



# Constructing a framework for the exploration of the relationship between the psychosocial and the physical learning environment

S. Baars<sup>1,2,3</sup>, P. den Brok<sup>2</sup>, S. Krishnamurthy<sup>1</sup>, J.P. Joore<sup>3,4</sup> P.J.V. van Wesemael<sup>1</sup>

1 Eindhoven University of Technology - The Netherlands

2 Wageningen University & Research - The Netherlands

3 NHL University of Applied Sciences - The Netherlands

4 Delft University of Technology - The Netherlands

## ABSTRACT

The research field regarding the relationship between the psychosocial learning environment (PSLE) and the physical learning environment (PLE) requires a commonly accepted theoretical framework, enabling comparison of research results and construction of a shared body of knowledge. Based on selected and reviewed literature, this study explores existing conceptualisations, distilling the main aspects as identified by earlier research, and processes these findings in a preliminary conceptual framework. This framework structures the PSLE into the dimensions: personal development; relationships; and system maintenance and change, and the PLE into the dimensions naturalness; individualisation; and stimulation. For each of these dimensions, the framework distinguishes the intended, implemented, and attained representation. Compared to the conceptualisations used in the reviewed literature, this preliminary conceptual framework is more comprehensive, with a balanced representation of both the PSLE and PLE. Further development and empirical testing will be necessary to demonstrate the validity, usability and reliability of the framework.

**KEYWORDS: PSYCHOSOCIAL LEARNING ENVIRONMENT, PHYSICAL LEARNING ENVIRONMENT, CONCEPTUAL FRAMEWORK**

---

*Siebre Baars is a lecturer at the department of the Built Environment at the NHL University of Applied Sciences, architect, PhD candidate at the Faculty of Built Environment of the Eindhoven University of Technology (TU/e), member of the research group of Living Cities- AUDE – TU/e, member of the research group Open Innovation - NHL, and member of the group of national experts of the committee on effective learning environments of the OECD. Working as an architect at various offices, he designed and conducted many school building projects. In addition, he supervised and conducted many practice research projects into the physical learning environment as a board member of the research group of the BNA (Association of Dutch Architects). Seven years ago, Siebre returned to the University as lecturer, researcher, and supervisor of graduate projects. He has been involved in various research projects of the NHL, including research projects into the adaptation strategies for school buildings to meet innovative pedagogies. For these studies, he has developed a methodology combining stakeholder analysis and building analysis. To improve this methodology, he started a PhD study, with as first result this theoretical substantiation of a preliminary conceptual model for the research into the relation between the psychosocial learning environment and the physical environment.*

## INTRODUCTION

Interest in research into the learning environment is growing, stimulated by the changing pedagogical visions, shifting from behaviouristic approaches towards progressive and constructivist approaches (Cleveland & Fisher, 2014). Initially, research mainly focused on the psychosocial learning environment (PSLE), emphasising the investigation of the perceptions and experiences of the users on the micro-level of the classroom (Moos, 1980). Recognising the mediating effect of the physical learning environment (PLE) on the PSLE (Oblinger, 2007), the relationship between both has drawn the attention of researchers, including Lackney (2000), and Fisher (2007). Based on explorative studies, various concepts for innovative PLEs has been developed, including those of Fisher (2005) and Nair, Fielding & Lackney (2013). These concepts have already been incorporated in school building policies (Hod et al., 2016), regardless of the scarcity of empirical evidence of the impact of innovative PLEs on the PSLE (Blackmore, Bateman, Loughlin, O'Mara, & Aranda, 2011) - sometimes entailing rigorous consequences. School buildings have been demolished because of presumed dysfunction or inadaptability. Innovative PLEs are stimulating the implementation of innovative PSLEs, but are sometimes impeding return to other PSLEs also (Cleveland & Fisher, 2014). Therefore, developing an evidence-based body of knowledge regarding the relationship between the PSLE and the PLE is of great academic and social interest.

## PROBLEM STATEMENT

In recent years, various frameworks have been developed to enable empirical research into the relationship between the PSLE and PLE. However, the research is divided over various disciplines, resulting in fragmented conceptual frameworks, complicating collective advances in this field (Ellis & Goodyear, 2016).

## AIM

The aim of this study is to collate the existing knowledge and merge this into a conceptual framework, enabling structured research into the interrelationship between the PSLE and the PLE.

## RESEARCH QUESTIONS

Therefore, the following research question is formulated:

- Which qualitative and quantitative aspects of the PSLE and PLE have been identified by the literature as relevant for the research into the relationship between the PSLE and the PLE, and in which way can these aspects be conceptualised in a framework?

## METHODOLOGY

To answer this question, a literature review was conducted. Keywords were derived from the research question, supplemented with frequently used keywords in the research field. Several search engines were used, combining keywords of the PSLE with keywords of the PLE in various combinations. The literature was selected based on inclusion and exclusion criteria, including the publication date, number of citations, research topic, and type of publication. Subsequently the literature was studied in detail. Identified qualitative and quantitative aspects of both the PSLE and PLE were processed in a table, enabling analysis by comparison. Conceptualisations of both the PSLE and the PLE were compared, and merged into a preliminary conceptual framework, processing dimensions and aspects for which there is a reasonable consensus. Subsequently, existing frameworks used in recent research were compared with the preliminary conceptual framework, establishing the differences.

## RESULTS

### REPRESENTATIONS OF THE PSLE AND PLE

Analogous to van den Akker's (2013) conceptualisation of the curriculum, this research distinguishes the *intended*, *implemented* and *attained* representations of the PSLE and PLE. Referring to the different temporal phases and stakeholders perspectives, several researchers apply comparable conceptualisations, including Blackmore et al. (2011), and Radcliffe et al. (2008). The intended representation refers to staff's ideals, described in formal policies. The implemented representation refers to the observable practice and the perceptions of those bringing policy into practice. The attained representation refers to users' performance and experiences. This distinction is relevant because in different representations aspects may be contradictory, causing mediating or moderating interactions (Akker, Gravemeijer, McKenney, & Nieveen, 2006). Unexpected research results can often be explained by these contradictions. Frequently mentioned contradictions include the staff's intended PSLE versus the teachers' perceived PSLE (Gislason, 2009), the staff's intended learning goals versus the assessed learning outcomes (OECD, 2013a), and teachers' actual use of the PLE versus the intended use of the PLE, requiring teachers' "spatial competencies" (J. A. Lackney, 2008).

### PSLE

Following the authoritative conceptualisation of the PSLE by Moos (1980), this research distinguishes the dimensions of *personal development*, *relationship*, and *system maintenance and change*.

#### Personal development

The dimension *personal development* can be conceptualised by the aspects *open-endedness*, *relevance/integration* and *environmental interaction*.

*Open-endedness* refers to the learning goals and outcomes, shifting from predefined end-products towards personalised, process-related learning outcomes, tailored to the student's individual learning potential, interest, and preferred learning style. *Relevance/integration* refers to the learning content, which, as a consequence of the open-endedness, should not be organised by subject matter, but by students' learning needs, in a multidisciplinary context similar to the reality outside school, where subject areas are not divided but interconnected (OECD, 2013b). *Environmental interaction* refers to the interaction of school's direct environment with learning, enabling students to provide an observable, meaningful contribution to the environment with their learning outcomes (OECD, 2013a).

#### Relationships

The dimension *relationship* can be conceptualised by aspects of *teacher support*, *critical voice*, *student negotiation*, *group cohesiveness* and *student involvement*.

Teacher support refers to teachers' sensitiveness to identify and to respond to individual learner's needs (OECD, 2013a). Conversely, learners must feel free to express their learning needs, and to comment on the learning and teaching activities, referred to as *critical voice*. *Student negotiation* refers to the students' construction of knowledge by mutually assessing the viability of ideas. Performing cooperative tasks requires learners being mutually respectful, helpful and supportive, referred to as *group cohesiveness*. Therefore, learners must be interested in the learning content, attentive to others, participating in activities, performing additional work, and appreciating being a group member, referred to as *student involvement*.

#### System maintenance and change

The dimension *system maintenance and change* can be conceptualised by the aspects of *order and organisation* and *shared control*.

*Order and organisation* originally refers to the qualitative sub-aspects on the micro-level of the classroom. Much literature on innovative PLEs focuses on defining the quantitative aspects on the micro-level and meso-level of the PSLE. Various authors,

including Fisher (2005) and Thornburg (2004), have conceptualised the learning modalities, learning activities and learning settings on the micro-level of students' PLE. On the meso-level of a school, the grouping of learners was critically reviewed, with the organisational units of the class, subject matter, and scheduling being questioned. Therefore, alternative concepts have been developed, based on block scheduling and students grouped in Small Learning Communities (SLC), supporting multi-disciplinary activities and fluently merging and splitting of learning settings (Nair et al., 2013). The aspect *shared control* refers to the learning activities management, traditionally the responsibility of the teacher. In learning-centred PLEs, learners are stimulated to be more self-regulating.

## PLE

Following the conceptualisation of the PLE by Barrett et al. (2015), this research distinguishes the dimensions *naturalness*, *individualisation* and *stimulation*. Although sometimes further subdivided, the same dimensions are distinguished in other conceptual models, including the PST framework (Radcliffe et al., 2008), and PLACES and SPACES (Zandvliet, 2014).

### Naturalness

The dimension *naturalness* can be conceptualised by the aspects *light*, *sound*, *temperature*, *air quality*, and *links to nature*. Research into the healing environment (Ulrich et al., 2008) stimulated the attention to aspects related to the natural needs for a safe and healthy PLE. A growing number of studies confirms the impact of these aspects on students' performance and wellbeing, including the recent research of Barrett et al. (2015).

### Individualisation

The dimension *individualisation* can be conceptualised by the aspects *flexibility*, *connection*, and *ownership*.

*Flexibility* refers to the availability of a variety of supportive technologies, furniture, fittings and equipment in students' PLE, as proved to influence the variety of teaching and learning activities (Imms & Byers, 2016). Pre-scheduling learning activities and learning spaces is contradictory to the aspect *open-endedness*, assuming immediate adaption of the learning settings to students' actual learning needs. Therefore, and because of efficiency, learning spaces will often be used for different learning settings simultaneously or sequentially by easy and quick rearrangement or simultaneously by a varied spatial arrangement.

*Connection* refers to the spatial configuration and interaction of learning spaces. Traditional classrooms are mostly too small-sized to accommodate multiple arrangements efficiently (Bissell, 2004). To avoid needless rearrangement, it is more efficient to compose a learning cluster of differentiated learning spaces (Nair et al., 2013). To enhance communication, interaction, and observation - prerequisite for *teacher support* and *student involvement* - these learning clusters must be open and transparent (Nair et al., 2013), only separating learning activities susceptible for interference. On the PLE's meso-level, internal connections are asserted to enhance the integration of disciplines, and external connections are asserted to enhance the environmental interaction.

*Ownership* refers to the perception of the users' ability to manage and control the PLE, promoting feelings of safety, responsibility, and belonging (Scott-Webber, 2004). Therefore, the spatial concepts usually exclusively allocate learning clusters to small learning communities. General logistical routes should not traverse these clusters, avoiding distortion of activities and presence of students not belonging to the SLC (Gislason, 2009).

### Stimulation

The dimension *stimulation* can be conceptualised by the aspects *complexity* and *colour*.

*Complexity* refers to the diversity of PLE's physical presentation. The peripheral perception of the PLE is asserted to influence learning by sensual stimulation as "third teacher" (Strong-Wilson & Ellis, 2007).

Colour refers to the colours used in the PLE. Research has shown that colours influence both emotions and physiology, but also that colour preferences are depending on personal characteristics (Higgins, Hall, Wall, Woolner, & McCaughey, 2005).

Despite strong claims, the impact of these aspects is not unanimously established in the empirical practice and therefore disputed (Blackmore et al., 2011).

PSLE– PLE Relationship (PPR) framework

	<b>INTENDED</b>	<b>IMPLEMENTED</b>	<b>ATTAINED</b>
<b>PSLE</b>	<i>ideal / formal intended</i>	<i>perceived / operational</i>	<i>assessed / experienced</i>
<b><i>personal development</i></b> <ul style="list-style-type: none"> <li>• <i>relevance/integration</i></li> <li>• <i>environmental interaction</i></li> <li>• <i>open-endedness</i></li> </ul>			
<b><i>relationships</i></b> <ul style="list-style-type: none"> <li>• <i>teacher support</i></li> <li>• <i>critical voice</i></li> <li>• <i>group cohesiveness</i></li> <li>• <i>student negotiation</i></li> <li>• <i>student involvement</i></li> </ul>			
<b><i>system maintenance and change</i></b> <ul style="list-style-type: none"> <li>• <i>shared control</i></li> <li>• <i>order and organisation</i></li> </ul>			
<b>PLE</b>	<i>ideal / formal intended</i>	<i>perceived / operational</i>	<i>assessed / experienced</i>
<b><i>naturalness</i></b> <ul style="list-style-type: none"> <li>• <i>light</i></li> <li>• <i>sound</i></li> <li>• <i>temperature</i></li> <li>• <i>air quality</i></li> <li>• <i>links to nature</i></li> </ul>			
<b><i>individualisation</i></b> <ul style="list-style-type: none"> <li>• <i>flexibility</i></li> <li>• <i>connection</i></li> <li>• <i>ownership</i></li> </ul>			
<b><i>stimulation</i></b> <ul style="list-style-type: none"> <li>• <i>complexity</i></li> <li>• <i>colour</i></li> </ul>			

Figure 1: PSLE– PLE Relationship (PPR) preliminary conceptual framework.

The aspects identified in this paper have been merged into a conceptual framework for exploring the PSLE – PLE Relationship (PPR) (see Figure 1). Comparing this PPR framework with frameworks used by the reviewed publications, this study observes that much research focuses either on the PSLE or PLE, with a comprehensive operationalisation of the PSLE and a limited operationalisation of the PLE, or vice versa, leaving key factors unexplored. Additionally, most research focuses on the micro-level of the classroom; the meso-level of the school organisation and the school building is under-researched.

Research focused on user's experiences, mostly provide limited or no information regarding the analysis of the PLE, in particular regarding the operationalisation of the quantitative aspects of the PLE related to the dimensions of *individualisation* and *stimulation*. The recent research of Zandvliet & Broekhuizen (2017), by example, analyses students' perceptions regarding the PSLE and PLE, but does not provide a quantitative analysis of the PLE studied.

Conversely, PLE-focused research mostly does not report comprehensively on the PSLE. For their study into the conceptualisation of school building types, Dovey & Fisher (2014) selected schools by their intended innovative PSLE. They

note that, contrary to expectations, several schools are not hindered by building types that are assumed to impede innovative PSLEs. An analysis of the intended, implemented and attained PSLE could have explained this apparent contradiction.

The research of Barrett et al. (2015) into the impact of the PLE on learning outcomes also lacks a comprehensive analysis of the implemented and attained PSLE. The operationalisation of the implemented PSLE was limited because recording teachers' perceptions was not allowed for privacy reasons. The operationalisation of the attained PSLE was limited to the cognitive learning outcomes. Contrary to expectations, the research establishes weak impact of the aspects *connection* and *complexity*. The authors presume that this might be explained by the predominant pedagogical approach, emphasising learning in the classroom. An analysis of teachers' perceived PSLE could have supplied more insight.

Most of the reviewed research focuses on the micro-level of the student's learning environment. To enable research into a wider variety of formal and informal learning spaces, the Pedagogy, Spaces and Technology (PST) framework was developed by Radcliffe et al. (2008). The PST framework uses trigger questions, promoting a project-specific operationalisation of the aspects of pedagogy, space, and technology in various life-cycle stages. Several studies have been conducted on a single subject, recording the changes in teaching modes, learning experiences, and technology use before and after changing the learning space (Byers 2016). However, whereas the flexibility enables application of the PST framework in different situations, it hinders an unambiguous interpretation of aspects and their operationalisation (Ellis & Goodyear, 2016), complicating the comparison of the identified aspects with other frameworks.

## DISCUSSION

This review merges the insights of research from various disciplines into the preliminary PPR framework. In this framework the key aspects, as identified and defined by the reviewed literature, have been arranged into dimensions, analogous to comparable conceptualisations of the PSLE and the PLE.

Compared to existing frameworks, aspects are added or amended, based on the reviewed literature. The meso-level of the aspect of *order and organisation* was not included in the reviewed frameworks, although frequently mentioned in the literature. The relevance of adding this aspect must be tested, including the demarcation between this aspect and the aspect *shared control*. Compared with the conceptualisation of the PSLE by Zandvliet, this framework adds the aspect *teacher support*, addressing the attitude of teachers towards learners, as the aspect *critical voice* addresses the attitude of learners towards teachers. Also for these two aspects, the demarcation requires attention.

In the PPR framework, the aspects are not operationalised in the distinguished representations yet. The relevance of aspects is not always undisputed. They may vary by educational level, and may be assessed differently depending on the stakeholder's position. Aspects may manifest themselves differently in the various representations, and may be difficult to operationalise in some situations. In addition, it should be noted that this framework is extensive. The operationalisation may prove to be rather elaborative.

## FURTHER RESEARCH

The relevance of the aspects, and possibilities for operationalisation must be established by further research. Therefore, prior research may be explored, investigating and selecting the most effective methodological instruments. Subsequently, case studies should be conducted, testing the operationalisations by using the selected methodological instruments. The framework can then be modified based on the results of the case studies, resulting in a final version, tested on validity, usability and reliability.

## CONCLUSION

This review started with the research question, which aspects are relevant for the research into the relationship between the PSLE and the PLE according to the literature, and in which way these aspects can be organised. This review establishes a reasonable consensus regarding the involved aspects, but also notes that the conceptualisations used are still under development. Merging existing conceptualisations, the preliminary PPR framework provides a fairly complete and balanced conceptualisation.

Further research is needed to test the preliminary PPR framework in an empirical setting to prove the validity, usability and reliability of the framework.

## REFERENCES

- Akker, J. Van den, Gravemeijer, K., McKenney, S., & Nieveen, N. (2006). Introducing Educational Design Research. In J. van den Akker, K. Gravemeijer, S. McKenney, & N. Nieveen (Eds.), *Educational Design Research* (pp. 1–163). Routledge.
- Barrett, P., Davies, F., Zhang, Y., & Barrett, L. (2015). The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis. *Building and Environment*, 89, 118–133. <http://doi.org/http://dx.doi.org/10.1016/j.buildenv.2015.02.013>
- Bissell, J. (2004). Teachers' Construction of Space and Place: the method in the madness. *Forum*, 46(1), 28. <http://doi.org/10.2304/forum.2004.46.1.6>
- Blackmore, J., Bateman, D., Loughlin, J., O'Mara, J., & Aranda, G. (2011). *Research into the connection between built learning spaces and student outcomes*. Melbourne: Department of Education and Early Childhood Development.
- Byers, T. (2016). A quasi-experimental and single-subject research approach as an alternative to traditional post-occupancy evaluation of learning environments. In W. Imms et al. (Ed.), *Evaluating Learning Environments* (pp. 117–130). Sense Publishers. <http://doi.org/10.1136/bmj.2.2169.258>
- Cleveland, B., & Fisher, K. (2014). The evaluation of physical learning environments: a critical review of the literature. *Learning Environments Research*, 17(1), 1–28.
- Dovey, K., & Fisher, K. (2014). Designing for adaptation: The school as socio-spatial assemblage. *The Journal of Architecture*, 19(1), 43–63. <http://doi.org/10.1080/13602365.2014.882376>
- Ellis, R. A., & Goodyear, P. (2016). Models of learning space: integrating research on space, place and learning in higher education. *Review of Education*, 4(2), 149–191. <http://doi.org/10.1002/rev3.3056>
- Fisher, K. (2005). Linking pedagogy and space: proposed planning principles. Melbourne: Department of Education and Training [Victoria]. Retrieved from [www.eduweb.vic.gov.au/edulibrary/public/assetman/bf/Linking\\_Pedagogy\\_and\\_Space.pdf](http://www.eduweb.vic.gov.au/edulibrary/public/assetman/bf/Linking_Pedagogy_and_Space.pdf)
- Fisher, K. (2007). Pedagogy and architecture. *Architecture Australia*, 96(5), 55–57.
- Gislason, N. (2009). Mapping School Design: A Qualitative Study of the Relations Among Facilities Design, Curriculum Delivery, and School Climate. *The Journal of Environmental Education*, 40(4), 17–34. <http://doi.org/10.3200/JOEE.40.4.17-34>
- Higgins, S., Hall, E., Wall, K., Woolner, P., & McCaughey, C. (2005). The Impact of School Environments: A literature review. London: Design Council. Retrieved from <http://128.240.233.197/cflat/news/DCReport.pdf>
- Hod, Y., Charles, E. S., Acosta, A., Ben-Zvi, D., Chen, M. H., Choi, K., ... Quintana, R. M. (2016). Future learning spaces for learning communities: New directions and conceptual frameworks. In *12th international conference of the learning sciences* (pp. 1063–1070). Retrieved from <http://repository.lib.ied.edu.hk/jspui/handle/2260.2/21266>
- Imms, W., & Byers, T. (2016). Impact of classroom design on teacher pedagogy and student engagement and performance in mathematics. *Learning Environments Research* 20(1), 139–152. <http://doi.org/10.1007/s10984-016-9210-0>
- Lackney, J. A. (2000). Thirty-three educational design principles for schools & community learning centers.

- Lackney, J. A. (2008). Teacher Environmental Competence in Elementary School Environments. *Children Youth and Environments*, 18(2), 133–159.
- Moos, R. (1980). Evaluating classroom environments. *Studies in Educational Evaluation*, 6(3), 239–252.
- Nair, P., Fielding, R., & Lackney, J. (2013). *The language of school design: Design patterns for 21st century schools* (3rd ed.). Minneapolis: Designshare, Inc.
- Oblinger, D. G. (2006). Space as a change agent. *Learning Spaces*, 1. <http://doi.org/10.1007/978-3-642-01039-2>
- OECD. (2013a). *Innovative Learning Environments* (Vol. 13). Paris: OECD Publishing. <http://doi.org/10.1787/9789264203488-en>
- OECD. (2013b). The Nature of Learning principles revisited. In *Innovative Learning Environments* (pp. 153–184). Paris: OECD Publishing.
- Radcliffe, D., Wilson, H., Powell, D., & Tibbetts, B. (2008). Designing next generation places of learning: Collaboration at the pedagogy-space-technology nexus. The University of Queensland. Retrieved from [www.uq.edu.au/nextgenerationlearningspace/](http://www.uq.edu.au/nextgenerationlearningspace/)
- Strong-Wilson, T., & Ellis, J. (2007). Children and place: Reggio Emilia's environment as third teacher. *Theory into practice*, 46(1), 40-47. [http://doi.org/10.1207/s15430421tip4601\\_6](http://doi.org/10.1207/s15430421tip4601_6)
- Thornburg, D. (2004). Campfires in Cyberspace: Primordial Metaphors for Learning in the 21st Century. *International Journal of Instructional Technology and Distance Learning*, 1(10), 1–12. Retrieved from [http://itdl.org/journal/oct\\_04/oct\\_04.pdf#page=7](http://itdl.org/journal/oct_04/oct_04.pdf#page=7)
- Ulrich, R. S., Zimring, C., Zhu, X., DuBose, J., Seo, H.-B., Choi, Y.-S., ... Joseph, A. (2008). A review of the research literature on evidence-based design. *Health Environments Research and Design Journal*, 1(3), 61–125. <http://doi.org/10.1177/193758670800100306>
- van den Akker, J. (2013). Curricular Development Research as a Specimen of Educational Design Research. In T. Plomp & N. Nieveen (Eds.), *Educational Design Research* (pp. 53–70). Enschede: SLO - Netherlands Institute for Curriculum Development. Retrieved from <http://international.slo.nl/publications/edr/>
- Zandvliet, D. B. (2014). PLACES and SPACES: Case studies in the evaluation of post-secondary, place-based learning environments. *Studies in Educational Evaluation*, 41, 18–28. <http://doi.org/10.1016/j.stueduc.2013.09.011>
- Zandvliet, D. B., & Broekhuizen, A. (2017). Spaces for learning: Development and validation of the school physical and campus environment survey. *Learning Environments Research*, 20(2), 175–187. <http://doi.org/10.1007/s10984-017-9228-y>