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Towards an interdisciplinary model of practice for participatory building design in education

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Abstract

It is recognised that educational environments influence learning experiences, so it is important to ensure that educational buildings are designed to be fit for purpose. In order to ensure that educational buildings meet the needs of those who use them, all relevant stakeholders should be involved in the design process. However, this is not straightforward and much remains unclear about how involvement in such complex design processes should proceed. This article presents the findings of four small heterogeneous groups of architects, educational designers, teachers and students from the UK and The Netherlands, discussing how they would envision optimal collaboration and involvement of stakeholders in the process of (re)designing educational buildings and instructional methods. Presentations from the four groups were transcribed and analysed. Informed by a review of existing models and frameworks, our findings were synthesised into a new interdisciplinary model of participatory building design in education. This new model focuses on an iterative design process with different stakeholders involved in different ways at different times. We propose that this model can inform policy and practice in educational building design, as well as within co-creation of curricula, learning, teaching and assessment.

1 | INTRODUCTION

Educational policy is continuously developing in response to new research about how best to prepare students for a rapidly changing world. In practice, educators attempt to create innovative curricula to enable students to develop collaborative skills and lifelong learning attitudes, engage with new technologies, and participate in decision-making in society (Vann Merriënboer & Kirschner, 2013). For successful implementation, goals underlying curriculum change must align with other elements of the educational system, including the built environment. This is because spaces for learning influence whether and how educational goals can be reached (Nordquist & Laing, 2014, 2015), including the teaching approaches adopted (Conner & Sliwka, 2014; Stukalina, 2010) and educational activities (Proshansky & Wolfe, 1974; Sigurðardóttir & Hjartarson, 2011). Thus, changes in educational vision that necessitate curricular change require corresponding changes to the spaces.

Reaching alignment between the educational design and the built learning environment is a challenge. Many school buildings are 'more or less living museums of past concepts of curricula and learning' (Nordquist & Laing, 2014, p. 556). Moreover, when designing new learning spaces, Nordquist and Sundberg (2013) argue that architects tend to use their own, often outdated concepts of learning and teaching to inform design, whilst Watson (2007) highlights the difficulties of developing new educational buildings for a 'learning future' that people find hard to visualise. A successful learning environment is one where the physical, pedagogical and organisational elements are aligned (Gislason, 2010), but existing research, policy and practice do not always recognise the importance of this alignment. For an effective design of both curricula and built learning environments, greater collaboration is needed between the different stakeholders (Cook-Sather, Bovill, & Felten, 2014; Nordquist & Sundberg, 2013; Watson, 2007). Collaboration for designing built environments is still relatively undefined in the literature, unlike the growing literature on collaborative approaches for designing curricula, learning, teaching and assessment (Cook-Sather et al., 2014; Healey, Flint, & Harrington, 2014). This article explores how architects, educational designers, teachers and students can collaborate in the design of educational buildings.

First, we report the findings from a discussion forum in which these stakeholders brainstormed how they envisioned a participatory design process and would involve different stakeholders. The three themes in their proposed approaches are: Reasons for involving different stakeholders; stakeholders' involvement throughout the design process; and facilitating collaboration between stakeholders by experimentation. Then, existing models that externally validate the findings and can inform participatory building design are described: Action research cycle, stakeholder analysis model, ladder/climbing frame of participation and participation matrix. Finally, our findings and existing models are integrated in an Interdisciplinary Model of Participatory Building Design.

In education, stakeholders have their own expectations and perceptions, so accounting for these perspectives is crucial to develop powerful learning environments (Könings, Seidel, & Van Merriënboer, 2014). In the context of curricula design, there is growing evidence of the importance of the empowerment of teachers in the design process (Kali et al., 2015; Cober et al., 2015), as well as evidence that student participation in learning design increases satisfaction with the learning experience (Cook-Sather et al., 2014; Könings, Brand-Gruwel & Van Merriënboer, 2010).

Recently, education policy in England took a pioneer position in supporting participatory design of school buildings with the Building Schools for the Future (BSF) programme (2003–2010) which aimed to rebuild or refurbish all English secondary schools. Government guidance was clear that there should be 'proper consultation with the staff and pupils of the school and the wider community' (DfES, 2002, p. 63). A selection of publications provides examples of 'participatory techniques' (DfES, 2002) and support for schools to develop best practices (CABE, 2004). Such interest in, and enthusiasm for, participation in the design of the physical setting can be seen as the coming together of parallel developments in architecture and design on the one hand, and in education on the other. This is most obvious in the case of the school sector in England, but the ideas reach beyond this setting. Essentially, the increasing value attached to participation in architecture and design (Blundell Jones, Petrescu, & Till, 2005; Day, 2003; Design Council, 2005) has occurred at the same time as a drive for student voice gathering momentum within education (Bovill, 2013; Rudduck & Fielding, 2006).

As has been discussed elsewhere (Woolner, 2010; Woolner & Clark, 2015), the parallel between student voice in education and participatory design in architecture extends to the benefits and limitations, suggesting the value, but also the challenges, of participation in the design of educational buildings. On the positive side, user involvement tends to improve the understanding of needs, resulting in a more suitable building (Clark, 2010). Yet, the potential of participation may be limited by the challenges of accessing and acting upon a diversity of ideas from very different stakeholders (Fielding, 2001a, 2001b). Contrasting expertise, cultures and priorities can pose a challenge for stakeholder collaboration. In educational change policy, different forces push forward an innovation: internal bottom-up initiatives, external top-down forces, and the personal beliefs and missions of those involved (Downes, 2013). For successful change, these forces must be acknowledged. It is argued that different stakeholders should share their ideas and expectations about reform to develop schools as collaborative and active learning environments (Stukalina, 2010). Hargreaves and Fullan (2009) stress the need to connect different viewpoints into a 'theory of action'.

Although it seems sensible that including more stakeholders in decision-making will improve the decision, more participants will increase the complexity of the process, for example when the opinions and needs of different

participants involved in designing a school are in conflict (Burke & Könings, 2016; Könings, Seidel, Brand-Gruwel & Van Merriënboer, 2014; Woolner, 2010). Yet this conflict may elicit new and productive ideas or ways forward if well negotiated. A clear conclusion from the research base is that the details of the approach taken to participatory educational building design matter. Suggestions to assist the process include the use of facilitators to ease communication between disparate groups (Parnell, Cave & Torrington, 2008; Woolner, McCarter, Wall & Higgins, 2012) and the benefit of visual activities to engage a range of participants (Clark, 2010), encouraging the sharing of ideas (Woolner & Clark, 2015). However, much remains unclear about how involvement in complex design processes should proceed. Our study investigates how interdisciplinary groups of stakeholders would prefer to collaborate in the process of (re) designing learning and teaching approaches and school buildings. These findings are subsequently connected to existing models and frameworks on participatory design from the literature in order to inform a possible road map for a productive participatory design process, visualised in a new interdisciplinary model of participatory building design.

2 | METHOD

In order to develop an approach for optimal involvement of all stakeholders in the process of (re)designing educational buildings and instructional methods, a discussion forum was organised at the symposium on Participatory Design of the Future-Building School as part of a funded exchange project between the UK and The Netherlands. Experts in the fields of educational design and instructional methods and architects designing schools from both countries gathered at the Teaching Hotel of the Hotel Management School in Maastricht, The Netherlands, which is a recently redesigned and refurbished castle used as a student-led hotel. As student voice is very important in this workplace-based learning environment, we invited local teachers and students to represent these two important stakeholder groups.

A two-hour session was organised around the question of how potential stakeholders envisioned their collaboration in the participatory design of a learning environment; including attention to both the educational methods and a well-aligned school building. The 16 participants – four architects/architect educators, four educational designers, four students and four teachers from the Teaching Hotel – were divided into four heterogeneous groups with one architect, one educational designer, one student and one teacher in each group to discuss how they envisioned a participatory design process focused on developing a new educational building and how they would involve different stakeholders. They were instructed to use visual tools to develop a concept map; post-it notes to collect ideas during the brainstorming; and a large piece of paper to draw a concept map representing their proposed approach. At the end of the session, a member of each of the groups presented their concept map in a plenary. These presentations were transcribed verbatim and analysed to find underlying similarities between the four approaches using qualitative data analysis software. We present the key themes from the presentations in the following section. The themes were: Reasons for involving different stakeholders, stakeholder involvement throughout the design process, and how to envision collaboration between stakeholders.

3 | PROPOSED APPROACHES FOR PARTICIPATORY BUILDING DESIGN

3.1 | Reasons for involving different stakeholders

The groups gave several reasons for inviting different stakeholders to contribute to the design of a building. They recognised that designing a new school building provides great freedom to use creativity to develop something new, which does not exist in the mind of any one stakeholder before the process commences:

> . . .the government. . .setting rules and goals. . .but in between there is this whole space that could be filled with creativity and different approaches. [group 2]

They also found that involving all key stakeholders in the process could prevent assumptions being made about the needs of different groups, and that, in the longer term, it could prevent mistakes being made in expensive buildings that are not fit for purpose.

...this is... kind of, pretty taken for granted...You know, it saves you millions and millions and millions and millions of pounds. [group 3]

There are no prefixed solutions or already existing designs. Often designs only make incremental improvements to an older space. To design a building that suits the needs of the teachers and students, one must expand one's knowledge of the possibilities for designing learning spaces. Group 1 elaborated on this:

... if you want something... flexible, adaptable... that's not something that we have readily accessible within our knowledge....it's not simply a matter of writing down what people find about it...You'll have to expand your knowledge and search for it, for example organise field trips, visit different places that use different approaches and...study a number of aspects to see how the space works, what interaction is between the activities and the space, how does the learning process take place there... [group 1]

Finally, an important reason for involving different stakeholders is that they have very different views of innovation and creativity. Participatory design can help to prevent 'groupthink' and one stakeholder group blocking radical innovative ideas, as became apparent in this comment on the role of educational publishers:

... these stakeholders often block innovation because educational publishers really like their books and the books drive the learning process and often the book is more important in structuring the educational process than the teacher. ...they tend to be quite conservative. [group 2]

3.2 | Stakeholder involvement throughout the design process

In all group presentations, stakeholder involvement throughout the whole design process was apparent. Teachers, students, architects, (young) professionals, architectural students, educational publishers, ICT specialists, and the community were all recognised as important stakeholders. The dangers of overlooking any particular stakeholder was highlighted:

... ICT specialists, people who are developing educational games and so on. ... we see these educational publishers or developers of educational tools like smart boards as important stakeholders, but... they are often invisible in the whole process. [group 2]

Stakeholder involvement varies during the different phases of the design process. All groups defined several stages, mostly starting from *defining the ultimate educational goal or purpose*, but also recognising preconditions, such as the brief, available budget, and time schedule. In this early phase, the role of architects is likely to be less important, whilst other stakeholders develop a firmer sense of the aims of the design project. Input from (young) professionals who are aware of the desirable knowledge and skills that students need to develop for their future careers and the community is perhaps more important at an early stage to help to inform the desired end results of a curriculum and learning environment, as summarised by group 2:

we were starting with the core of the education and the 'why' of the education... we came to actually the development of talents in society and in their profession. The 'why' of the education brings us to other goals we have and those goals we set up with professions. So they are the ones who say: 'Okay, these are the students we need in our professions', but next to that as well the governments who have some wishes in education and what we thought was very important...is to involve the young professionals...because they have the experience of their education and will have the first experience of being in the professional world and what they would need in education. [group 2]

A next step focused on how these goals could be reached. This requires the development of an *educational vision*. According to all groups, teachers, educationalists and students are likely to take the lead in this stage, but their levels of responsibility vary:

This involves the teachers. . . who know what the adaptation should be. Students and. . . teachers play the role of the user who know what's happening. And education specialists. . . are the advisers in the process. [group 1]

developing a vision for what we're doing . . . the educationalists, teachers, students leading the decision making and the architect maybe coming up with saying what things are feasible and. . . providing input into the decisions, but not necessarily being responsible for making the final decision. [group 4]

Ever more stakeholders are involved in developing the different components of the learning environment, including educational methods, learning materials, organisation and physical space. Attention in the design process increasingly focuses on the building, which must be well aligned with the educational vision, as discussed by group 3.

In the middle, the shift from that conceptual work to the kind of framing of a specific project. . . we're experimenting before we're kind of building, we're trying some stuff out. So we're defining a common vision. Does it need testing again against our initial ideas? [group 3]

Hence, the role of the architect becomes more prominent:

. . . taking these things forward into the. . . proposal development stage and the architect taking on more of a leading role in that stage with the other stakeholders providing input but not taking the lead. [group 4]

The need to develop learning materials and educational tools leads to closer involvement of educational publishers and ICT specialists, as emphasised by group 2:

the building, but also the products, the methods for studying, so it could be a smart board, it could be a book. . . And important in this phase of the design process are again the publishers because they really develop these products and the architects develop the building and the professionals they think about the way of testing the students. [group 2]

At a certain point, all plans are agreed and the *school building is realised*, the design process moves into a new phase in which the use of the building is stressed. Use of the building is still flexible, but within the constraints of what the new building allows. A continuous, lifetime approach to participatory design of the learning environment was proposed: Indeed, the process does not end when the physical building is completed.

The main product is design for change. . . you should take care of adaptability, of flexibility in what you create. . . . Something flexible that will allow the educational goals to be implemented in a variety of settings. . . it should provide the opportunity to at least evaluate what you've been doing with respect to the educational processes, but also use it in the educational processes to create something that works. [group 1]

In this continuous process, the key stakeholders are likely to change, with teachers and students becoming the most important agents to maximise learning within the new environment, whilst the professionals and the government will focus on evaluating the outcomes of the design process.

The life cycle doesn't stop of course, you start using it, people are getting education over there. . . there are different stakeholders important in that period: professionals of course and again the government. [group 2]

3.3 | Facilitating collaboration between stakeholders by experimentation

Collaboration and mutual understanding are very important for an effective building design. In many situations, stakeholders will not agree, so individuals must empathise with others' perspectives to be able to make concessions when taking decisions.

getting to know each other, building a relationship, building a connection. Actually, maybe even affection for each other and for each other's experiences and each other's expertise. . . you have to do concessions. Not

everybody can do whatever they want but they can make concessions on understanding because you understand each other's problems a little bit. [group 4]

Good communication is of crucial importance, as stressed by group 1: 'If you cannot listen, you don't learn'. Also communicating with peers and colleagues who are not directly involved in the design process is important to prevent possible resistance to change.

You have to find support with other people who are not in that creative process because you're going to do something new and there's going to be some resistance on that new phase….it will help to …get some support for the new ideas. [group 4]

In the design process, it is important to have ample room for experimenting and testing different design options before taking any decision. This was stressed by group 3:

So we're running experiments, we're making technologies; we are deciding where we're going to sit. So we're trying things out and the… teachers, educators and the architects are…experimenting and reflecting on that. [group 3]

Building the actual school does not allow for a trial and error process, but should be successful right away.

The point would be not to kind of make your plan, build a school and then test it. The point would be to build a space for exploratory play before you do that, in whatever way you can… This is trial and success. [group 3]

During this experimental design process, different possibilities are created and evaluated by teachers, students, and architects. Imagining spatial designs is difficult and negotiating different possibilities can be challenging, so visual tools, such as full-scale models are valuable.

You can for example use full scale modelling techniques by which you create out of cheap materials a mock-up in one-to-one scale of the real thing and see how people behave and operate within this environment. [group 1]

You've got to have some hands-on stuff. I'd say that bit, trying stuff out, is utterly non-negotiable in any participatory design process [group 3]

These models also make it possible to move away from incremental improvements to existing ideas towards imagining new possibilities, as suggested by the following group:

having an experimental process is to resist that stupid thing in the beginning where you say to people: 'What do you want?' And they go: 'Well, I want what I've already got' or 'I want this rocket chair.' So the only way you get round that… you have to do some hands-on, trying some stuff out, playing with it, having an exploration… you have to work with your ideas, materialize them some way. [group 3]

Within the design process, all participants collaborate in searching for possibilities and ideas, but at different points in time decisions must be made. Although it is a participatory process, there can be a need for a leader in such decisions, as indicated by two groups:

Although we want everyone to sort of have an equal investment in this project…at different stages different people…need to kind of lead the decision making. [group 4]

Sometimes in this design process it's really blurry…and there should be somebody… to say: 'Okay, now we're going to the next phase and we have to make a point and really getting stuck on that and go further.' [group 2]
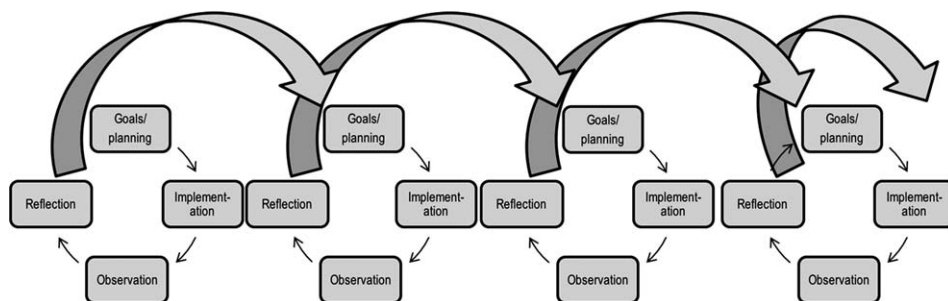
FIGURE 1 Spiral of repeated cycles of planning, implementation, observation and reflection

4 | DISCUSSION: MODELS TO INFORM PARTICIPATORY BUILDING DESIGN

Our participants developed ideas and mind maps on how to envision the participatory building design process. The findings underline the importance of the involvement of different stakeholders, as they all bring different experiences and expertise to a design process. The results suggested that stakeholder involvement changed throughout the design process, with stakeholders having different roles in different phases of the process. The pre-building experimental phase was considered by respondents to be a key stage in collaborative building design, perhaps not commonly found in collaborative curricular design.

The findings highlighted some common considerations in design processes that led us to reflect upon a range of existing models and frameworks that could offer useful perspectives: The Action Research Cycle, Stakeholder Analysis model, Ladder/Climbing Frame of Participation, and Participation Matrix, which all relate to who participates, when, and in what ways. By connecting these models and our findings, we propose a new Interdisciplinary Model of Participatory Building Design.

4.1 | Action research cycle

Many respondents spoke of a design process that reflected a cyclical model of planning which is reminiscent of the action research cycle. In Zuber-Skerritt's (1992) model of action research, there are distinct stages of planning goals, implementation, observation and reflection. Importantly, action research includes consideration of why, what, and how an initiative is carried out (in the goal/planning and implementation phase), but emphasis is also placed on observing and reflecting on progress towards the goals. Zuber-Skerritt illustrates this by the use of a spiral to represent repeated cycles of planning, implementation, observation and reflection (see Figure 1).

Another key element of the action research model is the emphasis placed on a participatory process and the expectation of working towards change (Zuber-Skerritt, 1992). The key characteristics and processes of the model overlap with elements of the participatory building design process. Thinking about this model alongside our current results elicited questions about which stakeholders are involved in design, in what ways, and at which stages.

4.2 | Stakeholder analysis model

Stakeholder analysis is a common tool that can be used in participatory building design to consider carefully who should be involved. A typical importance/influence matrix model enables a mapping of how key project stakeholders can influence a project, as well as identifying which stakeholders are important if the objectives are to be met (DFID 2003) (see Figure 2).

The UK Department for International Development (DFID) argued that those in Box A "require special initiatives if their interests are to be protected...Box B shows stakeholders...who can...significantly influence its success.
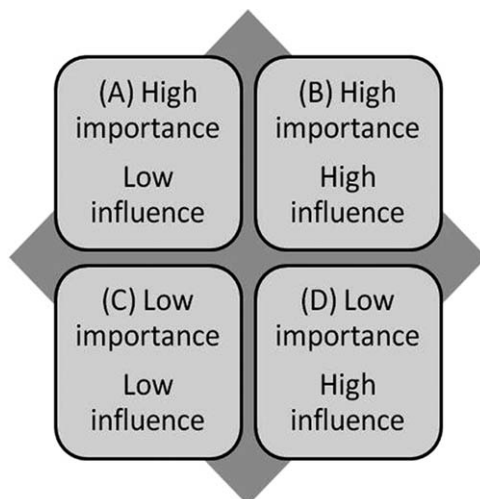
FIGURE 2 Importance/Influence matrix

Managers...will need to develop good working relationships with these stakeholders to ensure an effective coalition of support for the activity. Box C shows stakeholders who...may need limited monitoring. They are unlikely to be the focus of the activity. Box D shows stakeholders...whose interests are not the target of the activity. These stakeholders may be able to block the activity and therefore could constitute a 'killer risk'" (2003, pp. 2.4).

We could speculate that Box A is likely to be the box in which students are placed in relation to participatory building design. Architects and teachers could be placed in Box B, the community in Box C, and educational publishers in Box D. However, this will differ from one participatory building design project to the next and we should not see stakeholders as 'belonging' to a particular quadrant, but rather as adopting certain roles at certain stages of a project.

4.3 | Ladder of participation tool

Arnstein (1969) created a model of different levels of citizen participation based on a ladder which stretches from low rungs of non-participation, through rungs of tokenism, to the top rung illustrating citizens in control. It has been adapted by different authors for use in different settings (with young people, Hart, 1992; and for curriculum design in higher education, Bovill & Bulley, 2011). Singer and Woolner (2015) propose a climbing frame model that illustrates the multidimensional nature of participation and suggests the possibility of multiple ladders interconnecting. Different people involved in school design participate at different levels, which vary from informing, consulting, and partnership, to control. The climbing frame model aims to '...explore the space of exchange as part of a long-term process involving a range of participants' (Singer & Woolner, 2015, p. 197).

4.4 | Participation matrix

There is a danger with these models that we assume that stakeholder influence and importance are static. This crucial point was raised in the symposium discussions: In participatory building design, different stakeholders participate in different ways at different points in time. These concepts are captured in a 'participation matrix' (DFID, 2003) where consideration is given to the appropriate level of participation that different stakeholder groups should ideally demonstrate in the different stages of project planning (see Table 1). Stakeholders may only need to be informed of project progress at some stages, whilst at others, they may be consulted, work in partnership, or take control of a particular stage of the process. The context and the stages of the process influence what level of participation might be possible and desirable (Bovill & Bulley, 2011; Singer & Woolner, 2015).

TABLE 1 Example of a participation matrix to show stakeholder involvement in a project

Level of Involvement / Action Research Stage	Inform	Consult	Partnership	Control
1. Planning	Stakeholder A	Stakeholder B	Stakeholder C Stakeholder D	
2. Implementation	Stakeholder A Stakeholder C		Stakeholder B Stakeholder D	
3. Observation	Stakeholder A Stakeholder C	Stakeholder B		Stakeholder D
4. Reflection			Stakeholder B Stakeholder C Stakeholder D	

4.5 | Towards an interdisciplinary model of participatory building design

We have explored a range of existing models that provide a level of external validation of our findings. Integrating our findings and these existing models led us to propose an interdisciplinary model of participatory building design that could help educational policy makers and practitioners to consider a range of complex factors in the design of learning spaces (see Figure 3). For complex participatory building projects, the model combines the value of a participation matrix with the spiral of action research (or design) over time (left side of Figure) to illustrate how different kinds of participation by different stakeholders may be appropriate in different cycles of the project design (Plan, Experiment, Realise, Use).

The model illustrates how a limited group of example stakeholders could participate in different ways throughout the life of a participatory building project by indicating for each cycle which stakeholders have what role or responsibility (middle part of Figure). In reality, many more stakeholders may be involved and there may also be subgroups, such as groups of students with different interests and responsibilities.
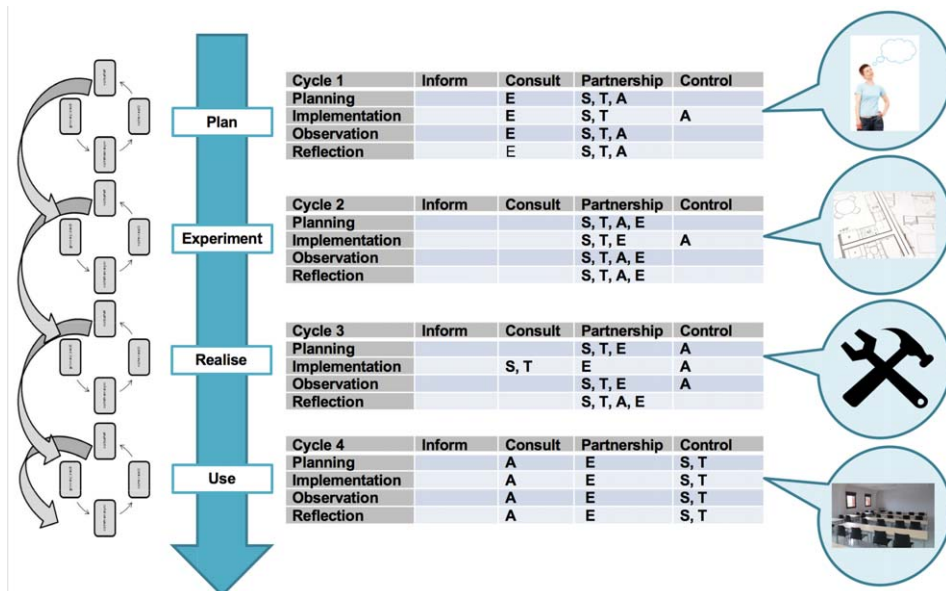

FIGURE 3 Interdisciplinary model of participatory building design [Colour figure can be viewed at wileyonlinelibrary.com]
Note. S = Students; T = Teachers; A = Architect; E = Educationalists

Consistent with our findings, four cycles are specified. In the first cycle 'Plan', at the top of the figure, time is spent on defining an educational vision. In cycle 2, 'Experiment', stakeholders focus on imagining designs that could meet the educational vision and test the proposed designs. Respondents in our study referred to this as the experimental stage, which included the idea of modelling buildings and learning spaces. In reality, experimentation may be repeated for several cycles in order to ensure that different possible designs are fully explored. However, there is a point after the experimental stage when decisions must be taken and a new school or university building will be built. This is illustrated in our model in cycle 3 'Realise' where the new building is constructed and opened.

The model illustrates that the stage when the building is completed and in use (cycle 4) marks a shift in stakeholders' participation (see participation matrix in Figure 3). Architects move from being key drivers of the project to a period of 'snagging' and monitoring how the building works, and their role will be less important than those who use the building, particularly students and teachers. The architect is likely to check that the building performs as it should and the users adapt to their new environment. The teachers and students may start new experimentation initiatives to work out the best ways to use new spaces for optimum learning experiences. They may even enter cycles of redesign of the interior of the building where smaller scale adaptations are needed to ensure that the educational vision becomes a reality. Nevertheless, the focus will have changed from creating an appropriate building to adapting and using spaces to enhance learning.

By synthesising our findings with existing models from literature, we developed a model that aims to provide a tool for educational practice in co-designing physical learning environments. It is a framework to be adapted and completed in order to suit particular design contexts in specific situations. Our study has some limitations, including a limited sample size, the limited time span of the discussion session, and the fact that groups were not requested to reflect on a concrete design process. Most groups, however, discussed concrete examples introduced by group members. A further study focusing on a real building design process was suggested. Given these limitations, we must be cautious in generalising the findings of this study, but they resonate well with the literature and existing design models.

5 | CONCLUSION AND POLICY IMPLICATIONS

Participatory building design for education is a very particular form of design that involves the participation of a wide range of stakeholders. What we have attempted to demonstrate in this article is the complexity of this process and that any framework that is offered as a way of guidance is by nature multidimensional and complex. One notable feature is the possibility and necessity of involving different stakeholders at different stages in the design process and in different ways. The participatory building design process has the potential to continue after the building is complete, with the students and teachers working in partnership to co-design the curriculum (Singer & Woolner, 2015; Könings et al., 2014). However, current literature on student partnership in curriculum design pays relatively little attention to the different ways in which groups of students and staff contribute at different stages of the learning process. Instead, current discussions of student participation in curriculum design focus on which students are involved (Bovill, 2014; Bovill et al., 2016; Moore-Cherry, Healey, Nicholson, & Andrews, 2015). The inclusion of a participation matrix in our model can help to distinguish between which students will participate and at which stages of a project. The matrix also highlights in what ways stakeholders will participate – will they be informed, consulted, work in partnership, or be in control of different elements of the project? On this basis, the model has potential to be informative in current discussions about active participation of students in the design of curricula, teaching methods, educational buildings and educational policy.

Another key feature of participatory building design, reflected in our framework, is the experimental stage(s) when ideas can be explored and models can be created and tested. Many stakeholders see this as a crucial part of the process in ensuring that the educational vision will be met by any new building. After this experimentation, a distinct point is reached where the building needs to be constructed, followed by another distinct stage where the focus shifts to participatory design and adaptation within the new built spaces. Throughout these stages, different stakeholders take on different roles, and the exact configuration of participants will vary in every individual participatory building design project.

The Review of Education Capital (James, 2011) may have criticised the idea of teachers and students participating in the design of school buildings, but this contrasts sharply with the United Nations view about children having a right

to a say in their own education. There is a growing recognition that to design educational buildings - whether schools, colleges or universities - without the participation of those who will be most affected by the buildings, raises the chances of making extremely expensive mistakes in the form of buildings that are not fit for purpose, due to a lack of user perspectives informing and guiding the design process. The design process can ignore key stakeholders, but whilst their perspectives may be absent, these stakeholders remain as a potential influence and they are often made more powerful through the impact they have on a process when they have been overlooked or excluded.

Participatory building design is far from straightforward. We offer our model of interdisciplinary participatory building design as one way of framing the participatory design process that can be helpful for policymakers and practitioners alike and that contributes to theory building on participatory design of educational change. The model will not overcome all the challenges of trying to understand the perspectives of others and involve all stakeholders, nor will it ensure that agreement will be found easily at different stages of the design process, the model highlights ways to think about and understand the process of participatory building design in a transparent way that goes some way to recognising the different expertise offered by stakeholders throughout the lifecycle of a new educational building.

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