buildings

MDPI

Article

Pedagogical Walks through Open and Sheltered Spaces: A Post-Occupancy Evaluation of an Innovative Learning Environment

Anna Kristín Sigurðardóttir [1,*], Torfi Hjartarson [1] and Aðalsteinn Snorrason [2]

[1] School of Education, University of Iceland, v/Stakkahlíð, 105 Reykjavik, Iceland; torfi@hi.is
[2] ARKÍS Architects, Vesturvör 7, 200 Kópavogur, Iceland; alli@ark.is
* Correspondence: aks@hi.is; Tel.: +354-6922742

Abstract: This paper describes a post-occupancy evaluation of a school building in Iceland that combines open and confined spaces, designed for manifold pedagogical approaches and multiple uses. The school was built for students at the primary and lower secondary school levels and serves a neighborhood still under construction in a coastal town about 40 km from Iceland's capital area. The building will be an essential part of a larger complex, constituting the heart of its neighborhood, including a compulsory school tied into a preschool, a public library, sports facilities, and a site for local events. Our aim was to map how plans for this innovative learning environment have succeeded, as viewed by practitioners and students. Several research interviews with leaders of the building project and a method called pedagogical walk-throughs were used to collect data. Four focus groups of teachers, teaching assistants, and students were asked to review selected sections of the building. The results serve to show the strengths and weaknesses of the design, as perceived by participants, as well as commend the methodology applied. They provide insights and considerations of value for anyone involved in the design and application of educational spaces.

Keywords: school architecture; school design; school building; innovative learning environment; open plan school; post-occupancy evaluation; pedagogical walk-through

check for updates

Citation: Sigurðardóttir, A.K.; Hjartarson, T.; Snorrason, A. Pedagogical Walks through Open and Sheltered Spaces: A Post-Occupancy Evaluation of an Innovative Learning Environment. *Buildings* **2021**, *11*, 503. https://doi.org/10.3390/buildings11110503

Academic Editors: Pamela Woolner and Paula Cardellino

Received: 15 September 2021
Accepted: 19 October 2021
Published: 25 October 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

Building a new compulsory school to provide education of quality—by current standards and for an unforeseen future—is an investment involving risks at many different levels for any community, large or small. A growing research body on the physical learning environment as a factor of schooling has yet to deliver extensive and profound evidence that would help to explain to what extent and in which ways architectural design affects student learning and teaching patterns. A recent review of the literature [1], however, leads to the conclusion that the physical environment does indeed affect processes of teaching and learning and could be assumed to have an impact, for better or worse, on student outcomes [2,3]. To invest in innovative school buildings and try out new design forms, registering and analyzing their effects on teaching and learning, can be viewed as an opportunity to enhance learning processes and improve outcomes for students.

Recent advances in the design of school buildings in Iceland are well documented [4–6] and reflect paradigm changes from traditional 19th- and 20th-century design forms, based on conventional classrooms along corridors, towards open and flexible learning spaces designed for teamwork and more student-centered approaches. This development has not always been clear-cut nor free of difficulties, but most schools or school extensions built in this century have been designed to accommodate open and flexible approaches in school practices [6]. A similar trend has been apparent in other parts of the world, including Sweden [7], Finland [8], Australia [9], and many other countries [10], often involving considerable challenges for school leaders, teachers, and students [11]. Stapaskoli, a

compulsory school designed by ARKÍS and inaugurated in 2020, is the subject of this study and a current case reflecting this national and international development. Our aim was to map how political, pedagogical, and architectural intentions behind its innovative facilities are succeeding, as viewed by different stakeholders—in particular, practitioners and students.

The following three research questions guided our investigation:

- What were the political, pedagogical, and architectural intentions guiding the design of the building?
- How do students and staff view the strengths and weaknesses of the building as an environment for teaching and learning?
- What do different stakeholders see as innovative features of significance in the new building?

The review of Duthilleul and associates [1]), as well as four themes developed by French and associates [12] to describe the conditions for a successful adaption of school practices into a new and innovative learning environment are used as points of reference in the review of our findings.

Academic interest in successful educational improvements has gone through several phases over time, leading to the current focus on a systemic approach, and emphasizing the complexity of educational systems and the significance of coherence and interdependency among their different components [13,14]. The physical learning environment is one such component that has to be in alignment with other components for educational efforts to succeed [12,15–17], which helps to underline how urgent it is to study new models of design and how they might support intended pedagogical approaches.

What counts as an innovative learning space is debatable and can be viewed from many perspectives, a physical point of view, of course, but also pedagogical, psychosocial, or perhaps technical angle [18]. We tend to classify as innovative any deviation from the traditional grammar of schooling, with classrooms of similar sizes lined up along corridors [7], and regard such design forms as open and flexible learning spaces, designed for collaboration and aiming to meet students with varied needs in optimal ways (see e.g., [5]). Bradbeer and associates [18] concluded, after reviewing twelve studies, that an innovative learning space would always be laid out to incorporate innovative pedagogies that aim to induce better learning outcomes and more competent students.

An interesting aspect to consider is where ideas about innovations come from; another is what the process from ideas to well-established practices looks like. Duthilleul and associates [1] found broad that collaboration between different stakeholders is essential at all phases of the design process. Collaboration takes place at the initial planning phase, before staff and students move in, as well as in the first months of practice, as students and staff adapt pedagogical work in their new environment. Collaborative post-occupancy evaluation, finally, serves to support such adjustments, evaluate how spaces suit educational needs, and assess whether facilities are used as intended. Deed and Blake [19] suggest a model that explains how teachers adapt their practice toward a flexible learning environment, starting with an awareness of the possibilities for change, then experiments, and finally, coherence. The last step includes the integration of spatial affordances and pedagogy, which calls for a purposeful interaction between teachers working together. Teacher agency and collaboration, obviously, are of the utmost importance in this process of adaption [7,8,20].

Different studies seem to suggest that changes in school spaces may have enhanced teaching and learning practice, but how this happens and to what effect remains debatable. Woolner and associates [17] maintained in a study on two schools in northern England that physical settings tend to influence pedagogical and social practice but could both support and constrain desired change. Australian teachers [21] reported a shift in pedagogy towards an increasingly student-centered approach as they changed their traditional classrooms into flexible learning spaces, while a case study in Iceland [5] showed how teachers of younger students adapted more easily to an open and flexible learning environment than

teachers at a senior level. Researchers do, however, in spite of such evidence, seem to agree that more is needed to illuminate to what extent and in what ways physical changes in school buildings affect educational practices [7,12,16,17]. Giving teachers ample time and opportunities to prepare, adapt, and reflect upon their preferences and practices in different phases of a construction project, preferably in some context with academic research, is, therefore, essential.

French and associates [12] identified four main themes that represent factors that affected how the staff at four schools in Australia and New Zealand succeeded in adapting to innovative learning spaces. The first one concerns teacher culture, empowerment, and opportunities to try out different things based on teacher relationships, collaboration, and reflection. The second theme is focused on the creation of constraints that make it harder for staff members to fall back to conventional ways of working. The third theme emphasizes structures that embrace new and different processes but maintain, at the same time, ties to older and more familiar procedures to bridge old and new behavior (see also [7,18]). Finally, there is the need for an accountability system to ensure that the new space is used as expected and new methods are firmly incorporated into the school culture.

Assisting staff members and students, just like teachers, need to find their place in a new setting. Grannas and Frelin [22] are among the few who have reviewed the perception and wellbeing of staff members other than teachers in this respect. They revealed that the architecture can both enable and limit the opportunities assisting staff members have to conduct their work; the physical environment can determine not only what is done, but also how, when, and where it is done. Senygit and Memduhoglu [23], on the other hand, interviewed children in Turkey and found out that classroom design elements, such as brightness (daylight), spaciousness, density (number of students), flexibility, and functionality, were considered important.

Kariippanon and associates [21] noted positive changes in student engagement and wellbeing, as well as the level of student choice and self-regulated learning, as traditional classrooms in Australia were transformed into flexible learning spaces. Secondary school students in Iceland [24] valued classroom arrangements that gave them flexibility or power to make decisions about their learning preferences or environment, and did not appreciate rigid environments for learning, crowded classrooms, or those that were too hot or lacking in flexibility to allow them to affect the circumstances. Their views in this respect were in clear contrast to the arrangements offered to them at school. Another study in Iceland [25] revealed that students at the primary level were rather pleased with their environment, both in conventional and open plan schools. They also complained about noise and limited access to computers in both types of settings.

2. Materials and Methods

This was a single-case study comprising a post-occupancy evaluation of Stapaskoli, a new school in an Icelandic coastal township about 20,000 inhabitants. It was built for around 520 students, aged 6–of 15 years old. The school serves a new neighborhood still under construction and will be an essential part of a complex constituting its heart, including a compulsory school tied into a preschool, a public library, sports facilities, and a site for local events. It was inaugurated in the autumn of 2020 and is currently attended by a growing number of students—around 280 in total from the data that was gathered in the spring of 2021.

Participants in our study included focus groups of teachers, teaching assistants, and students, as well as selected representatives in charge of architecture and educational leadership. The study was, in essence, a post-occupancy evaluation conducted in the adaption phase, as staff and students have only recently moved in and were still molding their culture and practice in the new setting. Four types of data informed the results, including data derived from documents, photography, interviews, and pedagogical walk-throughs. Data was collected in 2021 as the school was completing its first year of practice.

Documents reviewed include a report from the initial planning group, announcements and local news about the building project, technical drawings, and complimentary texts from the team of architects. Photographs include pictures taken on site during a field visit to conduct pedagogical walk-throughs, as well as pictures published by the municipality and local media.

Interviews conducted with an architect from the team of designers behind Stapaskoli and the director in charge of schools in the municipality served to reveal political, pedagogical, and architectural intentions behind the new building. They were conducted at the offices of each individual and lasted for about one hour each. Bits and pieces from informal conservations with the school leader as we gathered other data were registered in short notes as was seen fit and deemed necessary to compliment findings in the study.

Pedagogical walk-throughs require focus groups, most often comprised of teachers, that are asked to walk through educational facilities and review the strengths and weaknesses of their physical environment from a pedagogical perspective. This is an inductive research method that was developed in Sweden to make participants more aware of their physical environment and educational opportunities in that respect [26]. The method can be applied in different contexts at any school level for both pre- and post-occupancy evaluations [15]. It is currently being tried out within the framework of a European research project on collaborative redesigns of school buildings [27] and was used in this study to reflect the conceived strengths and weaknesses of a construction that represents new trends in school building design. A walk-through should constitute a tour in which a focus group is asked to make about five stops in selected areas within a building and make written notes about how they accommodate educational activities [26]. This is followed up with recorded discussions after each stop, or as in our case, the tour as a whole. The tour is designed to provide insights and overview in key areas, but one should keep in mind that it has its limitations, as it neither includes every space of significance in the school building under evaluation nor involves every staff member and student who might have significant viewpoints to share with the researchers.

Four focus groups did walk-throughs the same day, and each group was supervised by one researcher. There were two groups of nine teachers, a group of assisting staff that was made up of the caretaker and five teaching assistants assigned to different grade levels, and finally, a group of 13 students representing all grade levels, accompanied by one teacher. Each group made stops in four or five selected locations, including a double classroom assigned to two grade levels, a classroom or workshop area for art and crafts, the library, the assembly hall, and the corridors. Each member had a paper with forms to fill at each stop. Recorded discussions, lasting 15 to 60 min, were conducted right after the walk-through and took place in a meeting room within the administrative facilities of the school building. Some notions about staff facilities and the school playground were also recorded and reviewed.

Interviews and focus group discussions were recorded and transcribed up to a point that was deemed necessary for a thorough analysis of their content. Thematic analyses of the data were then used to illuminate the ideas and intentions behind the new building, as well as review conceived strengths and weaknesses of the areas visited in the school. Photographs were used to recall the perceived features of the building and examine them in more detail.

3. Results

The results are presented in three main parts that reflect the political and pedagogical intentions behind the new building, the design features of the new school and the architectural intentions behind them, and finally, the strengths and weaknesses of the new environment as viewed by the pedagogical walk-through focus groups.

3.1. Political and Pedagogical Intentions behind the Building

The municipality of Reykjanesbaer had been growing fast and was struggling with serious financial setbacks when it had to tackle the need for a new school, the building under review in our study. Ideas from drawings from two school buildings erected in the municipality several decades prior were, nevertheless, put aside, with the underlying notion that innovations that emerged since the time these older schools were designed called for a fresh start. With that in mind, the municipal directors of education and planning, together with the mayor, went to visit three newly built and innovative schools in Reykjavik and surrounding areas. A group representing different stakeholders from the neighborhood, municipal authorities, and prospective leaders of the school complex was then established to determine the underlying values, overall structure, and emphasis in pedagogy for the new building.

The preparatory group was to "take into account the needs of children, their families, the local community, and society as a whole" in accordance with the design down process, which was developed in Minnesota around the turn of the century and has been applied in Iceland in several school building projects since then [5]. The group included neither architects nor technical engineers but followed the method in other respects. It described in its report a school that was to be built in alignment with "modern needs", placing special emphasis on creativity and the arts, as well as flexibility and variation in educational practice. The school complex, including a preschool, a compulsory school spanning grades 1 to 10, and a music school, was to serve the local community as a communal and cultural center, with strong relations between the two school levels, teachers and parents, the school and the neighborhood, as well as ties to its natural surroundings—the open sea and fields along a low coastline, with lava spread out in the distance. The concept was illustrated as a heart in an initial report [28] and not defined in any detail as to how to go about teaching and learning. A more elaborate document was produced in continuation [29] that reflected ideas about round cores, wet areas, and workshops for art, tied into classroom areas for children from 2 to 16 years of age. Preconceived classrooms were not seen as "open plan" but rather as open and flexible spaces with a round core with upholstered benches, digital displays, a wireless network, and a number of breakout cells for each age group.

Five architectural firms were asked to participate in a closed competition on the basis of these preparations, and two of the competing teams were asked to take their ideas further. The architects from ARKÍS, who eventually won the competition, proved able to bring to the table profound insights into school building design, which were welcomed by the directors in charge of the project, as well as the school leader, who would later get deeply involved in design decisions, such as the choice of furniture and technologies to support innovative modes of teaching and learning.

3.2. Architectural Intentions behind Design Features of the New Building

The team of architects at ARKÍS was determined from the outset to design Stapaskoli as a bright and colorful building and a light and inviting construction, with clear ties to its natural surroundings and neighboring community, as well as a compulsory school set in a carefully intertwined complex of constructs for different needs and services, allowing for flexibility and multiple uses. Team members wanted the building to promote and maintain teamwork, collaboration, and a communal spirit, reflect ties to the natural environment, and be a venue for the neighboring community at large. Transparency and natural lighting from above and as many sides as possible were also issues of particular concern.

The leading architects were able to reach back to an era of attempts to build open plan schools in the seventies and eighties and recall how school building design had later taken a step back to more conservative design forms with conventional rows of standardized classrooms with groups of up to 30 students sitting in regular rows. They had been involved in a number of school building projects, competitions, and consultation assignments of a more progressive nature over the last two or three decades and were able to elaborate

the design project at hand and its manifold features in light of their extensive experience, rather than focusing on any one model or building project from the past.

The following subchapters reflect our own review of the building and their notions about "hearts within hearts", with the school building constituting the heart of its neighborhood, open and flexible classrooms representing the hearts of teaching and learning for cohorts at different grade levels, and a brightly lit oval core resembling a heart in the middle of each room. The idea of a heart filled with life was what the architects highlighted as the signature concept and leading idea behind their design, as well as, perhaps, the most innovative aspect of the whole project.

3.2.1. Heart of the Neighborhood

Buildings already built and those about to be built in a unified complex on the site of Stapaskoli constitute not only a compulsory school spanning grades 1 to 10, shown in Figure 1, but also a preschool for children from 2 to 5 years old and a community center with a public assembly hall, a school library, a building extension for sports, and a richly equipped playground open to the public after school hours. Spaces for lessons in music are in place, as are areas assigned to home economics or art and crafts. A church is also planned for the premises, opposite the entrance to the school.



Figure 1. Stapaskoli, compulsory school in Reykjanesbaer. The main entrance and entrance hall are underneath a grand library on the upper floor. The administrative section can be seen to the right, protruding southwards, on top of a classroom unit for grades 5 and 6.

3.2.2. Heart of the School and Community Center

The assembly hall, shown in Figure 2, is wide and open, reaching from the lower floor to the upper ceiling, with an abundance of different spaces and services in its immediate periphery. It was designed to be the combined heart of the whole complex, both the school and the community center. This constellation of spaces is bound together with light and flow from all directions, with a big staircase and indoor balconies towering over the hall, allowing audiences to view this brightly lit space from above. A wide entrance hall on the lower floor, a school kitchen and a lower floor hall for multiple uses, and extended space behind removable walls enrich the facilities. Also within reach are a storage room and a classroom assigned to lessons in music and backstage activities, as well as four soundproof cells for lessons on musical instruments.



(**a**) (**b**)

Figure 2. The assembly hall. (**a**) View from above to the north. An extension for sports will be built on the left side. An adjoining kitchen and a lower hall lie hidden to the right. (**b**) Balconies and giant steps are used to accommodate audiences and walls on the lower floor can be removed.

A school library, already in function on the upper floor and overlooking the hall, will be open to the public after school hours. Furthermore, yet to be built is a large extension construct assigned to sports. It will be tied into the library on the upper floor and open into the assembly hall at a lower level for special events, making it possible to use the assembly hall and adjoining spaces to accommodate visitors in great numbers. It will contain sophisticated facilities for both public use and educational purposes, including a weight gym, a swimming pool, and a sports hall of an acknowledged size, with dressing rooms elaborate enough to have the complex certified for official sports competitions.

Tied into all of this is the compulsory school itself, with its bright walls, long and wide entrance hall, extensive hallways running through the length of the building on both floors, administrative offices, open and flexible classroom areas, classrooms for special subjects, such as sciences or art and crafts, and a colorful playground stretched out along the southern side.

A preschool extension will be built at the far end of the school building. It will be tied into classroom sections assigned to the youngest students on the lower floor, as well as classroom facilities for home economics. A part of the playground is already confined by a fence in reserve for children at the preschool level, who are currently stationed in preliminary housing next to the school. Figure 3 illustrates the complex as a whole.

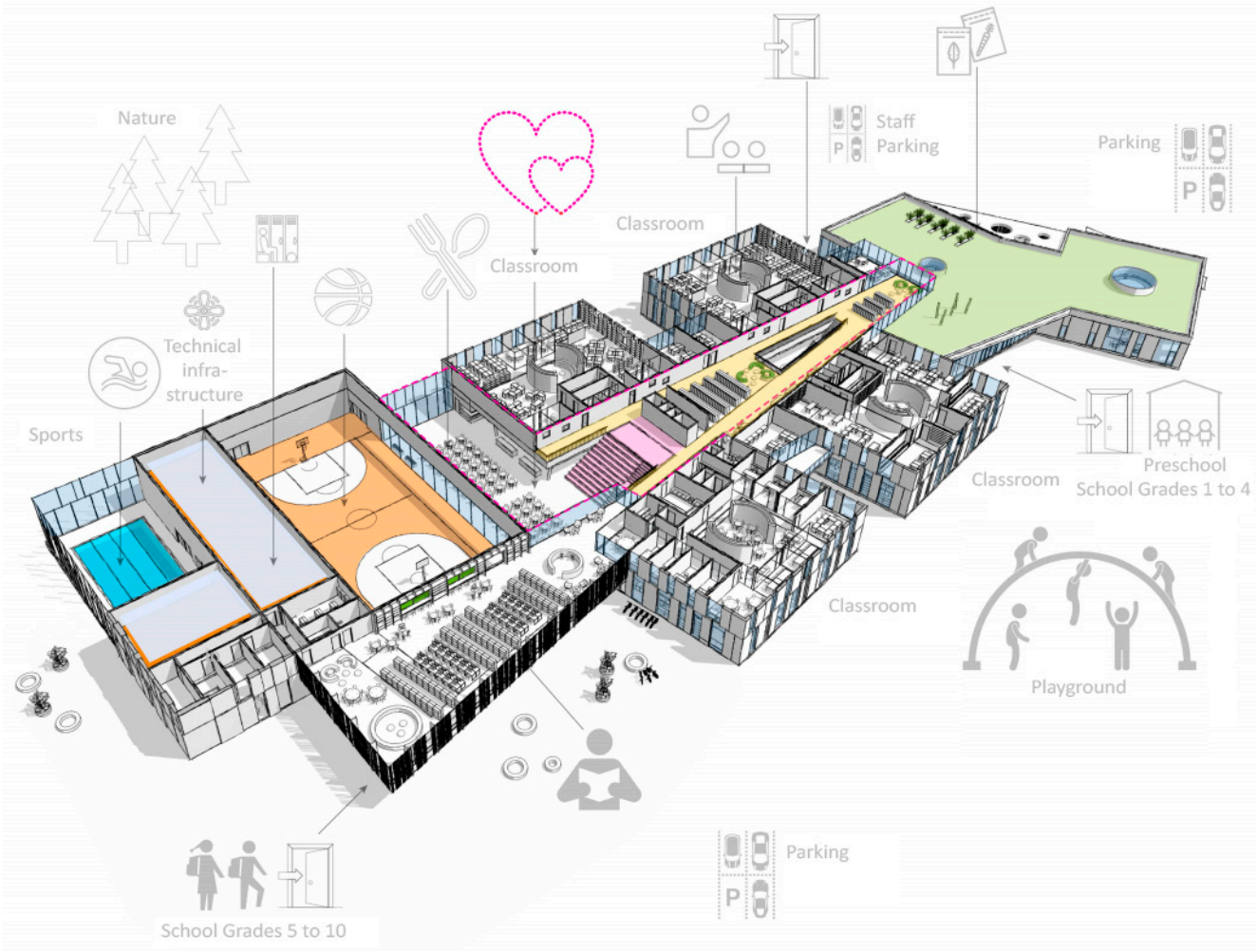


Figure 3. An early illustration of Stapaskoli from ARKÍS architects [30]. Sports facilities on the western end of the building complex, as well the preschool extension on the eastern end, have yet to be built. Two upper-floor classroom sections can be seen on the northern side. The library, a section for administrative functions, and a classroom section for art and crafts face the south. Three additional classrooms, a multifunctional hall, and music facilities lie hidden and out of sight on the lower floor.

3.2.3. Hearts of Teaching and Learning

Staff members at Stapaskoli use the Icelandic word *tvennd* (plural: *tvenndir*), meaning two of the same, when referring to open space classroom areas in the school building. Each classroom or *tvennd* is designed in a symmetric fashion to accommodate two cohorts of students and their teachers from two different grade levels, one in each half of the room. The idea is to let grades 1 and 2, 3 and 4, 5 and 6, 7 and 8, and 9 and 10 work together and share learning experiences up to a point determined by the teaching staff and, to some extent, the students themselves. The rooms, then, are five in all, with each classroom constituting the heart of teaching and learning activities for two cohorts or grade levels. Classrooms in the eastern part of the lower school level, the part of the playground reserved for younger children, together with the preschool construct yet to be built, constitute a hub or heart for preschool children and students in their early years.

The classrooms or *tvenndir* are spacious enough to be called open and flexible, yet divided in part by curved walls, a partly open circle constituting an oval core in the middle of the room. Four breakout cells behind glass walls are lined up along a wall separating the classroom from its hallway, two cells side by side in each half of the room. Between the two pairs of cells are two doorways leading out to the hallway, while restrooms are hidden behind a counter with cabinets facing the classroom. Tall windows with benches

and cupboards with shelves reaching the ceiling, mostly empty for the time being, but with built-in seating, cover both sidewalls of the room. On the wall opposite to the counter, doorways, and cells are more windows with benches for optional seating, and two relatively large breakout rooms, one in each corner, confined behind colored glass. Figure 4 shows one of these breakout rooms and the oval core. A drawing from ARKÍS representing a *tvennd* is shown in Figure 5.



(**a**) (**b**)

Figure 4. A classroom or *tvennd*. (**a**) One of two larger breakout rooms in a *tvennd*. (**b**) The oval core residing in the middle of the classroom.

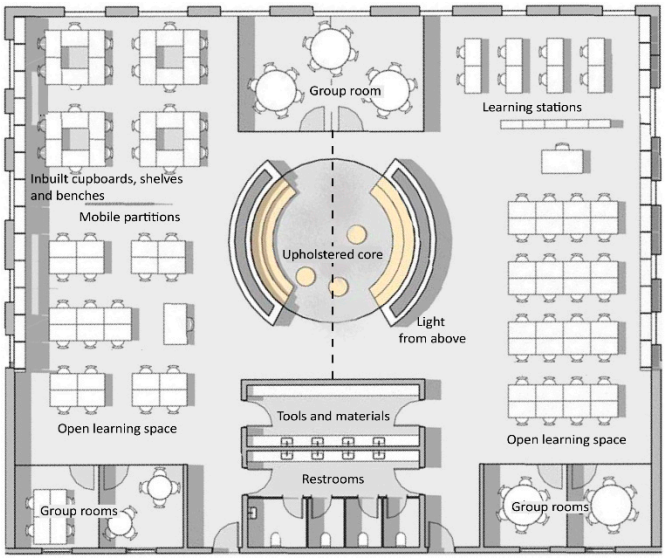


Figure 5. A draft illustration of a classroom or *tvennd* by ARKÍS architects [30].

Curved steps or benches that allow groups of students to be seated in three escalating rows are placed inside the core facing a curved constellation of nine digital displays connected to a sound system. Hovering over the core is a white cloth stretched over a round frame illuminated from above, while more conventional lights and a filtering cloth, hiding sound-absorbing materials, cover the ceilings in other parts of the room. Moveable and colorful furniture, including bean bags, cushions, desk chairs, and tables, are scattered all over the room. Podium stands on wheels serve as mobile work and storage stations for the teachers, while four large displays—two for students working in the open space and one for each breakout room—can be moved around at will. A set of iPads is also in store for each and every grade level.

3.2.4. Heart of Art and Crafts

A sixth *tvennd* or classroom is assigned to art and crafts in an open and flexible setting, subtly divided into three areas and used by students from all grade levels for creative work in subject areas including art, textiles, and woodworking, as well as creating with digital devices, such as for drawing, laser cutting, designing, and printing. The confined and more conventional space, which makes up approximately one-fourth of the *tvennd*, is used for lessons in natural sciences, computing, and digital programming. Restrooms, as well as breakout sections for heavy machinery, storage, and scientific experiments, are also in place.

3.2.5. Heart of Administration and Staff Facilities

Hallways running through the building on both floor levels are, in part, divided by a few rooms into two walkways. Three or four of these rooms are used for special subjects, while one is reserved for teachers stationed on the lower floor. A bright room for teachers working on the upper floor lies next to the administrative section, which resembles a *tvennd* and houses the school reception, offices of the administrative staff, meeting rooms, restrooms for staff members, and a teacher lounge placed in a round and stylish core resembling cores in the classrooms, with small tables for coffee and meals.

3.3. Strengths and Weaknesses as Viewed by Focus Groups

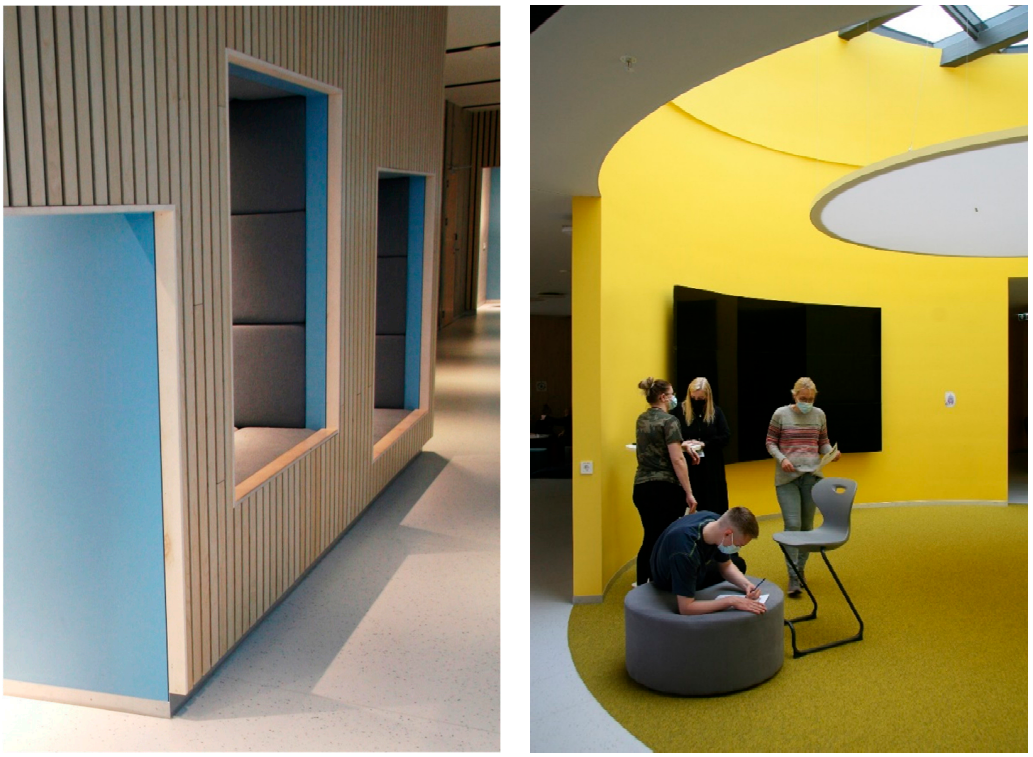
Our focus group of assisting staff appeared quite proud of their new school building, yet a bit more critical than members of the two focus groups representing teachers in our study when it came to the practical aspects of the facilities. Students made up the fourth focus group and appeared somewhat hesitant to share their views with the researcher or perhaps other members of their group. They did, nevertheless, put forward a number of positive viewpoints about the school building and the learning opportunities it had to offer, as well as some critical notions calling for "more calm and quiet" in their everyday school environment.

3.3.1. Open and Flexible Classrooms

Both teachers and the assisting staff described the classrooms as accommodating and spacious places for learning and commended a wide selection of comfortable seating options within the room. Teachers celebrated the variety of approaches they were able to apply in their everyday practice and related how dynamic the environment was in terms of allowing staff members to work together and create all kinds of learning opportunities for students. The assistants pointed out restrooms behind a wall of cabinets and a small area assigned to wheelchairs or other similar aids when not in use. Breakout cells and other confined spaces, both small and large, were generally seen as great assets; sometimes they were overcrowded, too warm, or too exposed, but they were quite useful on an everyday basis.

The round cores placed in the middle of classrooms were generally considered helpful shelters for individual students or small study groups, as well as spaces where a teacher would be able to interact with students in small or large numbers. Initial difficulties with

the audio system and the set of displays in these areas were being resolved. Thick curtains, sliding doors, or foldable walls, which allow teachers to close the core at will, were seen as an optional and perhaps feasible addition to the facilities. Compartments and open spaces in hallways outside the classrooms were also in use and considered yet another opportunity to provide students with an empowering selection of places for learning. Compartments in an open hallway and assisting staff members, reviewing a round core in one of the classrooms, can be seen in Figure 6.



(**a**) (**b**)

Figure 6. Focus groups and sheltered spaces. (**a**) Compartments and open areas in hallways were celebrated as optional settings for learning. (**b**) Oval cores in classrooms were also commended.

The assistants maintained that the tables and chairs in the classroom, which are assigned to the oldest students, would have to be adjusted or replaced to make an adequate fit for teenagers. Classroom doors were considered heavy and difficult to open. Heating and ventilation had proven to be problematic, in particular in the upper floor classrooms and the smaller break-out cells, as shown in Figure 7. Initial difficulties of that kind were said to be expected in a new building of this scale and staff members pointed out that shades or protective films placed in the windows would probably help to solve such problems. A simple but important fault, when it came to lighting in the classrooms, was also revealed—teachers and other staff members were not able to turn on and dim lights from the ceiling in their half of the room without affecting the lights in the other half. This, of course, would be easy to fix. Hooks or hangers for wet coats were deemed as something that could be added and placed behind the counter and wall of cabinets separating the restroom section from other parts of the room.



Figure 7. Breakout cells with recording devices and a selection of furniture. Windows connect the cells with the hallway areas outside the *tvennd* or classroom.

The variety of furniture offered was the feature that students liked most about their classrooms, with the opportunities they had to choose their own seating arrangements: "If you get tired of sitting on a chair, you can (always) have it cozy on one of the bin bags." They celebrated the technology in place and considered it much more advanced than in other schools they had been to, while also questioning the money put into a curved constellation of displays: "Who needs thirteen TV screens in one room?" When asked about negative aspects, they mentioned how noisy they sometimes found the classroom and that it was irritating not to have more space to hang things up on the walls. When asked for suggestions about conceivable improvements, some proposed a set of walls to split the learning space into two parts and provide each cohort with a classroom of its own.

3.3.2. Art and Crafts Classroom

Teachers in our focus groups celebrated the acoustics, spaciousness, dynamic flow, and emancipating freedom they had experienced in the open space classroom unit assigned to art and crafts. Students were reportedly allowed to move from one teacher and subject field to another and decide for themselves, to some extent, how to go about their work. They were not only able to collaborate with partners of their choice but also apply combined approaches and a broader selection of tools than in a more conventional setting that focuses on one subject area within art and crafts at a time. Communication between the teachers of art, textiles, and woodworking appeared to be lively and the teachers were able to send students over to their colleagues whenever they deemed fit. The room, shown in Figure 8, was considered bright and spacious, and the general atmosphere was both lively and relaxed. One teacher, praising the acoustics and flexibility in the classroom, pointed out how a big display on wheels would suffice as a convenient divider between groups occupied with different tasks.



(**a**) (**b**)

Figure 8. Classroom or *tvennd* for art and crafts. (**a**) Students attending a class in woodworking in an open space. The oval core is behind them. (**b**) Beyond the core is a room confined behind sliding doors assigned to natural sciences and digital programming. An open area for classes in art is in the far back.

The core, reportedly, would be used for short lectures, introductions, and discussions, but most often would serve as a central shelter where students could take a short break or find a relatively quiet place for the task at hand. A confined space behind a sliding door was assigned to lessons in natural sciences and digital technologies, making it approachable to tie experiments and programming to digital devices in the workshop areas. The teachers also proclaimed that they would never hesitate to send their students over to the art and crafts classroom whenever they wanted to extend some project work to include activities that involve hands-on tasks and which require particular tools or workshop materials.

The teaching assistants found the selection of seating in the classroom area for art and crafts too limited and the level of noise and back and forth motion among younger students in large groups somewhat frustrating. Some of the children apparently tended to roam without a clear aim from one area or group to another. More chairs, tables, and a few movable dividers, if not fixed or foldable walls, were thought to be helpful for students who might find the facilities for art and crafts compromising in this respect.

On a more positive note were notions commending the spacious facilities, a relaxed atmosphere, adjustable furniture, and the selection of tools used for woodworking, digital cutting, and 3D printing. Older students were said to be making extensive use of all this equipment, while the younger students were less likely to be applying such devices. Students, reportedly, were allowed to leave the area and take a short break in the hallway or rest for a while within the core residing in the middle of the room. This was seen as reasonable and helpful for tired or perhaps listless students in the course of long classroom sessions. Some concerns about absent-minded and unattended students, conceivably hiding away from their teachers or fellow students, were also noted.

Students praised the level of freedom they had in their open space art and crafts classroom. They would not only be allowed to seek out a chair, a table, or a spot on the window shelves to their liking—to be, up to a point, in charge of their own learning environment—but also choose what to work on, often by applying tools and methods from

different subject areas. They related the selection of tools they had to choose from and the fun they had working on their projects. They maintained, on the other hand, that some of the machinery and digital tools provided could be applied more often or to a greater extent. Some members of their focus group also suggested that a couple of walls erected within the classroom might help to make the environment more efficient and user-friendly.

3.3.3. Halls and Hallways

A long and wide entrance hall, running from the main entrance towards the assembly hall, was highly appreciated by members of the assisting staff, as it provided low shelves and excessive space for students in great numbers to take off and put away shoes when entering the school. Other hallways running through the whole building on both floor levels were also considered spacious, bright, and inviting by all focus groups. It was repeatedly pointed out how they provided students with extended areas and smaller spaces to interact, study, and play. Small booths or compartments along the corridors for small study groups, individual work, or social leisure during breaks appeared to be in particularly high regard, and they constitute symbolic features of design that aims for flexible school practices. Hooks or hangers to dry outdoor clothing were mentioned as a feasible addition to improve hallway facilities, as well as perhaps a small cell assigned to the assisting staff to dry their outdoor clothing after breaks in the open on a wet or snowy day.

The assembly hall, with adjoining spaces, giant steps, and upper floor balconies, was reportedly used for meals, social events, performances, and eventually, exhibitions, and generally regarded as a big success in terms of both design and practicality. High levels of noise in lunch hours had been seen as a potential problem factor when the assembly hall was first put into use, but staff members had quickly grown accustomed to the tumult characterizing the large groups of youngsters enjoying their meal. Students, in particular, described their appreciation of the hall, its beauty and bright walls, the round tables allowing them to chat with friends, and the view through extensive windows to a natural environment outside the building. They expressed their wish for more time at the tables after meals and were told by a teacher accompanying the group that the shape of the tables had been chosen to encourage just that, chatting and shared quality time over meals. The students also uttered wishes to have some background music playing during lunch hours and the distance between tables to be extended to allow for a more relaxed atmosphere and increased elbowroom in the hall.

The students liked the giant steps, shown in Figure 9, as a place to exercise, have a chat with friends, or even to learn without too many people around. They also mentioned the advantage of being able to charge computers and cell phones on the steps and reported how they would like to have more compartments in the hallways to enjoy with a small group of friends, study in private, or just have access to a learning environment different from their usual spot. A few of them mentioned a pleasant scent of baking or cooking coming from a room in the hallways currently used for home economics. A wall area designed for climbing, located outside the classrooms assigned to younger students, appeared to also be appreciated. Students expressed their wish to have it extended and supplied with a softer mattress. They also complained about the limited access to elevators running between the two floors, as only handicapped students were allowed to use them. The caretaker and teaching assistants told us how students would often claim to be sick or injured, in their attempts to use the elevators despite such restrictions.



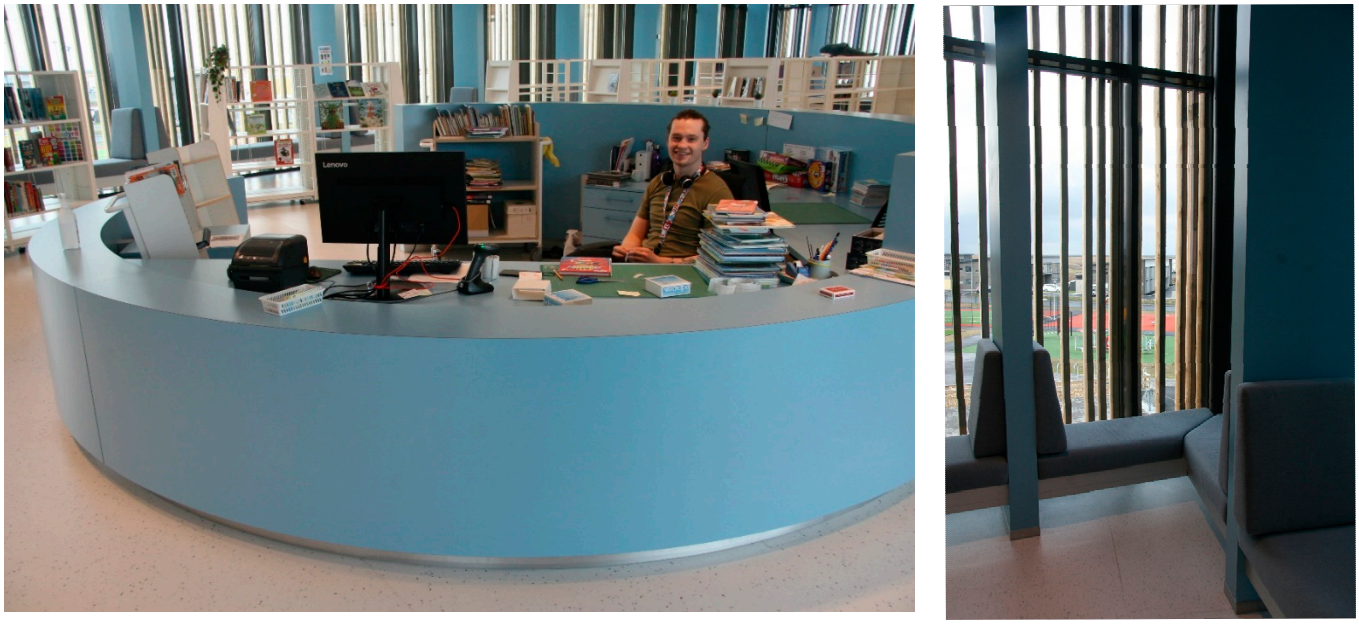
(**a**) (**b**)

Figure 9. Hall and hallways. (**a**) The giant steps facing the assembly hall can be used for studying, as well as charging digital devices. (**b**) A living tree on the lower floor. Booths and compartments for students are in the back. Note the window and doorway into a classroom unit.

3.3.4. Library

The library was seen as an exceptionally bright, spacious, and inviting environment supplied with abundant seating options and workstations for multiple uses. It was considered very popular and well attended by students and staff, reportedly for studying, project work in groups, leisure reading, chess and board games, and performances and readings involving students, staff, preschool children, parents, and eventually other guests. Teachers described visits to the library with groups of students from different grade levels and students made positive remarks reflecting how good it was to hang out in the facilities. A round reception desk, shown in Figure 10, as well as a bench that forms a circle and is used for readings and group discussions, were seen as clever efforts of design, echoing oval cores in other sections of the building.

Sunlight coming in at a low angle through large windows that surround most of the library was proclaimed to be difficult to deal with. Wooden bars lined vertically in a grid-like fashion outside the glass appeared to be of limited help in this regard. Teaching assistants found them decorative when seen from the outside but of little use from inside the building, even obstructing an otherwise pleasant view. The library had sometimes become overheated, as well as cold when attempts had been made to adjust the heating. This was seen as something that would be solved over time. A large breakout room behind glass walls was seen as an ideal learning space for project work but was currently being used by a study consultant to conduct interviews due to a lack of an office for such sessions.



(**a**) (**b**)

Figure 10. The library. (**a**) An oval reception desk resides in spacious facilities filled with light. The school is new, and many shelves are still empty. (**b**) Upholstered benches run along the walls. Wooden bars on the outside forming a striped pattern can also be detected.

3.3.5. Staff Facilities

The administrative section or *tvennd* did raise some contemplative remarks about staff members taking a break could conceivably disturb staff members attending to administrative tasks and vice versa, but it was generally seen as a pleasing and stylish environment. Two bright and relatively spacious rooms assigned to the teaching staff, one on each floor, appeared to be highly appreciated by all staff members alike and reflect a joyful atmosphere. We could see how these rooms were used to share mobile podium stands and other equipment among the teaching staff on a daily basis, and how markers with washable ink had been used to write both practical and playful bits of info and communications on the walls.

3.3.6. Playground

The playground was neither visited nor covered in any detail with our focus groups. A few remarks, however, made by members of the assisting staff, illuminated how popular it has become far beyond the school district. It draws in groups of youngsters and parents with young children coming from as far as the other end of the municipality. A colorful design, the choice of materials, and the bounty of equipment to play with appear to have hit their target. Teaching assistants overlooking the playground, as younger students went out for breaks between class hours, also commended how easy it was to look over the premises with the whole playground stretching out on the southern side of the school, rather than surrounding the whole building.

4. Discussion

The aim of this study was to map how political and architectural intentions for Stapaskoli have succeeded as applicable and innovative school facilities in the eyes of teachers, teaching assistants, and students. Our three research questions in this regard are discussed below in Sections 4.1–4.3, followed by a discussion about the overall aim of the paper as well as conclusive remarks.

4.1. Intentions Guiding the Design

Intentions guiding the design of the new building seemed relatively open and somewhat unclear, as documented in a preparatory report produced at the initial stage of the building project. A more elaborate and informative document was later established by municipal authorities leading the project. The overall political aim was to build a school and community center to meet the perceived demands of a new neighborhood in current times, but the pedagogical intentions were perhaps rather vague in terms of defining in detail how to organize teaching and learning in the new school. A text describing the winning design proposal from ARKÍS reflected the idea of a school as a heart of a community and classrooms as hearts of teaching and learning, but without much clarity when read with care. The proposal itself, as illustrated in drawings, on the other hand, appears carefully thought out in terms of showing how an open and flexible learning environment might help to sustain teaching and learning in teams and allow for variable learning and teaching conditions for everyday school practice. The team of architects had gained insight into school building design over decades and was able to produce a viable concept for the new school that was welcomed by the municipal directors of schooling and planning, as well as the prospective school leader.

4.2. Conceived Strengths and Weaknesses

Conceived strengths and weaknesses of the learning environment found in the data were many, as related in Section 3, which seems to commend pedagogical walk-throughs as a research method [26]. We are also able to confirm that the walks and discussions served to raise the awareness of a noteworthy school building offering opportunities for new ways of teaching and learning. Teachers and students agreed that the variety of spaces and furniture that allow students to choose their learning conditions for themselves could be considered the greatest strength of their new learning environment. The weaknesses often had to do with technical difficulties that were expected at the initial stages and were likely to be eliminated to some extent over time, while other weaknesses had more to do with disturbances that are likely to get worse as the number of students increases over the next few years. A comparative study in a few years might prove interesting in that regard.

A sense of empowerment and the will to grasp opportunities to try out different things based on teacher relationships, collaboration, and reflection—one of the requirements for the success of putting an innovative learning environment to use, as laid out by French et al. [12]—was sometimes detected as we walked or talked with teachers and teaching assistants in our focus groups or visited classes included in our scheduled walks through the building.

We were also able to identify physical constraints that make it harder for staff members to fall back to conventional ways of working—another theme from the same source as above [12]. The sheer ambition, beauty, and strength of the physical design in the halls and hallways was a feature likely to prevent people from tampering with or fragmenting these environments, while oval walls and breakout areas in the classrooms would probably call for troublesome adjustments if anyone wanted to break up a *tvennd* or classroom with new walls.

Ties to familiar procedures and surroundings, in coherence with yet another theme laid out by French and associates [12], were also detected, such as the library or the number of shelves in classrooms, presumably designed for folders and books. A somewhat debatable uniformity of the *tvenndir* or classrooms resembling, to some extent, symmetric classrooms from other recent building projects, was, perhaps, yet another example of such ties to older times.

The fourth theme from French et al. [12], however, calling for accountability to ensure that the new space is used as expected and that a new culture is consolidated, were not detected in our formal data nor seemed to be applicable within the scope of our study. Notions from the school leader and the teachers indicated, however, that taking up older ways of teaching would not be an option for the staff members. The school leader also

maintained, in one of our short conversations, that the teachers were held accountable for collaboration and teamwork in and beyond their classrooms.

Students valued the level of freedom in their new school, as they were not only allowed but rather expected to regulate, to some degree, the conditions and subject matter of their learning. This is coherent with the results of Kariippanon and associates (2018), who recommended student self-regulation to support the transfer from traditional classrooms to flexible learning spaces. This freedom of choice is also clearly innovative in comparison with results from recent studies at the primary, lower secondary [31], and secondary school levels [24].

4.3. Conceived Innovative Features

Innovative features of significance in the new building in the eyes of stakeholders who participated in our study were numerous. They were generally pleased with their new school, and fascinated, even, with the spaciousness, natural light, bright colors, transparency, and dynamic flow among staff and students alike. They appreciated how well different functions and spaces had been intertwined to create a heart-like core in and around the assembly hall and were able to articulate opportunities that would come with the whole building complex fully built. They proudly pointed out many details or more substantial features of design, such as small indoor windows between spaces, windows and gaps bringing in natural light through the roof or upper floor, grand views through extensive windows or transparent indoor walls, an exceptionally furnished playground, restrooms within classrooms, excellent acoustics in crowded spaces, a shared classroom for art and crafts, giant steps in the assembly hall, and indoor balconies along corridors, as well as small spaces designated for individual assistance, learning how to play musical instruments, studying in quiet, team work, or technical tasks, such as recording and editing media. Mobile podium stands and large displays on wheels were commended as practical novelties, as were the oval cores, oval benches, and round tables and desks placed throughout the whole building. Original details, such as having a living tree and a wall for climbing on the lower floor of an abundance of seats in windows, were also celebrated.

What struck us in this study was how well the design of the school building, both in broad and more specific terms, appeared to fit open and varied pedagogical approaches based on teamwork and collaboration. Such alignment among the physical environment, pedagogic practice, and school culture is the deciding and most profound factor in school building design, as has been so frequently reflected in the literature (e.g., [5,12,15–17]).

4.4. Intentions and Reality

Political and pedagogical intentions behind the construction of Stapaskoli were ambitious from the outset but relatively vaguely defined. Adaption and occupancy are also in their early stages, which makes it difficult to determine whether the new building is a success. Architects brought experience and valuable insights into the building project, while municipal authorities seemed to have maintained venues of consultation and collaboration between key stakeholders and the design team throughout the project up to date, in line with recent recommendations of Duthilleul and associates [1]. One indicator in this respect was the agency of school leadership when it came to decisions on furniture and technology, presumably two important and successful elements of design in the building. The empowerment involved in this kind of collaboration has been recommended by not only Duthilleul and associates [1] but also several other researchers [7,8,17].

Also noteworthy is the freedom that was handed to the architects for this project and how the design drew on their previous experiences from over two or three decades. This serves to show how school building design in Iceland has evolved over time [6] and how it has deviated from the previously accepted grammar of schooling [7]. We might even raise the question of how long new design forms deviating from tradition can be classified as innovative or unconventional. Are open, diverse, and flexible learning spaces that are

supported by digital technologies conceivably the new norm in school building design allowing for a more progressive grammar of schooling to override older traditions?

5. Conclusive Remarks

The novelty of the school building under review in our study could be debated, and some of its features could potentially be called the new norm. The results serve, at least, to show considerable strengths and some noted weaknesses of a learning environment deemed as innovative by teachers and teaching assistants, as well as students attending the school under review. The building represents current trends in school design at the national level and resonates with similar trends in many parts of the world. It appears to be a success in terms of supporting teamwork and flexible teaching practices, allowing students to affect their own conditions and subject matter of learning, while proving to be potentially difficult regarding the level of noise and disturbances experienced by some students.

Teachers, teaching assistants, and students alike seemed to commend the new building as a school and community center, as well as appreciate its bright and spacious design. The number of attending students, however, will grow in the coming years, making a comparative study in a few years an interesting prospect. We may also—without going into any technical details at this point—want to look further into some of the faults and potential amendments suggested by staff and students in this study and consider their impact on school practices. A richly furnished playground, which was not included in our study but which flashes a variety of facilities, would furthermore be worth a particular study. Stadler-Altman [32] related how the school ground should provide opportunities for both playing and learning, and it would be of interest to examine to what extent this sophisticated playground meets such requirements.

The data collection method of pedagogical walk-throughs [26] has certain limitations, related in Section 2, but proved to be fruitful and appeared to provide valuable insights with regard to our research questions. It may also make an interesting comparison should we choose to try out other methods that are presented within the framework of a European project on the collaborative redesign of educational spaces [27]. Diamond ranking, to name one, might help us to find out which innovative learning spaces in this ambitious school building work best for teachers, assistants, and students. That is, after all, what innovative learning spaces are supposed to do—work well for the students and the teaching staff.

Author Contributions: Conceptualization, A.K.S. and T.H.; methodology, A.K.S. and T.H.; validation, A.K.S., T.H. and A.S.; formal analysis, A.K.S. and T.H.; formal analysis, A.K.S. and T.H.; investigation, A.K.S. and T.H.; resources, A.K.S. and A.S.; data curation, A.K.S. and T.H.; writing—original draft preparation, A.K.S. and T.H.; writing—review and editing, A.K.S. and T.H.; visualization, A.S. and T.H.; supervision, A.K.S.; project administration, A.K.S.; funding acquisition, A.K.S. and T.H. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and Lög um persónuvernd og vinnslu persónuupplýsinga nr. 90/2018 [Icelandic Law nr. 90/2018 on Personal Data Protection and Processing of Personal Data], see https://www.althingi.is/lagas/nuna/2018090.html (accessed on 25 August 2021).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Acknowledgments: We would like to thank students and staff in Stapaskoli and Reykjanesbaer most warmly for their participation in the research project. Their willingness to try out an unfamiliar data collection method to look for strengths and weaknesses in the design and application of their brand new school building was commendable and truly appreciated.

Conflicts of Interest: Aðalsteinn Snorrason belonged to the team of architects who designed the new school under review in this paper. He took no part in the actual study, but shared with his coauthors,

the researchers Anna Kristín Sigurðardóttir and Torfi Hjartarson, valuable insights and illuminating resources as the study was prepared.

References

1. Duthilleul, Y.; Woolner, P.; Whelan, A. *Constructing Education: An Opportunity Not to Be Missed*; Council of Europe Development Bank: Paris, France, 2021.
2. Blackmore, J.; Bateman, D.; Loughlin, J.; O'Mara, J.; Aranda, G. *Research into the Connection between Built Learning Spaces and Student Outcomes (Issue 22)*; Education Policy and Research Division, Department of Education and Early Childhood Development: Melbourne, Australia, 2011.
3. Byers, T.; Mahat, M.; Liu, K.; Knock, A.; Imms, W. *A Systematic Review of the Effects of Learning Environments on Student Learning Outcomes*; Innovative Learning Environments and Teachers Change; University of Melbourne: Melbourne, Australia, 2018; Available online: http://www.iletc.com.au/publications/reports (accessed on 25 August 2021).
4. Sigurðardóttir, A.K.; Hjartarson, T. School buildings for the 21st century: Some features of new school buildings in Iceland. *Cent. Educ. Policy Stud. J.* **2011**, *1*, 25–43.
5. Sigurðardóttir, A.K.; Hjartarson, T. The idea and reality of an innovative school. From inventive design to established practice in a new school building. *Improv. Sch.* **2016**, *19*, 62–79. [CrossRef]
6. Sigurðardóttir, A.K.; Hjartarson, T. Design features of Icelandic school buildings: How do they reflect changes in educational governance and daily school practice? In *Making Education: Material School Design and Educational Governance*; Grosvenor, I., Rosén Rasmussen, L., Eds.; Springer: Cham, Switzerland, 2018; pp. 71–91. ISBN 978-3-319-97019-6.
7. Frelin, A.; Grannäs, J. Designing and Building Robust Innovative Learning Environments. *Buildings* **2021**, *11*, 345. [CrossRef]
8. Niemi, K. 'The best guess for the future?' Teachers' adaptation to open and flexible learning environments in Finland. *Educ. Inq.* **2021**, *12*, 282–300. [CrossRef]
9. Kariippanon, K.E.; Cliff, D.P.; Okely, A.D.; Parrish, A.M. The 'why' and 'how' of flexible learning spaces: A complex adaptive systems analysis. *J. Educ. Chang.* **2020**, *21*, 569–593. [CrossRef]
10. OECD. *Innovative Learning Environment*; OECD: Paris, France, 2013.
11. Woolner, P.; Stadler-Altmann, U. Openness-flexibility-transition. Nordic prospects for changes in the school learning environment. *Educ. Inq.* **2021**, *12*, 301–310. [CrossRef]
12. French, R.; Imms, W.; Mahat, M. Case studies on the transition from traditional classrooms to innovative learning environments: Emerging strategies for success. *Improv. Sch.* **2020**, *23*, 175–189. [CrossRef]
13. Hopkins, D.; Stringfield, S.; Harris, A.; Stoll, L.; Mackay, T. School and system improvement: A narrative state-of-the-art review. *Sch. Eff. Sch. Improv.* **2014**, *25*, 257–281. [CrossRef]
14. Fullan, M.; Quinn, J. *Coherence: The Right Drivers in Action for Schools, Districts and Systems*; Corwin: Thousand Oaks, CA, USA, 2016.
15. Frelin, A.; Grannäs, J. Teachers' pre-occupancy evaluation of affordances in a multi-zone flexible learning environment—Introducing an analytical model. *Pedagog Cult. Soc.* **2020**, *13*, 1–17. [CrossRef]
16. Gislason, N. Architectural design and the learning environment: A framework for school design research. *Learn. Environ. Res.* **2010**, *13*, 127–145. [CrossRef]
17. Woolner, P.; Thomas, U.; Tiplady, L. Structural change from physical foundations: The role of the environment in enacting school change. *J. Educ. Chang.* **2018**, *19*, 223–242. [CrossRef]
18. Bradbeer, C.; Mahat, M.; Byers, T.; Imms, W. *A Systematic Review of the Effects of Innovative Learning Environments on Teacher Mind Frames*; University of Melbourne: Melborne, Australia, 2019; Available online: http://www.iletc.com.au/publications/reports (accessed on 20 August 2021).
19. Deed, C.; Blake, D.; Henriksen, J.; Mooney, A.; Prain, V.; Tytler, R.; Zitzlaf, T.; Edwards, M.; Emery, S.G.; Muir, T.; et al. Teacher adaptation to flexible learning environments. *Learn. Env. Res.* **2020**, *23*, 153–165. [CrossRef]
20. Woolner, P. Collaborative Re-design: Working with School Communities to Understand and Improve their Learning Environments. In *Spaces of Teaching and Learning: Integrating Perspectives on Research and Practice*; Ellis, R., Goodyear, P., Eds.; Springer: Cham, Switzerland, 2018; pp. 153–172. ISBN 978-981-10-7154-6.
21. Kariippanon, K.E.; Cliff, D.P.; Lancaster, S.L.; Okely, A.D.; Parrish, A.M. Perceived interplay between flexible learning spaces and teaching, learning and student wellbeing. *Learn. Envrion. Res.* **2018**, *21*, 301–320. [CrossRef]
22. Grannäs, J.; Frelin, A. Spaces of student support—Comparing educational environments from two time periods. *Improv. Sch.* **2017**, *20*, 127–142. [CrossRef]
23. Senygit, V.; Memduhoglu, H.B. End-user preferences in school design: A qualitative study based on student perspective. *Build. Environ.* **2020**, 185. [CrossRef]
24. Sigurðardóttir, A.K. Student-centred classroom environments in upper secondary school: Students' ideas about good spaces for learning vs. actual arrangements. In *Transforming Education: Design and Governance in Global Contexts*; Benade, L., Jackson, M., Eds.; Springer: Singapore, 2018; pp. 183–197. ISBN 978-981-10-5678-9.
25. Sigurðardóttir, A.K. Skólabyggingar og námsumhverfi [School buildings and learning environment]. In *Starfshættir í grunnskólum við upphaf 21. aldar [School Practices in Compulsory Schools in the Beginning of the 21st Century]*; Óskarsdóttir, G., Ed.; Háskólaútgáfan: Reykjavik, Iceland, 2014; pp. 57–83. ISBN 9789935230492.

26. de Laval, S.; Frelin, A.; Grannäs, J. *Ifous fokuserar: Skolmiljöer. Utvärdering och erfarenhetsåterföring i fysisk skolmiljö [Ifous Focuses: School Environments. Review and Experiential Feedback on Physical School Environments]*; Ifous: Stockholm, Sweden, 2019.
27. CoReD. Collaborative ReDesign with Schools. Available online: http://ncl.ac.uk/cored (accessed on 5 September 2021).
28. *Nýr skóli í Dalshverfi. Skýrsla undirbúningshóps [A New School in Dalshverfi. Preparatory Report]*; Reykjanesbær: Reykjanesbaer, Iceland, 2015.
29. *Nýr skóli í Dalshverfi Reykjanesbæ–Forsögn [A New School in Dalshverfi in Reykjanesbaer–Tender Requirements]*; Reykjanesbær–Umhverfis- og skipulagssvið og Fræðslusvið: Reykjanesbaer, Iceland, 2016.
30. *Grunnskóli Dalshverfi Reykjanesbæ [A Compulsory School in Dalshverfi, Reykjanesbaer (a Short Presentation Document)]*; ARKÍS Architects: Reykjavik, Iceland, n.d.
31. Sigþórsson, R.; Pétursdóttir, A.L.; Jónsdóttir, Þ.B. Nám, þátttaka og samskipti nemenda [Student learning, participation and communication]. In *Starfshættir í grunnskólum við upphaf 21. aldar [School Practices in Compulsory Schools in the Beginning of the 21st Century]*; Óskarsdóttir, G., Ed.; Háskólaútgáfan: Reykjavik, Iceland, 2014; pp. 161–196. ISBN 9789935230492.
32. Stadler-Altman, U. Indoors and Outdoors: Schoolyards as learning and playing opportunities. *J. Phys. Educ. Sport* **2021**, *21*, 62, 553–559.