

# Adaptive digital capability development: Professional learning for educators across disciplines

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237

In a cross-university project, a mixed methods approach was adopted to design a learning model for digital work practices in line with evolving industry needs. Drawing upon industry input ( $n=50$ ), developmental learning and technology affordance theory, a model was trialled with Design, Journalism and Engineering students ( $n=78$ ). Workshops were held at five universities with educators ( $n=66$ ) and this paper discusses their perspectives on the model. Their responses indicated a predominantly functional digital capability focus in their current learning and teaching practice; rather than integrating functional, perceptual and adaptive digital capabilities, which are in high demand but short supply in industry. The educators highlighted a need for their own professional learning and we offer practical suggestions for moving beyond a functional digital focus. We argue it is vital for students and educators to learn and use the vocabulary of technology affordances, to strengthen professional learning for digital work futures.

Keywords: digital enterprise learning, adaptive capability, technology affordances, professional learning, academic development

## Introduction

At a time of ongoing technological developments and change in the world of work, graduates need enterprise (21st Century) skills spanning communication, collaboration, critical thinking, design thinking, creativity, complex problem solving and entrepreneurship; the ability to select appropriate technology; and data literacy, including analytics, security and the ethics of data use (PriceWaterhouseCoopers, 2018). In this context of rapid technological change, lifelong learning as an attribute of workers is paramount (WEF, 2018). Evolution of the learning continuum concept, including preparation for work and ongoing career learning, is increasingly cited in higher education circles. Examples include the University of the Future Report (Cawood et al., 2018); the University of Queensland discussion paper on higher education trends and implications (Matthews et al., 2018); and re-imagining professional learning models in collaboration with industry (Peterson et al., 2018b). Understanding the digital literacy of entrants to higher education (Coldwell-Neilson, 2017), and shifting the focus of assessment to 21st Century requirements such as teamwork but also resilience (Sonnemann & Goss, 2017), are other examples of ways in which higher education thinking has responded to the changing needs of the workforce.

We, too, argue that enterprise or 21st Century learning, especially digital enterprise learning, needs to be uppermost in the development of curriculum and pedagogy, to ensure that students in higher education are well supported as they prepare for their work futures and ongoing learning. However, there may be a gap



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between this aspiration and some current practice in learning and teaching, according to research undertaken in an Australian cross-university project with stakeholders in industry and education. The Digital Work Practices project revealed that adaptive digital capabilities are in high demand yet short supply in industry, where changing workforce needs continue to be exacerbated by technological developments. At the same time, however, a key finding was that the focus of educators and students in higher education may be too much on digital capabilities that are functional, rather than perceptual and adaptive. *Functional* is the 'what and how-to' or operational level; *perceptual* is knowing the 'when and why' i.e. discerning use of technology in *known* contexts; and *adaptive* involves imagining possibilities for the use of technology in new ways or *emerging* contexts (see Peterson, 2018a; Peterson et al., 2018a, c).

The project team suggests that a different approach is needed in higher education, drawing upon affordance theory (e.g., Best, 2009; Evans et al., 2017); as well as deep and transformative learning about technology affordances, where critical engagement and reflection underpins the development of students' understanding of their experiential learning (e.g., Fullan & Langworthy, 2013; Marton & Säljö, 1976; Mezirow, 1997). A Digital Affordance Developmental Learning Model has been developed as a rapid prototype in the project, involving iterative engagement with industry stakeholders, educators and students.

This paper focuses on findings of the five workshops about this Model conducted with educators. Our initial response to the educators' feedback is addressed, including their call for support with professional learning for teaching in relation to the Model. The authors of this paper are the leader and two members of the project team involved. All three authors are experienced educators in Design, Communication and/or Business at different universities.

After explaining the research aim and methodology, we discuss the educator participants' written responses to questions in three broad areas: the key digital capabilities identified by industry participants in the project; the possible strengths and challenges of the proposed Digital Affordance Developmental Learning Model; and ideas for its implementation in teaching practice. Then we outline suggested approaches with examples to enhance teaching capability, for scaled-up implementation and transition to an adaptive digital capability development focus with students. Finally, we discuss some of the wider implications and highlight further research needed.

## Research aim and methodology

The aim of the project was to create a useful model for deep and transformative learning and teaching practice to support the development of digital capabilities in Design/Creative Arts, Communication, Business Management, and Engineering, with potential application in other disciplines. The intention was to meet new industry needs, whilst positioning graduates for emerging digital work opportunities in the globalized world of work.

A mixed-methods approach informed the learning model developed in this project from April 2017 to June 2018, including literature reviews and iterative stakeholder interactions. Data analysis was documented initially in a series of six reports available in the project website (<https://sites.rmit.edu.au/digitalworkpractices/>) and in journal and conference papers focused on different aspects of the research and findings.

Qualitative and quantitative analysis and synthesis in the project spanned employment information; five consecutive industry roundtable discussions in Melbourne, Sydney and Brisbane ( $n=50$ ); the design, implementation and refinement of pilot activities with Journalism and Design students at one university, and Engineering students at another ( $n=78$ ); and teacher reflections from the pilots. Educators at universities in Melbourne, Sydney, Brisbane, Perth and Adelaide were invited to participate in an online survey ( $n=91$ ) to ascertain what digital capabilities were being taught, practised and assessed; then, six months later, face-to-face educator workshops were held ( $n=66$ ) at the same five universities for feedback and further input to the Digital Affordance Developmental Learning Model. Discussions were also held with the project's Critical Friends Group during and at the end of the project. A final symposium involved an Expert Panel responding to the project findings and Model in relation to work futures, institutional strategy and learning futures.

In this paper, the insights gained from the educator workshops underpin our suggestions about professional learning for educators to support their students' adaptive digital capability development. The educator workshop participant input was first documented in the project website in a preliminary report (Peterson, 2018b). This paper draws and builds upon excerpts from that report.

The face-to-face workshops were held at universities in Melbourne, Brisbane, Sydney, Perth and Adelaide in March 2018, following the earlier online survey undertaken at the same universities in September/October 2017. The 66 educators who attended the workshops were from several disciplines: Design/Creative Arts (19); Business Management (15); Education (11); Communication (3); Engineering (3); Science/Health (3); and Information Management (2). Ten participants did not identify their discipline. Project team members designed and facilitated the workshops collaboratively, underpinned by the team's own different disciplinary perspectives from Education, Design, Communication, Business, and Engineering. A common format was used for the workshop presentations and activities, facilitated by different members of the project team.

Workshop participants were introduced to the research, including findings from the online survey of educators six months earlier. Workshop activities and discussion then focused on staff/student capabilities and applying the digital affordance concept, which is integral to the learning model proposed by the research project team. In the final stage of the workshops, participants were invited to provide individual written responses to seven questions, which yielded 320 written responses overall. The questions related to three areas: key themes from the project's industry roundtable discussions on the key digital capabilities needed; possible strengths and challenges of the learning model; and ideas for its implementation in teaching practice.

The educators' written responses from all locations were then grouped under each of the questions to explore any patterns emerging. As a phenomenological method, we used theme identification as a "sense-making tool" to generate meaning and reveal different ways to think about problems and solutions (Dorst, 2011, p. 528). Specifically, a social phenomenological approach was adopted in analyzing the educators' written responses. In this approach, "people living in the world of daily life are able to ascribe meaning to a situation and then make judgments" (Fereday & Muir-Cochrane, 2006, p. 81). As an experienced educator and leader of learning and teaching in higher education, one of us undertook to interpret patterns and initial themes emerging in the subjective data (i.e., in the participating educators' written responses). Reading and re-reading the grouped responses "provided the opportunity to sense and take note of potential themes in the raw data," where both single and repeated comments were important (Fereday & Muir-Cochrane, 2006, p. 86).

The study is limited to the initial themes thus identified; and to the educators who chose to participate in the workshops, providing written responses to our seven questions in the worksheet. Whilst there were some 'early adopters' in teaching for new digital work practices, many participants in the different locations and disciplines said they were less experienced, particularly with technology affordances. Insights to their written comments are provided below, together with sample responses in italics and attributed only to a workshop participant's identified discipline (see also Peterson, 2018b). These insights and participant comments informed our development of resources to support educators, discussed later in the paper.

## **Educator workshops**

### *Educator responses to industry themes on digital work/capabilities*

Prior to the educator workshops, industry participants had highlighted the importance of two key themes: a) analyzing and making sense of data, particularly to inform customer experience and engagement strategy; and b) artificial intelligence (AI) and machine learning (ML), particularly in terms of business and social implications. At the educator workshops, participants were asked to indicate if these industry themes were familiar or surprising, and if they could suggest ideas for addressing the themes with their students. Many educators responded that, although they were familiar with such industry trends, they did not have well developed understanding of AI and/or data sense making for customer or audience experience and engagement, and many were not addressing these themes in their teaching. Some indicated that they had a stronger understanding of these areas and were already addressing them with their students, at least to some extent.

*The degree I'm teaching, is IT and data analytics. We are just beginning to develop a sense of the true capabilities and business capacities for these. - Business participant*

*Data analysis in Internet of Things is key – so in fact people learning about Internet of Things will learn (hopefully) to understand different types of data, communication of data, data processing, data storage, data services, data visualisation...in other words it's a good carriage for understanding things like data, also machine learning, and even customer experience because it drives you to think about it in an adaptive way. - Communication participant*

Ideas were put forward for maximizing student learning in relation to the industry themes above. Some educator workshop participants encouraged self-directed learning activities and assessment. Many recommended multiple authentic projects for students working with industry to undertake research and problem solving specifically targeting customer or audience engagement. Many also underlined the importance of having such projects throughout the programme of study, rather than 'once only' experiences.

*Getting students to conduct interviews with customers and their experiences of a product/service and then make recommendations for a solution. - Education participant*

*Engagement data, creating significance and understanding how the creative production is received is a crucial part of the discipline now. These may be addressed whole of course through iteration. - Creative Arts participant*

### *Learning model*

After inviting the educators to respond to the industry themes identified in the project, responses were sought to the learning model proposed. An overview of the model concept had been explained at the workshops, which has also been disseminated in reports in the website (<https://sites.rmit.edu.au/digitalworkpractices>) and other publications (e.g., Fray et al., 2017; Jollands et al., 2017; Peterson, 2018a, b; Peterson et al., 2018a, b, c). Excerpts are provided below.

### *Model concept explained*

The Digital Affordance Developmental Learning Model integrates technology affordance theory and developmental learning. Affordance theory defines a technology in terms of the uses, interactions and possibilities that the technology affords to its users; and affordances can be categorized – according to their potential for achieving outcomes – as Functional, Perceptual, Maintenance and Contextual (Best, 2009; Evans et al., 2017; Fray et al., 2017). These categories were adapted in the project and re-named as functional, perceptual and adaptive, defined as follows:

- Functional affordances relate to the operation of technology; this includes naming, knowing and operating the features of a technology/technologies to perform tasks.
- Perceptual affordances relate to interpretation and being discerning about technology tools and practices for their suitability and in-context operation for outcomes in known contexts.
- Adaptive affordances relate to imagining, adapting and extending technology use in previously unexplored and emerging contexts for innovative outcomes; this requires some functional knowledge/skills and perceptual experience.

(Source: Peterson et al., 2018c, adapted from Best, 2009; Evans et al., 2017)

As explained in Peterson (2018b), the developmental learning ideas integrated with affordance theory are underpinned by educational theory, including hierarchies and stages of learning with acknowledgement of the learner, environment, outcomes and increasing complexity; and highlighting the importance of reflection-in-action for professional learning and practice in unpredictable and new circumstances (e.g., Piaget, 1936; Bloom, 1956; Biggs & Collis, 1982; Schön, 1983; Gagné, 1984; Anderson et al., 2001; Scott, 2016).

Peterson et al. (2018c) describe a spectrum of capability within the functional, perceptual and adaptive layers, and suggest different emphases as follows. Each affordance layer spans introductory to advanced levels. Realistically, in the adaptive layer, we can emphasise imagination and 'seeing' possibilities, rather than expect that all graduates will be capable of true innovation with technology. We recommend multiple opportunities for students to practise integrating functional, perceptual and adaptive thinking, rather than see these separately forming a linear path. Affordance layers can also be emphasised at different times to suit the needs of students; however, as adaptive digital capability is highly sought after in industry, it would be vital for final year students to focus on this and be able to critically reflect upon and discuss their work accordingly.

Digital Capabilities Descriptors illustrate ways in which affordance theory can be interpreted for scaffolded or developmental learning about industry-relevant digital work practices in different disciplines. Descriptors interpret affordances in sample domains, which are categories of practice and related capabilities for existing and emerging jobs or work roles. In the Digital Capabilities Descriptor for Design, for example, one of the practice domains identified by the project Design team is Persuasion; and within Persuasion, the work activity of 'Storytelling' could be interpreted as follows (see Peterson et al., 2018c):

- Name and define narrative approaches, use software for visualization and interface design to illustrate/present/argue (Functional digital capability for Storytelling).
- Analyze data to tell stories, develop content using techniques appropriate to a range of media, critically evaluate stories (Perceptual digital capability for Storytelling).
- Work with generative systems, artificial intelligence/machine learning to tell stories, developing new tools and platforms (or new uses) to tell and disseminate stories (Adaptive digital capability for Storytelling).

Digital Capabilities Descriptors scaffolded in this way, using disciplinary language in a work context, can guide the design of assessment and learning activities to enhance existing curriculum, or for new programme and unit development. The team deliberately wrote the Descriptors for each sample discipline, as illustrated in the example above, to encourage embedding the scaffold in the curriculum for both existing and new courses/subjects/units with direct relevance to contemporary industry practice.

### *Educator responses to learning model: strengths and challenges*

Applying functional, perceptual and adaptive lenses to using technology was noted by many of the educator workshop participants as a clear strength of the proposed learning model approach, which would address potential gaps in their own teaching practice. Building upon the earlier questions about industry themes, some participants also made further connections here to address industry developments such as artificial intelligence, the interpretation of data for customer experience, or application for social benefit.

*Useful in qualifying expectations of students and for students. - Engineering participant*

*I like this model – I think we can use these terms to explain to students where they currently sit on the digital capability spectrum and where they need to be to be employable in 5-10 years; the adaptive affordance can be used to develop creative approaches to problem solving i.e. how can big data be harnessed to map disease prevalence or public health programme take up. - Health participant*

There was wide support for the usefulness of the model, in terms of providing a framework for mapping curriculum in a whole programme of study. Through constructive alignment (see Biggs, 2003), the learning outcomes, learning activities and assessments would be clearly linked, with encouragement for students to make sense of their learning about technology affordances now and in future. Some participants saw the model as a useful way to emphasize the functional, perceptual and adaptive capabilities more at different levels such as first year versus final year, or undergraduate versus postgraduate. The student would move through learning outcomes of increasing complexity over time; for example, move from ‘describing’ something to ‘proposing’ as a more sophisticated outcome.

*Well-structured approach to categorise learning outcomes. Allows alignment of assessment and content. Allows scaffolding across different units. - Business participant*

Some participants were more cautious in their responses, indicating that they saw the model as being necessarily linear and prescriptive. There were clear signals to the team to clarify, for educators and students alike, that the model reflects hierarchical but integrated affordance layers. Adaptive capability requires some functional knowledge/skills and perceptual experience. This may mean knowing enough at the functional level to interact effectively with specialists and imagine the possibilities, rather than having advanced knowledge and skills oneself. Furthermore, encouraging an integrated approach to affordances does not preclude emphasizing different affordances in the hierarchy at different times, depending on the learning situation and learner needs. Several respondents appeared to be more comfortable with the integrated affordance aspect of the model, encouraging other educators and students to be brave. The significance of motivation and positive feelings about learning and teaching in a supportive environment, for students and educators, was evident in several responses.

*Work on own (and students’) fears...move from functional pure focus to integrated focus between the affordances (functional, perceptual, adaptive) - Creative Arts participant*

*Scaffolding from functional to adaptive. Self-driven experimentation, problem solving and collaborative oriented creative process/activity. - Creative Arts participant*

*Students as co-creators of engaging assessments; using coding skills to build models that explain physiological processes like insulin’s actions, action potential generation - Health participant*

Grappling with assessment surfaced in many of the educators' responses. Some indicated that the Digital Affordance Developmental Learning Model provides a useful way of thinking about scaffolded learning for capability development and assessment.

*Could be scaffolded over several assessments. Helps us move beyond functional, which is where it mainly sits at the moment. Develops digital fluency, rather than mere skills. - Information Management participant*

However, assessing adaptive digital capabilities was identified by many participants as a real challenge with workload implications, especially where their own and students' adaptive (and other) digital capabilities might currently fall short.

*Time and effort, staff capability, student acceptance and ability to learn especially adaptive affordance. - Business participant*

*Students' resistance to move away from conventional 'job readiness' definition based on mastering of functional skills. - Creative Arts participant*

### *Educator responses to learning model: ideas and recommendations*

When participants were invited to suggest the most useful aspects to focus on for student learning, several suggested that data analysis and interpretation should be prominent for perceptual and adaptive digital capability development, although functional cannot be ignored.

*Adaptive and problem solving. We probably do a lot of 'functional' affordance teaching but need to ensure that digital tech features in our problem solving exercises, such as my capstone project. - Science participant*

Many participant responses underlined the importance of communicating with students about their digital capability development, using the vocabulary of functional, perceptual and adaptive affordances of technology; and of graduates being able to discuss their capabilities for digital work in affordance terms.

*Opportunities to practice. Connect digital capabilities to job outcomes. - Business participant*

*Create a matrix to cross check the functional, perceptual, adaptive across subject learning objectives. - Creative Arts participant*

Participants suggested ideas on student/educator interconnections, together with promoting attributes such as lifelong learning and resilience. There was again acknowledgement that educator capabilities need to be developed. Safety for risk-taking – by students and educators – was seen by many as an important consideration in implementing the model.

*Ensuring that students are rewarded when they want to experiment. - Communication participant*

When asked about the first thing they would need to do, to make the model work for them with their students, many of the educators advocated again for a whole-of-programme action plan. Many intended to look at their curriculum for possible links to the model. They said that revisiting learning outcomes and assessment would need to involve discussion with discipline and industry contacts, for contextualization and identifying core technologies needed. Overall, there were renewed calls for closer connections and collaboration between education and industry, with encouragement for risk-taking raised again.

*More collaboration between universities and industry i.e. learn about their needs; develop units on data e.g. Design and Big Data. - Business participant*

*For specific disciplines, show where digital work practices are in the curriculum...how many [work integrated learning] projects relate to the digital future? - Education participant*

*Find a way to collaborate among academics, students and industry participants that goes beyond current practices. In other words: reward new, daring projects. - Communication participant*

Respondents continued to return to the significance of motivation and positive feelings about learning and teaching in a supportive environment. Time for educator reflection emerged as a common theme. Some also described students as co-creators, and prioritized developing confidence in students.

*Bring them along on the value of their understanding, and deploying of these affordances e.g. How will these affordances make me more employable? - Creative Arts participant*

*Evolve it, i.e. using an action learning context, giving the power to the class/students. Have them as a student-centred approach to digital literacies and competencies - run an evolving development, self-generated learning environment. - Business participant*

*Incorporating more choice/options for choosing technology to complete assessment tasks. Equipping students with the confidence to explore digital tools to complete tasks and problem solve. - Information Management participant*

Finally, we asked the participants how we could build on and improve the model, to help graduates prepare for work and meet industry needs. What should happen next? Several respondents underlined the importance of broad take-up of the model, supported by senior management as a priority. The needs for professional development and adopting a whole-of-programme or whole-of-school/institution approach were often raised. Some also said they were reluctant to engage in yet another ‘fad’ or university mandated curriculum mapping exercise.

*Adaptive affordance area is enormous task. Need whole school approach to teaching. All staff need to know how to incorporate these skills. - Science participant*

Developing confidence among educators for motivation is clearly a priority for many respondents, who often said they ‘get’ the learning model concept but need practical examples for its translation into practice. This need for examples also proved to be a strong common theme in the workshop responses.

*More professional development for staff to have confidence to deliver. - Creative Arts participant*

*Practical example of each i.e. functional, perceptual and adaptive in different disciplines and how assessment is applied. - Communication participant*

## **Enhancing teaching capability**

The Design, Journalism, Music Industry and Engineering examples of Digital Capabilities Descriptors developed during the project are provided in the website (<https://sites.rmit.edu.au/digitalworkpractices>). The website also includes documentation of planning, learning activity and assessment ideas, and teacher reflections from pilot interventions undertaken with students, when elements of the Descriptors were aligned with actual curriculum in action. We believe that these samples of disciplinary contextualization may provide a starting point for colleagues to debate, adopt or adapt in their own teaching practice.

### *Professional development*

A toolkit was created to support facilitators to run their own workshops to help other educators incorporate the Digital Affordance Developmental Learning Model into their teaching. The development of the toolkit built on the resources created for the project team’s own educator workshops and incorporated feedback received from those workshops. The toolkit was designed to provide a guide, resources and ideas for running short workshops (1-2 hours). Suggestions were given for structuring a workshop with ideas for discussion and activities. These were supported by further resources and hyperlinks to relevant areas on the research project’s website. Sample worksheets and slides that are easily adaptable were also included in the toolkit.

Three main topics were covered in the toolkit: first, an introduction to the learning model; second, selecting and developing digital descriptors for units/subjects; third, using the learning model in teaching.

#### Topic 1. An Introduction to the Learning Model

The first topic provides an overview of how the learning model was developed and why: a ‘walkthrough’ for the learning model, broadly exploring how the tools could be used and applied in the participants’ own situations. Activities in the toolkit aim not only to introduce what the model is and how others have used it, but also why participants might want to use the model themselves.

#### Topic 2. Digital Descriptors for Your Unit/Subject

The second topic focuses on using and adapting the existing digital descriptors developed by the project team, with the possibility of extending the workshop to practice in creating new digital descriptors for the educator participants’ units/subjects. The toolkit provides resources to guide educators through the process of identifying relevant domains of practice needing digital descriptors, checking the project website for existing

digital descriptors to use or adapt, and practising development of new descriptors if no suitable descriptors already exist in the website.

### Topic 3. Using the Learning Model in Your Teaching

The third topic supports educators by developing and sharing ideas for how they might use the learning model in their teaching. The toolkit guide encourages workshop facilitators to ask participants to bring along their subject outlines and learning outcomes/objectives to work on them during the workshop. The toolkit provides resources to 'walk through' how to apply the learning model to the participants' curriculum and lesson planning, including activities to collaboratively develop ideas for using digital descriptors to adapt and create unit/subject learning outcomes/objectives and assessments. The toolkit also provides resources to identify challenges to implementing the model and brainstorm ways to overcome those barriers and constraints.

#### *Encouraging flexible and adaptive uses*

As the participants in the project's educator workshops came from a variety of disciplines and were attempting to apply the model to a multitude of different units/subjects, the toolkit aimed to support flexible and adaptive uses to help fit individual needs.

The toolkit was not intended to provide prescriptive direction; rather, it encourages facilitators to view it as a menu from which they could select (and add to) to develop workshops for their own requirements. For example, a workshop could cover all three topics sequentially, or focus on one aspect in depth. Discussion questions and activities could be selected, added to and tailored to the workshop focus and participant needs. The worksheets and slides were unbranded to further support facilitators to make them their own.

#### *Integrated learning process*

The investigators who piloted the teaching model in their classes as part of the research project reported how their understanding of the Digital Affordance Developmental Learning Model developed, through applying and shaping the functional, perceptual and adaptive concepts to their actual teaching context and practice (Peterson et al., 2018c).

We recognized that other educators may go through similar learning processes and could be supported by the toolkit and guide. On the functional level, the educators needed to know what the concepts were and how they could be used, so we provided an introduction to the model and core concepts, as well as examples of how the model could be used in teaching and why. On the perceptual level, educators needed to be able to develop the capability to discern and apply the model to known contexts. To support this, we designed activities to work with digital descriptors already developed, which had been tested previously. However, we found that most educators' contexts had differences from the researched cases. Educators needed to be supported in developing adaptive capabilities to be able to shape the model and tools to their own unique and emerging contexts. Thus, we created activities to support educators to devise their own digital descriptors in the workshop and then share and discuss them in the group, along with challenges and opportunities for applying them to their own situation. Just as the learning model encourages real-world projects to develop digital capabilities, so too does the toolkit encourage hands-on practice and reflection-in-action (Schön, 1983) during the workshops. Through use, application and adaptation, educators can develop their capabilities to use the learning model and tools across the functional, perceptual and adaptive layers. While these layers are hierarchical, they are integrated and are not simply linear.

Similarly, we developed the toolkit with the recognition that other educator workshop facilitators may also be learning about digital affordances and the learning model, in the process of designing and delivering these workshops – not just their participants. Teaching has long been acknowledged as an effective way of learning (Cohen et al., 1982, Fiorella & Mayer, 2013), so running workshops provides opportunities for educators to develop their understanding of the concepts and capability to use the model and tools. In undertaking the pilot research studies and developing the toolkit, we observed our own processes of capability development and found that working at the adaptive level further developed our capability at the functional and perceptual levels. We developed more nuance at depth at the functional level through application at the adaptive level, which in turn helped us develop that nuance and depth in perceptual capability for the contexts we already knew!

Hence, we endeavoured to design the toolkit to be simple and easy to understand for those who were new to the concepts, while linking to further resources that could be explored if facilitators and participants wanted to extend their learning. We acknowledged that this is an emerging area where we are all developing our



understanding and capabilities, so we encouraged facilitators and participants to learn from each other as they explore ways to support learners in new contexts. We shared teaching resources, such as lesson slides, from the pilot projects in the research study, as examples of different real-world applications rather than as exemplars. We invited facilitators and educators to share the resources they create back with the community for the project website.

## Implications and further research

This paper has focused on the findings of workshops on the Digital Affordance Developmental Learning Model, with our initial responses to the participants' feedback in terms of developing professional learning support for educators. As experienced educators ourselves – in Design, Communication and/or Business at different universities – we have revealed our own team's professional learning journey in the design, development and implementation of the learning model.

The preparation of new graduates for emerging jobs that have new definitions and activity requires a differing approach to how they may have been educated in the past. Graduates need the ability to frame their skills and abilities in industry-relevant terms. What we have explored in this paper has focused on supporting educators with the implementation of a Digital Affordance Developmental Learning Model, designed to support the growing need for explicit incorporation of digital capabilities into subjects/units and mapping across a whole programme/course experience for the student.

Our work with educators highlights an opportunity for programme/course teams or universities to take the lead in shaping emerging practice further with industry, in relation to aligning learning and teaching practice with industry needs. As an example, an ability to interpret data for strategic decision making and customer/audience/user engagement, as well as using artificial intelligence and machine learning, is highly sought after in industry (e.g., CEDA, 2018; WEF, 2018). However, as one educator workshop participant lamented:

*There doesn't seem to be a sense of urgency in some parts of Higher Education to respond and adapt to these emerging [industry] themes. - Education participant*

Whilst it appeared that not all workshop participants are addressing these trends in their teaching practice, they did suggest ideas such as industry projects based on speculative scenarios. There was also mainly positive feedback about the proposed learning model, with participant suggestions for teaching practice ranging from introducing a functional 'bootcamp', to elevating perceptual and adaptive digital capability development through collaborative 'messy' problem-solving projects related to data, and work integrated learning projects specifically related to digital work futures. Creating 'self-generated learning and development environments' for students, and helping students to learn and use the vocabulary of affordances including their industry relevance, were also seen by the educators as being especially important. Several considered this would strengthen professional learning and counter any student perception of all jobs requiring only functional skills.

Furthermore, the educator workshops revealed the need for professional development and resources to underpin new approaches to preparing graduates for a changing world of work. We found the workshops created a valuable space for educators to reflect on, share and co-create new teaching and leadership practices.

The approaches suggested to enhance teaching capability for transition to an adaptive digital capability focus highlight further research needed. This includes scaled-up implementation of the Model with students. Longitudinal studies would be vital to evaluate outcomes for graduates who have experienced the Model. Further research on the professional development of educators and how they can be supported to apply and adapt the Model in their professional practice is also needed across disciplines. At a time when 'quality' in learning and teaching has different meanings and is under-researched, despite the increased focus on quality and implications of its measurement in higher education (Strang, Bélanger, Manville & Meads, 2016), it is vital that we continue to explore ways in which the actual student learning experience can be enhanced with tangible outcomes, in terms of work futures and digital work practices.

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