

# **Third Teacher goes *Raumwerkstatt* - participatory planning processes to redesign physical learning environments**

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**Abstract.** The transdisciplinary research project *Lehrraum\_digital* [Lecture Room\_digital] at the TU Dresden concentrated on developing and testing participatory methods and instruments to plan and design physical teaching and learning environments for vocational education and training (VET) considering the progressive digitalization of education. This paper presents case studies that were carried out at VET institutions in 2017 as the main part of the project. A special workshop format called *Raumwerkstatt* is the primary focus of the paper. The workshop was developed within the project *Lehrraum\_digital* and, with regard to the relevance of physical learning environments in VET, it was conducted in the form of case studies with trainees and apprentices.

**Keywords:** participation, learning environments, planning process, digitalization

## **1 Learning environments for vocational education and training**

Learning is an (inter-)active process. Learning places that enable interactive learning require a different spatial offer than they did before. Providing opportunities for different teaching and learning environments, physical teaching and learning rooms develop into a versatile infrastructure as "places of learning". Today's education rooms are characterized by a variety of methods: traditional teaching in front of the whole class, group or work in pairs, and reflective individual work. To meet these requirements, school teaching and learning rooms must be extremely flexible. This differs significantly from the concept of open teaching in the 90s [1].

Contemporary, versatile and highly flexible learning and working environments only develop if they follow a recognizable pedagogical-architectural concept and combine the necessary versatility with other properties that are essential for school environments and rooms. These pedagogical-architectural concepts are more and more including the support of learning with media and the corresponding availability of innovative media-supported teaching and learning opportunities as well as the consideration of the experiences and learning worlds of children and adolescents.

Most notably, creating learning environments that enable innovative teaching and learning processes means focusing on those involved in the learning process, on learners and teachers, as well as the content and available resources [2]. Even though teachers remain indispensable, peers, parents or external possible knowledge carriers on

the internet come to the fore and get involved in teaching and learning processes. Content is becoming more networked and collaboratively processed, and is characterized by a high level of expertise. Content and resources must be adapted according, to the new approaches.

The OECD recommends that both digital technologies and innovations in classroom design should be taken into account and used in a targeted manner [2]. More than ever before, learning can be self-determined and independent of formal or institutionalized teaching. This creates a new quality of learning experience, e.g. by means of project- and problem-oriented learning. At the same time, modern learning environments should inspire, consider the socio-communicative needs of the learners, enable easy and uncomplicated IT and media use, and allow for a flexible handling of different learning scenarios. Addressing classrooms as learning and teaching environments does not only lead to a broader perspective for the formal school context, but also puts rooms and media technology infrastructures into a pedagogical context.

In particular, this applies to vocational education and training (VET). Digitalized learning environments, which combine the current teaching situation with media-based learning concepts, are a proven means of effectively designing action- and transfer-oriented teaching-learning processes and integrating learning and teaching across different learning settings in VET [3].

## **2 Spatial discourse and challenges in planning**

In times of digitalization, learning processes no longer only take place at specific places and physical environments. This development in education is further reinforced by the current Covid19 pandemic. At the same time, it raises the question which pedagogy in particular was turned towards in recent years [4]: What significance do physical environments have for teaching and learning in the 21st century?

Since the lively discussions about the new school architecture in the 60s and 70s, a broad pedagogical knowledge on the potential of physical environments and its significance as a “common space of friendly co-operation” [5] has evolved. At that time, the demands for a fundamental redesign of teaching and learning rooms culminated in the dictum of the school environment as the third teacher [6]. Today, this discourse on physical environments in pedagogy is no longer conceivable without considering the progressive digitalization of the educational system. As a result of changing requirements for learning with digital media, the demands on teaching and learning environments are increasing. This also involves new challenges for the planning and design process of teaching and learning environments. New integrative environmental concepts [7] and methods are required to make spatial, educational, and media-technological design approaches usable for an interdisciplinary planning process.

In addition to specialist planners, numerous other actors and stakeholders also participate in the discourse on learning environments. Hence, processes that create a common base at an early stage, with a common language and a common understanding of individual goals, are crucial. Successful communication creates transparency and enables participants to understand the ideas and visions of everyone. Narrative formats,

such as stories or comics, as well as self-designed visual representations or models, help to implement this successful communication. Visualizations gain particular strength when used in combination with suitable communication formats [8]. Planning experts take on the role of an enabler or a mediator in this context.

The current reality looks different. Although planning methods and instruments are available in a great variety, they cannot meet the complex requirements of designing teaching and learning environments. The interaction of the different approaches and their integration and impact in the planning process does not take place in practice and is seldomly addressed in science [9]. In addition, the search for improved procedures in the planning process often collides with planning self-images and disciplinary specializations [9][10]. According to Förster [9], effective design potential for achieving the objectives of spatial planning projects lies in particular in deliberate linking of different communicative events and in strong face-to-face communication with a high degree of interaction between those involved in the planning. Looking at the planning experts alone is not enough. Design is a process that takes place in the triangle of client - designer - and user [11]. In learning environments, the users are teachers and learners. If different skills of actors involved in planning processes can be the focus of planning [12], why should it not also include the ability of learners to develop and apply spatial strategies for their individual learning process? A prerequisite for this is the availability of methodological formats in which learners can contribute and share their experiences and competences regarding learning environments and education rooms.

### **3 Case studies in vocational education and training**

From 2017 to 2019, representatives of educational science, architecture, and media technology at TU Dresden cooperated in an interdisciplinary working group with users and actors of municipal private educational institutions and further training facilities of companies in the research project *Lehrraum\_digital*<sup>1</sup>. The working group developed instruments for planning and designing physical teaching and learning rooms for vocational education and training, considering the progressive digitalization of educational systems. These instruments and methods close the gap between current education and design research and the planning practice of learning environments and education rooms. The aim is to support the work of actors and administrations of educational institutions of vocational education and training as well as of educational and funding institutions and decision-makers in planning processes. The empirical basis of the project also includes several case studies that were conducted in 2017 in various vocational training institutions.

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### 3.1 Goals and case selection

The aim of the case studies was to examine the interrelationships between spatial, media-technical and pedagogical features of learning environments in a specific case of educational practice and to present them in their interactions with each other. The case studies may contribute to case-related theses. These theses can include reasons for the successful design of educational environments, but also inhibitory factors for their effective design at the process level. The case studies focused on examples that reflect current developments in learning environments in vocational education and training.

The sample consist only best practice examples, all of which have received awards from federal or state governments for their media concept and innovative use of spatial environments. The users within these case studies are familiar with other than solely the classic room and digital teaching-learning concepts. Therefore, their mostly implicit knowledge is of particular importance for scientific consideration. An important criterion for the case selection was the close link between digital media (and tools) for teaching and learning processes and physical learning environments. A total of three case analyses were conducted.

By choosing the State Vocational School II in Bamberg, we selected an institution of the Bavarian Referenzschule für Medienbildung [Reference Schools for Media Education]. This status is awarded to all schools that have initiated or continued a sustainable quality development process in media use and have transparently documented this process in a media development plan. Examinations focus on media competence and further improvement of the quality of teaching. Therefore, implementing school-specific media and method curricula as well as systematic internal teacher training are to be integrated in the field of media education.

By selecting the vocational school Oskar-von-Miller in Kassel, a focal point was set on the link between learning and spatial environments. This school has been active in various European and international research programs for years. The implemented *learning step concept* is the basis for various didactic, spatial, and media technology innovations.

Additionally, learning rooms at the SITRAIN (Siemens Training for Industry) Education Center in Nuremberg were analyzed. The Education Center offers qualification programs for internal purposes and for partner companies worldwide. Furthermore, a variety of media-supported scenarios were used.

In addition to a tour through the existing physical teaching and learning environments (seminar rooms, training environments, etc.) and interviews with teachers, we conducted so-called *Raumwerkstätten* with learners within the framework of the case studies. This participatory format developed in the project helped to record the everyday life and the requirements of the learners. It also provided an opportunity to reflect the future of the learning environments.

### 3.2 *Raumwerkstatt*: Methodic procedure

The workshops were each conducted with six trainees or apprentices and implemented by two hosts. In most cases, the participants did not know each other because they came from different professional fields or from different training levels, even if they belonged

to the same organization. Methodologically, the modality of the social arrangement was designed differently, both in the plenary, in group and in pairs. The planned time frame for the joint work was two and a half hours.

In the actual implementation of the case studies, we used two different variants of the *Raumwerkstatt* (see Table 1). One hypothesis postulated that there might be a difference between the availability and also the actual use of rooms in schools and in training centers. In vocational schools, learners are familiar with the education rooms because they use them on a daily basis for several years. Companies, on the other hand, often use learning rooms of external training providers. Rooms therefore change frequently or are completely unknown to learners. The time spent learning in companies is also much shorter - about two days and not three years.

The whole course of the workshop is designed to keep the attention high, so that each participant can pass and share on his or her knowledge and the group can achieve strong results in a short period of time. The focus on individual learning creates a positive mood in both workshop variants. The work in the workshops with learners was solution-oriented and less problem-based, which led to a constructive analysis of the topic.

All results were documented and shown to everyone during the course of the event (see Fig. 2). Throughout the process, participants were repeatedly asked to write their ideas, visions, and thoughts on cards. If new aspects evolved during a discussion, these were added by the hosts. Those cards were hung up directly in the process for everyone to see. The main advantage of this method was that misunderstandings could be uncovered and corrected in a quick manner, as each participant was able to see what was adopted from what he or she said, what might be missing or whether there were misunderstandings. The results were constantly reviewed with the users to avoid misinterpretations and to increase transparency. The procedure was also based on the guidelines for summarizing, according to the content-analytic process model of Mayring [13]. The required categories of the *Raumwerkstatt* were inductively obtained from the individual results of the groups, and the category names were taken from quotes. They resulted from the frequency of the aspects assigned to them. Two researchers derived these categories separated from each other and matched their findings afterwards.

### **3.3 *Raumwerkstatt*: Workshop structure**

The question "How and where are we currently learning" was linked with a sensitisation to the topic of joint spatial planning by architects, media planners and didactics in phase A of the workshop. For this purpose, the different learning rooms and places of the facilities used by the participants were first identified by the participants and then analyzed on the basis of the categories *didactics* (including social and learning forms), *media* (including availability, type of assignment, scope of use) and *spatial environment* (including equipment, location, design, atmosphere). The three disciplines were initially considered separately. Those categories were helpful for the participants to focus on in phase D.

**Table 1.** *Raumwerkstatt: process variants*

Phase	Education rooms	
	known (e.g. vocational school)	unknown (e.g. training center)
Preparation	Photographing or presenting favorite places (places for communication, relaxation, learning)	Selection of learning places (photos) and analysis (favorite places)
A	Education room analysis	
B	Introducing individual and personal places of learning locations (own photos)	Introducing individual and personal places of learning locations (given photos)
C	Categories for self-learning, learning and communication with others, and relaxation (own photos)	Categories for self-learning, learning and communication with others, and relaxation (given photos)
D	Development of meta-criteria	

The preparation of the *Raumwerkstatt* drew the participants' attention to places and rooms that they preferred for learning. The involvement of the participants and their experiences in the process of the workshop increases the identification and thus also the acceptance of the results generated. In the run-up to the event, the vocational school students were asked to document three of their favorite places and rooms for learning, relaxing, or communicating on the school premises. This method is called "showing favorite places" and helps on the one hand to understand the reality of the participants and on the other hand to introduce the participants to the topic as novices in this field [14]. Based on the method "matching atmosphere" [14] participants in on-the-job training, who were only briefly and not regularly at the place of training, did not receive this task, because the learning rooms were hardly known to them. Photos of different spatially learning locations or learning situations were shown to the participants (see Fig. 1). As an introduction to the topic, participants were asked to select images that best represented the spatial environment they preferred for learning. Working with images allows to find a common linguistic basis and additionally exposes implicit knowledge, as it is a very simple approach. Another advantage is that all participants can automatically contribute and share their individual horizon of experience with the other participants.

Phase A is only about vocational school. Participants should describe and assess every place they learn at school. Then they collected pros and cons of didactics aspects, the room and the used media in it.

Afterwards, the attendees of both groups presented their own picture or the chosen ones to the group (phase B). They explained what is important and special about their favorite places. They assign keywords to the picture. Those were categorized in didactics aspects, the room and the used media technic similar to phase A.

In the next phase (C), the participants were divided into three groups, with the focus on learning, communicating, and relaxation from work. Based on the keywords from phase B, the participants created categories for each topic and are presented the results of their group to the other attendants of the workshop.



**Fig. 1.** Learning situations (Photos: Project Lehrraum\_digital)



**Fig. 2.** Extracting the important aspects (Photo: Project Lehrraum\_digital)

The concrete ideas and visions for future spatial learning environments was the focus of the final phase of the *Raumwerkstätten*, phase D. For this purpose, meta-criteria were created on the basis of the results of the phases A, B and C, referring to the question "how do we want to learn". At the end, the group discussed and evaluated the results.

### 3.4 *Raumwerkstatt*: Key results

Unexpectedly, there were no major differences between the two groups. This means that there are only minor differences between participants from vocational schools who know the rooms, and participants from the Siemens Training Center. Even the most important requirements, such as the possibility to bring your own device, were mentioned by both groups. In addition, the general conditions were very similar for both groups - trainees and participants from the Siemens Training Center - because, for example, they have to use the given media technology for legal reasons. We will differentiate between the two groups in the following. If there are differences, they will be mentioned explicitly. The results from phases A, B and C can be understood as an introduction and documentation of intermediate work steps. Accordingly, the evaluation of the workshops was based on the results of phase D. Nevertheless, the results of the first steps are also briefly presented below.

As the most interesting result in phase A, the participants did not only mention the teaching room or computer room as their favorite places, but also many places in-between, such as the corridor, the terrace or the schoolyard and informal locations, like the cafeteria. In general it was differentiated between classrooms, planned learning rooms and self-selected, non-planned places. With regard to the classroom, the large amount of material and technical equipment was mentioned as particularly positive. The equipment available in the room may only be used there. Regarding their atmosphere, however, these rooms were described as cold, impersonal, colorless and sterile. Contrary feedback was expressed on the mostly self-selected rooms and places, which only corresponded in individual cases to planned learning rooms. Nevertheless, in these self-selected rooms the participants lack technical equipment (e.g. WiFi). Also, there was a lack of seating. In comparison to the own learning rooms, which were also described positively in terms of their atmosphere, vocational school rooms should be less crowded and noisy. The problem is that there seems to be a high demand for learning rooms overall. More rooms are needed, especially for working in groups and learning on their own. Equipment is also required which is not only designed for frontal teaching. With regard to the self-chosen rooms (B), outdoor places on the one hand and places for working in groups on the other hand, were chosen quite frequently. The main difference between the attendees of the vocational school and the Siemens Training Center was the way they evaluated informal places. These informal places reminded the Siemens participants of unfinished work that they had to do at home. So for them it was the worst scenario, while the participants from the vocational school liked it best.

Phase C showed that the participants had the most ideas for the categories room and media. Therefore, didactic aspects seem to be much more complex for them. Interestingly, the didactic aspects were often implicitly reflected as restrictions in the other categories. For example: "If I want to work in a group I cannot sit in the lecture hall". With regard to the characteristics of the spatial environment, the participants



often mentioned atmospheric aspects, while the "media" category was concerned with furnishing and access. Finally, the whole group reflected on the results and generated meta-criteria that are considered to be important in any learning environment.

To conclude, the meta-criteria of all case studies were collected and subjected to further clustering, including thematic and content-related summaries, structuring and selection. The procedure for evaluating the results is based on inductive category formation according to Mayring [13]. The degree of abstraction was increased in order to apply all statements on the learning environments and rooms. Based on the meta-criteria of all workshops conducted, the following six main categories could be identified (in order of their low to high importance for the participants):

The category *media usage* all includes support of concepts such as "Bring your own device", stable and freely accessible internet access. For the attendees, media use was a way of combining learning and relaxation as well as working and learning. The category *personal exchange* focused on meeting people from other sectors or institutions (classes, departments, companies) and working with learning partners and groups. Rooms lead to improving exchange and the perceived personal closeness (face-to-face). These personal contacts are particularly important in the learning context at work, since important information is passed on here and the learners hope to gain support for their learning process. In order to achieve this, common spaces, areas for movement, meeting areas and small niches are necessary [15]. In the category *availability*, learners' requirements range from access to work materials, digital technologies, to soft drinks - everything they need for learning. Of particular importance to them is the availability of internet, PCs, or notebooks and digital teaching materials, which also include manuals as they are used in a company context. The availability is related to every place in the vocational school and the training center and not limited to the teaching rooms. The next category is *atmosphere* and covers the learners' preferred atmosphere qualities. The preferences of learners differ greatly in this category. Walden and Borrelbach [15] explain that the feeling is always subjective. Nevertheless factors such as shape, color, light, climate, acoustics, material and spatial distances are important features to influence the atmosphere, as most people react to them in a similar way. On the one hand, there should be an individual quiet working atmosphere which does not create a situation of pressure. On the other hand, learners want an informal atmosphere that allows communication but also relaxation and makes them feel like home. The next category *types of learning* is the second most important, also because it influences all other categories. The didactic adaptations can be very different and require different spatial structures. The requirements ranging from individual learning to learning with a group and from creative personal freedom to structured guided exercises. In particular, competence development, especially in preparation for changing work and life situations, occupies an important position in this category. First and foremost, it is about being able to design the learning environments flexibly, as we saw. According to Buddensiek [16], this user assessment on flexibility is one of the most central factors in designing modern learning environments. The category *spatial design* is the most extensive. Primarily, it is about being able to design the learning room flexibly in order to be able to use different forms of learning. Clearly, the spatial environment is perceived as a retreat for learning but also for relaxation. Particular attention is paid to the fit and consistency of the learning environments and rooms to the workplace in the company. Specialist training rooms that simulate the

normal working environment are of particular interest. But there are also general requirements for the classroom and its equipment, such as sufficient brightness, good acoustics and the comfort of the furniture. Finally, in the context of spatial equipment, digital media were addressed again. However, their role is closely linked with a clear, recognizable added value in the learning process.

**Table 2.** *Meta-categories*

<b>Categories</b>	
Media usage	Concepts as "Bring your own device", stable access, free internet access, create a connection between learning and relaxation.
Personal Exchange	Improved exchange, meeting people from other sectors or institutions, working with learning partners and groups, personal closeness (face-to-face), informal places.
Availability	Access to work and teaching materials, manuals, availability of internet, PCs, or notebooks, digital technologies, soft drinks.
Atmosphere	1. Quiet working atmosphere in the study area without pressure, 2. Informal atmosphere, communication, relaxation.
Types of learning	Individual learning, learning with a partner or a groups, guided exercises, personal freedom flexibility, competence development.
Spatial design	Most extensive: design the learning room flexible, fit and consistency of the place of learning and work, equipment, brightness, acoustic, the comfort of the furniture.

To classify the results of the meta-categories it is useful to take a look at Mäkelä and Helfenstein's framework [17]. It consists of six characteristics with two of them always opposing each other. *Conventionality* (tools and spaces) vs *novelty*, *communality* (relations, interaction, belonging, safety) vs. *individuality* (privacy and peacefulness, individualisation) and *health* (physical wellness, no overload) vs. *comfort* (physical ease, pleasantness) and in the centre of the model it is all about *flexibility and functionality*. Our results show that the four characteristics *communality*, *comfort*, *novelty* and *individuality* were important to the target group. Sometimes the aspects from the framework were even literally named and the *flexibility* is also found here as a connecting factor in almost all categories. The other two aspects *health* and *conventionality* were not relevant. So the results that *health* is more important for older learners [18] cannot be confirmed. The apparent contradiction between the wish for distraction and collaborative learning, as we found it in the category atmosphere, coincides with recent research [18] and is the main aspect, why flexibility is of high importance.

## 4 Conclusion

Based on the case studies in Bamberg, Kassel, and Nuremberg, the contribution of interdisciplinary design process for teaching and learning environments was evaluated on the basis of concrete applications in the field of vocational training. Therefore, the so-called *Raumwerkstätten* are of particular relevance for the project *Lehrraum\_digital*.

In these special workshops, a outlook for learning environments in VET was developed by presenting and analyzing existing learning rooms and places using didactic, media-technical and spatial possibilities and by identifying positively marked places (favorite places). During the room workshops, the individually created or selected representations served as starting points for a joint discussion, analysis, and evaluation of the framework conditions of learning environments.

The three disciplines of pedagogy, architecture and media are always interrelated in the design process of teaching and learning environments. It is a central conclusion of the workshops presented. The meta-categories presented partly overlap, indicating that they cannot be considered without evaluating the influence of the other factors. Almost every meta-category includes aspects from every discipline. In other words, the pedagogy, architecture and media interact with each other within the meta-categories. For example, the development of the spatial-related category atmosphere also depends, to a large extent, on pedagogical decisions, having to work in groups or individually.

The described categories only provided clues for the creation of learning and teaching environments. The results of the workshops were not based on statements by experts. The methodology of the *Raumwerkstatt* invited the users - the learners - to be noticed and taken seriously as actors in the design process of teaching and learning environments. The users' knowledge is important. They know their own learning process best. Learners also know how to change their learning space and have strategies to make it work as a "Third Teacher". With regard to planning research, the workshop presented here offers the possibility of transferring user experiences - here: learners - within a transdisciplinary planning process. That's why, the workshops does not shows a way of transferring requirements and experiences of planning experts - such as media planners or architects - but the experiences and strategies of users. The results of the workshops, thus, also contribute to the scientific discussion of user-centered design approaches in teaching and learning room design.

In a nutshell learners especially need free spaces that allow them to adapt to the learning environment to individual and even varying needs. They appreciate flexibility, but also want an atmospheric framework. Learners do recognize which learning location they need for their individual learning process. Even if this knowledge is rather implicit. That's why it is vital to factor in their knowledge and integrate it in the planning process of learnings environments, not only in VET.

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