AMPS Proceedings Series 17.1

Education, Design and Practice

Understanding skills in a Complex World

AMPS CONFERENCE 17.1

Education, Design and Practice – Understanding skills in a Complex World.

Stevens Institute of Technology, AMPS, PARADE, Architecture_MPS.
17—19 June, 2019

Education, Design and Practice – Understanding skills in a Complex World.

EDITOR:
Ellyn Lester

SERIES EDITOR:
Graham Cairns

PRODUCTION EDITOR:
Eric An

AMPS PROCEEDINGS SERIES 17.1. ISSN 2398-9467

ARCHITECTURE_MEDIA_POLITICS_SOCIETY
Amps

AMPS CONFERENCE 17.1

Education, Design and Practice – Understanding skills in a Complex World.

Stevens Institute of Technology, AMPS, PARADE, Architecture_MPS.
17-19 June, 2019

INTRODUCTION

This publication is the product of the conference *Education, Design and Practice – Understanding skills in a Complex World* held at Stevens Institute of Technology in 2019. The keynote speaker was Peggy Deamer, Yale University. The call upon which the conference and this publication are based argues that:

> The relationship between education and practice in any discipline is complex. In an ever changing world, it is also in flux. In a context such as the built environment, it is also interdisciplinary. Today, educators in the liberal arts still identify learning as an end unto itself, and designers still draw on ideas about intuitive knowledge. By contrast, the businesses behind urban development or city and regional growth call for graduates armed with the skills required in practice from day one. At the same time local government and cultural or city management firms need creative thinkers capable of continual adaptation. In the industries and sectors such as construction, transport and engineering, managers focus on a foundational baseline and value engineers and designers as both pragmatic problem solvers and visionaries.
>
> These alternative perspectives have been reflected in multiple changes to the practice and structure of the education sector. One such example was the Boyer-Mitgang report which restructured architectural education in the US to reflect other professions. As in other areas, it resulted in a 'degree arms race', with MAs and doctoral programs multiplying more rapidly than the research and teaching methods they required. At the same time, the 'widening participation' agenda produced an explosion of research and funding for new pedagogical approaches and initiatives. Attempts to fuse education with the creative arts, industry and business through university led partnership schemes also proliferated. More recently, changes in the financing of the HE sector in places like the UK, mean universities now stress educational efficiency and guarantees of graduate jobs.
>
> Working within this context, educators in sectors connected with the design, management and construction of the built environment have developed new and innovative ways to teach, they have embedded collaborative practices into their pedagogy, have forged unique partnerships across disciplines and outside the academy, and much more. However, research into best practice learning and teaching in the classroom is still evolving and educational initiatives can sometimes be seen as contradicting on-the-job realities in practice. The *Education, Design and Practice* conference publication explores this complex and contradictory scenario from multiple perspectives.

AMPS CONFERENCE 17.1

Education, Design and Practice – Understanding skills in a Complex World.

Stevens Institute of Technology, AMPS, PARADE, Architecture_MPS.
17-19 June, 2019

INDEX

DEVELOPING ARCHITECTURE STUDIO CULTURE: PEER-PEER LEARNING

Author:
SOFIE PELSMAKERS, ELIZABETH DONOVAN, KARI MOSENG, BIRGITTE TANDERUP EYBYE

Institution:
TAMPERE UNIVERSITY, AARHUS SCHOOL OF ARCHITECTURE

INTRODUCTION

Traditionally, architecture teaching has been centered around the architectural design studio [1], where students are taught usually on an individual project basis. This studio environment is a physical space but also a pedagogical and cultural space where learning and teaching happens.[2] Students also regularly present their design and design process to tutors, external guests and peers. The studio is based on project-based learning [3] and allows for reflective practice, and integration and testing of abstract knowledge into projects.[4] This unique pedagogical tradition of studio-based teaching is based on 'reflection in action' [5], developed from the master-apprentice model, as a simulation of 'real-life' practice, with regular feedback on the student's design development by tutors.[6] However, studio culture can also lead to unhealthy practices, such as peer-peer pressure and competition, long hours, isolation from other activities, and stress when exposed to negative 'public evaluation' of one's work.[7] Nevertheless, studio culture can also support reciprocal peer-peer learning, which happens in formalized group work but also informally in the absence of tutors.[8] Advantages include co-experimenting, and learning competencies, design processes and critical reflection from and with one another [9], building a student's confidence to try new things.[10]

Through four case studies, this paper illustrates ways to enhance the unique and positive aspects of studio culture, by fostering peer-peer learning to underpin and support deeper learning and healthier practices across years. Findings and reflections on each case are jointly discussed in concluding remarks at the end of the paper.

BACKGROUND

Design studio, has the ability to be a collaborative environment which harnesses peer interaction, communication and sharing both with peers but also instructors; they learn to work with others, critically reflect and question, and to articulate and communicate ideas. This is crucial to be prepared for the highly-collaborative nature of the architectural practice students will eventually enter [11]. Additionally, the studio's collaborative culture stimulates learning, socialisation and critical dialogue, corresponding with Bruffee's notion of 'constructive conversation'.[12] Students gain multiple perspectives, frequently conflicting, from both informal dialogues with peers and formalised learnings.[13] Formalising some peer-peer learning is not about teacher control, but to use the benefit of peer-peer learning for all. The idea is that students learn by explaining their ideas to others, and by giving and receiving feedback, beneficial for all– i.e. mutual or interdependent learning. [14]

In the architectural design studio, peer-peer learning might be particularly beneficial where each student can learn *from* others but also *with* others. For example, there is a paradox in learning to design, in that students cannot understand what designing means, and can only learn this through the actual experience of designing.[15] While tutors have a guiding role, students have to self-educate, self-appropriate, self-discover and question and put their trust in their tutors, so that "being willing to try something is a condition for acquiring an ability to do it" [16], but can also be the cause of great vulnerability and anxiety. [17] This is where peer learning can support a student's journey, individually and collectively, by creating a safe environment to learn together, reflect together and, to coach, and articulate ideas to promote self-discovery (and encourage others to do the same).

Educational context

The influences of peer-peer learning are especially relevant within the context of this paper as the teaching environment is solely design studio based. Aarhus School of Architecture (AAA) is one of two independent arts-based architecture schools in Denmark. The schools' practices are firmly based in the Beaux-Arts traditions. Architectural education is offered mostly through studio-based learning environments from Bachelors to Masters level, where studio projects are 100% of the semester grade.
Students are divided into three groups, 1st year; 2nd and 3rd year combined, and 4th and 5th year combined. AAA studio environments are also unique in that the education consists of diverse configurations usually, around 40 students in the Bachelors and 12-35 students in the Masters. Within the Bachelors the same (roughly) 40 students stay in the same (themed) studio for 2nd and 3rd year. They may change for Masters but then again remain in the same studio group for 4th & 5th year.
Additionally, students usually sit in table groups of four, often informally working together and are expected to be in the studio space from 9:00 am to 5:00 pm, Monday to Friday. As a result, students become very close during their education and the physical, pedagogical and cultural space where learning and teaching happens becomes very influential. The studio often becomes a 'second home' as all 600 students have their own desks all year round. What often looks like a mess to any teacher also represents a safe zone for the student. Though between peers, the studio also becomes a place of exposing vulnerability.

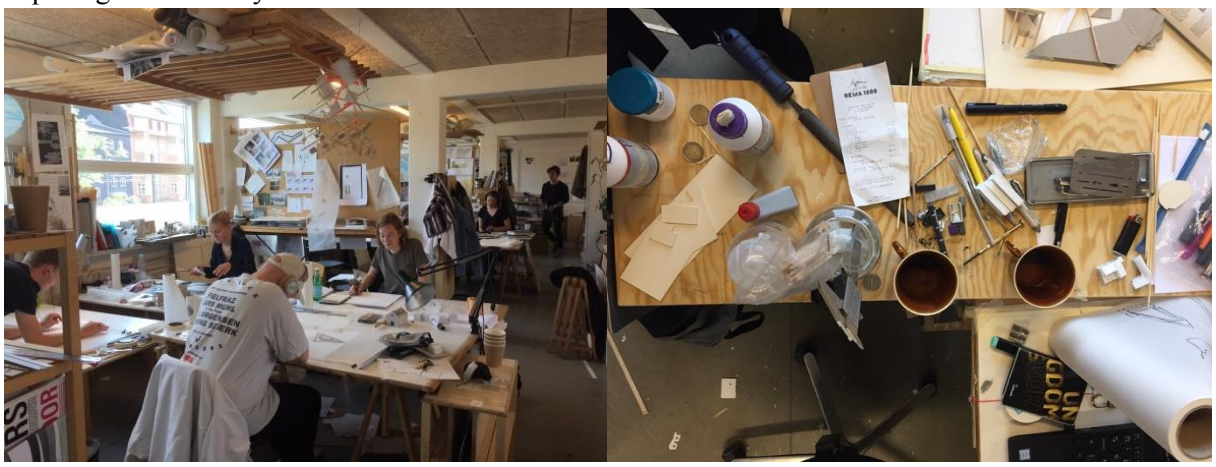

Figure 1. and 2 illustrate typical AAA studio working spaces, and how students make it their own.

METHODS

Four development projects and learning experiments were developed during 2018 and at different levels of architectural education at the AAA in Denmark. The first case study took place in 1st-year, while two case studies took place in the Masters program. Common for these three case studies, was diagnosing a problem in design studio and planning mutual or interdependent peer-peer focused teaching activities. The fourth and final case study, in particular, used 'vertical' peer-peer learning with around 95 2nd to 5th-year architecture student. In this case, experienced students mentored more junior peers (i.e. the traditional proctor model)[18]. However, in most cases, both mutual and proctor peer-peer learning occurred due to same-year students working together, as well as with those in 1 year above (or more years their senior, as described in case 4).

We worked semi-collaboratively by reviewing each other's teaching activities; some of us observed each other's experiments or contributed to the delivery. We discussed and reflected on shared experiences and themes, all with a common focus on how to best facilitate student dialogue. In particular, we were interested in investigating deeper learning from, and with peers, to underpin and support tutor-student learning activities in the studio.

FOUR CASE STUDIES

Case Study 1: Year 1 Design Studio

"Critiques" or "pinup" situations are part of our institutional evaluation and assessment culture, and peers are always invited to attend the sessions and to join discussions, which can take place over 2 or 3 full days. These events have substantial learning-potentials for the person presenting, but also for attending peers to reflect on their own learning, design process and project. However, participating students seem to have a hard time engaging and focusing in these more passive learning situations. Hence, this case study set out to investigate how to enhance the format to ensure engagement of the attending students, and to ensure that the time spent supports the overall course learning outcomes. The planned learning activity built on both informational, practical and emotional support between peers; the main considerations were as follows:

1. Giving all peers a prior described role;
2. Making slightly strict "rules" for the sessions and formalizing peer feedback after every presentation;
3. Using a very limited time frame;
4. Using the room as a didactic tool by "precoding" it in advance.[19] For example, in this case, the room was prepared with two-sided pinup areas to allow swift changeover, and with four chairs in each area with post-notes and a pen.

Halfway through a two-week assignment in the spring semester, which is a typical time for formative feedback, four students were asked to join, pinning up their material. In advance, the tutor had defined the one-hour learning activity; the rather strict "rules" were written on a whiteboard before students entered the room, and were defined as follows:

- Student 1 presents (5 minutes); no questions or interruptions
- Students 2, 3, 4 and teacher reflect on material/presentation and prepare comments (2 minutes)

• Student 2 gives feedback to student 1 - No answers (2 minutes)
• Student 3 gives feedback to student 1 - No answers (2 minutes)
• Student 4 gives feedback to student 1 - No answers (2 minutes)
• Teacher gives feedback to student 1 - No answers (2 minutes)
After this Students 2 presents etc.

Reflections and findings

Observing the engagement of the students, it became clear that defining the expectation of peer-feedback made all students participate equally, unlike in the traditional pinup sessions. All four students described it as useful to have defined roles, and that it made them feel safe to comment on each other's work. Moreover, students felt that it was an interesting challenge to let the material stand-alone and not being able to respond to their peer's comments after the student feedback.

Case Study 2: Masters Heritage Design Studio

In the heritage design studio, the semester starts with group work, including a detailed building survey and the compilation of a building report. From this, students then develop individual projects; in addition to a few studio presentations (i.e. pinups), each student meets with a tutor once weekly to discuss their process and progress. All the students work with the same building, hence they share knowledge and experiences, but it also means that the design tutor ends up repeating certain information in individual tutorials. As such, peer-peer learning activities that were integrated with the individual design phase, were developed to enhance learning outcomes, effective teaching and to support students.
Specifically, group teaching was introduced alongside individual tutorials to go in-depth with relevant themes. Moreover, students prepared and formulated constructive feedback for each other's projects (i.e. apply, analyse, evaluate (Blooms's taxonomy of higher learning levels [20])); this allowed students to learn from each other's' challenges and approaches. The peer-learning and feedback activity is unfolded below:

1. Each student identifies an issue in their project, on which they want to have feedback.
2. Two students are appointed peers on each project and have two full days of preparation.
3. Teacher and students gather around a table.
4. Student 1 presents their issue within five minutes; drawings and models are in the middle of the table, where each participant can see and discuss them. Peer 1 and 2 comment. The student listens to peer feedback, while a fellow student takes notes (active listening).
5. Then, the teacher and the rest of the students join the discourse.
6. Themes and issues relevant to the broader group are raised to meta-level instructions by the teacher.
7. Wrap up, including individual instructions for the next meeting.

Reflections and findings

Based on the above teaching and learning activity, it was clear that small-class teaching with peer-peer feedback clearly supported deeper learning and more effective teaching. Themes relevant to others in the group only needed to be discussed once on a meta-level compared to individual tutorials.

Students were active and engaged; it enhanced and helped develop a supportive studio culture with positive student feedback. They also felt it was a more relaxed atmosphere compared to pinups. Students found it rewarding to focus on specific issues and to receive sufficient preparation time (for both sides).

Case Study 3: Masters Sustainability Design Studio

Both in architecture school, and in practice, the aesthetic of sustainable buildings are often aesthetically 'deterministic': i.e. their architectural language results in a 'collage' of technological solutions, in a drive to meet energy or sustainability targets. This case study investigated how to overcome this by embedding sustainable design and energy literacy teaching in design studio, an integration which is typically lacking – as also noted elsewhere.[21] Twelve masters level students across year 4 and 5, studied and critically applied the integration of renewable solar energy technologies and the aesthetic implications for their design projects. Sustainability knowledge was brought into their everyday design studio space [22], where students co-experimented and critically reflected on the implications of the new knowledge for other's and their own design projects, including architectural aesthetics.

Focusing on the reciprocal peer-peer learning aspects, specific studio-based learning activities were developed [23]; this involved a case study analysis with subsequent informal group presentations by self-selected student pairs, followed by group discussion. Afterwards, students together learned to estimate the energy use and carbon footprint of a case study building, and to evaluate its suitability for solar technology. They then applied this knowledge to their own individual design projects, supported by wider group discussions of the aesthetic and architectural implications of solar technology use.

Reflections and findings

In addition to expanding knowledge about energy technologies through "background learning," students benefited greatly from teaming up and wider peer discussion to help them immerse and test their critical position in a safe environment. The paired study and informal presentations especially seemed to help initiate the more junior students, building their confidence through critical reflection and articulation of their position. There were other benefits to peer-peer learning too; for example, some students miscalculated some energy numbers in the common workshop, but they checked and helped each other. Another example is when a more senior student transferred the workshop exercise into a spreadsheet and then shared it with everyone, helping the group to move forward collectively. Equally, during the discussion about the aesthetic and architectural implications of solar technologies, some students gently disagreed with other students' evaluations. Yet all parties were able to listen and reflect on their position in a safe environment, understanding that there might not be a "right" or "wrong" answer in qualitative assessments of buildings.

Case Study 4: Vertical peer-peer learning

The fourth case study in particular used 'vertical' peer-peer learning, where around 95 2nd to 5th-year architecture students worked together in a 2-week introductory workshop. The peer-peer learning centered around more experienced students mentoring more junior peers, and to encourage project work outside tutoring presence and formally scheduled workshop events. Teachers from two bachelor units and one masters studio came together to conduct a workshop with all of the students. The large group was divided into three teams consisting of seven smaller groups each. Each group was assigned

a leader from the Masters programme to help facilitate, share knowledge and integrate deeper learning about sustainability. The peer learning within this workshop aimed to establish a culture of reflective practice across teaching programme as well as creating a sharing and non-competitive atmosphere.
This workshop involved three developing tasks which included different levels and methods of peer learning, and ranged from more formal exercises to informal group work and discussions. The more formal exercises initiated the workshop to help introduce the process, and this included group work; group and team discussions to complete a provided matrix with information, and a larger group presentations. Following this, students had input from different recorded lectures, which they then had to discuss and share with their group and then larger team to create and complete one larger exercise together. Lastly, analytical drawing exercises were undertaken; while this task was more individual, knowledge needed to be shared between groups to understand each of the drawings, with students learning by explaining, and giving and receiving feedback [24]; this was facilitated by the 5th year student team leader.

Reflections and findings

In addition to upskilling and gaining knowledge about sustainable architecture, students were introduced to different peers and teachers, helping to bridge the connection to each other and different teaching years. Setting peer-peer tasks facilitated how the students worked together but subsequently also meant that all students gained a larger amount of knowledge, gaining insights form the entire group and team, learning through discussions and presentations as well as the direct vertical learning which occurred within each of the individual groups in informal ways. Peer-peer learning was beneficial, as students learned from others in similar positions to themselves [25], however, an improvement could be placing greater emphasis on expectations of tutor and student roles (especially Masters students), and clarifying the benefits of peer-learning to the individual and the collective group.

REFLECTIONS AND CONCLUDING REMARKS

The four cases highlighted that the studio-based peer-peer teaching and learning activities supported certain learning outcomes such as working with others, critical reflection and enquiry, communication and articulation of knowledge and ideas, and how to learn (individually and collectively). It also helped students to "think like an architect" (i.e. making connections between general knowledge and problem-based scenarios), and with 'reflection in action'.[26] The role of students was critical, and perhaps more important than that of the tutor [27]: peer-learning elevates the group's role and responsibility, yet allows flexibility for each individual to contribute equally. However, the session must be clearly framed and structured, so that students are aware of their role (expectations) and can engage actively.
In all cases, the importance of the design tutor's facilitating and 'coaching' role [28] was emphasized: i.e. to guide, demonstrate, and question. While the structuring of peer learning activities is important, it is crucial to allow room to practice 'knowing in action' [29], by moving into the centre of the learning to flexibly respond to the situation and interactions (e.g. to contract or expand activities or students' roles and participation, or recognize deeper learning opportunities). Importantly, the teacher needs to balance an appreciation of student engagement and inputs, while qualifying and validating the group discussion content. Therefore, space is needed for active questioning, listening and responding at

meta-level [30] and for differentiated teaching and guidance (i.e. challenging/encouraging/guiding the individual student, while in the group). This might mean assigning an asymmetric role to the tutor in some activities to allow teachers to transverse learning-points.

While some refinements can be made, the four cases illustrated that peer-peer learning activities could positively support more traditional architectural teaching methods. Despite peer-learning culture being supported by the design studio's unique nature, moving the studio from individual tutor-student format to a hybrid approach with formalized peer-learning, requires a culture change. Embedding a more collaborative studio culture throughout architectural education might be achieved by introducing peer learning activities in the early stages of architecture education. Clearly, elevating active peer-participation and dialogue is in support of co-operative life-skills highly valued in architecture practice, and in society generally.

REFERENCES

[1] Donald Bates, et al, Studio Futures, Changing Trajectories in Architectural Education (Melbourne, 2015), p 4

[2] Lueth, The architectural design studio as a learning environment: a qualitative exploration of architecture design student learning experiences in design studios from 1st-4th year (USA, Iowa State University, 2008)

[3] Barry Maitland, Problem-based learning for an architecture degree, in David Boud, et al, The challenge of problem-based learning (St Martin's Press, London, UK, 1991), p 203-224

[4] Donald Schön, Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987)

[5] Donald Schön, Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987)

[6] Donald Schön, Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987)
And Jenny Toynbee Wilson, Project Management Teams: a model of best practice in design, in David Boud, et al, Peer Learning in Higher Education: Learning from & with Each Other (London, Kogan Page 2001), p 99-114

[7] Lueth, The architectural design studio as a learning environment: a qualitative exploration of architecture design student learning experiences in design studios from 1st-4th year (USA, Iowa State University, 2008)
and AIAS, Toward An Evolution Of Studio Culture (USA, AIAS, 2008)

[8] David Boud, et al, Peer Learning in Higher Education: Learning from & with Each Other (London, Kogan Page 2001), p 1-12

[9] David Boud, et al, Peer Learning in Higher Education: Learning from & with Each Other (London, Kogan Page 2001), p 1-12

[10]Donald Schön, Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987)

[11] M.J. Crosbie, The Schools: How They're Failing the Profession (and What We Can Do about It) (1995), and Daniels, R.W. Reinventing ourselves: interdisciplinary education, collaborative learning, and experimentation in higher education, J. High. Educat., 73 (2002), pp. 667-669 and Sofie Pelsmakers, "Reflections on the changing shape of practice: what does this mean for architectural education?" in "Emerging Architectures and Sustainability – Changing Shape of practice" (Arkitektskolens Forlag, April 2018,) p 110-115

[12] Bruffee, K.A., Collaborative learning: higher education, interdependence, and the authority of knowledge. (2nd ed. Baltimore: John Hopkins University Press, 199), p 12

[13] David Boud, et al, Peer Learning in Higher Education: Learning from & with Each Other (London, Kogan Page 2001), p 1-12

[14] David Boud, et al, Peer Learning in Higher Education: Learning from & with Each Other (London, Kogan Page 2001), p 1-12

[15] Schön, D.A., Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987), p 80
[16] Schön, D.A., Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987), p 119
[17] Schön, D.A., Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987), p 93
[18] David Boud, et al, Peer Learning in Higher Education: Learning from & with Each Other (London, Kogan Page 2001), p 1-12
[19] Nordentoft, H.M., Mariager-Andersson, K. & Smedegaard, A.: Kollektiv akademisk vejledning: en introduktion. Aarhus: DPU, Aarhus Universitet (2016)
[20] David R. Krathwohl, A Revision of Bloom's Taxonomy:
An Overview, THEORY INTO PRACTICE, (Ohio State University Volume 41, Number 4, Autumn 2002)
[21] Sonja Oliveira, Elena Marco & Bill Gething, Towards an energy 'literate' architecture graduate? UK educators' and students' evaluation (Architectural Engineering and Design Management, 2018)14:4,317 329, DOI: 10.1080/17452007.2017.1364217 and Elizabeth Donovan, Sustainable Architecture Theory in Education: How architecture students engage and process knowledge of sustainable architecture, Implementing Sustainability in the Curriculum of Universities (World Sustainability Series, Springer, 2017)
[22] Elizabeth Donovan, Sustainable Architecture Theory in Education: How architecture students engage and process knowledge of sustainable architecture, Implementing Sustainability in the Curriculum of Universities, (World Sustainability Series, Springer, 2017)
[23] Discussed in more detail in Elizabeth Donovan, et al, Integrating sustainability in design studio through blended learning, Education, Design and Practice – Understanding skills in a Complex World, AMPS, Architecture MPS; Stevens Institute of Technology, New Jersey / New York (17-19 June, 2019), **in publication.**
[24] David Boud, et al, Peer Learning in Higher Education: Learning from & with Each Other (London, Kogan Page 2001)
[25] David Boud, et al, Peer Learning in Higher Education: Learning from & with Each Other (London, Kogan Page 2001) and Schön, D.A., Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987)
[26] Schön, D.A., Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987), p 39
[27] Schön, D.A., Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987), p 38
[28] Schön, D.A., Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987), p 38
[29] Schön, D.A., Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions (Jossey-Bass Publishers, USA, 1987)
[30] Christensen, C. The Discussion Leader in Action: Questioning, Listening, and Response. In C. Christensen, D.

BIBLIOGRAPHY

AIAS, American Institute of Architecture students, Toward An Evolution Of Studio Culture, USA, (2018)
Bates, D., Mitsogianni, V., Ramirez-Lovering, D., Studio Futures, Changing Trajectories in Architectural Education,Melbourne (2015)
Boud, D., Cohen, Sampson Peer Learning in Higher Education: Learning from & with Each Other, Kogan Page, (2001)
Boud, D., Feletti, G., The challenge of problem-based learning, St Martin's Press, London, UK (1991)
Bruffee, K.A. , Collaborative learning: higher education, interdependence, and the authority of knowledge. 2nd ed. Baltimore: John Hopkins University Press (1999)
Christensen, C. The Discussion Leader in Action: Questioning, Listening, and Response. In C. Christensen, D. Garvin, and A. Sweet (eds.), Education for Judgment: The Artistry of Discussion Leadership. Boston: Harvard Business School Press (1991)
Daniels, R.W. Reinventing ourselves: interdisciplinary education, collaborative learning, and experimentation in higher education, J. High. Educat., 73 (2002), pp. 667-669

Donovan, E., Sustainable Architecture Theory in Education: How architecture students engage and process knowledge of sustainable architecture, Implementing Sustainability in the Curriculum of Universities, World Sustainability Series, Springer (2017)

Donovan, E., Pelsmakers, S., Integrating sustainability in design studio through blended learning, Education, Design and Practice – Understanding skills in a Complex World, AMPS, Architecture_MPS; Stevens Institute of Technology, New Jersey / New York (17-19 June, 2019), in publication.

Donovan, E., Holder, A., 2016. How architecture students gain and apply knowledge of sustainable architecture, in: Innovation for Sustainable Future. Presented at the Central Europe Towards Sustainable Building (CESB16), Grada Publishing, Prague.

Wyckmans, A.,Environmental Learning in Architecture. From Individual Choice to Collective Responsibility, Nordic Journal of Architectural Research, Volume 20, No 3, (2008)

Lueth, The architectural design studio as a learning environment: a qualitative exploration of architecture design student learning experiences in design studios from 1st-4th year, USA, Iowa State University (2008)

Krathwohl, D., A Revision of Bloom's Taxonomy: An Overview, THEORY INTO PRACTICE, Ohio State University Volume 41, Number 4, Autumn, 2002

Maitland, B., Problem-based learning for an architecture degree, in Boud, D., Feletti, G., The challenge of problem-based learning, St Martin's Press, London, UK (1991), p 203-224

M.J. Crosbie, The Schools: How They're Failing the Profession (and What We Can Do about It) (1995)

Nicol, D., Pilling, S., Changing architectural Education, towards a new professionalism, Spon Press, London & NY (2000)

Nordentoft, H.M., Mariager-Andersson, K. & Smedegaard, A.: Kollektiv akademisk vejledning: en introduktion. Aarhus: DPU, Aarhus Universitet (2016)

Oliveira, S., Marco, E., Gething, B., Towards an energy 'literate' architecture graduate? UK educators' and students' evaluation, Architectural Engineering and Design Management, 14:4, 317-329 (2018)

Pelsmakers, S., "Reflections on the changing shape of practice: what does this mean for architectural education?" in "Emerging Architectures and Sustainability – Changing Shape of practice", April 2018, ISBN: 978-87-90979-75-1, Arkitektskolens Forlag, p 110-115

Roaf, S., Bairstow, A., The Oxford Conference - A re-evaluation of education in architecture, Wiley (2008)

Schön, D.A., Educating the reflective Practitioner, Toward a new design for teaching and learning in the professions, Jossey-Bass Publishers, USA (1987)

Toynbee Wilson; J., Project Management Teams: a model of best practice in design, in David Boud, Ruth Cohen and Jane Sampson, Peer Learning in Higher Education: Learning from & with Each Other, London, Kogan Page (2001)