first of which is the inherent visual complexity of the room / ceiling shape. As already implied, except in one case, the Norwegian schools seen were quite plain in this respect. The other aspect concerns the use of visual displays on the walls and this was more variable owing to differences in the availability of display space as discussed above. The combined result was that two schools had quite a lot of classrooms with broadly appropriate levels of visual complexity, either owing to fairly complex visual spaces and some displays; or simpler spaces and a higher level of display. In the newer school there was a low level of visual complexity to the spaces and only minimal display material leading to a very low overall effect, as shown here.



In the English schools studied it was quite common for there to be an optimal or a higher than desired level of visual complexity. The newer Norwegian school is simply off the scale in terms of how low it is on this criterion.

3.10 Colour

This factor was again found to be curvilinear, with the optimum use of colour being made up of a calm backdrop with highlights provided by brighter colours on a “teaching wall” or a recess and in the furniture. Two of the schools provided this calm backdrop, in one case with pastel shades on the walls and in another with yellow brickwork. In these cases the teaching wall was not differentiated in any way (which can be beneficial for focusing in this direction), nor were there other focal areas of colour. That said some additional highlights were provided by a variety of features, running from coloured curtains to natural wood for some furniture and fittings. Overall the effect in these two schools was generally around the mid-level of stimulation. The same cannot be said of the newer school where, apart from very brightly coloured



flooring, there was a complete absence of colour owing to the glass partitions and the choice of white / grey tables and black chairs. Oddly in this school the staffroom did display some of the colour features on the walls and in the furniture.

In the English schools a range of colour stimulation was found. The use of coloured furniture was more common than in the Norwegian schools seen, but curtains were not to be found.

4 Discussion and summary of survey

This section reflects more broadly on the above detailed survey findings, structured using the three main design principles (SIN).

4.1 Naturalness

This design principle is driven by the following parameters: light, air quality, temperature, sound and links to nature. The Norwegian schools seen generally perform well on these fronts. The issues that emerge for the schools seen are as follows:

- Levels of lighting maybe low in some areas?
- Humidity levels quite low?
- Hard flooring and in places walls may lead to the problematic acoustic performance of classrooms – this should be checked, especially where glass walls being used.
- Opportunity to use outside space adjacent to the classroom could be explored.

4.2 Individualisation

This area involves the parameters of: flexibility, ownership and connection. The Norwegian schools seen have generously-sized classrooms compared with UK schools, but they tend to be used in a relatively undifferentiated way, with desks in rows or pairs facing the front. Teachers in Norway have their own offices, which does not happen in the UK and takes more pressure off the classroom space. The issues that emerge for the schools seen are as follows:

- In the more traditional schools the opportunity to create stronger sub-areas, or differentiated learning zones, could be considered. This could involve the use of furniture, colour, lighting and furnishings. In the newer school there is a clear opportunity for the linked areas to deliver distinctly different learning environments. This, of course, depends on the pedagogical imperatives being followed, but if there is a desire to teach differently, led by a pupil-centric emphasis, this leads naturally to the notion of making available alternative options to respond to variations in pupils' learning styles.
- Linked to the above, and given the relatively generous class sizes found even in the older schools, there is a parallel opportunity to experiment with different configurations of desks, maybe using islands to support individual and group work. Again this is closely connected to issues of pedagogy. The important thing is for there to be a "fit" between the spatial provision and the teaching and learning strategies. This is why the above have been suggested as opportunities to be explored.
- Ownership of the classrooms by the pupils themselves is enhanced where the spaces are distinctive, whereas many seen were quite bland (see section below) and limited the scope to display pupils' individual or collective work. The issue of inadequate wall display areas does appear to impact heavily on teaching practice.

4.3 Stimulation

This involves visual complexity and colour and the optimum for studying has been found to be a mid-level of stimulation. The significant area identified here concerns the newer school seen especially.

- Classrooms in this school had: glass walls, hard flooring (providing a block of colour), generally undifferentiated box-like rooms, very limited scope for wall displays, white walls, and white, grey and black furniture. As a result the level of stimulation owing to the combined effect of visual complexity and colour is very low indeed. Far lower than anything seen in the HEAD UK schools. Given a mid-level of stimulation is optimal for children's learning, this raises serious challenges for the users of these spaces.

5 Feedback from workshop

Taking the findings and analysis from the survey, a workshop was hosted at the Directorate of Education and Training in Oslo on 27 April 2016. Twenty varied stakeholders to the school design / provision process were present, drawn from across Norway. This included teachers, designers, clients and policy actors. Thus, a rich context was provided within which to explore the issues raised by the survey. In particular, the extent to which the initial findings make sense and can stimulate feasible action, informed from diverse viewpoints and locations. The findings were presented and then an open discussion held, followed by two sessions of group work around particular issues. The main points raised were:

- There is a public (Government funded) school system across Norway with quite considerable consistency in aspects of school operation, including pedagogy. This increases the likelihood that the findings of the sample schools seen can translate more generally. What was seen from these three schools was clearly familiar to the stakeholders and they did not highlight any significant gaps. An exception is perhaps the very small "village" school, although the principles discussed were thought to apply here too.
- On newer "flexible" school design with large teaching areas and teams of teachers, there is in fact a long tradition of experimentation in some parts of Norway. This exploration of different spatial use, for example, the creation of explicit learning zones, was thought to be (educational) "fashion-driven" to an extent. That said, in relation to the open, flexible approach, arguments were put forward that it resonated with notions of team working, cooperation and transparency, especially amongst staff. This can be seen potentially to link to the teachers having their contiguous office spaces and time in the afternoon to prepare lessons and mark work alongside colleagues.
- As the "flexible" approach perhaps represents a trend, it should also be recorded that it was thought to carry pros and cons. Many teachers are not keen (especially initially) on the glass walls, whereas school principals seem to value the ease of observation it brings. Distraction for the children seems to be less a problem in practice than it might seem in theory. An important insight was the suggestion, from experience, that flexibility can lead to problems of ownership. If everyone "owns" everywhere, then no-one owns anywhere. The counter argument was put that the ownership needs to be engendered at the bigger group level, focused towards the linked spaces in their locality.
- It was accepted that, in general, it would be good to create a variety of distinctive learning opportunities to respond to variety in the pupils' learning styles and to engender active learning by the children. In the traditional school layouts, where the spaces are quite generous (compared with the UK) this could argue for the more active use of learning zones and less use of rows of desks facing the front. In the large

“flexible” spaces in newer schools this could lead to the creation of specialist (maybe subject-specific) sub-spaces in a given teaching area.

- It was accepted that hard flooring, and sometimes wall finishes, do seem to lead to problems of acoustics (especially in larger spaces) and that teachers do need wall areas to use for the display of teaching material and pupils’ work. It was also accepted that under-stimulation was an issue that should be addressed. This was especially so in the sort of configuration of the newer “flexible” school, where greater creativity was felt to be needed in the use of colour, furniture, etc to provide both display areas and increased ambient stimulation through the use of colour and visual complexity.
- A general issue was raised as to whether school design was maybe too dominated by an adult perspective and should perhaps accept the child’s perspective more. One example was colour, where it was pointed out the HEAD findings actually suggest the functional optimum for learning is somewhere between the “corporate” adult view and the bright colours children are thought to prefer.
- Outside of the classroom, the notion of “corridor libraries” was felt to have merit, subject to the demands of clear circulation routes. Also thought worthy of consideration was the more active use of the outside area immediately adjacent to the classroom as a teaching resource.

6 Conclusions and recommendations

Based on the survey findings, and then the “testing” of the issues and possible responses raised through the workshop, the conclusions below can be drawn. These are driven by pupil-centric principles concerned with the provision of optimal physical learning environments. As such they apply to new school designs, but also to maximising the positive effects of the sector’s majority provision, delivered by existing schools. The conclusions seem to fall naturally into a strategic SWOT format, and so for simplicity have been structured in this way.

6.1 Strengths

The “naturalness”, comfort factors are generally being addressed well. Air quality and glare control were especially good in the schools visited.

6.2 Weaknesses

There is a question mark about the acoustic environment provided in some schools and further investigation with specialist testing is recommended to assess the size and scope of the issue. Carpeted areas could be considered as part of the solution of any problem identified (there are low allergy options, like gym mats or similar). Some consideration could also be given to possible patches of slightly low artificial light levels, as these were commonly observed. It was noted that humidity levels were towards the lower end of the acceptable range.

6.3 Opportunities

Classrooms are generally fairly, and sometimes very, generously sized, at least compared to provision in the UK. In traditional “cellular” layout schools there are often opportunities to use the space available in a more differentiated, active, way through the creation of activity-specific learning zones. This of course depends on the pedagogical choices of the teacher, but from a physical learning environment perspective it seems to be a missed opportunity to provide pupils with a range of learning options to meet diversity in their learning styles.

In the newer “flexible” schools, with a range of spaces available to a large group of pupils being taught by a team of teachers, the same issue arises, but on a different scale. The,

typically, quite anonymous flexible spaces offer the opportunity to create a range of grouped, distinctive learning spaces, maybe by age, maybe by subject, but actively realising the potential of the spaces to support distinctive learning experiences.

Other opportunities to consider are: the provision of “corridor libraries” subject to the availability of sufficiently broad areas within the circulation routes; and the more active use of the outside space next to the classroom as a teaching facility, where this can be readily accessed.

6.4 Threats

The level of stimulation in the schools seen was generally quite low. However, in the newer, flexible school it was *extremely* low owing to a combination of little colour in the decorations or furniture, to some extent the result of a lot of glass partitions, which compound the problem by providing little chance of mounting wall displays, all within a very plain physical space. To the extent that the HEAD results for English schools show that a mid-level of stimulation is optimal for learning, and that the new school visited represents likely future designs in Norway, it can be seen why this issue is typified as a threat.

The challenge is not about the choice of flexible learning spaces and glass partitions *per se*, but it is about how spaces such as this can be delivered into use in a way that provides a midlevel of stimulation. At the same time it should also be possible to enjoy flexibility without driving out distinctiveness and so ownership of the spaces by the pupils working in the group of spaces provided.

6.5 In conclusion

The HEAD study of English primary schools did find clear aspects of the design of learning spaces that had significant impacts on the learning rates of the children experiencing them. These have been published in the papers and reports referenced below and in the case of the “Clever Classrooms” report there is practical advice for designers and teachers. What becomes clear in that publication is that there are many potential action points for both users of existing school buildings and for designers of new schools. The original question that stimulated this study was: do these results apply to Norwegian schools for young children (5-11 years old)? From what has been seen, discussed and reported above it can be seen that:

- Some care is needed in the translation of the HEAD results from the English to the Norwegian context. However, the fact that the SIN model used is person-centric does appear to mean that the HEAD results can enable Norwegian school spaces to be objectively assessed at the level of design principles and parameters.
- Throughout this report *assessments* of the SIN factors have been given and, for example in the case of naturalness the standard in Norwegian schools seems to be generally good.
- In other areas the HEAD analysis enables *opportunities* to be suggested from the comparison of English and Norwegian provision, for example in relation to “corridor libraries.
- On some issues *challenges* could be raised owing to the new visibility of factors owing to the HEAD results about children and learning, for example about the low level of stimulation provided in some situations, and asking the question as to how this can be addressed.

- Overall, nothing in the survey work or workshop suggested that the HEAD results do not provide useful guidance for the Norwegian, so long as the suggestions made are intelligently integrated with the provision and practices of specific Norwegian schools.

This study of Norwegian schools, in the context of the HEAD results of English primary schools has highlighted a range of issues. It is hoped that this fresh external perspective will help those with responsibilities for school design and the delivery of education within them to make the most of their physical learning environments.

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