05. New Horizons

Uncertainty in Circular Architectural and Engineering Education and Challenged-Based Learning

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It is hopeful to see how hard researchers, practitioners, teachers, and students work on new knowledge and practices for circularity. Yet, in the transition to a circular built environment, there is so much that we still do not know. Geopolitical shifts can have a big and unpredictable effect on the availability of materials. Tracing waste flows and remanufacturing products also comes with a high degree of uncertainty as it is hard to balance between demand and availability. And there is still little knowledge to guide decisions when it comes to choosing between robustness and more environmentally friendly materials. More importantly, the transition towards a circular built environment challenges the established hierarchies and the traditional roles of the stakeholders involved in the built environment. Architects and engineers still have to determine how they will be positioned in this transition.

But how does uncertainty impact circular architecture and engineering education?

What is uncertainty?

In the Merriam Webster dictionary, there are two main definitions for uncertainty. The first meaning of the word is familiar to most of us as an individual experience: the state of being uncertain. The second meaning of the word is what we mean with uncertainty in circularity, namely the 'thing that is uncertain'.

Things can be uncertain in several ways. Uncertainty can develop because of a lack of sufficient knowledge or by the sense that any knowledge will be incomplete. It can also be generated by the rapidity of change in the world and its fluidity that is becoming more vivid than ever. But it can also arise from the multiplicity of different interpretations and conflicting perspectives. Especially in circular transitions, policy makers for example, can be torn between different strategies to solve the same issue.

The impact of uncertainty in teaching and learning

Students' attitudes, their values and belief systems, are tested by uncertainty. Some students resist it, others fall into relativism, while some others try to embrace uncertainty. The lack of clear-cut answers is also challenging for teachers: is teaching still about helping students acquire new skills? Some educational experts have noticed that *the pedagogical task is shifting towards helping students to not simply withstand uncertainty, but to be able to act judiciously in conditions of uncertainty. And in this shift, enhancing human qualities like thoughtfulness and courage become as important as sharing knowledge and teaching specific skills.*

In my own research, I have found *conversing* to be the most common strategy for helping students in the decision-making process when confronted

with uncertainty. That includes teacher-student interaction, but also peer-to-peer reflection where students have the chance to give advice to each other and to share their concerns. Designing space for these encounters becomes a critical addition to the design of any course.

How can we make space for uncertainty in education? The paradigm of challenged-based learning.

There is a wide array of didactic approaches that aim to encourage teachers to let go of standing in front of a lecture room. Instead, they advocate for working collaboratively with their students in- and outside the classroom with real life problems. Challenge-based learning is one of these approaches and it is increasingly gaining traction in architectural and engineering education.

As its name suggests, this pedagogical approach is structured around a complex issue – challenges - that are not clearly defined and for which no solution exists yet. The method requires that learners *engage* purposefully in formulating a research and/or design question from practice, in collaboration with a wide range of different stakeholders. Based on their strengths and their skills as a group they are then asked to *investigate* possible scenarios. During the last stage, learners need to *act* by developing a solution or a concept of a solution, experiment with making models or prototypes, test them and evaluate the results. Inclusion of different perspectives and the continuous exchange of information between all partners is key in this process all the way from ideation to prototyping.

This shift in didactics can be compared to swimming. You can learn to swim in the well-organized lanes of a swimming pool, such as a lecture hall, where it is clear what is right and wrong. Challenge-based learning is then much more like open water swimming. Where you might know the general direction of where you want to swim but must decide on your own course of action. Which also means dealing with all the unexpected things that might happen along the way. In both cases you learn to swim, but the latter makes for much more adaptive swimmers than the first.

Integrating uncertainty in our teaching leads to a more conditional use of academic knowledge and skills and it enhances critical human qualities. Swimming in open seas requires that students also build the capacity to listen to others, be more receptive, become aware and develop the critical skills that are necessary to evaluate diverse input within a given context. In this paradigm, again, conversing with others who share the same concerns is key to creating meaning and knowledge.

Both for teachers and students, it takes courage to talk about uncertainty. So, let's create the brave learning spaces we need to teach about circular transitions.