CRC for
Water Sensitive Cities

# Catalysing WSCs through professional learning: design and delivery recommendations

Edited by Brian S. McIntosh

Australian Government
Department of Industry, Innovation and Science

Business Cooperative Research Centres Programme

**Catalysing WSCs through professional learning: design and delivery recommendations**
*Strengthening educational programs to foster future water sensitive cities leaders* (Project D4.1)
D4.1–1–2018

**Authors**
Brian S. McIntosh[1]

[1]International WaterCentre



**Publisher**

Cooperative Research Centre for Water Sensitive Cities
Level 1, 8 Scenic Blvd, Clayton Campus
Monash University
Clayton, VIC 3800

**p.** +61 3 9902 4985
**e.** info@crcwsc.org.au
**w.** www.watersensitivecities.org.au

**Date of publication:** July 2018

**An appropriate citation for this document is:**

McIntosh, B.S. (ed.). (2018). *Catalysing WSCs through professional learning: design and delivery recommendations*. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

# Table of contents

# Executive summary

The CRCWSC has invested in research to better understand how to develop the skills and knowledge required across urban water and related professionals, to enable and catalyse the implementation of WSC approaches. The CRCWSC has also invested in developing and running a range of professional learning products from Masters courses through to training courses of different kinds. Mostly these investments were done through the vehicle of Project D4.1 *Strengthening educational programs to foster future water sensitive cities leaders,* which ran during the first tranche of the CRCWSC's funding.

This report is an edited synthesis of some of the deliverable reports produced by Project D4.1. It provides a way to easily access project outputs, and in particular the outputs of the project that answer the following questions:

1. What do we know generally about how and what adults learn?
2. What are the most important skills and knowledge for urban water professionals to have for the purpose of delivering WSC projects and programs, and their intended outcomes and impacts?
3. How do urban water professionals want to access learning?
4. How can those WSC skill and knowledge needs and professional learning preferences be effectively fulfilled through different kinds of learning processes?

The answers to these questions come from a mixture of critical review of learning and cognitive science literature (adult learning), primary qualitative research involving interviews with successful champions of WSC approaches from across industry and government (skills and knowledge needs assessment), primary survey research of over 120 Australian urban water professionals (learning access) and desk-based research (how to satisfy WSC skill and knowledge needs through different kinds of learning process).

Educational, learning and knowledge management literature is critically reviewed to provide a firm foundation of theory and empirical evidence about what we know generally about how to structure and deliver effective adult learning. Learning effectiveness is partly a function of how deeply engaged learners are in their own learning, a characteristic which can be facilitated and encouraged by educators through the design and delivery of courses and programs. Learning effectiveness is also a function of the structure of the learning process itself – the way that a course or program is structured. Structural guidance is available regarding:

- learning process design, which emphasises the benefits of interleaving different learning tasks at the same time (i.e. learning in parallel rather than in sequential chunks)
- spacing learning tasks so that learners are brought back to the same task or topic, skill or knowledge over time (again a principle that encourages effective learning design as not involving discrete chunks of time with no return to the same material)
- ensuring some kind of recall practice or testing / assessment is involved in learning process design, to encourage engagement and memorisation.

Additionally, it is important at the outset of designing a learning process to recognise the intended kind of knowledge to be learned or developed, because this may have profound implications for course or program design. Developing know-how (or skill development), for example, requires practice and continual feedback – quite different from the development of know-why (scientific, or causal understanding).

In both developed and developing country contexts, results from Project D4.1 research interviews with successful WSC approach champions showed institutional barriers and inadequate organisational arrangements are the main

obstacles for transitioning to water sensitive cities. Lack of cross-departmental collaboration within as well as outside the organisation hinders the integrative nature of water sensitive cities practices and projects.

The skills and knowledge needs that interviewees mentioned more often as being crucial to advance for WSC approach implementation were:

- Economics of water sensitive cities
- Policy and regulations regarding water sensitive cities
- Strategic planning
- Risk analysis (strategic risks and water related risks)
- Community and stakeholder engagement
- Management and maintenance of WSUD assets
- Change management
- Land use planning (including GIS, modelling, etc.)
- Integrated water management
- Project management (proposals, planning, management, evaluation).

These skill and knowledge needs were verified via a survey, which was completed by a sample of Australian urban water professionals from across industry and government.

In addition to what is known about how to design and deliver adult learning processes generally, Project D4.1 survey research revealed additional preferences among Australian water professionals about how they like to access and engage in learning:

- Preferred kinds of structured learning activities: Respondents have a strong preference for activities requiring up to one day of engagement (e.g. masterclasses, seminars, workshops and lectures). The longer the time required to undertake structured learning activities, the lower the level of interest respondents have in undertaking such activities, meaning respondents are most likely to engage with low contact hours courses or programs. This result presents a challenge for effective learning, particularly of skills or know-how.
- Preferred features of structured learning activities: 53% of respondents strongly prefer face-to-face interaction, followed by the use of case studies (47%) and engaging with respected water sector leaders (47%). Less than 15% of respondents have strong preference for purely online based features (both interactive and passive learning). Blended or hybrid learning (combination of face-to-face and online learning) scored 34% as a strong preference.
- Constraints on undertaking structured learning activities: Respondents considered time availability to be the highest constraint, followed by geographical location, money and support from employers. At least 86% of total respondents also indicated they don't usually have a specific allocation of time and money for undertaking professional development activities. This result makes delivering WSC focused training a challenge without injecting funds from outside of the implementation organisations involved.

Finally, the CRCWSC has invested in developing and delivering a range of learning products targeting individuals working both nationally across Australia and internationally. These products fall into a range of types, each with unique characteristics in terms of their:

- learning effectiveness of different types of knowledge
- role in promoting the adoption and diffusion of WSC ideas and approaches
- market demands – cost, time and accessibility.

Project D4.1 developed and used a framework for assessing different types of learning products in terms of the kinds of knowledge being developed – know-what, know-why, know-how, know-who and know-when – and the

characteristics of processes that are effective at developing each kind of knowledge. The range of learning products that the CRCWSC has developed and delivered to date were then assessed using the framework to arrive at the following conclusions:

- MOOCs – Massive open online course content has great potential for awareness raising and promotion of WSC approaches, great accessibility (online and free), has strong potential for detailed know-what and know-why development. But, depth of learning overall is constrained by the lack of individual and detailed assessment and feedback mechanisms.
- Short courses – These products are good for developing know-what and know-why with some limited opportunities for developing know-how (skills). They also present some opportunity for in class assessment and feedback, strong market appeal in terms of low cost, and require only a short time away from work.
- Multi-day workshops – These workshops are a good way of bringing together stakeholders and interests to learn together, and so help to grow the relationships required for WSC approach delivery. Active and participatory workshop learning approaches are good for learning and offer some opportunities for know-how development. They also have strong market appeal in terms of low cost and requiring only a short time away from work. However, know-how development is limited, because they are generally short,
- Masters modules (face to face) – Face-to-face modules are a good way of developing detailed know-what, know-why and know-how through multiple interactions between learners and staff and between learners themselves over time Know-how development is good but typically classroom based, so there are some limitations in terms of artificiality compared with work based learning. Their high cost and high time required away from work limits market appeal.
- SPOCs / Masters modules (online) – Small private online courses (SPOCs) can be used to deliver Masters modules purely by distance (online) and are good for developing know-what, know-why and know-how. However, learning process design is important, to ensure they are as effective as face-to-face learning. They are high cost and require a moderate time away from work, although being online makes them more accessible.
- Plan+coach short courses – This new model of learning – developed by Project D4.1 within the CRCWSC and detailed in this report – blends a 1 or 2-day short course with individual development planning and the development of practical know-how in the work place supported by coaching. These courses are relatively low cost and involve low time away from work, with strong value returned to employers. But they are very new in terms of format and on the surface look as if they involve 3 months of learning (albeit in the work place as part of a normal job), so there will be barriers reflecting the extent to which potential participants see the value versus the cost at least initially.

Given the differences between the products, the following factors may help interested urban water management organisations to determine how to move forward with designing and delivering WSC oriented learning products:

- Purpose – What does an organisation considering developing WSC learning courses or programs want or need to achieve nationally and internationally from having participants develop knowledge about WSC approaches? Do they want to simply raise awareness or do they want to develop particular knowledge or skills in particular audiences for particular purposes?
- Role of learning products and more broadly capacity development to urban water management organisations – Is learning and capacity development a core part of the set of activities that urban water management organisations engage in, and why? Is it a way of generating income or an investment that will benefit the Australian and international urban water sectors, by achieving objectives around developing and promulgating WSC approaches? How should organisations seek to partner with one another to develop and deliver learning products for particular purposes, audiences and areas of knowledge?

This report provides some of the analysis, evidence and learning process design and delivery ideation to help answer these two questions. But taking the next steps requires discussion, consensus and perhaps coordinated action from the urban water management organisations that play a role in Australian cities and beyond – about how they should collectively engage with professional skills and knowledge development, and individual scale learning, to more effectively catalyse WSC approach implementation.

# 1 Introduction

During Tranche 1, the CRC for Water Sensitive Cities (CRCWSC) sought to strengthen existing and develop new professionally oriented education programs, to improve the process and outcomes of developing the next generation of urban water leaders who can facilitate water sensitive city (WSC) change and transition processes. This agenda was implemented through the work of project D4.1, *Strengthening educational programs to foster future water sensitive cities leaders*.

Project D4.1 worked for three years to: produce and integrate two Masters modules into the curricula of the programs delivered by the International WaterCentre (IWC) and UNESCO-IHE; develop an innovative professional and skills oriented learning process design and implement it in the form of a course to build business case skills in urban water professionals, and; develop and deliver short courses for different international audiences across Europe and Asia. Underpinning the development, delivery, and the practical work and outputs of this research were research and assessment activities that helped characterise, among other things:

1. the kinds of skills and knowledge that professionals need to play an active and leading role in developing and delivering water sensitive city projects and programs
2. the ways that urban water professionals like to access learning opportunities, and the time and financial budgets they have to do so
3. the relative strengths and weaknesses of different kinds of learning products against the skills and knowledge needs, and learning preferences of urban water professionals
4. the issues and considerations that should inform the development of a broader WSC learning strategy focused on improving and enhancing higher education provision
5. the revenue and cost consequences of different business models for providing WSC focused professional learning services by the CRCWSC.

This report summarises the key frameworks, findings and outputs of project D4.1, to support those involved in commissioning and developing effective professional learning courses and programs. This report synthesises elements of some of the project D4.1 deliverables in a sequence that adds clarity and value, and acts as a useful summary. Interested readers can pursue more detail in supporting milestone reports on the CRCWSC website https://watersensitivecities.org.au/content/project-d4-1/.

In synthesising the key findings, this report will help to answer the following questions:

1. What do we know generally about how and what adults learn?
2. What are the most important skills and knowledge for urban water professionals to have for the purpose of delivering WSC projects and programs, and their intended outcomes and impacts?
3. How do urban water professionals want to access learning?
4. How can those WSC skill and knowledge needs and professional learning preferences be effectively fulfilled through different kinds of learning processes?

# 2 How and what do adults learn?

## 2.1 Introduction

Designing and delivering effective learning activities that build the capacity of participants to deliver WSC approaches in their cities is a complex activity. It requires understanding and experience of (i) how adults learn; (ii) how to design learning products that respond to the ways in which adults learn and; (iii) how to deliver those products in a way that engages learners to effectively build their capacity within the context of their ability to pay, to take time away from work and other activities, and to physically access learning programs and resources.

This section assesses what is known about how adults learn, drawing on a mixture of educational, cognitive science and knowledge management literatures. The insights gained are used to interpret the results from interview based research on the kinds of skills and knowledge that urban water professionals need to develop to more effectively deliver WSC projects and programs into recommendations for learning process design and delivery.

So, how do adults learn? What is known about how to get adults to learn effectively? Indeed, what does effective learning mean? What are its features and how can it be promoted? And how can different kinds of learning (in terms of differences between what is being learned) be conceptualised, and what are the implications of doing so for designing learning processes (courses and programs)?

Answers to these questions are important for urban water management and the undergoing shift in how urban spaces and communities are conceived. The CRCWSC is promoting a paradigm-shifting vision of water sensitive cities, and is supporting it by producing innovative concepts, theories and practices. The adoption of these by industry, the government system and the community will be impacted by the capacity of the sector's practitioners to understand, promote, implement and manage WSC approaches. Effective learning processes will enable the successful development of this capacity in individuals.

## 2.2 Kolb's learning cycle and beyond

A rich and voluminous research literature on learning processes in adults has developed over the past few decades, particularly since the seminal work of David Kolb (Kolb 1984). Kolb characterised learning as a four stage process, with different types of learners exhibiting different learning preferences in relation to different types of learning activities. However, research over the past 14 years has begun to challenge Kolb's model of learning and the ideas of learning styles and preferences that Kolb's work stimulated. This section engages with Kolb's model and the concepts of learning styles and preferences, as well as with recent research that casts doubt on the central proposition that distinct learning styles can be identified with particular learning preferences.

*David Kolb (1984) developed a four stage cyclical model to represent how adults learn from experience. The model has become a foundation to contemporary understanding of adult learning processes and how to engage adults in learning effectively.*

Figure 1 shows Kolb's learning model.

Kolb distinguished between four learning stages – concrete experience (CE), reflective observation (RO), abstract conceptualisation (AC) and active experimentation (AE). He proposed that adult learning proceeds round the four stages although it may begin in any of them. Having a real experience provokes reflective observation about that experience, which leads to changes in how the learner conceptualises and consequently how they act and have further experiences.

Kolb also distinguished between two key dimensions in adult learning – the horizontal dimension in Figure 1 known as the processing continuum (how we do things), and the vertical dimension known as the perception continuum

(how we think about things). Central to Kolb's experiential learning theory (ELT – the name given to his process based model of learning) was the proposition that there are discrete types of learners with so-called learning styles, based on the four quadrants marked by the two dimensions:

- Accommodators – people who learn from hands-on experiences and gut feelings rather than logical analysis (AE/CE learners)
- Divergers – best at viewing concrete situations from many points of view (CE/RO learners)
- Assimilators – best at understanding a wide range of information and putting information into a concise (RO/AC learners)
- Convergers – best at finding practical uses for ideas and theories (AC/AE learners).

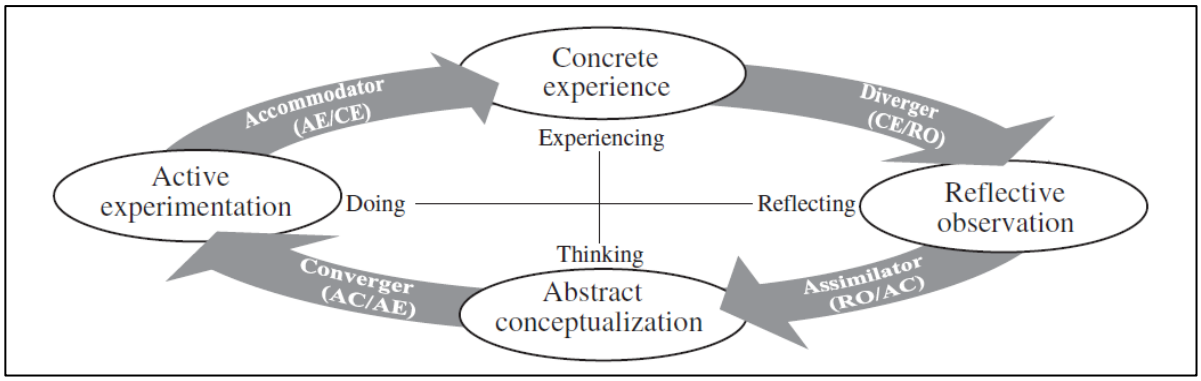


**Figure 1: Kolb's experiential learning cycle (from Bergsteiner et al., 2010)**

Kolb's work is commonly referred to in a very wide range of work, from collective social learning for change (Brown and Lambert 2012) through to practical Master training manuals (Mekong River Commission 2011). The idea is that individual adults have one of the four learning styles and so tend to prefer particular learning activities e.g. hearing, reading, hearing and seeing, observing live activities, writing about live activities and engaging in live activities (Bergsteiner and Avery 2014). If this is correct, a central challenge then is to understand the learning styles of the learners (e.g. the participants of a training course) so the most appropriate learning activities matching their learning preferences are selected.

However, serious doubts have been raised about the empirical validity of the four learning styles and their proposed learning preferences – evidence shows that within each learning style there is wide variation in learning preferences (Loo 2004). Also, there is significant variation in how learning styles are conceptualised (e.g. see Felder and Silverman 1988). Many more dimensions and ways of characterising learning styles have been proposed since Kolb, making it difficult to tell which framework for thinking about learning styles is empirically robust, valid and useful. To learn more about Kolb's ELT, the work on learning theory it spawned and a range of criticisms, see Bergsteiner and Avery (2014), Brown *et al.* (2014) and Felder and Silverman (1988). Before detailing some alternative views of adult learning, the next section examines some of the learning styles work that Kolb inspired – the work of Felder and Silverman.

## 2.3 Learning styles and teaching approaches

Kolb's ELT highlights the importance of knowing the learning audience in terms of learning styles and design learning products to match the range of styles and their implied learning preferences. But how should this be done? Kolb's work spawned a wide range of recommended ways of characterising learning styles, and ways of matching teaching activities with learning styles. There is not sufficient space to comprehensively review this literature, but recent empirical criticisms cast doubt on the validity of the concept of learning styles and preferences, indicating

learning can be made effective without any reference to learning styles at all. However, despite such criticisms there is significant practical value from considering the ways different adults might engage in learning and how learning activities might be structured.

Felder and Silverman (1988) introduced a five dimensional way of categorising learning styles and characterised a set of teaching approaches to meet the needs of those styles (Figure 2).

| *Preferred Learning Style* | | *Corresponding Teaching Style* | |
|---|---|---|---|
| sensory / intuitive | perception | concrete / abstract | content |
| visual / auditory | input | visual / verbal | presentation |
| inductive / deductive | organization | inductive / deductive | organization |
| active / reflective | processing | active / passive | student participation |
| sequential / global | understanding | sequential / global | perspective |

**Figure 2: Felder and Silverman's (1988) learning styles and teaching styles system**

Felder and Silverman's system characterises learners in terms of their preferences around perception, input, learning organisation, processing and understanding. Under each of these five preference categories are two learning styles e.g. under input, some learners prefer visual input while others prefer auditory input. For each learning style preference, they describe an appropriate teaching style e.g. for the input learning styles (visual and auditory) they characterise corresponding teaching styles as visual or verbal.

While Felder and Silverman's model can be criticised, as with Kolb's four learning styles (see Bergsteiner and Avery 2014), the characterisations of how different adults learn and how to provide learning in a practical teaching or learning activity sense are useful.

## 2.4 Approaches to learning

More sophisticated models of learning have been proposed to better match what we know empirically about how adults learn in different situation. However, these models remain tentative and require validation themselves so won't be described here (see Bergsteiner and Avery (2014) for more).

As an alternative to learning styles, Ramsden (2003) proposed the concept of the learning approach, which has been tested. The learning approach concept assumes learners can be engaged in a surface way with a learning task, or in a deep way. Surface learning is not effective whereas deep learning is. So what is the difference between the two?

First, learning might be thought of as an activity that comprises both a 'how' and a 'what'. The 'how' of learning is the act of experiencing, structuring and organising learning by the learner. It can be either 'holistic' – where the learner seeks to focus on the whole of the learning activity and subject – or 'atomistic' – where the learner seeks to focus on the parts of the learning activity and subject, and does not engage in the whole.

The 'what' of learning is the meaning aspect of learning – that which is experienced and the significance of the learning task. It is either 'deep' – where the learner focuses on what the task is about – or 'surface' – where the learner focuses on words and sentences or symbols, but not the meaning. Holistic-deep learning is effective and to be encouraged, while atomistic-surface (or surface) learning is not effective and not to be encouraged. Table 1 characterises the differences between the two learning approaches.

**Table 1: Deep vs surface learning approaches (from Ramsden 2003)**

| Deep learning approach | Surface learning approach |
|---|---|
| • *Intention to understand*<br>• *Participant maintains structure of task* | • *Intention only to complete task requirements*<br>• *Participant distorts structure of task* |
| Focus on what is signified e.g. the author's argument | Focus on the signs e.g. the words and sentences, or formula for a problem |
| Relate previous knowledge to new knowledge | Focus on unrelated parts of the task |
| Relate knowledge from different courses | Memorise information for assessments |
| Relate theoretical ideas to everyday experience | Associate facts and concepts unreflectively |
| Relate and distinguish evidence and argument | Fail to distinguish principles from examples |
| Organise and structure content into a coherent whole | Treat the task as an external imposition |
| Internal emphasis | External emphasis: demands assessments, knowledge cut off from everyday reality |

Under the learning approach model, all learners have the capacity to engage with all learning activities and tasks if the conditions are right. It does not matter what learning style or set of learning preferences each learner might potentially have – rather the effectiveness of learning depends on a range of conditions that can be influenced by the deliverer of the learning process (e.g. a teacher or trainer). Table 2 shows how.

**Table 2: Characteristics of the learning context that influence learning approach (adapted from Ramsden 2003)**

| Surface learning approaches are encouraged by | Deep learning approaches are encouraged by |
|---|---|
| Assessment methods emphasising recall or the application of trivial procedural knowledge | Teaching and assessment methods that foster active and long term engagement with learning tasks |
| Assessment methods that create anxiety | Stimulating and considerate teaching, especially teaching that demonstrates the trainer's personal commitment to the subject matter and stresses its meaning and relevance to participants |
| Cynical or conflicting messages about rewards | Clearly stated academic expectations |
| An excessive amount of material in the curriculum | Opportunities to exercise responsible choice in the method and content of study |
| Poor or absent feedback on progress | Interest in and background knowledge of the subject matter |
| Lack of independence in studying | Previous experiences of educational settings that encourage these approaches |
| Lack of interest in and background knowledge of the subject matter | |
| Previous experiences of educational settings that encourage these approaches | |

Using the concept of learning approaches then, the central challenge when designing and implementing learning products (e.g. a one-day short course) is not to diagnose individual participant learning styles and preferences, but rather to ensure the right conditions are in place for deep (or effective) learning.

The Mekong River Commission (2011) provides a practical articulation of how deep learning approaches can be implemented with adults, stating adults learn when it:

- is self-directed
- fills an immediate need
- is participative
- is experiential – from shared experience across learners
- is reflective
- includes feedback (or formative assessment – see below)
- shows respect for the learner
- is done in a safe and comfortable environment (where safe means not being potentially a source of embarrassment for perceived failure).

## 2.5 Active learning strategies for effective learning

Ramsden (2003) (see Table 2) outlines ways for promoting deep learning approaches. Effective learning can also be thought of as being a consequence of employing a particular set of active learning strategies. Brown *et al.* (2014), in synthesising over a decade of psychological research into the determinants of effective learning, recommend the following:

- Interleaving – Evidence shows weaving together more than one topic at a time promotes more effective learning than simply focusing intensely on one topic until it is 'mastered'. Such supposed mastery gained by intense and exclusive focus tends to disappear significantly over a short period of time, while interleaving different, particularly compatible, topics seems to help learners build effective mental models and develop good competency.
- Spacing – Leaving time between learning and then re-engaging with learning material on a particular subject significantly increases retention and understanding of material. Spacing as a strategy naturally complements interleaving.
- Retrieval practice – While testing is often criticised as a learning strategy, particularly around risks of promoting surface learning approaches, evidence shows regular, appropriately formed testing promotes more effective understanding and retention of information and concepts.

Brown *et al.* (2014) notes Kolb's traditional concept of learning styles and the work that followed is not convincingly supported by evidence (and that preferred learning styles may change over time and between situations). However, Brown *et al.* (2014) also argues some individual cognitively rooted learning type differences do exist around two simple dichotomies: between rule learners and example learners, and between high and low structure builders:

- Rule learners tend to abstract the general principles or rules for any given subject while Example learners tend to memorise the examples or case studies rather than the general principles or rules.
- High structure builders tend to extract salient ideas and construct mental frameworks more easily than low structure builders, who may find it difficult to set aside unimportant information and to add elements to their mental models or cognitive structures of topics.

Example learners can learn how to improve their rule learning abilities so these are not totally fixed distinctions, while our understanding of the causes and potential remedies for low structure building cognitive abilities is very early and not yet well understood. So, even though the emerging evidence supports the cognitive roots of effective learning, we do not know enough to act practically.

## 2.6 Alignment and assessment

A final important component of encouraging deep learning is to ensure a strong alignment between the learning needs of the audience, learning objectives, the methods (learning activities) employed and how competency is assessed.

Poorly chosen learning activities will not promote effective, deep learning if they do not match the nature of the capacity being developed, or the learning objectives set. However, there is no simple table to guide one through selecting the right learning activities for the particular learning objectives for a subject.

Assessment can be done for formative purposes – to provide feedback to a learner – or summatively – to provide a grading or competency evaluation. In both cases, rules must be observed if the assessment is to be an effective tool for promoting deep learning and an effective assessment of ability. Ramsden (2003) characterises the rules as:

- Link assessment to learning – focus first on learning, second on encouraging effort and third on grading; assess during the experience as well as at the end of it; set tasks that mimic realistic problems whenever possible, and; reward integration and application.
- Never assess without giving comments about how to improve.
- Learn from your participant's mistakes – use assessment to discover their misunderstandings, then modify training to address them.
- Deploy a range of assessment methods.
- Get participants to engage in the assessment process by:
    i. discussing the assessment methods used and how they relate to the training course objectives
    ii. jointly designing assessment questions and criteria
    iii. using self or peer assessment
    iv. offering participants a choice between different assessment methods.
- Give lucid and repeated messages throughout the training that memorisation, reproduction and imitation will be penalised and success will only come through decisive demonstration of understanding.
- Use multiple choice tests cautiously and preferably in combination with other assessment methods.
- In subjects where participants need to demonstrate ability to undertake a quantitative exercise, also require a prose explanation of why they have tackled the question the way they have.
- Do everything in your power to lessen the anxiety associated with assessment.
- Never set an assessment question you are not prepared to answer yourself.

## 2.7 What is learned – developing different kinds of knowledge

So far, we have examined how adults learn and how effective learning can be facilitated. Now, an additional question remains: what should adult learning activities try to develop in (or "teach to") adults? This is a difficult question to answer in the WSC domain, which integrates a multitude of different disciplines (e.g. politics, social sciences, environment, engineering, etc.), cross-cuts across sectors (e.g. government, private sector, academia, community, etc.) and involves inter-organisational relationships among different areas and roles. The capacity needed to push WSC approaches forward is diverse and grand. However, Collison and Parcell (2001) provide a framework that can help to categorize WSC capacity as different types or areas of knowledge. This framework is presented and described below:

**KNOW-HOW:** Also known as Skills, implies the ability to produce some action, to be able to do something, to know how to do something. It is captured in routines, techniques and tools. Examples in the WSC context may include:

- undertake an economic assessment of a WSC project
- build a bio-retention system
- implement a community engagement strategy.

**KNOW-WHY:** Implies an ability to articulate a conceptual or causal understanding of an experience – mental models, paradigms, perspectives, assumptions, etc. For example:

- understand why and how bio-retention systems remove different kinds of pollutants
- understand why and how the urban heat island works
- understand why and how people perceive streetscape aesthetics differently.

**KNOW-WHAT:** Refers to the activities that are required to complete a task (e.g. the information necessary to make a decision or the things that must be in place before making something):

- know what to consider when making a business case for a WSC project
- know the processes required to recycle wastewater to drinking standards.

**KNOW-WHO:** Also known as the "I know a man who can" factor. It is knowledge about relationships, contacts, competencies, networks etc. that are necessary to undertake a task. For example:

- know who are the key local government actors that can influence a certain WSC projects.

**KNOW-WHERE:** It is the ability to navigate through and select the right information required for a task. For example:

- Know what are the most relevant guidelines to inform the development of WSUD features (Water By Design guidelines, state government guidelines).

**KNOW-WHEN:** The sense of timing. It relates to knowing when is the best moment to instigate, change or end something. For example:

- be aware and understand the political and organisational cycles that can impact the implementation of a WSC project.

Generally speaking, different learning activities will be more suited than others to develop particular types of knowledge. For example, it would be difficult to build know-how through a learning activity that does not include practical learning – doing things that develop skills. Developing skills requires feedback from doing and seeing how things work (or don't work).

Knowing what type or types of knowledge to prioritise when designing learning activities will depend on various factors. The target audience and their needs are key. For example, progress in the WSC space may be enhanced if high level managers and political leaders have WSC related know-why, so they understand the benefits WSC approaches can provide to society and hence support and drive its adoption. By contrast, operational level officers may require WSC related know-how, to implement WSC approaches on the ground and to develop compelling business cases to get permission from high level managers in the first place.

It is important then that the development of learning activities is based on a comprehensive assessment of the capacity needs of the target audience / system. McIntosh *et al.* (2015a) showcases an extensive capacity needs assessment of the Australian and overseas urban water context, and gives insight on the types of knowledge required by practitioners in the sector. The following sections of this report refer to this work.

# 3 Skills and knowledge for WSC projects and programs

## 3.1 Introduction

What specific skills (know-how) and knowledge do urban water professionals need to have in Australia and internationally to be better equipped to deliver WSC projects and programs? The first phase of Project D4.1 of the CRCWSC (*Strengthening education programs to foster future water sensitive city leaders*) sought to identify the kinds of knowledge and skills across state government, local government, utility and consultancy based urban water professionals need to improve their capability to deliver WSC projects and programs. Because WSC projects and programs are typically not standard practice (yet), the skills and knowledge needs are those necessary to deliver innovations in urban water management practice.

McIntosh *et al.* (2015a) presents and discusses the findings obtained through interviews with urban water champions from Australia, The Netherlands, Vietnam and Bhutan, representing local governments, state planning and regulation institutions, water utilities and private companies. The interviews aimed to gather insights on what skills and knowledge are needed to transition towards more holistic water sensitive city approaches in different developed (Australia and The Netherlands) and developing (Vietnam and Bhutan) country contexts.

The interviews were structured using a framework based on the notion of an innovation uptake 'S-curve' (Figure 3).

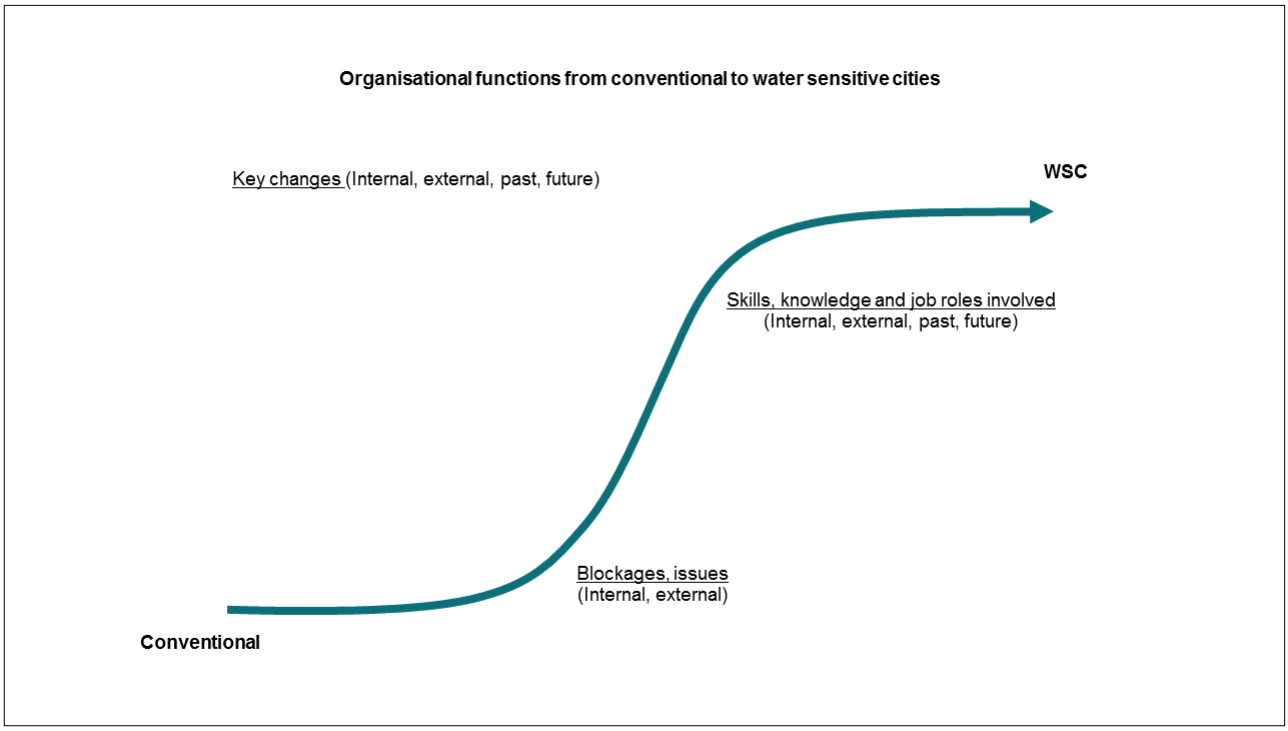


**Figure 3: Innovation or transition S-curve framework – the curve shows the process of WSC innovation uptake from one state (conventional water management approaches used) to another state (WSC approaches used) as starting off slowly and then gathering momentum as capacity is built and challenges overcome (based on Rogers, 2003).**

The S-curve (Rogers 2003), also known as a transition curve within the WSC community to describe the uptake and diffusion of WSC innovations, can apply to a single organisation or to an area like a city. It describes how

innovation uptake processes are initially small scale and slow. Gradually innovations go from pilot to full scale, and are rolled out in programs as knowledge and confidence in the new approaches grows, and as challenges (resistant attitudes, organisational structures that do not accommodate the new approaches) are overcome. The S-curve can work in reverse, however, as the factors that act to resist innovations are either not overcome or begin to dominate. Innovations include the full gamut of WSC approaches – technology, policy, planning and design thinking.

The S-curve framework acted across the interviews to tease out where different organisations and cities are in terms of water sensitive cities innovation uptake. From there, discussions focused on understanding how those organisations and cities got to where they are in terms of actions (projects, programs and capacities), what is preventing them moving forward along the curve, and what additional capacities they need to do so. The elicited capacities were then used to identify the key kinds of skills and knowledge that are needed in and across organisations to progress WSC projects and programs.

Table 3 shows the underlying conception of conventional vs WSC approaches used in the interviews to ensure the interviewees understood both ends of the S-Curve and provided responses that were calibrated with respect to each other as a consequence.

**Table 3: Comparison of urban water system attributes between conventional and WSC approaches to managing water, used to guide discussions with "water champions"**

| Urban water system attributes | Conventional approach | Water sensitive cities approach |
|---|---|---|
| Purpose | Water supply<br>Sewerage<br>Drainage and stormwater<br>Flood control<br>Public health protection | Multiple purposes for water – waterway health; other needs (transport, recreation, amenity, micro-climate, energy, food)<br>Fit for purpose water<br>Reuse of water – consumption and waste are closely linked |
| Management approach | Compartmentalised by functions (planning, supply, wastewater etc.)<br>Optimisation of individual components of urban water cycle | Integrated management across functions<br>Managed as a total water cycle<br>Adaptive<br>Multiple purposes considered |
| Expertise | Engineering and economic focus | Interdisciplinary (including planning, ecology, health, hydrology, community participation)<br>Multi-stakeholder learning across social, technical, economic, political, design, ecological spheres |
| Service delivery | Centralised and linear<br>Engineering and economic efficiency<br>Service organisations act independently of each other | Decentralised, interconnected, flexible<br>Engineering and economic efficiency plus social and ecological benefits<br>Service organisations collaborate effectively. |
| Role of public | Water managed by government on behalf of communities | Co-management of water between government, business and community |
| Risk | One size fits all risk management | Risk management tailored to context |
| Service sustainability | Based on maintenance and capital investment of water infrastructure<br>Technical and legislative solutions for flood and drought planning | Built in resilience to change (climate change, population increases etc.) through diversification and decentralisation<br>Multifunctionality of assets (e.g. green spaces for recreation and flooding) |

Interested readers may read the main deliverable (McIntosh *et al.,* 2015a) for more detail on the method and a full description of the results, which include an assessment of institutional barriers to WSC innovation uptake as well as a statement of the skills and knowledge needed for WSC project and program success. This report focuses on the Australian urban water sector WSC project and program skills and knowledge needs that were uncovered in the greatest detail.

## 3.2 WSC skills and knowledge needs

Generally, water champions did not consider technical skills for implementing water sensitive cities approaches to be an issue, except the need for better training in building and maintaining WSUD assets within local government. Rather, the main skills and knowledge that are needed relate to improved capacity to effect change within an organisation and to better engage with internal and external stakeholders. Water champions also identified improved understanding of the economic, regulatory and policy aspects of WSC as key areas to develop.

> *Fifty per cent of our business is justifying an investment on economic terms; 25% is managing the regulation and legislation; 15% is developing customer systems; and 10% is building the infrastructure and technology. The technology is proven and standardised, so this is not an issue.*
> (Private organisation)

The following section discusses in more detail the skills and knowledge needs that the water champions identified,: economic justification of WSC approaches; policy and regulatory considerations; planning and risk analysis; and developing internal and external capacity for collaboration.

***a. Economic justification for water sensitive cities***

A consistent theme across organisations and states was the need for a better economic understanding of water sensitive cities approaches. There should be a good economic rationale for implementing water sensitive cities. If new approaches are promoted, organisations need the ability to conduct an economic analysis showing who will pay for it, who will maintain it, what are the costs, and where the revenue will come from.

Economic skills identified include:

- budgeting for integrated projects
- economic analysis of water investments that includes externalities such as health and environmental aspects, and
- economic analysis that incorporates small scale and large scale water sensitive cities investments (household to catchment).

> *There is a need to understand rudimentary economic concepts and environmental economics, such as contingent valuation and hedonistic pricing, as these are being used to evaluate projects.*
> (Local government)

> *Calculating ROI from an economic value, but also how to value health and wellbeing and environmental services to compare options while thinking about multiple benefits.*
> (Local government)

> *We need modelling of costs and volumes and business cases for precincts and greenfield areas. How to make a case for change and take this to the decision makers. This is a skill set that is still developing.*
> (State planning/Regulator)

***b. Policy and regulations for water sensitive cities***

Water champions felt councils and developers do not sufficiently understand the regulatory and compliance regimes, which can slow down the development process. State planning and regulatory organisations can also inhibit developments due to lack of flexibility in their application of regulations.

> *More training is needed in regulatory requirements so that developers and councils realise what is needed. It is not onerous.*
> (State planning/Regulator)

> *At the moment, each state has their own view and system and they can be pedantic about their regulations. They are risk averse and if they stick to regulations then they are safe.*
> (Private organisation)

Other knowledge and skills identified within this category were:

- policy development within organisations for WSC approaches (2 respondents)
- awareness raising and influencing politicians and decision makers (2 champions).

> *The more we can influence the elected people, the better chance we have of building consistence and longer term policies. This requires good education of why these policies should be in place.*
> (Local government)

***c. Strategic planning and risk analysis***

Organisations should consider long term business and strategic planning, linked with regulatory regimes (understanding the context), best use of existing assets and strategic risks.

> *There needs to be a strategic approach to looking at economic aspects. A total planning concept that includes supply and demand; micro and macro; and broader aspects such as health, liveability and energy consumption.*
> (State planning / Regulator)

> *We see the need for change because a lot of our assets will have to be replaced in the next 10–20 years. So do we just replace them or are their alternatives that could result in better investments? Community values are changing and the environment is changing. So what are the best options and what are the risks to ensure that your long term investments are robust? Engineers are still stuck in the single loop learning cycle, whereas we need double loop learning.*
> (Public water utility)

> *The old system tended to have engineers at the front of the planning process. This is gradually being swapped around to have strategic planners calling the shots and working together with community to develop integrated approaches. The engineers are then at the end of the process and asked to develop possible solutions to fit the requirements of the collaborative planning process.*
> (Local government)

Risk analysis also includes better understanding health risks in fit-for-purpose water systems.

> *At the moment, we have an industry where people accept the status quo and don't question if things could be done differently and too easily say it can't be done. They use health and risk as an argument against it.*
> (Private organisation)

***d. Community and stakeholder engagement and collaboration***

Water champions identified community engagement as a key skill, with all types of organisations mentioning the need to involve or respond to the community in the planning process. An important element of implementing WSC is to involve the community in planning and implementing change. This approach creates positive reinforcement with policy and decision makers, and minimises the risk of unexpected outcomes. Communities are the end users of any WSC approach and they should be included as much as possible in the decision making process.

*Community engagement skills are in short supply…..There is a need for support and training in how to collaborate effectively with the community and the benefits of taking the time to build this collaboration.*
(Local government)

One local government water champion felt it was important to properly engage the community. An initial criticism was that too much time was taken to collaborate and engage the community, and too little was done on the ground. Neighbouring councils were seen to be doing things more quickly. But this local government persisted, because it considered it was important to build a support base. Now, in the absence of grants, it can see other councils have stopped doing things, whereas it continues with small projects that work toward its overall strategy.

Stakeholder engagement and collaboration includes community engagement, but also involves other internal and external stakeholders for an organisation. This was a key skill identified by four of the water champions.

*[one public water utility] realises that they can't silo around professions anymore and it has restructured to be process oriented. However, many people are still not prepared for working with people from different disciplines and don't understand the different mindsets. It is understood as an issue but we have not worked out how to solve this yet due to the changes in thinking needed and the broader IWM abilities needed.*
(Public water utility)

*There is room for small, niche businesses that could link utilities and government with developers and other small utilities. They could help in aspects such as regulatory liaison and developing relationships with government. They would be specialist hubs and centres of knowledge.*
(Private organisation)

Effective stakeholder engagement and collaboration also requires effective communication skills and three of the water champions mentioned this as an important aspect. This applies to communication with decision makers (how to make a good case for WSC approaches), as well as communication across disciplines within an organisation.

*What is the language we use? How to frame ideas in a positive way?*
(Local government)

*How do we break down siloed teams and promote not only experts in a particular field but also understanding across fields. If you have 10 experts around a table, how do you make it efficient and functional and how do they understand each other's perspectives?*
(Local government)

***e. Management, maintenance and compliance of WSUD assets***

Councils' staff need technical training for them to better build and maintain WSUD infrastructure.

*Many contractors didn't understand why WSUD was designed in a particular way and so modified it, which led to poor construction. There is a need for builders to understand it so that it is built in the right way.*
(Local government)

*Staff were taught how to manage the UV systems for stormwater harvesting but it was a complicated process and many of them didn't feel confident to manage this. There needs to be better ongoing support and a better training system put in place for some of the complex aspects of WSUD.*
(Local government)

### *f. Other skills and knowledge needs*

Some water champions mentioned other skills and knowledge needs, although these were not discussed in detail. These suggestions are categorised below.

- Managing change
    - Institutional barriers to change
    - Critical thinking
    - Leadership
    - Change management
    - Adaptive management
- Land use planning
    - Land use planning and natural resource management
    - Mapping and GIS
    - Catchment modelling
    - Soil ecology and hydrology
- Whole of water cycle assessments
    - Integrated water cycle assessment (stormwater, wastewater and drinking water)
    - Energy and water flows for developments (from big to small)
- Project management
    - Writing submissions for complex water projects
    - Interdisciplinary project management
    - Evaluation of projects
    - Business planning for project options.

# 4 How do urban water professionals want to access WSC learning?

## 4.1 Introduction

Building capacity involves a range of interventions, from building the skills and knowledge of individuals through developing organisational processes, systems and strategies to changing governance and regulatory arrangements, and building broader community water literacy. Project D4.1 focused on building individual scale capacity by, among other things, working with partners across the CRCWSC to develop and deliver structured professional learning courses and programs. These courses and programs will build the capacity of individuals to get innovative projects and programs up and running within and across organisations, to improve the success of such projects and programs, and to drive processes of transformation and change that will embed water sensitivity at city scale. The term 'structured professional learning' indicates education or training courses and programs that are structured; that is:

a. They are designed and structured to deliver particular learning outcomes.
b. They are targeted at developing skills and knowledge in working professionals.
c. While they may employ a range of learning approaches (including self-directed learning, problem based learning and coaching), they fundamentally involve participants engaging in particular material and undertaking particular tasks, often in a particular sequence to achieve stated learning outcomes.

Structured professional learning differs from providing access to resources in hard copy or online and then leaving people to engage with those resources as they see fit with no particular learning outcomes or syllabus structure. Instead, structured professional learning courses and programs are delivered in the form of part day, 1 day, multi-day or even multi-month or year courses in face-to-face, online or blended modes. They will have accompanying resources.

As part of project D4.1, the CRCWSC created and launched a market research survey in late 2014. The survey had two objectives:

- First, evaluate how the CRCWSC currently seeks to build sector capacity to deliver WSC outcomes (e.g. blueprint documents, webinars, industry partner forums, etc.).
- Second, understand which skills and knowledge must be developed across the urban water sector in Australia to better deliver WSC outcomes, and preferences for how professional learning might be delivered through structured courses to satisfy those skills and knowledge demands.

The survey was sent out via the CRCWSC newsflash, and a total of 122 responses were received.

This section of the report characterises and assesses the survey results, for the purpose of proposing ways of building the capacity of urban water professionals to deliver WSC outcomes through structured learning courses. In essence, this section assesses the learning preferences of urban water professionals in Australia. Combined with understanding how and what adults learn, and the kinds of skills and knowledge needed to deliver WSC projects and programs, section 5 of the report assesses and recommends different kinds of learning products (courses and programs delivered in different ways). The main survey report deliverable is available as McIntosh *et al.* (2015b).

## 4.2 Demographics – who completed the survey?

Of the 122 responses received, 37.7% were from CRCWSC industry participants and 41.8% from non-CRCWSC participants. Just 5.7% were from CRCWSC research participants, a positive result, given the survey was designed to elicit information from urban water professionals.

The majority of respondents identified themselves as working in planning (36.9%), natural resource management (32.8%), engineering (28.7%), policy (27.9%), (natural) science (26.2%) or urban design/architecture/landscape architecture (19.7%). Only a very few (around 4–5%) identified themselves as working in social science, education, law, business/economics or marketing/communication. Fewer than 1% identified themselves as working in the humanities (0.8%). Figure 4 provides a detailed breakdown.

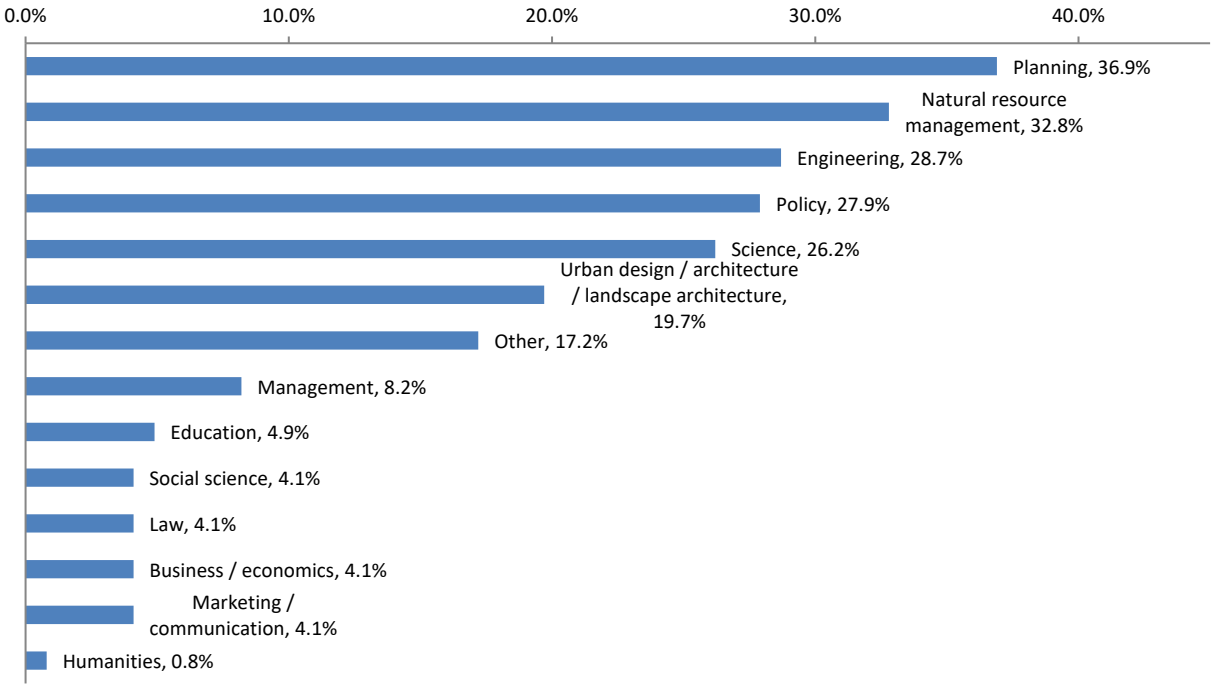


**Figure 4: Percentage of respondents working in each discipline**

Most had been working in their discipline for more than six years (73.8%), with 26.2% having worked in their discipline for more than 15 years, 13.1% for 11–15 years, and 34.4% for 6–10 years. Respondents consequently mostly identified themselves as having mid-level (33.3%) and team level (37.5%) roles, with some reporting as senior managers (10.0%).

Geographically, the majority were from Victoria (35.3%), followed by Western Australia (27.9%), New South Wales (14.8%) and Queensland (11.5%). Only 6.6% of respondents identified themselves as internationally located.

## 4.3 What skills and knowledge are in demand?

The survey was developed to triangulate the results of interviews carried out in 2014 with acknowledged WSC champions, to identify key skills and knowledge involved for organisations to deliver WSC outcomes (McIntosh *et al.,* 2015a).

Figure 5 shows the results with the skills and knowledge areas being those identified in the champions interviews.

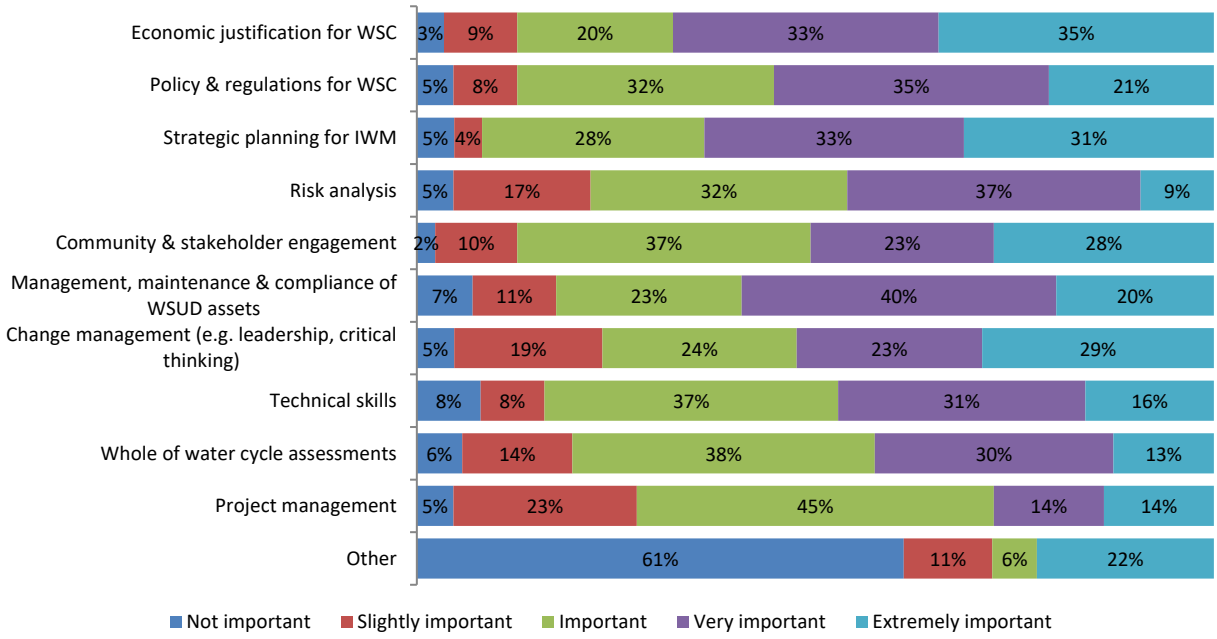


**Figure 5: Skills and knowledge that respondents consider important to develop to improve their ability to deliver WSC outcomes**

Respondents did not receive specific definitions for the various skills and knowledge areas – the idea was to quickly triangulate the champion interview results, which were much more detailed.

As shown above, skills and knowledge that scored the highest when summing ‘very important’ and ‘extremely important’ responses were:

- economic justification for WSC (68%)
- strategic planning for WSC (64%)
- management, maintenance and compliance of water sensitive urban design (WSUD) assets (60%), and
- policy and regulation for WSC (56%).

Moreover, areas such as 'change management’ and ‘community and stakeholder engagement’ scored slightly lower in the sum of ‘very important’ and ‘extremely important’ (52% and 51%), but scored significantly as ‘important’ (37%). Additionally, ‘project management’ scored very low as ‘very important’ and ‘extremely important’ (28%), but had the highest score (45%) as ‘important.

The ‘other’ skills and knowledge responses provided were a mix of leadership and change skills and technical knowledge:

- water balance requirements, storage, minimum flows, allocation frameworks and appropriate offtakes
- real world, practical knowledge
- (how to secure) funding for innovative projects
- collaboration
- leadership, and
- selling the vision internally.

There were some differences across the states, in terms of the perceived importance of different skill and knowledge areas, although these differences were not pronounced and have to be interpreted given the likely sampling error (122 respondents). They tended to be relatively small differences in the distribution of perceived importance of different skill and knowledge areas. For example, on average respondents from one state perceived a particular skill and knowledge area as being slightly more important compared with respondents from another state, but overall respondents from both states perceived the area as being important, very important or extremely important. The following key differences were detected:

- More respondents from Victoria and Western Australia rated developing skills and knowledge in the economic justification for WSC as ‘extremely important’ than in Queensland or New South Wales.
- More respondents from Victoria rated ‘policy and regulations for WSC’ as ‘extremely important’ than Queensland, Western Australia or New South Wales. But, more respondents from Queensland and Western Australia rated ‘policy and regulations for WSC’ as ‘important’ than in Victoria and New South Wales, so the differences average out.
- Respondents from Victoria and Western Australia rated ‘risk analysis’ as most important across the states.
- ‘Community and stakeholder engagement’ was rated as most important by respondents from Queensland, followed by respondents from Victoria, and then those from Western Australia and New South Wales combined.
- ‘Management, maintenance and compliance of WSUD assets’ was rated as ‘very important’ by respondents from New South Wales and Victoria, and as ‘important’ by respondents from Western Australia. Respondents from Queensland did not record a significant difference between the levels of importance assigned to this knowledge and knowledge area.

The percentage data is not given for these differences, because the quantitative data is subject to sampling error, making the qualitative differences the most important feature. Further, the data for interstate differences is too large to comfortably present here, so is presented in the main deliverable.

## 4.4 What types of structured learning are preferred?

Respondents were asked to indicate their preferences for the type of structured learning that could be used to develop their WSC skills and knowledge. This feedback covered aspects such as (i) kinds of structured learning activities (from shorter-than-a-day masterclasses to postgraduate programs), (ii) features of the structured learning activity (face-to-face, online, hybrid, case studies, fieldtrips, etc.) and (iii) the importance of accreditation (academic or industry).

### 4.4.1. Kinds of structured learning activities

Figure 6 shows respondents' preference for different kinds of structured learning options. This question gathered information about how much time respondents would be willing to invest in structured learning activities.

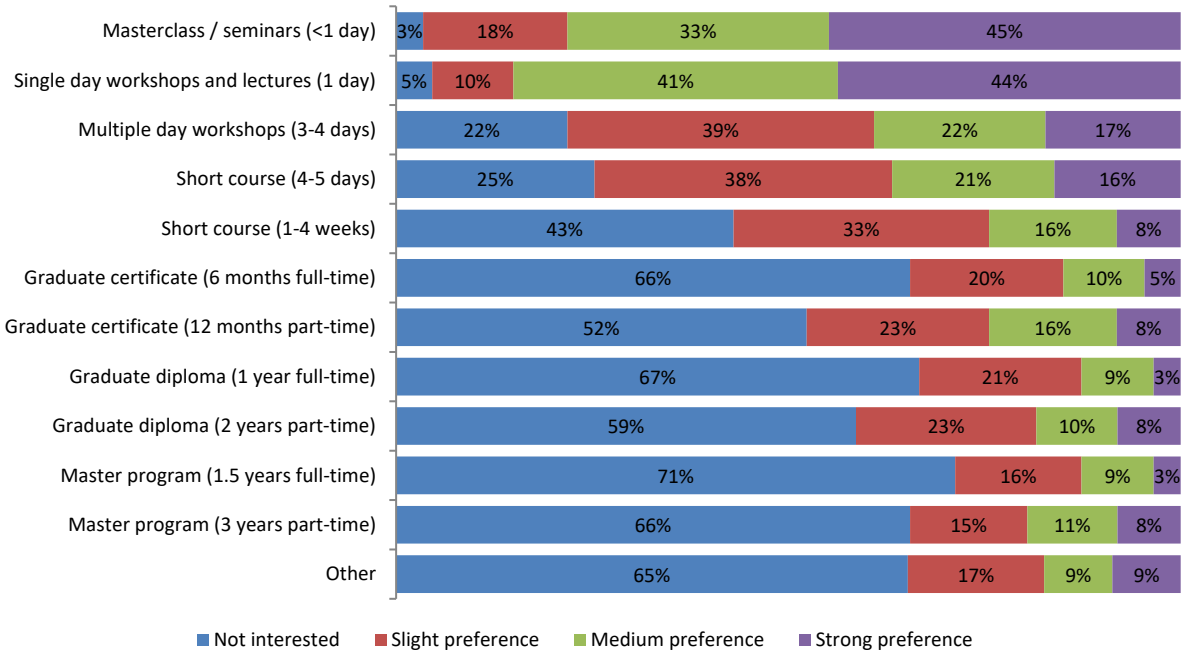


**Figure 6: Respondents' preference for different kinds of structured learning activities**

Respondents indicated their clear strong preference for activities requiring up to one day of engagement, such as masterclasses, seminars, workshops and lectures (over 40% of 'strong preference'). Further, the longer the time required to undertake structured learning activities, the lower the level of interest respondents have in undertaking such activities.

Three to five-day activities (workshops and short courses) take the second place, with a still significant preference from respondents (over 16% of 'strong preference' and 21% of 'medium preference').

Although more than 50% of respondents are not interested in any of the postgraduate structured learning options – graduate certificates, graduate diplomas and masters programs – importantly, respondents preferred part-time versions of postgraduate structured learning activities over full-time versions.

When looking at the 'other' preferred structured learning activities, responses emphasised other factors that are not necessarily related to the time required to participate in the activity, such as where the activity is delivered and its features (these aspects of structured learning activities are explored in further sections of the survey). Comments are shown below.

- *Structured learning opportunities (short courses) based in South East Queensland would be good.*

- *Access to events through webinars would be extremely valuable. Sometimes the travel time (and additional cost) to an event is the impediment. I am also keen to experience site visit / tours too for a more 'hands on learning' experience.*
- *Online materials, online assessments. Also 'not for assessment' opportunities.*

Figure 7 displays respondents' preferences relating to the following features of the structured learning activities:

- **Face-to-face / classroom:** Traditional learning approach, whereby students directly engage with an instructor in the same room.
- **Interactive online sessions:** Both instructor and participant are online at the same time, using a mix of communication methods (teleconferencing, chat, etc.).
- **Use of passive distant learning materials:** Student-centred, offers flexibility to provide students with stand-alone learning, a self-paced environment, any-time and any-where accessibility. Examples of these are webinars and massive open online courses (MOOC).
- **Hybrid learning:** Combines different delivery modalities and technologies, such as online learning and intensive face-to-face sessions.
- **Relevant case studies:** Use of real examples to illustrate and explain the topic being explored.
- **Involvement of respected water sector leaders:** Students have the opportunity to engage with water sector leaders to discuss the topic being explored and learn from their experience.
- **Group activities:** Students are teamed in groups and assigned tasks to be achieved by collaborating with group members.
- **Field trips:** Experiential learning outside of the classroom environment. May include visits to representative sites and organisations, where topics being explored are applied in practice.

Results indicate a clear 'strong preference' for face-to-face interaction (53%), as well as the use of case studies (47%) and engaging with respected water sector leaders (47%), while purely online based features (both interactive and passive learning) scored less than 15%. However, hybrid learning, which combines face-to-face and online learning, scored a significant 34% in 'strong preference' and the highest score in 'medium preference' (45%). Finally, there is also a significant 'strong preference' and 'medium preference' for field trip activities (34% and 39% respectively).

Only one respondent entered a comment in the 'others' section:

> *(…) many government entities have difficulty in accessing some kinds of online content (e.g. YouTube) which can impact on ability to use certain online content.*

This barrier must be considered when developing structured learning options that include online features.

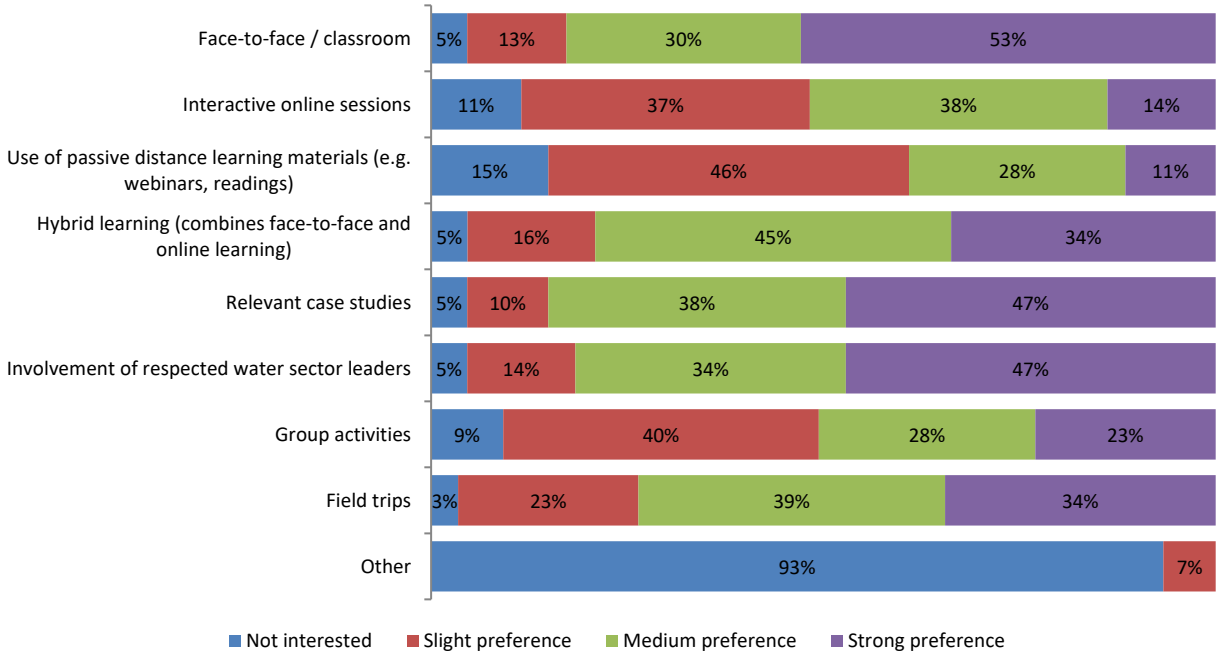


**Figure 7: Respondents' preferred features of structured learning activities**

### 4.4.2. The importance of accreditation

Survey participants were asked how important accreditation is when undertaking structured learning activities. This study described accreditation options as academic (the activity is assessed and counts towards a qualification or degree) and industrial (the activity is recognised by a peak industry body or association).

Figure 8 shows the results.

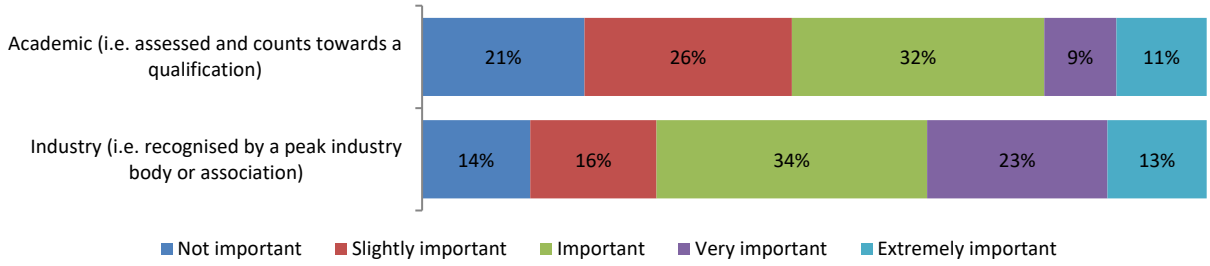


**Figure 8: Respondents' opinion about the importance of accreditation when undertaking structured learning activities**

Respondents considered neither academic nor industry accreditations to be 'extremely important' (only 11% and 13% respectively). However, 23% of the respondents ranked industry accreditation as 'very important', while academic accreditation scored only 9%. Moreover, both accreditations scored similarly as 'important' (32% and 34% respectively). Overall, results suggest a preference for structured learning activities to have industry accreditation.

## 4.5 What are the constraints on undertaking structured learning activities?

The survey's final section explored what respondents considered to be the constraints and opportunities for them to undertake structured learning activities, including time and economic constraints, location and support from their employing organisation.

### 4.5.1. The main constraints

Figure 9 displays what the survey respondents consider to be the major constraints to undertake structured learning activities.

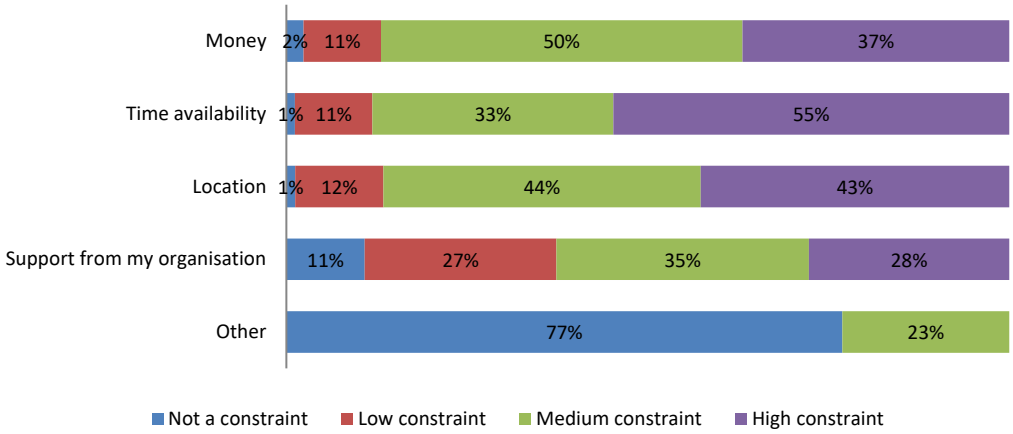


**Figure 9: Main constraints to undertake structured learning activities**

Time availability was the highest constraint (55%), followed by location (43%), money (37%) and support from employer (28%). Comments from 'other' constraints also refer to time availability being the limiting factor, because it would require them to take time out from work or other responsibilities such as family. Examples are outlined below:

- *(…) duration away from workload is all a serious consideration*
- *Family responsibilities*
- *Times of the year – quiet in Dec and January, very busy most of the rest of the year*
- *Sufficient notice (time to plan)*
- *Taking time off work, away from projects and productive time.*

### 4.5.2. Annual time and financial allowance for professional development

First, respondents were asked about how much time and money are they allowed to use on professional development each year, and if this allowance was fixed or granted on request.

Figure 10 shows the results.

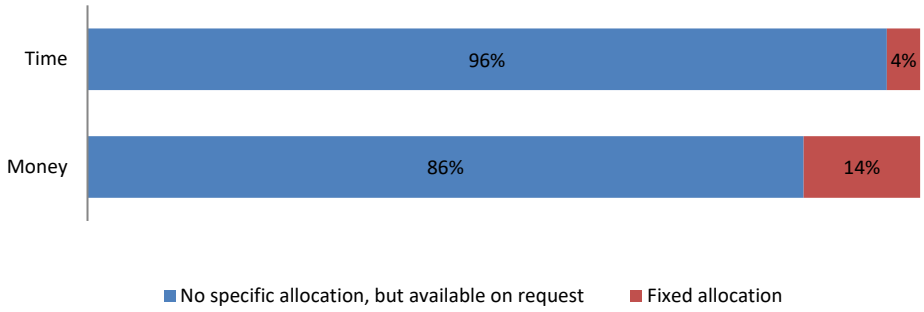


**Figure 10: Time and money allowance to use on professional development**

The majority of respondents said they do not have a specific allocation for both time (96%) and money (86%). For respondents with a fixed time allocation (4%), the time allowance ranges from 3 to 10 days per year. The respondents that have a fixed money allocation (14%) indicate yearly amounts that range from $0 (no allowance at all) to $4,500.

### 4.5.3. How much are respondents willing to pay for structured learning activities?

To gather an indication of how much money professionals are willing to invest in structured learning activities, respondents were asked about the maximum amount they would be willing to pay for a one-week short course (excluding travel and accommodation costs).

Figure 11 shows the results.

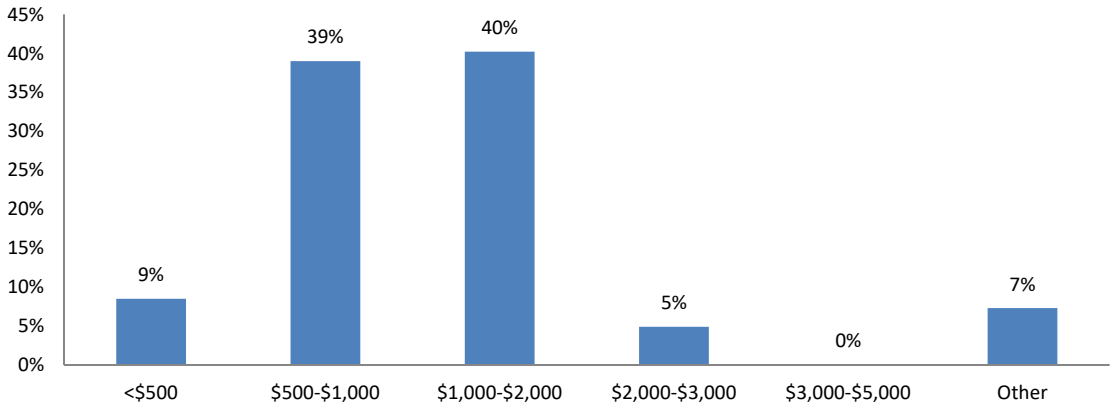


**Figure 11: Maximum amount respondents are willing to pay for a one-week short course**

Results indicate 40% of respondents would be willing to pay between $1,000 and $2,000, while an additional 39% would pay between $500 and $1000. There was a low preference for amounts below $500 or over $2,000.

Comments from 'other' answers (six people) highlight that they didn't choose a particular amount because they were are not interested in one-week short courses, or that they can't afford the time to do a one-week course.

## 4.6 Additional comments

Throughout the survey, respondents' comments suggest a strong need for WSC resources and learning that can be easily and rapidly applied to solve real problems. As seen in previous sections of this report, respondents demand short structured learning activities that feature active learning, and evidence shows they are also constrained by the time and money available to undertake these activities. The comments below seem to support this, indicating respondents undertaking structured learning activities will only do so if the benefits to them from attending are immediate, relevant to their day-to-day activities and rapidly transferable to drive change in their organisations. Importantly, these comments were written in the 'other' section of four different questions, and do not necessarily relate to the concerned questions. Approximately, these comments represent 30% of the total number of entries.

- *Case studies are particularly useful. Convincing colleagues that the technologies actually work is very difficult and case studies are useful for this.*

- *Short, non-technical summary reports that are quick to read and easy to understand.*

- *I use tangible and practical knowledge to deliver outcomes because the WSC outcomes are too fluffy and not realistic.*

- *Summary reports specifically designed for end users to share research and research products with a wider audience (unable to access journal articles or attend conferences). They are designed to be short, concise, in plain language with application examples.*

- *Real world, practical knowledge is always left out of the CRC. It's always too high level and only benefits the CRC and not anyone actually implementing it.*

- *Would be interested in mentor sessions, maybe online via webinar, but reflecting on real life situations. In a previous job, I sought a peer review in the sense of peers in my professional area commenting upon my work and offering guidance. It was useful for all, because in commenting, you also reflect on your own practice and find options for improvement.*

- *Keep it real.*

- *It is always useful to have learning that is very relevant to immediate action; learning that helps next week instead of needing another week to process. Want pragmatic learnings, that is built upon the understanding that in the workplace there is very little time for researching options.*

## 4.7 Conclusions about urban water professional learning preferences

The main conclusions that can be drawn from the survey are as follows:

- **Skill and knowledge needs:** Respondents indicate the most needed skills and knowledge are 'economic justification for WSC', 'strategic planning for WSC', 'policy and regulation for WSC' and 'management, maintenance and compliance of water sensitive urban design (WSUD) assets'. This aligns with the skills and knowledge needs assessment, which indicated a stronger need for developing know-how rather than know-what and know-why.

- **Preferred kinds of structured learning activities:** Respondents have a strong preference for activities requiring up to one day of engagement (e.g. masterclasses, seminars, workshops and lectures). Results suggest the longer the time required to undertake structured learning activities, the lower the level of interest respondents have in undertaking such activities.

- **Preferred features of the structured learning activity:** 53% of respondents have a strong preference for face-to-face interaction, followed by using case studies (47%) and engaging with respected water sector leaders (47%). Fewer than 15% of respondents have a strong preference for purely online based features (both interactive and passive learning). Hybrid learning (combination of face-to-face and online learning) scored 34% as a strong preference.

- **Accreditation of structured learning activities:** Neither academic nor industry accreditations were considered to be extremely important. However, respondents preferred industry accreditation over academic accreditation.

- **Constraints to undertake structured learning activities:** Respondents considered time availability to be the highest constraint, followed by geographical location, money and support from employers. At least 86% of total respondents also indicated they don't usually have a specific allocation of time and money for undertaking professional development activities.

- **Conditions for undertaking structured learning activities:** Respondents will engage in structured learning activities only if the benefits from participating are immediate, relevant to their day-to-day activities and rapidly transferable to drive change in their organisations.

# 5 Providing water sensitive cities learning products

## 5.1 Introduction: Designing a product to respond to market needs

This section brings together our understanding of how and what adults learn, with the WSC skills and knowledge needs assessment and the WSC learning preferences, to propose a learning product design that meets the various demands expressed, crudely, by the Australian urban water professional market. The final section then provides a comparative analysis of how this product fits with a broader range of existing or potential WSC learning products. The product design proposed and detailed in this section blends together a short period of face-to-face training with work based learning supported by online group coaching. The product type is labelled (perhaps not that attractively, but at least understandably) a 'plan and coach short course'.

### 5.1.1 Recap: skills and knowledge needs

Our findings on the skills and knowledge needs showed the main gaps relate to improved capacity to effect change within an organisation and better engagement with internal and external stakeholders. Improved understanding of the economic, regulatory and policy aspects of WSCs are key areas to develop. By contrast, technical skills for implementing water sensitive cities approaches were generally not considered to be a gap, except the need for better training in building and maintaining WSUD assets within local government (McIntosh *et al*., 2015a). The top five WSC related skills and knowledge needs are (starting with the most important):

- **Economic justification** of/**business case** for WSC projects and programs
- **Policy and regulation** to enable the delivery of WSCs
- **Strategic planning** and **risk analysis** to assess and support the incorporation of WSC approaches
- **Engagement and collaboration** across stakeholders and with community to support adoption of WSC approaches
- **Management**, **maintenance** and **compliance** of WSC assets to ensure continued function at reasonable cost.

### 5.1.2 Recap: Learning preferences

When investigating the learning preferences of urban water practitioners, we found a strong desire for WSC related resources and learning approaches that can be easily and rapidly applied to solve real problems. Practical, active and experiential learning could be supported via real case studies, engagement with industry leaders and field trips (McIntosh *et al*. 2015b). These activities should allow practitioners to learn new ideas, put them into practice and incorporate them into their day-to-day work – essentially, 'learning by doing' (McIntosh *et al*., 2015b). These results suggest focusing on developing practical skills (know-how) more than just conceptual understanding of WSCs principles (know-why) or knowing the pathways to progress towards WSC (know-what).[1]

In terms of the WSC learning approaches portfolio, the research suggests it should include a range of products ranging from long-term postgraduate programs (e.g. 2-year Masters program in urban water management) to one-day (or shorter) seminars or workshops (McIntosh *et al*., 2015b). However, practitioners have a stronger preference for the shorter options (the shorter the time, the stronger the preference). Further, practitioners can be constrained from undertaking professional development activities (e.g. training) by various factors, the most critical being a lack

[1] As defined by Collison and Parcell (2001), there are different areas of knowledge. 'Know-how', or practical skills, implies the physical ability to produce some action. Other areas include 'know-why', which refers to the ability to articulate a conceptual understanding of an experience (e.g. paradigms, perspectives, assumptions, etc.), and 'know-what', which denotes knowing what needs to be done to achieve a particular task (e.g. the recipe to bake an orange cake).

of time, then geographical location, lack of money (most urban water professionals – 88% – would not pay more than $2000 for a one-week course) and lack of support from their organisation (McIntosh *et al*. 2015b). This reinforces the attractiveness of learning approaches such as short one-day courses that do not demand much time from work and are likely to be inexpensive compared with longer-term learning programs (e.g. Masters).

Practitioners prefer face-to-face approaches when undertaking structured learning activities. Online based interaction by itself is not attractive, but blended approaches (combined face-to-face and online) had potential for delivering learning, particularly for practitioners constrained by their geographical location and time (McIntosh *et al*., 2015b).

### 5.1.3 The challenge

While understanding the market was critical to develop adequate learning products targeted at urban water practitioners, our findings about capacity needs and learning preferences posed an interesting challenge: How do we develop a learning approach that can help practitioners to develop WSC related know-how effectively, in the shortest time and with the lowest cost possible, that is accessible for people around the country and is attractive enough to employers to support their staff in undertaking it? The following discussion explains our response to this challenge.

## 5.2 A model focused on developing 'Know-How'

Traditional learning approaches, such as lecture-oriented programs, are widely used to provide learning to professionals of any industry. These often use an almost one-directional, lecturer-centred process, where the teacher imparts knowledge to sitting students, who hopefully will assimilate as much of this knowledge as possible, ask some questions to clarify doubts or contest the concepts and facts coming from the lecturer, and potentially go through an exam or assignment that assesses the students' performance. Although this is a generalised view, these traditional learning approaches do not offer many opportunities for active or experiential learning, which ultimately is necessary to develop practical knowledge (know-how). However, they are effective in building knowledge that does not necessarily require practical experience, such as know-why (i.e. the concepts, the 'big picture' of things) and know-what (i.e. the facts about something).

The theories on how adults (our main target audience) learn give some insight on how to better tackle the challenge of effectively building know-how in professionals. To recap on section 2 for instance, as explained by Kolb (1984), adults learn through a four-stage cycle (Figure 12): a concrete experience (stage 1 – experiencing) provokes reflective observation about that experience (stage 2 – reflecting), which leads to changes in how an adult conceptualises (stage 3 – thinking) and consequently how he or she acts and has further experiences (stage 4 – doing). Importantly, this process does not necessarily start in stage 1, and is a continuous cycle.

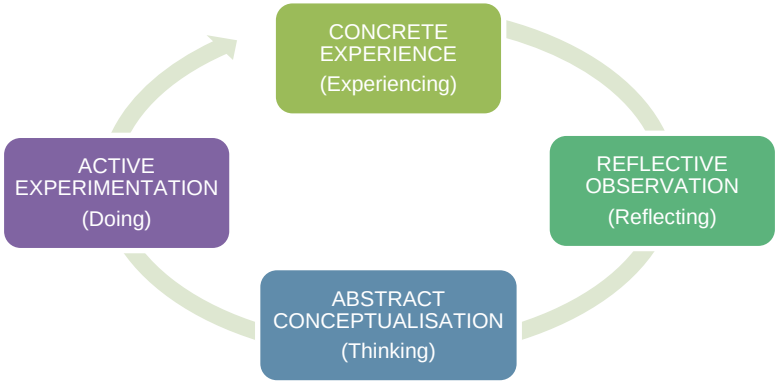


**Figure 12: Kolb's experiential learning cycle (adapted from Bergsteiner *et al.*, 2010)**

Further, Malcolm Knowles's (Knowles 1984) andragogy[2] model of adult education argues adults, as self-directed individuals, are self-motivated to learn, use their accumulated reservoir of experiences as a learning resource and orient their learning towards the immediate application of knowledge to improve performance in their social roles. Adult individuals take the initiative, with or without the help of others, in defining their learning needs, outlining learning goals, identifying resources for learning, selecting and implementing appropriate learning strategies, and evaluating learning outcomes.

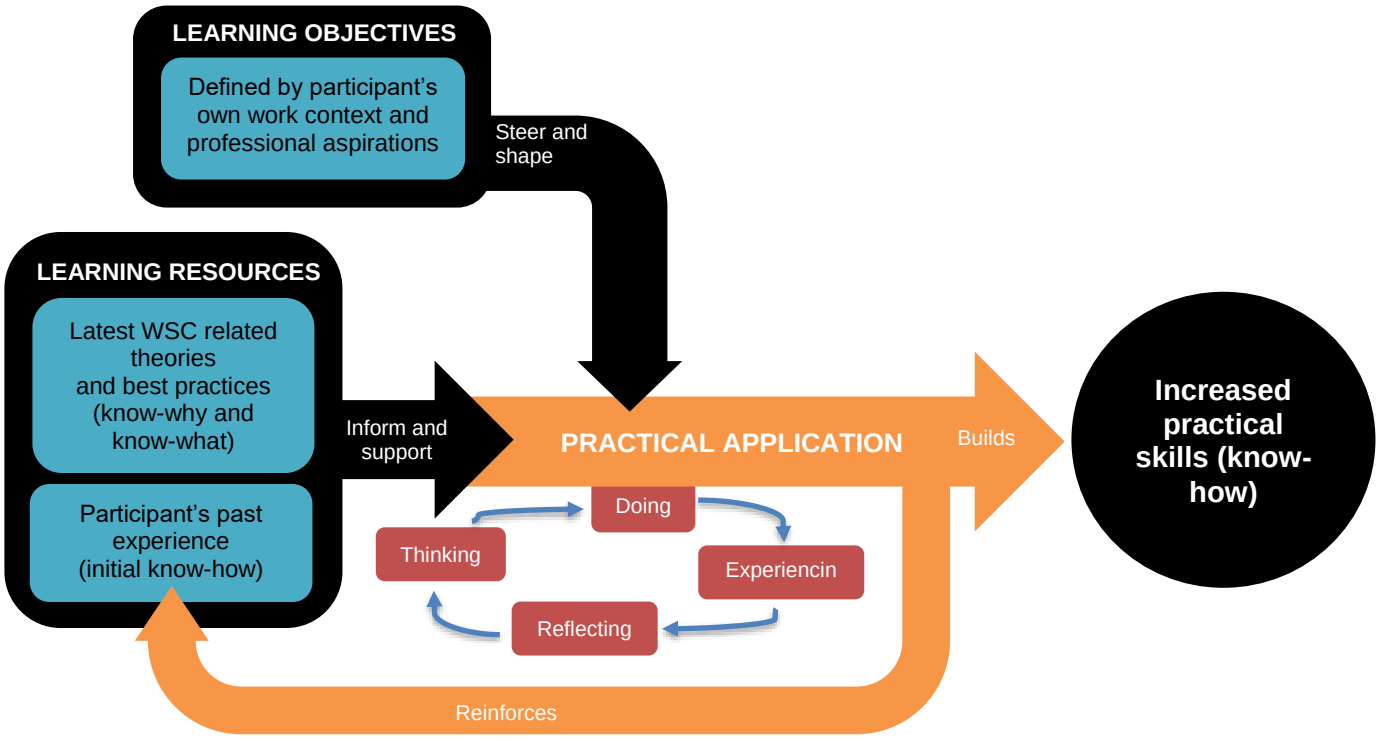


**Figure 13: Learning model focused in building WSC related know-how through practical application**

Given this, we recommend moving away from conventional lecture-centred learning approaches. Rather, we propose developing a process that allows participants to tailor their learning to their own work context and their personal professional aspirations, and to draw lessons from both their past experience and from experimenting new ways of doing things, aiming for immediate application of the new gained capacity. To complement this process – and especially to support stage 4 of Kolb's experiential learning cycle (abstract conceptualisation or thinking) – we propose including a component that builds participants' know-why and know-what. Including this component ensures the practical learning (resulting from experimentation) feeds from and aligns with the latest theories and best practices in the WSC domain. Figure 13 outlines the proposed learning process.

The next section describes how we translated the conceptual learning process into a real learning product that would respond to a particular capacity need and learning preferences (and constraints) expressed by urban water professionals. We outline the different elements, resources and methodologies used to enable it, as well as the economics behind its development and delivery, the proposed business model, and the lessons learnt from its implementation.

[2] Andragogy is the art and science of helping adults learn.

## 5.3 A Plan+Coach course for developing business case skills

The priority skills and knowledge gap communicated by urban water professionals in the market survey and in interviews relates to being able to develop the **economic justification** of and **business case** for WSC projects and programs. When investigating this capacity gap more deeply, the study revealed practitioners who design and implement WSC projects and programs (especially those in local government) struggle to line-up resources and get support from management to push these projects and programs forward. This difficulty arises because the sector has traditionally called for 'concrete-and-steel' infrastructure and financially focused economic efficiency to provide optimal solutions to specific problems. However, WSC approaches use a systems approach and offer multi-dimensional benefits that can be difficult to describe, measure and value, and often accrue over the medium to long term. This situation raises questions about who bears the costs, and who benefits and when, making it difficult for project managers to justify WSC initiatives.

Recognising this, the first plan+coach course – ***Building a strong business case for water sensitive city projects and programs –*** helps urban water professionals to understand, influence and respond to the processes, stakeholders and key decision makers involved in delivering WSC projects and programs. Developing business cases and gaining support for WSC approaches requires multidisciplinary skills and knowledge. Whether it is conducting stakeholder analysis to understand who the real decision makers are, assessing and quantifying the intangible benefits that a WSC project would generate, or designing an engagement strategy to gain support from management, this course aims to give practitioners with the know-why, know-what and know-how to develop a strong business case and gain buy-in to increase the chances of WSC projects or programs being approved. Its overall learning objectives are to:

- understand the challenges involved in gaining support for WSC projects and programs
- know how to identify the key stakeholders, their interests and decisionmaking role
- be able to construct an appropriate narrative, translating the WSC project or program outcomes into benefits for a range of stakeholders
- know how to adequately assess the costs and benefits of WSC projects or programs, and
- develop capacity to construct a robust engagement strategy to influence and generate buy-in from stakeholders in supporting the business case.

### 5.3.1 Course structure, features and methodology

The course delivery model promotes active learning via lectures, workshops, at-work learning and online expert coaching. It comprises 2 main components:

- Component 1: Face-to-face intensive

  The program starts with two full days of talks, workshops and dialogue. Leading researchers and industry practitioners impart the course content and facilitate learning through short lectures, group discussion and workshops, leveraging from representative case studies across Australia, and most importantly, from participants' own work experience. Participants complete a pre-course survey before Component 1, so the delivery team better understands participants' backgrounds and therefore deliver a more personalised learning experience.

- Component 2: At-work learning

  Component 1 gives participants the concepts, methodologies and tools needed to better build, and get support for, business cases for WSC projects and programs. Component 2 focuses on developing participants' practical skills to design and implement this new knowledge in their own work environment.

Before completing Component 1, and with guidance from the delivery team, participants identify improvement opportunities to progress their own WSC project or program. Each participant outlines personal developmental objectives, and the actions required to meet them, to establish and gain support for their WSC project or program. Participants implement this Return-to-Work Plan (RWP) over the following three months, so that they learn by doing in their own work environment and to achieve their own developmental objectives.

To support participants, Component 2 features three online group coaching sessions (one 1.5-hour session per month). The delivery team facilitates these session, to help participants achieve their RWPs objectives and further professional development aims. Participants can share their experience in applying the lessons from Component 1, compare notes (peer-to-peer learning), and receive expert advice from expert coaches.

The coaching sessions are tailored to participants' needs and experience. One week before session, the delivery team emails participants, asking them to identify their priority issues and experience about implementing their RWPs. The delivery team categorises this feedback, to structure each online session.

An online discussion forum is also available for participants to exchange notes and questions with the delivery team and peers.

The total 'class' engagement time for participants is around four full days over three months, comprising the 2-day face-to-face intensive, three 1.5 hour online sessions and around one hour a week for the online discussion forum. Figure 14 summarises the learning process that participants undergo, highlighting the course structure, resources used, methodology and impacts.

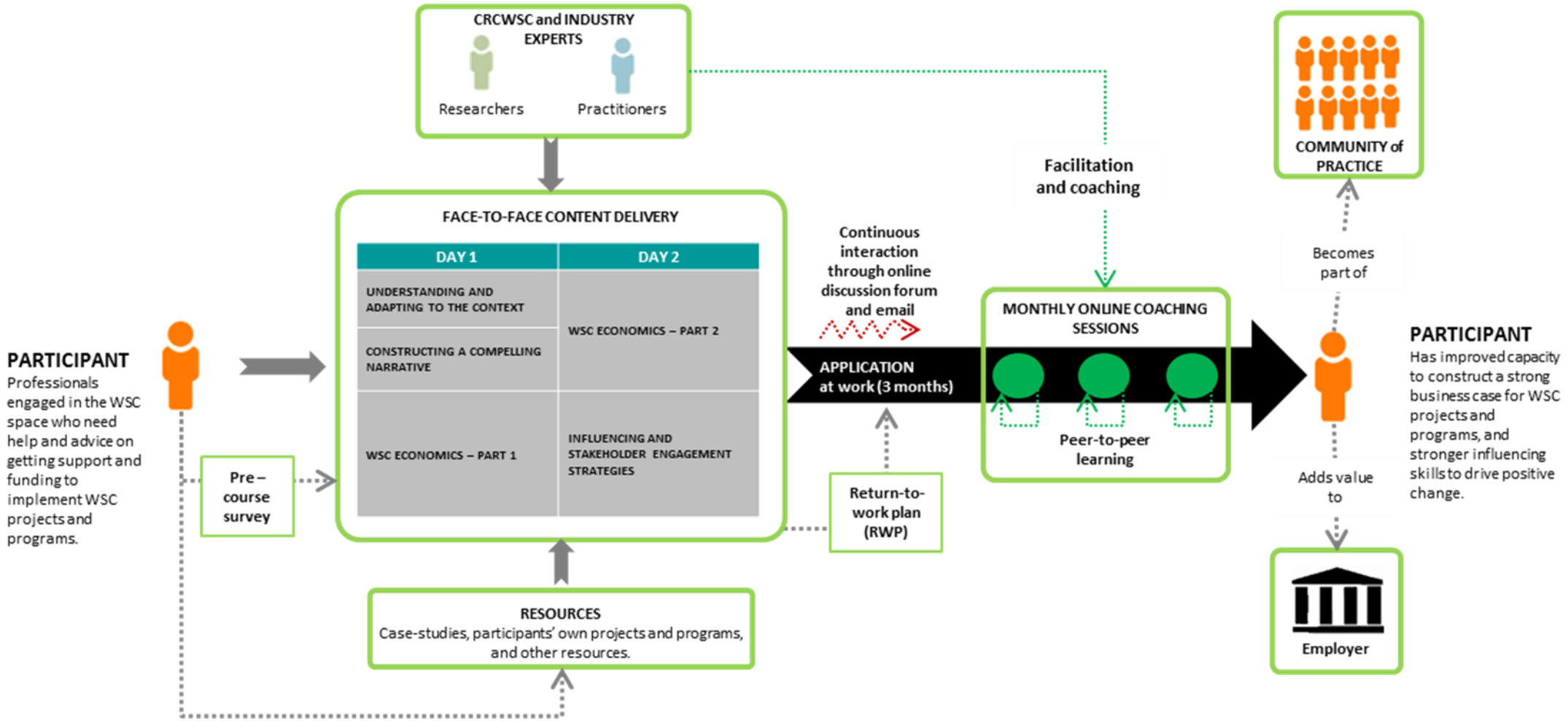


**Figure 14: Course concept diagram**

# 6 Recommendations for providing WSC learning products

## 6.1 Introduction

Designing and delivering effective learning activities that build the WSC related capacity of participants is a complex activity. It requires understanding and experience of (i) how adults learn; (ii) how to design learning products that respond to how adults learn and; (iii) how to deliver those products in a way that engages learners to effectively build their capacity within the context of their ability to pay, to take time away from work and other activities, and to access learning physically.

This section builds upon the insights into how and what adults learn established in section 2. It sets the background for analysing various learning products that have been and could be employed to develop the WSC capacity of urban water practitioners. This analysis aims to:

- characterise various learning products/approaches that the CRCWSC could consider to help develop the capacity of practitioners in the urban water sector
- analyse the pros and cons of these learning products, in terms of the knowledge they help to develop, learning activities or approach they use, and their effectiveness in developing such capacity
- outline recommendations to the CRCWSC about what learning products to pursue, that align with its strategic vision.

## 6.2 What WSC learning products are being used?

To start characterising different learning products, and to set the scene for further analysis, we mapped various learning products against two dimensions: (i) interactivity and (ii) time commitment:

> **Level of interactivity** refers to the level of engagement, discussion and feedback between the participant and other stakeholders involved in the learning process (e.g. teachers, facilitators, guest speakers, mentors and other participants). More interaction can represent an enhanced degree of tailoring to the specific learning needs of a participant (where, for example, project based learning is negotiated to suit each learner, or a syllabus is tailored to reflect a group of learners), or can represent a more frequent or intensive process of feedback between staff and learners (where feedback is provided on written work or practical / physical work and performance), or can represent a more frequent or intensive and deeper use of discussion, debate and problem solving as part of the learning process.
>
> **Time commitment** refers to the time a participant has to invest to complete the learning process, which itself is a function of the degree of sophistication and difficulty of developing the knowledge that is the focus of the learning product. From the perspective of the participant, time commitment is a dimension that will influence his/her decision to undertake a particular learning course or program (e.g. a full-time professional might find it difficult to commit to a full-time Masters program as opposed to a one-day short course).

As shown in Figure 15, we selected examples of learning products including typical approaches used widely in the market, as well as others already used or proposed by the CRCWSC and its partners through the project *Strengthening educational programs to foster future water sensitive cities leaders* (Project D4.1) (i.e. International WaterCentre (IWC) and UNESCO IHE). The size of the bubbles generally indicate (not necessarily at scale) the size of the product in terms of number of participants. The colours group learning products with similarities in their

methodologies (e.g. short courses, post-graduate programs, distance education, etc.). A short description of each learning product group is also provided.

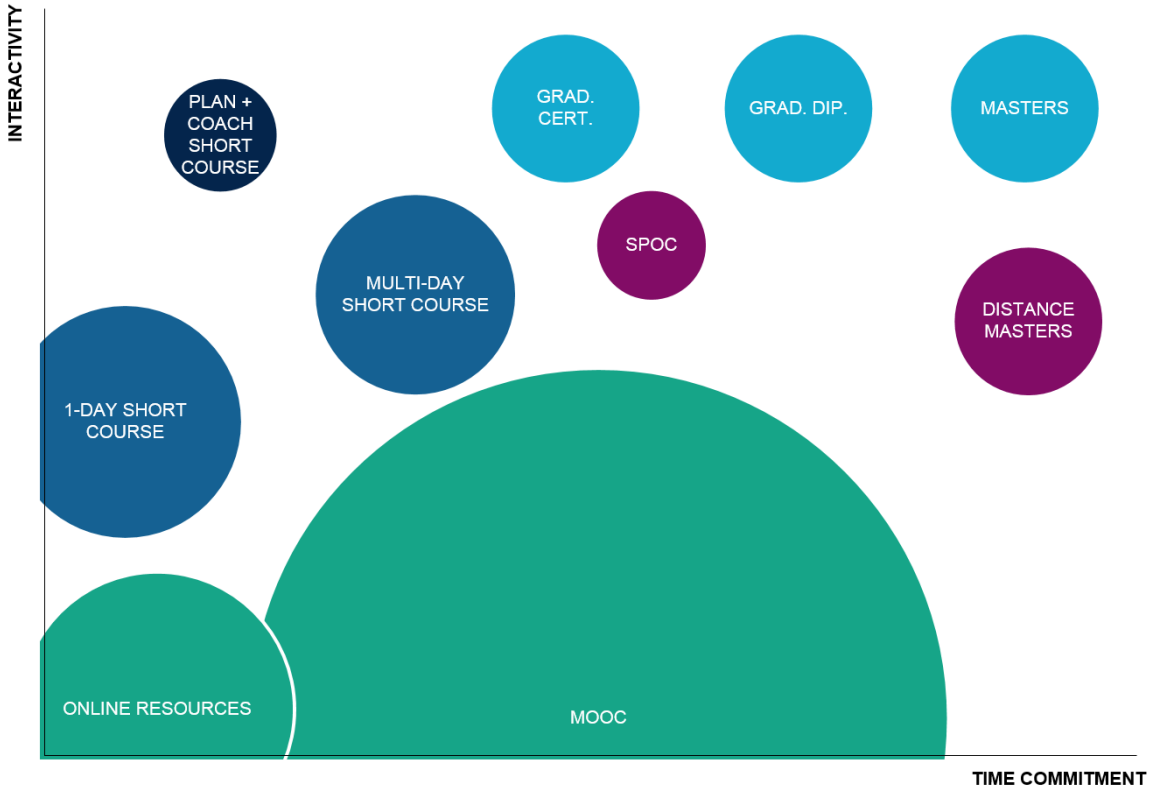


**Figure 15: Mapping learning products – Interactivity and time commitment (size of circles represents, approximately, relative size of a single running of each learning product)**

**Online resources and MOOC (Massive Open Online Courses)**: They are based purely online and offer an asynchronous learning model (the student can decide where and when to use the learning resources, with little or no interactivity). A MOOC may offer a small level of interactivity through open discussion forums and will follow a more structured process (a sequence of topics that the student may choose to follow) than purely providing online resources for learners to access. These are usually offered for free, thus attracting high numbers of people.

**Short courses**: Whether it is a one-day or multi-day short course, these are generally delivered face-to-face in the form of lectures, although sometimes combined with workshop activities. Short courses are a commonly used learning option for professionals, because they do not require much time away from work, and may offer the possibility to count towards academic or industry accreditations.

**Distance delivered Masters and SPOC (Small Private Online Courses)**: Although they are delivered online, they offer a higher level of interactivity compared with a face-to-face but purely lecture based delivery. Both distance delivered Masters and SPOCs can combine online resources (e.g. readings and videos) with scheduled online sessions facilitated by a lecturer. Distance based Masters can also involve some intensively delivered face-to-face session. For online learning, students log into a classroom platform with teleconferencing features that simulate a life classroom (e.g. two-way real-time video and sound, virtual breakout rooms for group work, etc.). Learning methodologies can include *flipped learning* – a reversal of traditional teaching. Students are first exposed to new material outside class, usually via online resources (films or readings), and

class time is used to do the complex work of assimilating that knowledge through active learning strategies such as problem solving, discussions or debates (Brame 2013).

**Plan + coach short courses**: This innovative learning process allows students to learn by applying concepts and techniques in their own world, probably work based situations. This learning-by-doing process is usually guided by the student's personal professional development objectives, which are translated into a developmental plan. The learning will ideally be supported and facilitated by expert coaching, and possibly some peer-to-peer coaching and discussion, perhaps online. Such a course may combine a day or two of face-to-face lectures and workshops (to impart foundation knowledge to students, such as the latest theories and best practice), and online resources and interaction to support the practical application component. Interaction time can be short (e.g. two days of face-to-face lectures and one 2-hour coaching session every month for three months). Most of the learning is achieved during the student's time back at work.

**Postgraduate programs**: Including graduate certificates, graduate diplomas or Masters, these are university and potentially also industry/professional body accredited programs targeted to those who already have a bachelor degree, and/or significant professional work experience in a relevant area. Usually delivered as face-to-face programs for full-time study, these take longer to complete than other learning products (i.e. six months for a certificate, one year for a diploma and up to two years for a Masters). They include varying combinations of coursework, project work and research delivered via lectures, workshops, field trips, team and individual projects. They are designed to enhance the participant's professional skills or help acquire a deeper understanding of a specific area of knowledge. Part-time delivery of Masters can also occur, either as a purely distance based process or a blended mix of face-to-face intensives and online distance learning.

Different learning products have different levels of interactivity and require different time commitment from participants. They also use a wide range of learning methodologies and platforms. They may also be more or less difficult for learners to undertake and complete, or more or less expensive than others. So a question arises: What are the relative strengths and weaknesses of different learning products for different knowledge development purposes?

Urban water and water sensitive cities approaches integrate many disciplines (e.g. urban planning, water resources, social sciences, governance, health, engineering, etc.), sectors of society (e.g. various levels of government, private sector, civil society, academia, etc.), and management layers (e.g. from technical/operational to high level decision making). Given this, participants are likely to have diverse needs and willingnesses / abilities to engage with different kinds of learning processes and products. So, what combination of learning products might form an effective set of ways to promote effective WSC capacity building across the sector?

## 6.3 Assessing different WSC learning products

We developed a framework to characterise and compare products, and identify the strengths, weaknesses and complementarities of different learning products for WSC capacity building. Our aim was to inform how the CRCWSC might strategically invest in different learning products, based partly on the in-principle strengths and weaknesses of different learning products, and partly on evidence from running different products since Tranche 1 of the CRCWSC started.

The level of interactivity and the time commitment for each product give some insight on how the participant engages in the learning process, but do not showcase how the product and learning processes embedded within the product develop different types of knowledge in the learner and enable deep learning. For this reason, our further characterises learning products based on the knowledge they aim to develop, the learning activities for enabling this, and their effectiveness in developing such knowledge among learners. This framework allows a more systematic analysis of each learning product and elucidates their strengths and weaknesses in developing capacity.

The proposed framework (see Orams and McIntosh, 2016) is an easily populated template, starting with general information about the learning product (e.g. name, topics it explores, target audience, overall learning objective, etc.). Then, through a two-dimensional matrix, it gathers information about the type of knowledge (as proposed by Collison and Parcell (2001)) the product aims to develop, what learning activities or methodologies it uses to develop such knowledge, and how effective / successful it was. The framework also seeks for additional information about the financials of developing and delivering the learning product, the time commitment it requires from learners, and where it is delivered.

We asked people involved in developing and delivering the following representative WSC learning products to populate the information:

- MOOC: *Water for Liveable and Resilient Cities* (delivered by Monash University, Australia)
- Short course: *Water Sensitive Cities short course* (delivered by UNESCO-IHE, The Netherlands)
- Multi-day workshop*: Problem focused charrettes* (delivered by UNESCO-IHE, The Netherlands)
- Postgraduate Masters: *Urban Futures: Delivering Water Sensitive Cities Masters module* – Module WATR7600 of the Masters of Integrated Water Management full-time program (delivered by the International WaterCentre, Australia)
- SPOC: *Urban Futures: Delivering Water Sensitive Cities Masters module* – Module WATR7600 of the Masters of Integrated Water Management part-time program (delivered by the International WaterCentre, Australia)
- Plan + coach short course: *CRCWSC Innovation Skills Series – Building a strong business case for WSC project and programs* (delivered by the CRCWSC).

## 6.4 MOOC: *Water for Liveable and Resilient Cities (Monash University/CRC for Water Sensitive Cities)*

This MOOC targets anyone in the world interested in water and sustainable cities (and with an internet connection), both practitioners and broader-community members. It focuses on the foundations of what WSC are and how can they be achieved. Topics include the challenges cities face and how WSC approaches can be a response to these challenges, the concepts of resilient and liveable cities, urban climate, and the behavioural and institutional changes required to adopt WSC practices.

It is mainly asynchronous, meaning students can access any of the course's learning resources at anytime, anywhere. However, it is offered as a seven-week program, and during this period participants can engage in online discussion forums and peer-reviewed assignments and tests. If following the seven-week program, participants must invest approximately 4 hours per week.

Although it is offered as a free course, MOOCs are usually very expensive to develop. This course required approximate $300,000 (including monetary funding and in-kind contributions from implementing stakeholders) to implement, to obtain input from the best expertise and deliver the highest quality possible for the learning resources (e.g. videos).

On the one hand, this MOOC is effective at developing general know-why and know-what, especially about the fundamental WSC concepts, theories and practices. Targeting a diverse audience (ranging from experts in the field to an international general public), the course offers more breadth than depth, and has successfully promoted – or 'spread the word' about – the WSC vision and how it can be achieved. It also ensures practitioners are up to date

on the latest advances in the WSC domain. Evidence of this success includes international practitioners being exposed for the first time to the WSC domain through the MOOC, and Australian water organisations recognising its value and expressing their willingness to encourage their staff to undertake it. Also, the MOOC resources are used by other learning products (including short courses).

On the other hand, this MOOC does not develop know-how. However, it may allow participants to validate or challenge their existing know-how or practical experience via interaction with other expert participants, as well as non-expert participants who can offer broader community perspectives of what WSC practices are achieving on ground. In this way, the MOOC may encourage practitioners to innovate their on-ground practices. The MOOC may also develop know-who by exposing participants to the work of leading practitioners and academics, although this contact is not direct. Know-where and know-when capacity may also be developed, when participants engage with the course's learning resources (especially those related to WSC leadership and change management) and interact with the course lecturers and other participants. However, this is not done systematically and there is no evidence about how effectively the course develops these knowledge types.

## 6.5 Short course: *Water Sensitive Cities* (UNESCO-IHE/CRCWSC)

This UNESCO-IHE post-graduate course awards five ECTS (European Credit Transfer System) credits. It targets any post-graduate level expert involved or interested in urban water management related activities (e.g. water supply, flood management, drainage, etc.) and focused on integrating various components of the urban water system. The course objective is for the participant to gain a solid understanding of WSC principles and practice and its relevance in different geographical regions, based on real case studies. It addresses the data requirements, tools, approaches, relevant planning policy frameworks, decision making and implementation experiences needed to build and foster water sensitive cities.

The course is delivered face-to-face and runs near-full-time over three weeks, averaging 50–60 contact hours a week. It employs a traditional learning approach, including lectures, facilitated discussions, class exercises and assignments, supported with learning resources including, for example, videos from the MOOC described above.

It costs approximately $4,000, and at least 8–10 participants are needed to achieve recover costs.

Similar to the MOOC, this course focuses on developing know-what and know-why capacity. It helps participants to understand and internalise the drivers behind the vision of WSCs and how they relate to various aspects of urban water cycle and cut across sectors and disciplines. It also showcases how WSC principles and practices are reflected on the ground.

To develop know-how, the course uses class exercises to build participants' practical skills in using available economic assessment tools and perform stakeholder analysis. However, these class exercises are constrained by the short time available in the classroom and may not effectively develop sound and long-lasting know-how. The course may develop know-who, know-where and know-when skills, but it is not part of the course's scope.

## 6.6 Multi-day workshop*: Problem focused charrettes* (UNESCO-IHE/CRCWSC)

For specific problems related to WSC, especially for developing countries, UNESCO-IHE offers charrette-style workshops in cities. Workshops usually target a particular stakeholder group and focus on a particular topics (e.g. a water utility to discuss water supply related issues) and often involve broader stakeholder groups (e.g. scientific groups, politicians, NGOs, etc.) and local and international industry experts. The process involves a participatory and collaborative brainstorming exercise, that aims to develop solutions to a problem faced by the city in question. One example is a workshop on climate change adaption of the water supply in Ho Chi Minh City. Vietnamese and

International experts participated to develop solutions to help Ho Chi Minh City (HCMC) to achieve water supply security in the short, medium and long term.

These workshops take approximately four days and the learning process is highly interactive, combining intensive hands-on workshopping exercises, lectures, facilitated discussions and case studies.

This is an expensive learning model, because it often involves flying in international experts to provide expertise when developing content and facilitating workshops. However, costs do vary, depending on various factors such as location, topic, the number of experts involved, etc.

Using a learning-by-doing approach, workshops can develop participants' know-how, especially in high-level practical skills such as the conceptual design or rapid cost estimation of green infrastructure. Feedback from participants shows they appreciate this active learning approach more than traditional lecturing. Participants may also develop their know-who, by interacting with other local stakeholders and local and international experts.

Know-why and know-what is developed through more traditional methodologies (lectures, discussions, group presentations and case studies). However, feedback suggests the WSC principles (e.g. the multi-dimensional benefits of WSC solutions) or the transition pathways to achieve WSCs (e.g. legislative and institutional changes) are difficult to grasp or considered to be unachievable by local stakeholders. This result may be because this product is targeted at cities in developing countries where urban water management may still focus strongly on traditional, large grey infrastructure solutions.

Know-what is also developed by understanding the expertise pool required to implement the solutions proposed by the workshopping process. Again, however, developing this knowledge may be difficult given the lack of case studies from developing countries showcasing successful WSC adoption.

## 6.7 Postgraduate Masters module: *Urban Futures – Delivering Water Sensitive Cities* (International WaterCentre/CRCWSC)

This module is part of the full-time Master of Integrated Water Management, delivered by the International WaterCentre through the University of Queensland. It envisions and explores a new paradigm for how the hydrological cycle interacts with the urban landscape to support liveable, sustainable, productive and resilient cities. It targets junior to mid-career professionals from developed or developing country contexts, either working in the urban water sector and seeking to learn key skills and knowledge around some innovative urban water management approaches and how to introduce them or; seeking to develop and move their careers into urban water management.

Participants critically engage with the underlying principles of a Water Sensitive City. They examine socio-technical pathways for facilitating its delivery, and are equipped with knowledge and skills for translating ideas about the Water Sensitive City into a range of local urban water management contexts. The course comprises specialist lectures, in-depth discussions, practical exercises, case studies, interactive workshops and field trips, to provide understanding about urban configuration, micro-climate, green infrastructure, multi-scale technologies, governance and institutions.

The module is delivered face-to-face through one semester of the Masters, and is equivalent to one quarter of a full-time study load (or 150 hours of learning). This includes assessment, reading and participating in lectures, workshops, fieldtrips, etc. The Masters as a whole recovers costs; this module costs around $4,500.

This Masters module develops know-how, know-why and know-what, through individual and group exercises, class discussions, individual and group written assessments, group debate based assessments, lectures, discussions, key learning resources (readings and videos), fieldtrips to significant sites, and relationship building with academics and industry experts. Participants develop know-how, by learning how to conceptualise WSC principles and their

applicability to different contexts; how to critically assess, interpret and use data and information related to WSCs; and how to plan, design and develop WSC solutions.

Developed know-why includes learning to understand, characterise and articulate WSC concepts, theories and principles, its drivers and history, its potential multi-dimensional benefits on society and the pathways to achieve it. Developed know-what includes knowing what to consider (e.g. risks), and what must be in place (e.g. support from stakeholders) to transition to a WSC vision. Additionally, this module, and the Masters program in general, allows participants to develop their professional networks (and hence their know-who) through exposure to and interaction with academics, industry experts and class peers.

Know-where development is also supported by the library and internet based research required to complete the module's assessments, allowing students to know where to find the key information (e.g. research, policy, reports, guidelines, etc.). Deliverable D4.1.4d provides more information.

## 6.8 SPOC: *Urban Futures – Delivering Water Sensitive Cities* (International WaterCentre/CRCWSC)

This is the same Masters module described above, but it is part-time and delivered entirely online using a mixture of written and film resources and interactive online classes (using the Adobe Connect platform).

Although the engagement is the same as the full-time face-to-face version of the module, its interactivity level is reduced. For example, all group assignments, class exercises and workshops are done entirely online, and field trips to representative sites are not possible. This is a disadvantage compared with the full-time version. It is more difficult to develop stronger professional and personal relationships, the benefits of hands-on learning on an interactive workshop environment are reduced, and the value of seeing practices on the ground at a site is not available.

## 6.9 Plan + coach short course: *CRCWSC Innovation Skills Series – Building a strong business case for WSC project and programs* (CRCWSC)

This learning product helps mid-level urban water professionals in local government to understand, influence and respond to the processes, stakeholders and key decision makers involved in delivering WSC projects and programs. Developing business cases for WSC projects and programs and gaining support for them requires a multidisciplinary set of skills and knowledge. Whether it is performing a stakeholder analysis to understand who the real decision makers are, assessing and quantifying the intangible benefits that a WSC project would generate, or designing an engagement strategy to gain support from management, this course aims to provide practitioners with the capacity to develop a strong business case and gain buy-in to increase the chances of WSC projects or programs to happen.

The course, which involves approximately four days of contact time spread over three months, employs a delivery model that promotes active learning via lectures, workshops, at-work learning and online expert coaching. It comprises two main components: Component 1 is a two-day face-to-face intensive, where a team of leading researchers and industry practitioners impart the course content and facilitate learning through short lectures, group discussion and workshops, leveraging from representative case studies across Australia, and most importantly, from participants' own work experience. Component 2 is done over three months and follows an at-work learning process. Participants develop, in their own work environment, the practical skills to develop and push forward business cases for WSC projects and programs. The latter is guided by a Return-to-work plan developed by each participant and supported by an online coaching process facilitated by the course's expert lecturers and online peer-to-peer interaction.

This course has not been trialled, but it is fully developed, costing around $23,800. The running costs are estimated at around $48,400 (including redevelopment after each delivery). The estimated running cost per participants is $1,936, assuming 25 participants (which is ideal for the best learning experience).

The course focuses on developing know-how, especially the practical skills required to construct, inform and get buy-in for a business case for a WSC project or program. This is achieved through the practical exercises during Component 1, but mainly through experiential learning via Component 2. Learning is self-directed, because participants tailor the learning objectives according to their own professional aspirations and develop practical skill readily applicable to their day-to-day work. This learning-by-doing mechanism fosters sound and long-lasting skills that are developed only through experience. The course also intends to help participants develop their know-who; practitioners supported by a network of peers with similar challenges are more likely to succeed in pushing forward WSC projects and programs. This is done by enabling peer-to-peer interaction throughout the course and promoting a community of practice.

To develop know-how, Component 1 focuses on enabling know-why learning. It also builds awareness and understanding of the general WSC principles, but more specifically about the challenges that business cases for WSC projects and programs face. Component 1 also focuses on developing know-what, giving participants knowledge about the different strategies, methodologies and tools to overcome these challenges. Both the know-why and know-what developed must be precise and relevant to WSC business cases, given Component 1 is delivered in two days. For this reason, the course assumes participants are already engaged in the WSC domain and understand its value. Different course methodologies also indirectly support know-where and know-when capacity development.

## 6.10 A comparative assessment of different WSC learning products

Learning plays a critical role in creating the professional knowledge that will underpin the adoption and diffusion of WSC approaches in cities nationally and internationally. But effective learning and the development of individual skills and knowledge in adults is complex, and made more complex by market tensions and forces that must be considered along with pedagogy and andragogy. Fantastic learning products exist, but are they easily accessible, are they at the right price, do they require an amount of time that fits within the time budgets of potential participants?

The CRCWSC developed and trialled a range of learning products during Tranche 1 of the CRCWSC a range of learning products, albeit covering only a relatively small fraction of the range and depth of knowledge associated with and required for delivering different WSC approaches (described above). Table 4 compares and assesses the characteristics of each product, to identify how each can be used to provide effective WSC learning for urban water professionals. Full details of the assessment are provided in Orams and McIntosh (2016).

**Table 4: Comparison of different WSC learning products in terms of their key features and likely uses to the CRCWSC**

| Learning product | Key characteristic | Comment on product use for WSC learning |
|---|---|---|
| **MOOC** | Free and online | Easily accessible – so a good way of raising awareness of and promoting WSC approaches and knowledge |
| | Best at developing know-what and know-why | Should not be used as the primary mechanism for developing know-how because individual feedback mechanisms and provision are limited, so practical performance of activities cannot be easily developed / coached. |

| Learning product | Key characteristic | Comment on product use for WSC learning |
|---|---|---|
| | Breadth vs depth | Although the current WSC MOOC focuses more on developing breadth of knowledge, there is no reason why more detailed know-why and know-what about more specific areas of WSC approaches could not be developed. The lack of individual feedback mechanisms (assessments with detailed feedback) likely to limit the depth of knowledge that can be learned though through a purely MOOC approach. |
| **Short course** | Best at developing know-why and know-what | The time limited nature of short courses means know-how or skill development cannot be undertaken to any depth. Some learning by doing with feedback within class from course deliverers and peers can be provided, but the opportunity for in-depth practice over a longer period is not possible. |
| | Short and relatively inexpensive | The cost and short time required away from work makes this kind of product very attractive for working professionals. |
| **Multi-day workshop** | Likely to involve a range of deliverers to represent different areas of expertise or interest | The larger delivery team can mean that the workshops are good at tackling complex and/or inter-disciplinary problem areas, but they also mean increased cost |
| | Best at know-what and know-why but some know-how learning possible | Workshops are by their definition interactive and active learning processes. This form of learning by doing can help promote the development of know-how as well as know-what and know-why. The duration of workshops and the lack of work based practice limits what can be achieved in terms of know-how development. |
| | Participation from a range of stakeholders from an area | Workshops often bring together a diverse set of stakeholders to learn together about a complex area of activity. As such they help promote the development of relationships and networks, which can assist in WSC approach adoption and diffusion. |
| | Short and relatively inexpensive | The cost and short time required away from work makes this kind of product attractive for working professionals. |
| **Masters module (face-to-face)** | Lasts three or so months and involves multiple face-to-face interactions across a range of different tasks and learning activities | The length of time combined with the interactivity means this kind of product is ideal for developing deep understanding of and application skills in WSC approaches as a consequence of multiple interactions with delivery staff, verbal feedback in every |

| Learning product | Key characteristic | Comment on product use for WSC learning |
|---|---|---|
| | covering know-what, know-why and know-how | session and formal feedback associated with assessments |
| | | Know-how development is not done in the context of work, which implies some limits about developing the depth of know-how. |
| | Classroom based rather than work based | Masters modules are only likely to appeal to a restricted set of working professionals for both financial and time away from work reasons. |
| | Long and relatively expensive | |
| **SPOC/Masters module (online)** | As for Masters module (face-to-face) but with less interactivity | Capable of developing deep know-what and know-why, with some know-how development possible, but less likely to be as individually tailored as face to face. To be as effective, particular attention needed to design online learning sessions. |
| | | Provides improved access for participants so potentially a wider market |
| | Delivered purely by distance (online) | |
| **Plan + coach short course** | Work based know-how development | Participants develop their know-how (skills) in the work situation with some form of coaching to provide feedback. This means deep, applicable learning. |
| | Limited time for know-what and know-why development | The restricted time available for upfront delivery of know-what and know-why could mean that participants have to take responsibility for this component, which could introduce variability in learning effectiveness. |
| | Relatively low cost | Relatively low cost financially and in terms of time away from work, so should in principle be appealing to working professionals. |
| | New product type | A new kind of learning product that will require investment to demonstrate it works and to promote in the urban water sector – likely to be low uptake initially |

Table 4 illustrates no single type of learning product is suitable for all learning purposes, or all purposes associated with helping to promote the adoption and diffusion of WSC ideas and approaches. Nor is any single learning product type suitable for all market demands in terms of cost, time and accessibility. Rather, each product has strengths and unique selling points that broadly reflect three dimensions:

- learning effectiveness in terms of different types of knowledge
- role in promoting the adoption and diffusion of WSC ideas and approaches
- market demands – cost, time and accessibility.

Given variation in these characteristics across product types, anyone seeking to commission, develop or deliver WSC focused professional learning must clarify their strategic intent towards individual learning and more broadly towards capacity development. Doing so will help guide decisions about how to engage and perhaps invest in developing and delivering products going forward. This strategic conversation might be usefully guided in terms of the following considerations:

1. Purpose –What is wanted or need to achieve nationally and internationally from having professionals develop knowledge about WSC approaches? Do they want to simply raise awareness or do they want to develop particular knowledge or skills in particular audiences for particular purposes?

2. Role of learning products and more broadly capacity development – Is learning and capacity development seen as a core part of the set of activities of the commissioning / developing / delivering organisation, and why? Is it seen as a way of generating income or an investment that will benefit that organisation, by achieving its objectives around developing and promulgating WSC approaches? Should the organisation seek to partner with other organisations to develop and deliver learning products for particular purposes, audiences and areas of knowledge?

## 6.11 Learning and WSCs – some conclusions and recommendations

The CRCWSC has invested in developing and delivering a range of learning products targeting individuals, largely water professionals, working both across Australia and internationally. These products fall into a range of types, each with unique characteristics in terms of their:

- learning effectiveness for different types of knowledge
- role in promoting the adoption and diffusion of WSC ideas and approaches.
- Market demands – cost, time and accessibility.

Our review of the learning product types the CRCWSC may have developed and across Tranche 1 yielded the following conclusions:

- MOOCs – Massive open online course content has great potential for awareness raising and promotion of WSC approaches, great accessibility (online and free), has strong potential for detailed know-what and know-why development. But, depth of learning overall is constrained by the lack of individual and detailed assessment and feedback mechanisms.
- Short courses – These products are good for developing know-what and know-why with some limited opportunities for developing know-how (skills). They also present some opportunity for in class assessment and feedback, strong market appeal in terms of low cost, and require only a short time away from work.
- Multi-day workshops – These workshops are a good way of bringing together stakeholders and interests to learn together, and so help to grow the relationships required for WSC approach delivery. Active and participatory workshop learning approaches are good for learning and offer some opportunities for know-how development. They also have strong market appeal in terms of low cost and requiring only a short time away from work. However, know-how development is limited, because they are generally short,
- Masters modules (face to face) – Face-to-face modules are a good way of developing detailed know-what, know-why and know-how through multiple interactions between learners and staff and between learners themselves over time Know-how development is good but typically classroom based, so there are some limitations in terms of artificiality compared with work based learning. Their high cost and high time required away from work limits market appeal.

- SPOCs / Masters modules (online) – Small private online courses (SPOCs) can be used to deliver Masters modules purely by distance (online) and are good for developing know-what, know-why and know-how. However, learning process design is important, to ensure they are as effective as face-to-face learning. They are high cost and require a moderate time away from work, although being online makes them more accessible.
- Plan + coach short courses – This new model of learning – developed by Project D4.1 within the CRCWSC and detailed in this report – blends a 1 or 2-day short course with individual development planning and the development of practical know-how in the work place supported by coaching. These courses are relatively low cost and involve low time away from work, with strong value returned to employers. But they are very new in terms of format and on the surface look as if they involve 3 months of learning (albeit in the work place as part of a normal job), so there will be barriers reflecting the extent to which potential participants see the value versus the cost at least initially.

# 7 References

Bergsteiner, H. and Avery, G.C. (2014), 'The twin-cycle experiential learning model: reconceptualising Kolb's theory', *Studies in Continuing Education* 36(3):257–274.

Bergsteiner, H., Avery, G.C and Neumann, R. (2010), 'Kolb's experiential learning model: critique from a modelling perspective', *Studies in Continuing Education* 32(1): 29–46.

Brame, C., (2013), *Flipping the classroom. Vanderbilt University Center for Teaching*. Retrieved from http://cft.vanderbilt.edu/guides-sub-pages/flipping-the-classroom/

Brown, V.A. and Lambert, J.A. (2012), *Collective Learning for Transformational Change: A Guide to Collaborative Action,* Earthscan, London.

Brown, P.C., Roediger III, H.L. and McDaniel, M.A. (2014), *Make it Stick – The Science of Successful Learning*, Harvard University Press, Cambridge, Mass.

Collison, C. and Parcell, G. (2001) *Learning to Fly*, Capstone, Oxford.

Felder, R.M. and Silverman, L.K. (1988) 'Learning and Teaching Styles in Engineering Education', *Engineering Education* 78(7): 674-681.

Knowles, M. (1984) *The Adult Learner: A Neglected Species,* Gulf Publishing, Houston, 3rd Edition.

Kolb, D.A. (1984) *Experiential Learning: Experience as a Source of Learning and Development*, Prentice-Hall Inc, New Jersey.

Loo, R. (2004) 'Kolb's learning styles and learning preferences: is there a linkage?', *Journal of Experimental Educational Psychology* 24(1): 99–108.

McIntosh, B., Pathirana, A., Veerbeek, W. and Wegener, P. (2015a) *Water Sensitive Cities skills and knowledge needs An Australian and international assessment,* Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

McIntosh, B., Orams, P. and Patschke, S. (2015b) *Delivering Water Sensitive Cities professional learning – Understanding the learning needs and preferences of the Australian urban water sector*, Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

Mekong River Commission (2011), *Manual for Training Trainers in Integrated Water Resources Management in the Mekong Basin*, MRC, October 2011.

Orams, P. and McIntosh, B.S. (2016) *Innovation Skills Series – Developing practical skills across urban water professionals*, Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities.

Ramsden, P. (2003) *Learning to Teach in Higher Education*, Routledge Falmer, London, 2nd Edition.

Rogers, E. (2003) *Diffusion of Innovations*, Free Press, 5th Edition.


**Cooperative Research Centre for Water Sensitive Cities**


Level 1, 8 Scenic Boulevard
Monash University
Clayton VIC 3800


info@crcwsc.org.au


www.watersensitivecities.org.au