Working towards academic knowledge integration

Facilitating integral design of multifunctional flood defenses

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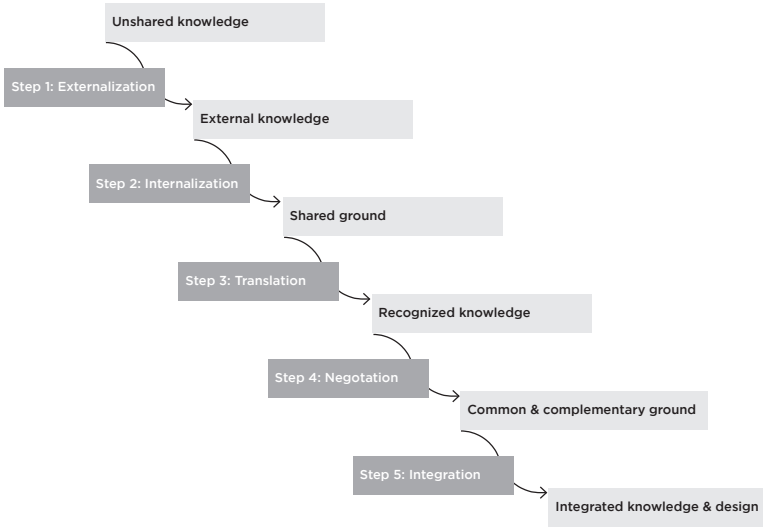


Figure 1. Working towards Academic Knowledge Integration (WAKI) for integral MFFD-design.

Figure 2 (left below). WAKI Step 1: Knowledge externalization by means of mini-lectures for colleagues.

Figure 3 (right below). WAKI Step 2: Knowledge internalization.

Baukje Kothuis

WORKING TOWARDS ACADEMIC KNOWLEDGE INTEGRATION

FACILITATING INTEGRAL DESIGN OF MULTIFUNCTIONAL FLOOD DEFENSES

Dr. Baukje Kothuis was a Postdoc in the STW-MFFD program at the Faculty of Technology, Policy & Management, TU Delft in the project 'Integrated design'. Currently she works at the Faculty of Civil Engineering & Geosciences as a researcher in the NWO Program 'Integral & sustainable design of ports in Africa' and for TU Delft and Texas-based universities as an independent consultant and co-PI in the NSF-PIRE research and education exchange program 'Coastal Flood Risk Reduction' to develop partnerships for international research and education.

The MFFD research program aims for integral design of multifunctional flood defenses. A team of academic researchers from multiple disciplinary backgrounds would integrate their knowledge to reach this goal. The aim of the current research project was to design and organize an interactive trajectory by means of Action Research to facilitate the collaboration process within the research program. This was easier said than done. In the very first team meeting, the researchers discussed 'the definition of a MFFD', and it became clear that many concepts featuring in the design of a MFFD meant different things to different participants. The challenge became clear: how could we integrate these different perspectives towards an integral design?

This chapter explains the analytical framework I developed as a practical route towards integrating academic knowledge. Additionally, I provide examples of several practices we developed to reach the goal and finish with the lessons learned in this challenging, but fun, trajectory.

Working-towards-Academic-Knowledge-Integration (WAKI)
Differences in conceptual approaches, assumptions, and terminology are sometimes explicitly acknowledged by the disciplines, but more often they are implicitly present. To deliver an integrated design, multidisciplinary teams need to find common and complementary ground, and use this space to interweave their specific disciplinary knowledge. To make this possible, researchers not only need to share their knowledge, but also have to go through a knowledge integration process.

To provide insight into this process, I expanded a basic model of Van Beers (2005), created for knowledge integration in an ICT project. The five-step model, now called the Working-towards-Academic-Knowledge-Integration-model (WAKI, Figure 1), reflects the steps we found to be productive and valuable for integrating activities in the MFFD program.

Step 1. Externalization
Every researcher has specific disciplinary knowledge that is unfamiliar to other researchers. This 'unshared or internal knowledge' becomes 'external knowledge' when the researcher communicates it. We made this step by means of mini-lectures and case presentations. However, communicating knowledge is a one-way action. It does not mean that other researchers actually absorb the information given. To achieve this, they have to become active as well.

Step 2. Internalization
Only when other researchers internalize 'External knowledge', does it become 'Shared ground'. The researchers have to actively acquire the content being communicated. However, sharing is still shallow, since acquiring the content does not imply processing or understanding. The words and concepts describing the knowledge content might still entail different meanings and assumptions in different disciplines.

Step 3. Translation
Recognizing and acknowledging multi-interpretability and disciplinary differences permits the 'Shared ground' to be translated into 'Recognized knowledge'. In this step, researchers work to understand each other's assumptions and points of view, which gives them a collective pool of knowledge. As words can have different meanings in different disciplines, or different words can have the same meaning, it is necessary to co-create tangible objects in this step (e.g., maps, architectural models, games, drawings) and discuss the underlying ideas during the process. We discovered that different interpretations became clear when tangible objects had to be designed together. 'Ah, so this is what you mean by design variables.' Nevertheless, after this step, researchers may - and often will - still have different insights, goals, or values for the final design. However, at this stage, they now recognize each other's insights, goals, and values.

Step 4. Negotiation
When the differences and commonalities between researchers in the team are recognized and understood, the floor is open to negotiate common and complementary ground and find the design-space for co-creating an integrated design.

Step 5. Integration
Once this common and complementary ground has been established, different disciplinary knowledge blocks can be combined into an integrated design.

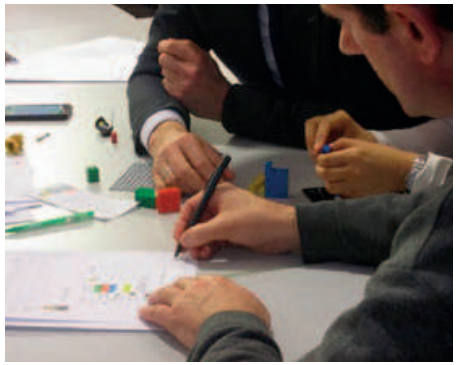
In the collaborative design process, these five steps are often iterated and do not always occur in this precise order. Designing, like many other creative activities, is a 'messy process'.

Figure 4 (below left). WAKI Step 3: Knowledge translation. Calculating with Lego©-game techical, environmental, social, and financial input.

Figure 5 (below right). WAKI Step 4: Knowledge negotiation. Workshop collecting, connecting and negotiating research-input and -output needs.

Figure 6 (below below left). WAKI Step 4: Knowledge negotiation. Choose optimal location for wind turbines on or near dike.

Figure 7 (below below right). WAKI Step 5: Knowledge integration.



AKI practices in MFFD program
We developed several ways to support knowledge integration within the MFFD program. This included three overarching and regularly recurring activities:

- Three-monthly *Program Reflection Days* (RDs) with all researchers in the program (PhDs and postdocs), often with the Program Leader, the MFFD Project Officer from STW, and - when relevant - various project leaders and supervisors. The RDs generally lasted a full day and included multiple activities contributing to the steps in the WAKI process (see also page 132).

- Monthly *Postdoc Meetings* (PDMs) to develop integration on a theoretical level and to develop activities to practically facilitate the knowledge integration process within the full research team. For the last goal, the PDMs worked fairly well. Although the postdocs were based in different (sometimes competing) faculties and universities, these regular personal contacts created mutual trust. The PDMs also led to collective activities and Program Case studies (see page 138). However, integration on a theoretical academic level turned out to be very difficult, if not impossible, and only few multidisciplinary publications resulted (see also page 140-141).

- Yearly *User Days* (UDs) to disseminate knowledge gathered by the researchers, to exchange their experiences and needs, and to collectively learn from other projects and users. UDs were also only partly successful, as many practitioners are unable to devote a full day to an academic research program. This meant that only a handful showed up. Despite the low turnout, the UDs were successful in persuading researchers to summarize and communicate their work at various stages and for different audiences (including their MFFD colleagues). Users who did participate were generally positive about what they learned and could communicate during UDs.

Lessons learned
1. *Trust and interaction* are necessary to make knowledge integration happen, especially at the stage of going from Shared ground to Common & Complementary ground, which is a necessary condition for integration. This seems to be best created by regular meetings in person, which not only entail 'work' (exchanging content), but also 'play' (building trust and mutual understanding).

2. Researchers need to *collectively tinker with tangible objects* to effectively integrate multidisciplinary knowledge; discussing and presenting information is not sufficient. We acknowledged that researchers from different disciplines often speak different 'languages', with their specific knowledge and jargon and discovered that just talking does not make them bridge their specific boundaries or recognize multi-interpretabilities. However, collectively creating tangible objects often lead to an 'aha experience', making researchers aware of these disciplinary boundaries and better able to transcend them.

In the MFFD project, this pattern was clear with the maquette-game of wind turbines on a dike (see page 133), and the development of the Lego game (see page 132). It was also reflected in many of the interviews. When we asked the question 'When you experienced that different disciplinary knowledge was effectively integrated, what was taking place at that very moment?' many respondents mentioned making something tangible. By drawing, cutting and pasting, screwing, hammering, sketching or coloring, while at the same time discussing and negotiating their knowledge, they were able to achieve a collective outcome.

3. To stimulate knowledge integration, *the aim must not be perfection*! When building, communicating and 'playing' with the tangible objects, being imperfect, not pretending that everything is correct and under control, is precisely what tempts other participants to bring in their knowledge, to make changes, additions, or maybe even remove parts. There is often a tendency to make serious games for knowledge integration ever more perfect, for example by using the most sophisticated simulations. Of course, this demonstrates professionalism, but it also has an adverse effect on knowledge integration. For participants, the perfection suggests that everything has already been thought of and is 'correct', which constrains new contributions.

This means that a topographic map with rough, hand-sketched contours provides a better base for co-design than a printed digital version. And asking a group of researchers to co-build a potential design by hand, using wood, ropes, plastic toys, Lego© or 'play-Slime©' is more likely to prompt them to contribute and share than asking them to 'move blocks' virtually in a professional pre-designed environment on an iPad.In many activities, 'imperfection' can also be reached by using the 'pressure-cooker' method. Having limited time prevents participants from working too analytically and trying to make things perfect – something which academic researchers, in particular, seem inclined to do - but instead makes them interact intuitively, opening space for creativity and new input.

4. Integration in an academic research program needs *professional support*: it does not happen by itself. A program that aims for multidisciplinary knowledge integration requires resources in time and money to support the WAKI group process. Additionally, experienced and knowledgeable researchers must be appointed to guide and study this process. This involvement provides the key to a successful WAKI process: personal engagement with all researchers, and time to create and facilitate activities that help develop mutual recognition and trust, and assist in the group process.