On Reflection: Learning, Meaning and Identity in the Design Studio

M Crabbe¹, N Pawlicki¹, S Jansen¹ and E Roswag-Klinge¹

¹Natural Building Lab, Technische Universität Berlin, Straße des 17. Juni, 10623 Berlin

crabbe@tu-berlin.de

Abstract. Successfully transitioning to a more sustainable building sector will require schools of architecture to explore new methods, approaches and formats for learning. Challenging some of the outdated values and assumptions at the core of the architecture profession starts in the design studio, where early professional identities, relationships and understandings of collaboration are forged. While there is an increasing focus on inter- and transdisciplinary learning in today’s higher education landscape, investigations into the pedagogy of the design studio are both relatively limited and disproportionately dominated by theory based on Donald Schön’s ideas on the “reflective practitioner”. In reality, the lack of any kind of coherent training for teaching staff means that most often approaches tend to reproduce that which the teachers themselves experienced during their own studies. The paper uses a series of autoethnographic vignettes to describe design studio teaching at Natural Building Lab from the perspective of a university educator based on the example of a masters design studio in winter 2021-22. Etienne Wenger’s Communities of Practice model, and specifically the four dimensions of design for learning, are used to unpack and discuss some of the dialogies at work in studio learning. The study should be seen as a form of practice-based research, using teaching formats as a way to actively gain new insights into new forms of practice with a focus on sustainability and student-empowerment. The paper provides an intimate and personal insight into some of the questions and challenges facing educators, students and project partners as participants in emergent and collective learning processes.

Keywords. Design Studio, Autoethnographic Enquiry, Architectural Education, Collective Learning, Communities of Practice, Transdisciplinary Collaboration

1. Introduction

The building sector is now correctly acknowledged as one of the world’s biggest polluters, responsible for 40% of worldwide CO₂ emissions. For the next generation of young designers, climate change and resource scarcity are the themes that will define the discourse and direction of the profession for the foreseeable future. Transitioning towards a more sustainable architecture profession requires not only an increased focus on existing building stock and natural building materials, but also a change in the way architects approach inter- and transdisciplinary collaboration. Schools of architecture play a crucial role in influencing the direction in which students develop their early professional identity and their understandings of collaboration. Challenging some of the outdated values and identities at the core of the architecture profession starts in the design studio and the kind of simulated practice which it presents.
In the introduction to his 2013 book “Together: the rituals, pleasures and politics of cooperation”, Richard Sennet describes a society that is weakening or “deskilling” both our desire and ability to cooperate with one another. Cooperation is in Sennet’s view a skill, one that needs to be honed over time and through which we can gain access, through the most “demanding” kinds of cooperation, to new insights into ourselves and the consequences of our actions [1]. The design studio is not usually framed as a place to learn cooperation, although it is sometimes a positive side-effect. This reflects the reality that much of mainstream architecture practice is not about cooperation - one talks about the architecture competition rather than the architecture cooperation - moreover authorship in architecture more often is accredited to principle architects, rather than to the collective that actually produced the work. Breaking down this outdated value requires studio teaching based on other more collaborative and collective learning models, focused on student empowerment and meaningful interaction with non-expert and non-university actors.

There is a huge diversity to architectural teaching, just as there is to architectural practice and there is no universally accepted “theory of learning” to explain how design teaching functions. Furthermore, the relative lack of research focusing on pedagogy in architecture – compared to material, formal or urbanistic themes – means that there is actually very little for educators to base their teaching practice on, other than a reproduction of their own experiences. This paper can be understood as a small-scale test of Etienne Wenger’s Communities of Practice [2] theory as a framework to explore design studio teaching in a specific context. In this instance we will especially focus on Wenger’s four dimensions of design for learning to explore some of the dynamics common to studio teaching practice at Natural Building Lab, thereby providing an insight into the challenges and potentials that confront university educators and students as participants in open-ended and transdisciplinary learning processes.

2. Vocabulary
Throughout this paper we will use, where possible, the same vocabulary we use to in our teaching practice. This means we will try and avoid descriptions of roles such as teacher and student and rather talk about participants, which includes both the “teaching” team and the students themselves. We will also mostly talk about learning rather than teaching or educating. Finally, rather than referring to our “teaching practice”, the paper will refer more often to “studio practice”, which should reflect our focus on integrating practice- and research centred themes into our design studios. In the main text of the paper we refers to the team of authors, all of whom are part of the teaching team at NBL. In the context of the vignettes, which are written in the first person, we applies to the entire studio group of participants including students and teachers.

3. Background: Learning in the Design Studio
The design studio is the prevalent model for architectural education internationally, its origins rooted in the Beaux-Arts tradition of the 17th century. The model has proved incredibly resilient, weathering numerous periods of ideological unrest to remain the model by which the vast majority of people learn to become architects. The design studio tends to mirror architecture practice, this is what Donald Schön found so interesting about the studio model, seeing that its success was rooted in the fact that it accurately simulated real professional action. This feat was hard to achieve in other professions, whose teaching practices he saw as overly technical and rationalized [3]. Schön was and still remains one of the very few authors to have attempted to “theorise” the studio model and his ideas about professional education and reflective practice gained increasing traction over the subsequent 20 years and have spawned a lineage of reflective theories [4]. However, more recently critical analyses of his ideas have emerged, interpreting Schön’s design tutorial as a form of disciplining [5] and ignorant of the powerful “hidden curriculum” in architecture [6].

In today’s higher education landscape, the focus is increasingly on the pursuit of inter- and transdisciplinarity with universities moving towards new models such as service-learning [7] - the idea that university teaching and research should be conceived to “serve” the needs of civil society, and
transformative research [8] - research as a process to drive change processes and social innovation for and with society. While these ideas are transforming the way that institutions conceive their purpose, the focus in creative learning has moved away from Schön’s focus on what the tutor does and towards what the student does [9] and how the university interacts with external actors in transdisciplinary interactions. This shift requires those who design formats for studio learning to move away from the idea of an expert teaching a student, and towards an understanding of the teachers role as facilitator, moderator and communicator. Schön correctly acknowledged that the essence of studio learning is the seamless integration of theory and practice, yet we would support Helen Webster’s view that he fails to acknowledge “the cognitive, affective and corporeal dimensions to learning that take place both within the design studio and in other settings.” [10] Although there are many different “theories of learning” [11] that could be applied to analyze studio teaching, it is beyond the scope of this paper to test the relevance of all of these, rather we will focus on one particular model (Communities of Practice) and one particular investigative tool (autoethnographic enquiry) associated with it.

What makes the design studio a unique format for learning is its potential for intense collective experiential learning. One of the most outdated myths at the center of architecture practice, is that only architects as individuals are involved with the creative production of the built environment [12]. Breaking down this myth requires more focus on internal as well, inter- and transdisciplinary cooperation in the studio. At Natural Building Lab our studio practice always comes back to the idea of the collective, an organization form currently enjoying a revival in alternative architecture practice [13]. This focus on group working makes Communities of Practice an appealing model for investigating our approach, because it is an inherently social and collective understanding of learning based on practice and identity.

The Communities of Practice model has been successfully applied to examinations of studio culture in architecture by researchers in both the UK [14] [15] and Australia [16]. Both of these studies highlight some of the straightforward practical issues that affect the degree to which participants feel in- or out of placeness, for example the amount of time physically working in the studio or the participation in events outside of the formal studio framework. They also highlight the importance of ritual events, that should be identified as an intrinsic part of the course rather than tacit and mysterious practices, as contributing to the way that learners develop Bourdieu’s concept of habitus. As with architecture practice itself, in an educational setting there are significant differences in how different teachers/departments approach their practice and it is this diversity that makes the university context so rich. Rather than generalising, this study will focus on the specific practices that sets Natural Building Lab studio teaching apart from other departments and attempt to generate new context-specific understandings through the application of the communities of practice model.

4. Scope & Methodology
Natural Building Lab (hereafter NBL) is the chair for constructive design and climate-adaptive architecture [17] at the Technische Universität Berlin, since 2018 we have been planning, facilitating and participating in learning formats for students as part of their bachelors and masters degrees in architecture. As a team we have a background in DesignBuild [18], which has strongly affected that way that we approach our teaching practice.

Rather than trying to describe our approach directly, the paper will borrow from the format used by Wenger in Communities of Practice. Three first person vignettes are provided, which outline three situations from the semester from a teacher’s perspective. This auto-ethnographic [19] approach should give an insight into NBL studio practice from a human viewpoint, the texts should show which questions and concerns come up during different phases of a studio project. In the second part of the paper these situations will used to illustrate applications of Wenger’s Four Dimensions of Design for Learning [20]. The study should be seen as a form of practice-based research, using teaching formats as a way to actively gain new insights into our practice and its wider impact from the perspective of teacher, learner, participant or researcher.
The primary source material for the paper stems from semi-formal interviews with participants in film, text and audio form from a masters design studio with 20 participants and two members of the teaching team undertaken in winter semester 21-22. These materials were supplemented by auto-ethnographic materials from the primary author in the form of learning diaries written weekly over the course of the semester. The context for the studio was the transformation of an existing 1960s building in Potsdam currently used as creative center and increasingly facing the threat of demolition. The aim of the studio was to develop new architectural and usage scenarios for the building’s transformation in close collaboration with the users [21].

4.1. Vignette 1: Presentation First Task
It is four weeks into the semester, today the studio are presenting the outcomes of the first task. By this point everybody has got to know each other somewhat, we have had a kick-off plus two studio meetings and a couple of group excursions. These interim meetings were important because the participants had a chance to get familiar with the teaching team and each other. There are some specific formats that we use in every studio, for instance we start each session with a stand-up, everybody should speak and say how they are doing and what happened since the last meeting. We then talk about the projects; this should always include at least two groups and the second group should be the first to give feedback to the first. At the end of the day, we have another stand-up; in the current climate one big topic for discussion has been how to deal with physical meetings and the pandemic situation, but we also do another round regarding the direction of the task, again everybody should be heard. Themes or ideas develop as we go around the circle and at the end there is a strong feeling of consensus - we make sure to implement these decisions into planning for the next few weeks. This usually means that the schedule has to rearranged and, in this case, led to the first task being extended for a week to allow the ideas to progress further.

Honestly, today I am quite nervous, mainly because of the extra complications of maintaining a hybrid set-up to allow people to participate who could not be here physically due to pandemic complications. It is always important to try and keep to the schedule in the first presentation, it sets the standard for the rest of the semester and shows the students and cooperation partners, that we respect each-other’s time – today we are not just the studio and our team, we also have some of the users of Rechenzentrum in attendance, who we will be working with all semester. Although some of the groups have been in contact with the users to gather information for the first task, this is the first time we have come together in this kind of presentation scenario. This can also be a little nerve-wracking because you never know what direction the discussion will go in, today we will see what kind of shared vocabulary and culture of discussion we have as an extended group. The results that I have seen so far look great, this is the first time where the discussions and ideas that we have had taken on a physical manifestation and become things that can be interpreted by the group and by other people.

4.2. Vignette 2: Group Formation
It is only one week later - today we are starting the second phase of the project and that means: we are forming new groups. This is always a bit of a semester milestone and we have tried out a lot of different strategies. It is important for us to mix up the groups over the course of the semester to avoid things becoming competitive - for us the projects should be complimentary to each-other and the outcome of the entire studio process with ideas and inspiration travelling between different groups. In my own experience as a student, it was often the case that you worked either alone or in pairs and things could get quite heated and competitive especially when your main interaction with the other groups was in a presentation situation. In situations where some people know each-other already, forming groups can also be quite strategic and to the disadvantage of less well networked participants. We try to have larger groups but do not have any kind of limit. We are aware that this can be very difficult for students and requires a lot of communication and negotiation compared to working alone or as a pair but the potential benefits in terms of both learning, diversity and output more than make up for this.
Figure 1. Day 1: First big circle in the courtyard at Rechenzentrum, the participants, team and project partners introduce themselves. (image: Matthew Crabbe)

Figure 2. First (hybrid) presentation with studio and users in Kosmos, the shared space in Rechenzentrum. (image: Matthew Crabbe)
This time around we took some inspiration from the current German political situation and had coalition negotiations. We had discussed the format in advance, we suggested just doing it randomly – in the end it gets the same result - but the consensus was to form groups based on thematic interests. We set out five different directions that the projects could go in, each a combination of maximal-minimal transformation of the building and maximal-minimal change to the current user community. This formed the basis for the negotiations and each person started on a table they were interested in, over the course of the next 45 minutes everybody visited different tables and the discussion at that table was changed by people coming and going. At the end everybody had to decide on a table and try to find a consensus with the others at that table about the things they wanted to explore over the coming weeks. During the process it became clear that the categories we had set out proved to be somewhat confusing, so we decided to change them. In the end we had four groups rather than five, each with between 4-6 people.

4.3. Vignette 3: Exhibition Opening

Fast forward three months, we have just opened an exhibition of the outcomes from the semester. There were meetings, presentations, press-commitments and a few bumps in the road in between. The last few weeks have been intensive for everybody and with a digital presentation as well as an analogue exhibition, not to mention pandemic, it has been a demanding end to the semester. The final presentation was yesterday, today is a Saturday. I would say nearly everybody is here, some people are always more peripheral members of the group than others and that is totally fine. Everybody will take different things from the last few months. This afternoon everybody pitched in to get things ready in time, obviously it was still a little bit last minute.

Everybody is really happy with the results; we have had a lot of attention from the newspapers and there are politicians and users and all sorts of people here tonight. There are different kinds of people in the exhibition and the groups are on hand to answer questions. Especially in this context there are a lot of “non-architects” here and there are lots of questions to be answered. The project setting is quite controversial and the task left it up to the group to decide how to deal with this. Being featured in the local newspapers opened up the projects for some criticism and difficult questions: how much is it going to cost? But also some other kinds of difficult questions: Are you going to come back and work more with us next semester?

It will probably take everyone a few weeks to come down from the last few weeks but I am confident that we will be seeing a lot of the group in other courses soon, it seems that there is also interest in staying involved with the process here and taking some of the projects further, which would be fantastic. From the outside it looks like we produced exactly what was needed at this point in time, in between it feels more like you are carrying a leaky bucket and constantly trying to keep the water in.

At the end of the semester, it is always a little bittersweet for me because I know from experience that at the end of the course, the dynamic changes dramatically. The group is not held together by the requirement to do the module, the formal framework for their participation changes into something more voluntary and for a lot of people they cannot make that commitment. The masters only consists of three design studios, so next semester they might want to try out a different department with a different thematic focus and teaching style. We will also have a new studio group, who will interpret our methods and ideas in new ways. There is always a complex balance of continuity and transformation.

5. Communities of Practice: Dualities for the Studio

As characterised in the above vignettes, for NBL the design studio is a context for collective learning and is by nature a highly dynamic context. In “Communities of Practice: Learning, Meaning and Identity” Etienne Wenger sets out a model for an inherently social understanding of learning based on practice and identity. Communities of practice are everywhere and not limited to school or university environments, indeed we all belong to numerous communities of practice throughout our lifetime whether through family ties, the workplace or hobbies. In some of these communities we are a central actor and in some a more peripheral member. Sometimes we also find identity by non-participation in the communities that we set ourselves apart from. As a participant we have a trajectory and over time
we can move in and out of different communities of practice. As we participate in a form of practice,
we generate new meanings and transform our identity in relationship to these meanings.

Key to all of the ideas contained in communities of practice is the idea of duality, two poles which
are not mutually exclusive - rather distinct and complementary. More of one does not automatically
mean less of the other, both poles are in a dynamic equilibrium. In the following sections we will
consider some of themes in the above vignettes using Wenger’s four dimensions of design for learning.
It is important to note, that in this context design relates to both the “…production of artefacts [22],
but also the design of social processes such as organisations or institutions.” For the purposes of this
discussion design will refer to the design of the studio from a teacher’s perspectives unless otherwise
specified.

5.1. Duality 1: Participation & Reification
The duality of participation and reification is a central dimension of Wenger’s concepts of practice and
identity, they influence both the direction of a practice and the trajectory of a person. This duality is
quite easily identified in the design studio. Participation in the meetings, discussions, presentations and
other rituals of the studio is essential and provides the opportunity for participants to develop an identity
related to each other, to NBL’s values and to the studio practice itself. These rituals are important because they provide a link to a shared history of learning, being themselves the product of previous studios and providing a link to previous generations of participants.

Reification is the process of giving form to our experience by producing objects that embody this experience. In an architecture context this can clearly be understood as the projects or outcomes themselves, they are the embodiment of the collective knowledge and experience that creates them. Yet reification is not only to be understood as physical objects, it can also be understood as other things that manifest participation such as shared vocabularies or more mundane artefacts like schedules or procedures – all objects in which participants find some kind of meaning.

The duality of participation and reification is inherently present in a design studio, it is the balance
of doing things together and reifying this experience into physical objects, which are themselves
discussed and refined over the course of the semester. These artefacts are necessary as a marker upon
which to test ideas and opinions. This experience is particularly intensified at major milestones such as
presentations, where the outcomes serve as boundary objects and mediate between the studio, other
actors and other generations of practitioners [23].

Finding the right balance between participation and reification is key to facilitating learning in a
community of practice, too little reification and it is difficult to anchor discussions in the real world,
while too much reification can be stifling, resulting in too much focus on output and limiting creative
freedom.

5.2. Duality 2: Designed & Emergent
The duality of designed and emergent is the balance between improvisation and structure. According to
Wenger the dynamic or emergent nature of practice - and our everyday condition - means that practice
is never the result of design, it is only ever a response to it. That means that there always exists an
inherent uncertainty between the two. The key is to be aware of the emergent nature of practice and to
make opportunity from it. This duality seems very present to the authors in teaching, it is important to
have a plan and to have structure, but it is just as important to know when to let go of that and be flexible
or embrace things going in their own direction. It is this improvisation and innovation, which provides
the chance for practice and identity to negotiate meaning anew.

At the start of the semester participants need structure and milestones, yet if a task takes on a new
direction, then it can make sense to let it go on for another week. We as teaching staff could tell
participants in which groups they will work, but this sacrifices the potential of a day like the “coalition
negotiations”, where everybody has a chance to negotiate new meanings with each-other through an
exchange. Loss of control is an inherent part of studio learning and is a serious challenge when working
with external collaboration partners. It is very hard to make a commitment about some specific outcome,
because of the inherently emergent nature of the process. In the end, it looks like the studio did exactly that, but in the middle you can never be sure. Wenger talks about robust design having an opportunistic side and being minimalist [24]. Studio learning needs to be open-ended and adaptive, yet still offer the necessary structure to facilitate emergent practice. In some situations, providing schedules or specifications can provide more space for the participants to be creative, in others it makes sense to let the group develop these tools for themselves.

The benefit of the university context over architecture practice is that it can afford to embrace the emergent nature of a group process, without the restrictions of some prescriptive real-world factors like schedule delays or cost overruns. Yet this does not do justice to the situation, when working with real-world contexts, people and materials, it is also necessary to keep projects on track and to make good on commitments and expectations. Understanding this reality as a manifestation of the duality of designed and emergent, and that one is not mutually exclusive of the other, offers a new way to frame planning.

5.3. Duality 3: Local & Global
In this context, local and global as a duality is a more abstract concept. Wenger argues that no community can fully design the learning of another, yet no community can fully design its own learning. This paradox seems actually self-evident in many situations, no person or community of practice is an island and it is essential to look for interactions beyond one’s own group. In the studio this can be understood as interactions with external partners, local actors and other disciplines. Returning to the idea of boundary objects [25], these objects connect us to in various ways to communities of practice to which we do not belong. Wenger describes different kinds of boundary object, for instance accommodation - an object which lends itself to different activities or standardisation - the information in a boundary object is in formed so that different communities know how to deal with it locally. These ideas relate directly to the problem of media and representation in architecture, many of us will be familiar with the difficulties of communicating using plan drawings with people who are not familiar with this media. Considering the outcomes of the semester as boundary objects, which are open to use by other communities of practice in a format like an exhibition, opens these artefacts to a whole new range of interpretations and connections - they become a nexus for perspectives and remain so even when none of the participants are on hand to answer questions. These interpretations can be positive or negative and can lead to boundary objects taking on meanings, that were initially not anticipated. Accepting these challenges and trying to consider a broad range of connections in the use of boundary objects is fundamental in design for learning.

5.4. Duality 4: Identification & Negotiation
The duality of identification and negotiation is a manifestation of the fact that design is not neutral. In one respect it is a focus for identification - and possibly for non-identification. On the other hand, a design is a bid for ownership of meaning - and possibly for sharing this ownership. In a community of practice, the design creates a field for identification but relies on this being negotiable in practice [26]. In the experience outlined above, the balance of this duality shifts during the semester.

In the first weeks it is not yet clear to the participants what kind of bid for meaning is being made by those with the power to define the design (teachers). In many experiences students do not have the power to negotiate the design with teachers. To use a placative example: normally you are not welcome to decide which questions will be on your own examination. Also, the exact nature of the community’s identity is not clear, the group have not had sufficient shared experiences together, people are still feeling each other out, deciding whether they really identify with NBL’s values and methods, as well as those of the other participants. Over the course of the semester, it is key to share the ownership of the design, whether through open-ended tasks open to interpretation or by allowing the group to take charge of important practices such as group formation. This allows participants to share control over the studio’s definition of meaning and indeed affects the kind of identities and practices the design facilitates. What separates this duality from designed & emergent is the realisation that these processes can inevitably
lead to some kind of privileging or non-identification, indeed design is a stake in the ground around which these identities and non-identities crystallise. As described in the introduction, design studio practices and just as diverse as architectural practice itself and provide opportunity for participants to try out different identities over the course of their studies, some of which they will feel a strong affinity to and some which they will not. Understanding that the balance of this duality is inherently dynamic and indeed providing opportunities for sharing the ownership of meaning, should allow everybody to decide how to participate in the process meaningfully.

6. Conclusions:
As discussed in the paper, there are numerous theories of learning, which could be used to analyse studio learning. This paper chose to focus not only on one model (Communities of Practice) but also on one method (auto-ethnographic enquiry) to discuss this example. The material in the paper is related to an ongoing practice-based PhD Thesis investigating teaching practice at Natural Building Lab, where many of the models and themes will be discussed in more detail. As such, there are of course limitations in the application of Wenger’s ideas to this example. In order to fit the format of a paper, the study has been limited to discussing one course, over one semester. Intuitively the potential of using this model to interrogate teaching practice has a much greater scope.

One of the most attractive aspects of communities of practice, is that it takes into account the development of both a practice and an identity over time. The idea that an individual has a trajectory and can move in and out of different communities of practice is one of the mechanics, which can affect the strongest transformations to a sense of self. NBL’s community of practice is actually much larger than just one studio in one semester with one group, it is the continued transformation of our practice over time by a constantly changing cast of new participants. Furthermore, in some cases, this connection continues after members of the community leave the university providing a way to establish links with the larger or more global community of architecture practice in general.

This aspect is what links this investigation to the themes of the conference. A transformation towards a sustainable building sector requires solving innumerable wicked technical and social challenges. Even as students architects are constantly faced by questions to which there is no easy or binary answer, this only becomes more difficult in professional practice. Finding a way to navigate these situations and equipping students with the experiences, confidence and values needed to find answers to these challenges themselves, is the central focus of our teaching approach.

Delivering on these ambitions requires us as teachers to constantly reflect on our practice and to strive to improve it. In this context, applying the four dualities to the example of this semester provided a way to better formulate many ideas or considerations, which had until now remained intuitive. Understanding these different aspects of planning or performing a studio as dualities, rather than opposing ends of a scale seems both fitting and full of potential, capturing the dynamic nature of working with real people and real environments. In the end it seems clear that all of our practice lives from the tension between these dualities.

References
[1] Sennett, Richard. Together: The Rituals, Pleasures and Politics of Co-Operation. London: Penguin, 2013.
[2] Wenger, Etienne. Communities of Practice: Learning, Meaning, and Identity. 1. paperback ed. Learning in Doing. Cambridge u.a.: Cambridge Univ. Press, 1999.
[3] Schön, Donald A. The Reflective Practitioner: How Professionals Think in Action. Routledge, 1983.
[4] Brockbank, Anne, and Ian McGill. Facilitating Reflective Learning in Higher Education. Buckingham; Philadelphia, PA: Society for Research into Higher Education & Open
University Press, 1998.
Moon, Jennifer A. Reflection in Learning and Professional Development: Theory and Practice. Hoboken: Taylor and Francis, 2013.
https://public.ebookcentral.proquest.com/choice/publicfullrecord.aspx?p=672465.

[5] Webster, Helena. ‘Architectural Education after Schön: Cracks, Blurs, Boundaries and Beyond’. Journal for Education in the Built Environment 3, no. 2 (December 2008): 63–74. https://doi.org/10.11120/jebe.2008.03020063.

[6] Dutton, Thomas A. Voices in Architectural Education: Cultural Politics and Pedagogy. Bergin & Garvey, 1991.

[7] Bachhaus-Maul, Holger, Jahr, David. ‘Service Learning’. In Handbuch Transdisziplinäre Didaktik. Bielefeld: Transcript, 2021.

[8] Schäpke, Niko, F. Stelzer, Matthias Bergmann, and D. Lang. ‘Tentative Theses on Transformative Research in Real-World Laboratories: First Insights from the Accompanying Research ForReal’. TATuP - Zeitschrift für Technikfolgenabschätzung in Theorie und Praxis 25, no. 3 (1 November 2016): 45–51. https://doi.org/10.14512/tatup.25.3.45.

[9] Webster, Helena. ‘Facilitating Critically Reflective Learning-Excavating the Role of the Design Tutor’. Art, Design & Communication in Higher Education 2 (1 March 2004). https://doi.org/10.1386/adch.2.3.101/0.

[10] Webster, Helena. ‘Architectural Education after Schön: Cracks, Blurs, Boundaries and Beyond’. Journal for Education in the Built Environment 3, no. 2 (December 2008): 63–74. https://doi.org/10.11120/jebe.2008.03020063.

[11] For example: Akpan, Ben, and Teresa J. Kennedy. ‘Introduction—Theory into Practice’. In Science Education in Theory and Practice, edited by Ben Akpan and Teresa J. Kennedy, 1–13. Springer Texts in Education. Cham: Springer International Publishing, 2020. https://doi.org/10.1007/978-3-030-43620-9_1.

[12] Awan, N., T. Schneider, and J. Till. Spatial Agency: Other Ways of Doing Architecture. Taylor & Francis, 2013. p.28

[13] For example: Donat-Cattin, Natalie, ed. Collective Processes: Counterpractices in European Architecture. Boston: Birkhäuser, 2021.

[14] Coldham, Sibyl. ‘Learning to Be an Architect: The Office and the Studio.’, n.d., 10.

[15] Williams, Julian. ‘Design Studio: A Community of Practitioners?’ 2017, 13.

[16] Morton, Janne. ‘Communities of Practice in Higher Education: A Challenge from the Discipline of Architecture’. Linguistics and Education 23, no. 1 (März 2012): 100–111. https://doi.org/10.1016/j.linged.2011.04.002.

[17] ‘Natural Building Lab’. Accessed 6 June 2022. https://www.nbl.berlin.

[18] Pawlicki, Nina Maria. ‘Agency in DesignBuild’, 2020. https://doi.org/10.14279/depositonce-9685. p25-29

[19] Ellis, Carolyn, Tony E. Adams, and Arthur P. Bochner. ‘Autoethnography: An Overview’. Forum Qualitative Sozialforschung / Forum: Qualitative Social Research 12, no. 1 (2011). https://doi.org/10.17169/fqs-12.1.1589.

[20] Wenger, Etienne. Communities of Practice : Learning, Meaning, and Identity. 1. paperback ed. Learning in Doing. Cambridge u.a.: Cambridge Univ. Press, 1999. P232-42

[21] ‘RE:chenzentrum – RZ Erhalten Zukunft Gestalten — Natural Building Lab’. Accessed 6 June 2022. https://www.nbl.berlin/projects/rechenzentrum/.

[22] Wenger, 1999, p220

[23] Wenger, 1999, p106-7, p128-9

[24] Wenger, 1999, p233

[25] Wenger, 1999, p106-7, p128-9

[26] Wenger, 1999, p220

[27] Wenger, 1999, p23