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# The diffusion of Innovative Learning Environments: Integrating Rogers' Theory with Baars' Psychosocial-Physical Perspectives

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**Abstract:** This study addresses the limited adoption of innovative learning environments in higher education by integrating physical and psychosocial perspectives with diffusion theory. Building on the PLE/PSLE framework (Baars, 2023) and Everett M. Rogers' innovation-decision process, the research develops a conceptual and intervention-based approach to increase acceptance, demand, and effective use of such spaces. Two co-created learning environments—a Flexible Learning Room and an Active Learning Room—serve as empirical cases. An integrated framework is constructed that links spatial attributes with adopter categories, communication channels, and intervention strategies. Rather than evaluating isolated measures, the study conceptualizes a design logic for investigating and supporting adoption processes. In doing so, it contributes to learning environment research by shifting the focus from physical design toward user-centered adoption processes and by explicitly incorporating organizational and psychosocial dimensions into the study of innovation diffusion.

**Keywords:** Innovative Learning Environment; Diffusion of Innovation; Physical Learning Environment (PLE); Psychosocial Learning Environment (PSLE); Co-creation; Adoption Processes; Higher Education; Communication and Intervention Design

## 1 Current Perspectives on Innovative Learning Environments

### *The need for Innovative Learning Environments*

In an era defined by rapid technological and societal transformation, future skills – particular those linked to innovation and entrepreneurship – have become essential for individuals and organizations to adapt, innovate, and remain competitive. These skills include those that empower people to communicate effectively, learn continuously, think critically, and act creatively and self-reflectively (Stifterverband 2026). In the context of these changing learning requirements, a collaborative learning process is becoming more important, which does not only address students but also includes teachers and other stakeholders (Papageorgiou 2022: ). Consequently, this requires learning environments in

which learning can take place as a social process and that can adapt to different needs in various learning settings.

However, recent research results indicate, that many Higher Education Institutions (HEI's) still rely on 'traditional' learning spaces with rather traditional row seatings or new learning environments are not yet achieving their full potential (Ninnemann 2025). Ninnemann (2025) specifically points out that the use and adoption of new learning environments is not granted, and more persuasion is needed before a larger group will recognize and utilize the advantages of innovative learning spaces (Ninnemann 2025). Therefore, she recommends further research that specifically takes challenges into account that particularly arise around organising such new learning environments.

> "While aspects of pedagogy, space, and technology can be analysed based on existing extensive knowledge in research and practice, organizational issues have not yet been systematically observed and conceptualized and require further investigation in real-world laboratories" (Ninnemann, 2025).

### *The field of research for Innovative Learning Environments*

The field of classroom learning environment roots back to the 1960s (Fraser 2023) and research on learning spaces and concepts like Active Learning Classrooms (ALCs) has been done since the 1990s (Talbert 2019, Bonwell 1991). In this context Whiteside has shown that ALCs put teachers in the role of learning facilitators and strengthen teamwork. According to her study the students' background also plays a role in their assessment of the different learning spaces as "students from metropolitan areas rated the new learning spaces significantly higher than their […] rural counterparts". (Whiteside et al., 2010). Barrett et al. (2015) have shown the impact of physical learning space dimensions, such as Naturalness, Individualization and Level of Stimulation, on the performance level of pupils. Zandvliet et al. (2019) provide an overview of questionnaires that are used for the evaluation of classrooms, while all of them address physical features and some items also analyse the nature of interpersonal relationships between teachers and students, the wellbeing of students and the connection between wellbeing and learning outcomes. However, some aspects in the context of learning environment research still remain untapped. As Fraser (2023) summarizes his work on the evolution learning environments research as:

> "However, it is disappointing to observe that although new designs or redesigns of learning spaces usually aim to change the psychosocial learning environment in specific ways, it has been rare to evaluate their effectiveness in terms of changes in psychosocial characteristics" (p. 7).

## Conceptional background

### *Psychosocial learning environment (PSLE)-Physical learning environment (PLE) relationship*

In line with Baars (2021) this research understands a physical learning environment (PLE) as "a school's built environments that are intended as learning places, including […] buildings and learning spaces and their spatial structure, furniture, fittings and equipment" (p. 45). Based on a broad literature review Baars derived three subdimensions of learning environments, which are: (i) naturalness - light, sound, temperature, air quality and links to nature), (ii) individualisation - fitness, flexibility,

connection and personalisation and (iii) stimulation - complexity and colour (Baars, 2023). However, according to Blackmore et al. (2011), these physical aspects might influence the behaviour inside the room but do not automatically lead to innovative learning and teaching styles:

> "If teachers are not prepared for the pedagogical and technological use of innovative PLE, they tend to retreat to the safety of their well-known traditional teaching styles (Lackney 2008), adjusting the PLE within their possibilities by, for example, shaping classrooms with moveable interior elements. This illustrates that the pedagogical practice does influence the nature and use of the PLE and, thus, how the PLE is experienced (Blackmore et al. 2011).

Therefore, a psychosocial Learning Environment (PSLE) describe learning as a constructive and social activity that takes place in a learning environment and includes the learning context (Baars 2021). Referring to Moos (1980), Baars describes the subdimensions ***Personal development*** (personal growth and self-enhancement), ***relationships*** (nature and intensity of personal relationships within the learning environment, the involvement of people, and feelings of being affiliated, accepted and supported) and ***system maintenance and change*** (order, control, expectations and responsiveness to change, including grouping of students and teachers, scheduling and regulation of the learning process).

In his complex synthesis of these PLE/PSLE attributes, Baars (2021, 2023) assigns over 40 empirical study results to analyse their operationalisations as well as their empirical evidence. Furthermore, the analysis of his own interview findings with the focus on the PLE sub-dimensions of personalization – **fitness, flexibility, connection and personalisation** – provides valuable insights into the interplay between the physical and psychosocial aspects of space use, as only a few examples demonstrate:

**Table 1** Examples for PLE / PSLE attributes and experienced relationships

| *Element* | *PLE aspect* | *PSLE aspect* | *Experience* |
|---|---|---|---|
| Displays, Writable Surfaces | Fitness / Availability | Connection / Student cooperation | Exchange of ideas |
| Furniture's moveability | Flexibility / Rearrange ability | system maintenance and change | Rule clarity |
| Furniture arrangement | Fitness / Congruency | Personal development | Spatial competency & engagement |
| … | … | … | … |

(Baars 2023)

## *Diffusion of innovation*

Similar to the previously addressed PLE/PSLE perspectives of a learning environment and their interdependencies (Baars 2023), Rogers (2003) refers to psychological and social processes in which learning takes place in his well-established theory of innovation adoption and diffusion. He categorizes individuals (or "decision making units") into several kinds of adopters based on their willingness and time to adopt innovative solutions and therefore distinguishes between five adopter categories – innovators, early adopters, early majority, late majority and laggards (p.282).

The variables determining this rate of adoption point out a number of similarities to PLE/ PSLE perspectives, like ***compatibility*** to existing values, experiences and needs (Rogers 2003: 240), while suitable communication channels and contents as well as interventions have to be identified.

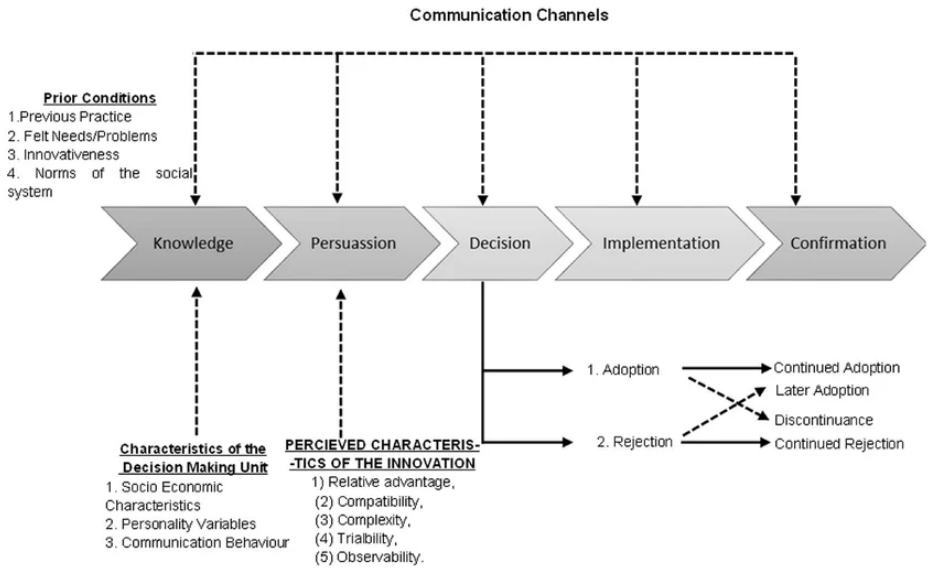


**Figure 1** Model of Five Stages in the Innovation-Decision Process (Rogers 2003)

At the beginning of the knowledge stage, awareness-knowledge needs to be built. The predispositions of people influence their behaviour toward communication messages: they are more open to those ideas that are in accordance to their interests, needs and previous attitudes, and avoid messages that are in conflict with their existing predispositions (Rogers 2003: 171).While mass media might be a good choice to transport the first messages about the existence of an innovation at an early stage, at a later stage, change agents may transport the necessary 'how-to' knowledge, especially if the innovation is complex. According to Rogers, the mental activity at the knowledge stage is mainly cognitive whereas "the main type of thinking at the persuasion stage is affective (or feeling)" (Rogers 2003: 175).

In the context of convincing individuals to adopt new solutions, the perceived characteristics of this solution influence their acceptance and should therefore be communicated clearly (e.g., relative advantage, compatibility). This also involves addressing uncertainties, exchanging ideas with peers, and testing things out through demonstrations (Rogers 2003: 177).

Furthermore, the individual and collective culture influences the individual's decision, while in later stages of the implementation process, problem solving and assistance play an important role.

In his research Rogers (2003) also provides valuable insights on specific needs of the different adopter categories as their characteristics, preferred communication channels, and the different timing and content of outreach efforts.

Combining both, Baars (2023) PLE/PSLE perspectives and Rogers (2003) theory of adoption and diffusion, the following section derives a conceptual framework combining psychosocial and physical aspects of learning environments with physical ones with different types of (innovation) adopters.

## *Research gap and aim of the study*

Building on previously outlined work in the context of learning environment research, three main gaps have been identified driving this research: (i) the lagging behind of German HEI's in the development of innovative learning spaces, (ii) the systematisation and conceptualisation of organizational issues, which will be referred to

as a social learning and diffusion process, and (iii) a greater emphasis on the psychosocial aspects of learning in as well as about innovative environments.

Therefore, the main objective of this research is to increase the acceptance, demand, and usage of innovative learning spaces among various user groups. The aim is to develop focussed interventions, appropriate communication channels and contents that do not only take the physical characteristics of the learning environments into account, but, in particular, also consider psychosocial aspects.

In summary, and in line with Baars (2021, 2023) and Rogers (2003), the following basic assumptions guide the actions:

- Students' and teacher's competencies influence the effective use of the PLE, with positive results; both have to develop new 'spatial' competencies.
- It takes time to develop these competencies
- Willingness can be stimulated by users' ownership of innovation and by involving teachers and students in the design and maintenance.
- The psychosocial environment develops in interaction with the innovative PLE to solve the experienced frictions.
- New balances are sought between control and empowerment in the various relationships - teacher–student, teacher–teacher, and teaching team–management—including the alignment of these new balances into the system's organisation at different levels.

Based on these assumptions, the following research questions have been derived:

- Which dimensions of the PSLE-PLE framework can be identified to be similar to and relevant for the diffusion process according to Rogers on both individual (decision-making process) and social level (rate of adaption)?
- How can these identified dimensions and factors be used to develop an appropriate implementation tool or system to communicate the Innovation "Learning Environment" within a social system (with norms, leadership, change agents and aides) via suitable channels?
- How can we explore and develop teachers' and students' – and other stakeholders' – experiences and competencies with the innovative learning environments on an individual and social level?

## *Methods*

Central object of this study are two learning rooms at a HEI in Germany that were developed as part of the EMPOWER project "Experimental spaces". Both rooms were co-designed with a mixed stakeholder group through an iterative process and which are currently being implemented. With the participation of students, faculty, and instructional design experts, two traditional, teacher-centered classrooms are transformed into two learning environments modelled after the "Flexible Learning Room" and "Active Learning Room" concepts (Ninnemann 2024, 2025) and adapted to meet specific needs.

The "Flexible Learning Room" is conceptualized in order to enable different learning and teaching styles, which is for example meant to supported by flexible furniture and different technical options. The "Active Learning Room" is designed to facilitate group work and interaction among students, primarily through the arrangement of workstations.

Both rooms are equipped with writable walls and interactive displays.

To increase the acceptance, demand, and usage of these innovative learning environments among various user groups a conceptual framework is needed to understand and order the different psychosocial, physical, communicative and timing

aspects. Therefore, the psychosocial-physical relationship (PPR) of a learning environment (Baars 2023) is combined with Rogers' model of innovation diffusion.

By combining the different aspects of the learning spaces with the concept of the diffusion, this study operates at the intersection of action research (Gorál et al. 2021) - which focuses on the study and development of individuals and social systems - and design science research (Hevner 2004), which focuses on the development of artifacts.

The research approach and design of this study reflects Roger's (2203) diffusion process and includes measurements at several points. It still has to be discussed critically, whether the impact of some special interventions should be measured or bundles of actions over time. Regardless of this decision, the Study Design will follow the following logic:

1. Measurement Point 0: "Base Assessment"
2. Phase 1: "Knowledge stage activities" (broad, mass media)
3. Measurement Point 1
4. Phase 2: "Persuasion stage activities" (social, interpersonal)
5. Measurement Point 2
6. Phase 3: Decision (targeted support)
7. Phase 4: Implementation (sustaining)

To measure the impact of communication initiatives and/or individual interventions, and to gain a general understanding of relevant learning environment or innovation characteristics a recurring survey is conducted prior to any initiative (Base Assessment). This survey addresses students as well as faculty members. This survey should ask for

- Perceptions of recent learning spaces (current status)
- Values and needs for innovative teaching
- Desired characteristics of innovative learning environments according to Rogers' (2003) attributes
- The requires PLE/PSLE dimensions according to Baars (2023)

### *Integrated communication- and intervention framework to diffuse Innovative Learning Environments*

As illustrated in several examples above, the PLE/PSLE attributes resemble innovation attributes. It is therefore likely that the development of certain spatial attributes also represents a step toward the diffusion of innovation.

The following overview combines Baar's (2023) PLE/PSLE components with Roger's (2003) innovation attributes and stages. It is a first step toward answering the first research question. By doing so it intends to outline when and how acceptance or adoption of new learning environments can be increased. While starting this process with a more general communication process, the PLE/PSLE aspects (Baars, 2923) as well as the innovation attributes defined by Rogers (2003), are becoming increasingly important as the adoption rate intends to grow

***Table 2*** Integrated communication- and intervention framework to diffuse Innovative Learning Environments (Examples)

| Rogers Attribut | PLE/PSLE | Knowledge Stage | Persuasion Stage | Decision Stage | Implementation Stage |
|---|---|---|---|---|---|
| **Relative Advantage** | Fitness | **"Mass media":**<br>• "Snackable" knowledge bites ("3 Benefits of Active Learning Spaces")<br>• short videos from courses<br>**Innovators:** Early Insights Reports | **Interpersonal:**<br>• Testimonials from Early Adopters<br>• Brown-Bag Sessions<br>**Early Adopters:** Showcase Events | **Interpersonal:**<br>Personalized consultation ("What's in it for me, exactly?")<br>**Early Majority:**<br>use cases from practice | **Interpersonal:**<br>Supportive coaching<br>**Late Majority:**<br>Benefits & Best Practices |
| **Compatibility** | Personalisation | **"Mass media":**<br>Personas ("How Prof. X uses the space") / specific examples | **Interpersonal:**<br>Exchange formats<br>**Early Adopters:**<br>Community of Practice | **Interpersonal:**<br>Co-Design Workshop<br>**Early Majority:** show option on how to adapt | **Interpersonal:**<br>customization scenarios<br>**Late Majority:**<br>standardized templates |
| **Complexity** | Flexibility | **"Mass media":**<br>"It's That Easy" Guides – 1-Minute Tutorials | **Interpersonal:**<br>Hands-on Workshops<br>**Early Adopters:**<br>Testing group | **Interpersonal:**<br>Support Hours<br>**Early Majority**<br>accompany the process | **Interpersonal:**<br>On-demand Support<br>**Late Majority:**<br>Plug & Play solutions |
| **Trialability** | Flexibility & Connection | **"Mass media":**<br>Invitation to the Pilot Phase: "Risk-Free Testing" | **Interpersonal:**<br>Micro-Teaching sessions<br>**Innovators/Early Adopters:**<br>Pilot rooms | **Interpersonal:**<br>low-threshold booking systems<br>**Early Majority:**<br>temporary use, testing lectures | **Interpersonal:**<br>Integration into routine operations<br>**Late Majority:**<br>peer cooperation |
| **Observability** | Connection | **"Mass media":**<br>Before-and-After Stories: Visualized Use Cases | **Interpersonal:**<br>Peer Visits<br>**Early Adopters:**<br>as multiplicators | **Interpersonal:**<br>peer case consultation<br>**Early Majority:**<br>social validation | **Interpersonal:**<br>Community Building<br>**Late Majority:**<br>"Everybody is using it" effect |

(own illustration)

## Conclusion and Further Research

The co-creative design of innovative learning spaces involving diverse user groups represents a promising pathway toward increasing both the acceptance and sustained use of such environments, particularly when considering the physical–psychosocial–environmental (PPE) dimensions. From a diffusion of innovations perspective, the actors involved in these co-creative processes assume critical roles as peers, innovators, and change agents, thereby contributing to processes of persuasion and communication within the social system.

However, the effectiveness of innovative learning environments at the institutional level depends on adoption beyond the group of innovators and early adopters. For meaningful impact on teaching and learning practices, it is essential that broader user groups are both willing and enabled to engage with these environments. Addressing this challenge represents a key objective of the present study.

A central question concerns whether instruments designed to enhance physical and psychosocial conditions for diffusion should be differentiated according to adopter categories or whether the study design should instead follow a more process-oriented logic that supports individual adaptation across user groups. Closely related to this is the methodological question of how intervention measures should be evaluated: whether through aggregated assessments of their overall impact or via the discrete quantification of individual interventions.

Beyond the intervention formats discussed so far, the proposed framework may also encompass structural mechanisms - such as service offerings, support infrastructures, and organizational processes - that facilitate the adoption of innovative learning environments. This raises further questions regarding the necessity and appropriateness of defining clear boundaries for such mechanisms, or whether openness and adaptability should be maintained as a core design principle.

Ultimately, this study seeks to contribute a novel perspective to the discourse on learning environment development, which has thus far been predominantly shaped by a focus on spatial and physical transformations. By integrating diffusion theory with a PPE-oriented lens, the study shifts attention toward the dynamic interplay between environment, users, and adoption processes.

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