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Preparing students for the workplace through designing productive assessment tasks: An actionable knowledge perspective

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Preparing students for the workplace and assessing their readiness are often major challenges for university teachers. What kinds of concrete tasks help students develop professional capacities needed for situated knowledgeable action in a broad range of possible future workplace settings?

Our research examined assessment tasks that university teachers set for students in courses that were preparing them for work placements in five professions: nursing, pharmacy, teaching, social work, and school counselling. We combined ‘actionable knowledge’ and ‘objectual practice’ perspectives and investigated what students were asked to do, what they were expected to learn and how. Specifically, we analysed the nature of the objects that teachers selected for assessment tasks and the nature of the concrete artefacts that students were asked to produce.

Our results show some fundamental differences in teachers’ choices of objects. They ranged from basic and very specific aspects of professional work to some of the hardest and most broad-ranging challenges in the profession. The tasks also required students to engage in the production of a wide range of artefacts. We classified these as ‘cultural artefacts’, ‘conceptual artefacts’ and ‘epistemic artefacts’. Our discussion draws parallels between these three kinds of artefacts and the notions of ‘work ready’, ‘work knowledgeable’ and ‘work-capable’ graduates, respectively. We argue that teachers, through task designs, shape ways in which students learn to link action (skill) with meaning (knowledge). Our findings raise some important questions about the kinds of authentic tasks that help prepare work-capable graduates for future learning.

Keywords: Objectual practice, knowledge artefacts, assessment

Introduction

Development of productive pedagogies that can help prepare students for complex knowledge-demanding professional work has received significant attention in higher education. Various approaches have been proposed, trying to bridge university teaching with workplace practices and demands. A number of these approaches have focussed on the development of students’ knowledge and the cognitive capabilities needed to solve complex professional problems. Example approaches include case-based learning (Barnes, Christensen, & Hansen, 1994; Thistlethwaite et al., 2012) and problem-based learning (Barrows & Tamblyn, 1980; Walker, Leary, Hmelo-Silver, & Ertmer, 2015). Some other approaches have focussed on the development of students’ skilfulness with respect to physically or socially demanding professional tasks: simulations, role plays and other forms of mimetic learning, for instance (Billett, 2014; Hopwood, 2017). Some approaches try to connect learning of

knowledge and skills with the formation of other professional qualities, by engaging students in various mindful, situated learning experiences, such as communities of practice (Wenger, 1998), reflection (Schon, 1987) and cognitive apprenticeship (Collins & Kapur, 2014).

In parallel, a variety of techniques have been proposed for assessing students' professional competence and workplace readiness, ranging from formal tests – such as objective structured clinical examinations (OSCE) (Harden & Gleeson, 1979) – to naturalistic, competence-based assessments, embedded in authentic practice – such as professional learning portfolios (McMullan et al., 2003).

The question then arises: what kinds of tasks do university teachers actually design in order to both prepare students for knowledgeable and skilful work and assess their readiness for professional work? What serves as a material foundation for learning workplace capabilities in university settings and for making judgements about students' readiness? How do these tasks and assessments align with the ways in which professional knowledge practices and learning take place and get evaluated in workplaces?

Studies of assessment practices in university settings often examine the tasks that students do from measurement, competence and other normative perspectives (Boud, 1995). They rarely investigate these practices from perspectives that are used to theorise knowledge practices and learning in workplaces (Nicolini, 2013). This theoretical gap hinders development of congruent understandings of how students' learning and assessment practices in university settings can be made continuous with the ways in which productive knowledge work and learning happen and are evaluated in workplaces.

In our research, we adopted an *epistemic practice* view on students' knowledge work and learning (Knorr-Cetina, 1999; Langemeyer, Fischer, & Pfadenhauer, 2015) and examined assessment tasks that university teachers set for students in courses that were preparing them for professional work. In each case, our selected assessment tasks were related to students' work placements (practicums, internships). We focussed on what we call 'developmental assessment' tasks – substantial learning and assessment tasks through which students were expected to learn and to demonstrate certain workplace-related capacities. We call this kind of assessment 'developmental' because of its resemblance to *developmental evaluation* - which fills in an important gap between *formative* and *summative* evaluation in the contexts of organisational innovation, change and learning (Patton, 2011). Such tasks are located where academic knowledge and workplace action overlap. They offer a productive research site for examining academic-workplace relations. In analysing what students were asked to do, we combined 'actionable knowledge' (Markauskaite & Goodyear, 2016) and 'objectual practice' (Knorr Cetina, 2001) perspectives and aimed to answer two specific questions:

1. What is the nature of the objects that teachers choose for professional learning and assessment tasks?
2. What are the epistemic qualities of the artefacts that students construct in such tasks?

We aimed to discover the kinds of knowledge practices students engage in when they construct these artefacts for assessments, and how this helps them develop knowledge that supports their knowledgeable action in the workplace.

Theoretical approach

Bringing intelligence to bear on activity, as Yinger and Hendricks-Lee (1993) argued, requires ‘working knowledge’, which in our work we call ‘actionable knowledge’ (Markauskaite & Goodyear, 2016, p. 89). This kind of knowledge helps get things accomplished in practical situations. As Nicolini (2013) said, in practice settings,

...knowledge is conceived largely as a form of mastery that is expressed in the capacity to carry out a social and material activity. Knowledge is thus always a way of knowing shared with others, a set of practical methods acquired through learning, inscribed in objects, embodied, and only partially articulated in discourse. (p. 5)

Such knowledge is defined by a sense of relevance to getting a job done in a way that is meaningful and considered effective in a professional community or workplace. This knowledge is partly individual and implicit – as it involves personal capabilities to establish productive relationships between the self, the social and material environment and action – and it is partly shared and explicit – as it draws on symbolic and material tools that allow these connections to be made knowledgeably within a given context.

‘Objects’ are usually defined as entities people act towards and/or act with (Star, 2010). They are the ‘ultimate reasons’ behind behaviours of individuals and groups (Kaptelinin, 2005). Objects are central to everyday life – they give meaning to human activities and shape their values – they also play vital roles in professional knowledge work and learning. As Knorr Cetina (2001) argues, in knowledge-generating settings, practices largely evolve around certain ‘problem-knowledge constellations’ that are formed as practitioners explore problems and construct knowledge. She calls such constellations ‘epistemic objects’ and practices that evolve around them ‘objectual practices’. In professional work, objects are often both meaning-producing and practice-generating; they provide the foundations for both continuation of what professional communities do and for extension of their practices. While objects are sometimes seen as abstract entities that motivate activity and give an orientation to it, they can also be concrete entities that instantiate these motives in tangible forms that guide actions. This mirrors a well known difference between *predmet* and *objekt* in the sociocultural literature (Kaptelinin, 2005). *Predmet* refers to a broader target and denotes objective orientation of activity (i.e. a motive), while *objekt* has a narrower meaning and refers to material objective reality.

Material artefacts that people produce – when they are solving problems encountered in their practical activity and/or constructing shareable representations of their knowledge – play important roles in knowledgeable work (Bereiter, 2002; Miettinen & Virkkunen, 2005). They provide concrete material grounding for engaging in knowledge work and give visibility and permanence to otherwise invisible or ephemeral expressions of human thought.

While objects and artefacts alone cannot explain all aspects of professional knowledge work and learning, investigating their qualities and how people engage with them can yield good insights into how knowledge work is actually done and what kinds of capacities it embodies (Nicolini, Mengis, & Swan, 2012). In professional learning contexts, assessments that students do as part of preparing for professional practice serve as productive objects for investigating what kinds of knowledge and capacities students are expected to master, how these capacities get expressed in concrete tasks and artefacts, and how students’ readiness for the workplace gets assessed (Markauskaite & Goodyear, 2016).

Methodology

We drew upon a combination of sociomaterial (Fenwick, Edwards, & Sawchuk, 2011) and socio-cognitive (van Dijk, 2014) methods for studying knowledge work and learning, and sought to get insights into the epistemic nature of objects and artefacts that guided students' learning.

We investigated 20 professional practice courses from five professions: pharmacy, nursing, social work, school counselling and education. We selected units of study (courses) specifically aimed at preparing students for the workplace. There were three stages of data collection. In Stage 1, we collected and reviewed formal course documents: including course aims, outcomes, general designs, topics and assessments. In Stage 2, we conducted epistemic interviews (Brinkmann, 2007) with the academics coordinating each course. We asked about the course design, including aims, structure, pedagogy, assessments, and changes in the course over time. We also collected detailed course materials, such as specifications of assignments given to the students, lecture and tutorial materials, and samples of work completed by students. In Stage 3, we selected one or two specific developmental tasks from each course and explored them further, conducting additional interviews to ask the academics about various aspects of task design.

Our data analysis drew on principles of thematic analysis (Braun & Clarke, 2006). To answer the first research question, we analysed course descriptions and interviews with the academics and initially identified the overarching 'motives' of each course. Then, we identified specific objects of the tasks by analysing what kinds of capacities students were expected to develop, how and why. We organised the final themes according to the epistemic nature of the capacities that students were developing and their relationships with daily professional tasks.

To answer the second research question, we analysed what, specifically, students were expected to do in each task; how they did this, and what kinds of artefacts they were producing. We simultaneously examined detailed teaching and learning resources related to each task and teacher interviews explaining the task designs. We looked closely at the *kinds of knowledge and ways of knowing* that were enacted in the *production* of these artefacts. We organised the final themes according to the epistemic qualities that these artefacts embodied.

Findings

Objects of assessment tasks

The university teachers 'objectified' these broad course motives into specific tasks in a range of ways that varied along two dimensions: a) the focus on particular kinds of professional capabilities; and b) the relationship to common tasks performed in workplaces (Table 1). Along the first dimension the selected objects ranged from a focus on fine-tuning professional skill and knowledge for carrying out specific professional actions (aka. doing); to shaping professional vision that helps students see the world and act in a particular way (aka. seeing); to creating various professional artefacts (aka. producing). Along the second dimension, the focus ranged from the capabilities involved in core everyday practices, to hard and rare aspects of professional practices.

Specific key skills and knowledge needed in everyday professional work, and that require focussed development and fine-tuning through repeated practice, were a common object of the tasks. For example, pharmacy students were learning skills to communicate with clients by engaging in role plays; school counselling students were learning to do behavioural assessments by administering tests on each other, and later on a child. In some other cases, the

object of students' tasks was specifically the *hardest elements of professional practice*. In one example, pre-service teachers were learning to use new inquiry-based pedagogical approaches by developing and teaching lessons in groups.

Table 1: Common objects of professional assessment tasks

Objects of tasks	Core aspects of professional practice	Hard, hidden or rare aspects of professional practice
Doing: Fine-tuning professional skill and knowledge	<i>Key specific skills and/or knowledge</i> that require targeted development and repeated practice. E.g. communication with clients in pharmacy	<i>Hardest elements of professional practice</i> that require special preparation. E.g. teaching most difficult topics of the school curriculum in pre-service teacher education
Seeing: Shaping professional vision	<i>Core inquiry frameworks</i> that are used to guide solutions of professional problems across situations. E.g. a generic inquiry framework used in pharmacy practice: gather information, process information, and deliver service and recommendation	<i>Hidden elements of professional vision</i> that are invisible to lay perception. E.g. understanding roles of aboriginal officers in schools, noticing important details that should inform decisions in curriculum documents, lesson plans and teaching resources
Producing: Making professional artefacts	<i>Production of everyday professional artefacts</i> of, or for, professional practice, in an informed way. E.g. production of lesson plans and teaching resources for particular purposes	<i>Production of generic artefacts</i> for professional use in a range of possible situations beyond one's own practice. E.g. production of guidelines for nursing informed by best practice

Development of professional capability to see the encountered phenomena, and structure professional actions in a particular way, was the second common object of the tasks. In such tasks students often learnt to use core inquiry frameworks of professional practice. For example, pharmacy students learnt to use a generic inquiry framework – gathering information, processing and working out an appropriate solution, and delivering a service – which was used in various situations that ranged from a regular dispensing of medications in a pharmacy to complete medication reviews in complex cases. In these tasks, the focus was less on knowledge and skill to respond effortlessly and automatically to the encountered situation, more on development of a conscious ability to see the world and structure actions through particular (overtly learnt) professional frameworks. In other cases, the focus of tasks was on hidden elements of professional vision – aiming to develop students' capacities to see aspects of professional practices and artefacts that are invisible to lay perception. For example, pharmacy students were examining pharmacy layouts in order to notice important details; pre-service teachers were unpacking the roles of an aboriginal officer in a school by interviewing them in order to understand how they, as teachers, should collaborate; they were also systematically examining curriculum documents, lesson plans and various teaching resources in order to discern important aspects that should inform their decisions and actions.

Development of the capabilities needed to make professional artefacts – and a range of other capabilities that students learnt through making – was the third common object of the tasks. Some making tasks involved production of artefacts that are used in everyday situated professional work, such as lesson plans, resources or tasks for teaching particular lessons, designs of disease state management services that could be implemented in a community pharmacy, etc. In some cases, students created generic professional artefacts for professional use, such as kits for school excursions, guidelines for nursing informed by best practice, etc. In these tasks, the main focus was not just an artefact for a specific situated professional purpose, but a generic artefact-tool that could be reused by others in other situations. The capability to make connections between general knowledge that was embodied in these

artefacts and concrete situated knowledge and action that these artefacts aimed to support was often the central object of learning through making these generic artefacts.

Artefacts of assessment tasks

Students were using and producing a broad range of artefacts that had very different epistemic qualities. Drawing on the literature on mediational roles of artefacts (Bereiter, 2002; Norman, 1991; Rheinberger, 1997), we organised them into three broad categories: cultural artefacts (action and practice), conceptual artefacts (analytical and design) and epistemic artefacts (knowledge-connecting) – see Table 2.

Table 2: Professional artefacts that students construct in assessment tasks

Artefacts of knowledgeable action	Examples
<i>Cultural artefacts</i>	
<i>Action artefacts</i> – social and material goods and other main products of professional work	A lesson conducted by a teacher; an assessment of a family produced by a social worker; dispensed medications and counselling provided by a pharmacist. These artefacts materialise a profession's <i>raison d'être</i>
<i>Practice artefacts</i> – artefacts that are commonly produced and used to mediate daily professional work within a professional culture	Professional mediating artefacts produced using useful frameworks, templates, heuristics, rules of thumb, etc. They embody the shared interpretative frameworks and routines of a profession
<i>Conceptual artefacts</i>	
<i>Analytical artefacts</i> – products of a deliberative inquiry aimed at constructing explicit articulated ('know that') knowledge for professional judgements	Professional critiques, evaluations, interpretations, reflections, deconstructions and other analytical re-descriptions of existing professional artefacts and practices, including reflections on one's own professional practice.
<i>Design artefacts</i> – products of deliberative knowledge work constructing actionable knowledge for professional practice ('know how')	Plans, concepts, models, designs and other common outputs of knowledge-creating designerly work. They give explicit meanings to actions and guide complex professional activities
<i>Epistemic artefacts</i>	
<i>Epistemic artefacts</i> – artefacts that link 'know that' with 'know how', and conceptual with cultural aspects of professional knowledge into one ensemble that enables a person to produce situated knowledge for action	Best practice guidelines in nursing; a teaching 'kit' for a specific topic with meta-guidance on how to use and adapt it for various situations; similar artefacts that allow concrete meanings to be established during use of the artefact

Tasks in which students were learning skills, knowledge and other capabilities directly related to professional work, also simultaneously engaged students in production and use of two kinds of artefacts that are an intrinsic part of such practice and professional culture: action artefacts and practice artefacts. *Action artefacts* are direct products of professional work, such as medications dispensed by a pharmacist, an injection given by a nurse, or a lesson taught by a teacher. Some of these artefacts are ephemeral, as they are results of actions carried out in the world, providing services or creating immaterial rather than material goods. Such ephemeral artefacts are captured in permanent material form only in indirect ways (e.g. in logbooks, records of teacher feedback, or other traces of action).

In more challenging professional tasks, students also drew upon various characteristic artefacts-tools of professional culture – for structuring their ways of seeing, thinking and interacting with the world – and simultaneously produced various *practice artefacts*. For example, pharmacists were using interview templates for asking patients questions and recording important information during medication reviews; school counsellors were structuring their examinations for diagnosing students' learning difficulties using specific

behavioural testing instruments and procedures. The use and production of such practice artefacts were seen as part of the regular professional practices that students were mastering, while fine-tuning professional skill, knowledge and vision.

In complex professional tasks, students engaged in deliberative knowledge-producing work. This work usually involved production of two kinds of *conceptual artefact*: analytical artefacts and design artefacts. (We use ‘conceptual’ in a conventional sense, to denote an idea expressing a particular view or understanding. We do not limit this term to mean only formal disciplinary conceptual knowledge.) When learning professional practice required understanding some aspects of professional practice that were invisible to lay perception, students often engaged in purposeful inquiry and produced *analytical artefacts*, such as deconstructions, evaluations and reflections. For example, pharmacists were analysing medication information leaflets, and pre-service teachers were deconstructing lesson plans from a social justice perspective. These conceptual artefacts rendered articulate and explicit the ‘know that’ knowledge which should inform professional judgements.

In some tasks, students were producing *design artefacts* that not only informed, but also guided, professional action. For example, pre-service teachers were producing excursion kits, worksheets and other lesson resources before teaching a lesson; pharmacists were designing health promotion programs. These design artefacts embodied concrete solution and ‘know how’ knowledge suggesting how things should be done.

In other cases, students were making *epistemic artefacts* for creating situated knowledge for knowledgeable action. For example, pre-service teachers were designing case study packages composed of lesson plans, resources and descriptions of how these packages could be used in teaching; nursing students were creating best practice-informed guidelines for nursing procedures – to inform knowledgeable action in local professional settings. A distinguishing feature of these epistemic artefacts is that they contain knowledge for making links between ‘know that’ and ‘know how’ aspects of professional knowledge, and between conceptual knowledge – expressed in formal professional knowledge artefacts – and practical knowledge, expressed in cultural artefacts and situated actions. (In other words, linking ‘know why’ and ‘know when’.) In all cases, the knowledge and ways of knowing that students learnt through production of these artefacts was as important as the knowledge captured in these artefacts.

The fundamental epistemic differences between the ways of knowing that are enacted in the production of these three kinds of professional artefacts become clear when we look how they help bridge professional action and meaning. Much habitual professional work is mediated by cultural artefacts. That is, the link between action and meaning is usually established through direct repetitive practice expressed in action artefacts, where additional practice artefacts are often cultural by-products of this work. They are created by drawing on evolved human abilities to notice patterns, preserve useful ‘tricks’ and use the external environment to scaffold effective knowledgeable action (Sterelny, 2012).

In contrast, conceptual artefacts are the products of deliberative knowledge work (Bereiter, 2002). The link between the meaning and an encountered situation that demands action is established by engaging in analytical inquiry or design modes of knowledge production. These artefacts mediate knowledgeable action by giving explicit meanings to the encountered situation and possible actions, but they can be independent from concrete situated actions and the cultural artefacts that mediate them.

The epistemic artefacts join these two kinds of meaning making. They do not necessarily contain in themselves detailed situated knowledge that guides how a person should act (as cultural artefacts do). Rather, they contain knowledge that allows a person to produce such situated knowledge. Making these epistemic artefacts requires engagement in ways of knowing that bridge the knowledge that is traditionally embodied in conceptual artefacts with the knowledge that is carried over through cultural artefacts. Figure 1 depicts the continuum that emerges from these links.

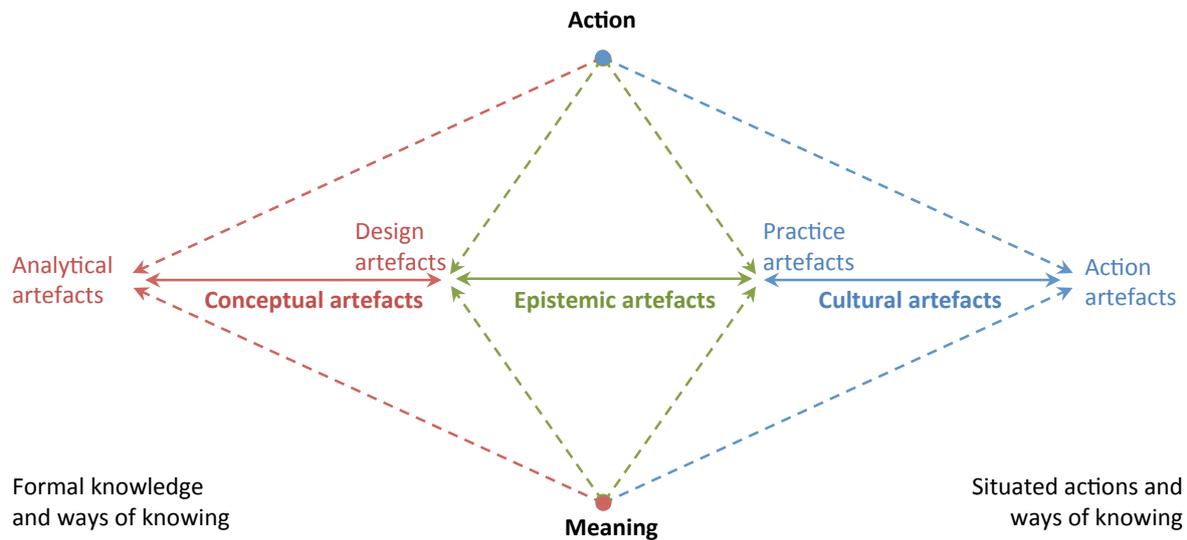


Figure 1: Relationships between the artefacts

Discussion and Conclusions

Several general insights emerge from our findings. Firstly, formative learning tasks and formal summative assessment are often seen as two separate and hard to reconcile kinds of tasks, with formal assessment tasks often done ‘after’ and ‘on top of’ learning. In contrast, many of the tasks we studied were simultaneously learning and formal assessment tasks. While the assessment design literature increasingly recognises that formal course assessments should engage students in productive learning activities (Gibbs & Simpson, 2005), the existence and potential of such developmental assessment (cf. Patton, 2011) tasks has not been widely recognised.

Secondly, our findings give new insights into how the tasks through which students learn capacities for knowledgeable action relate to authentic workplace practices. They show that students learn actionable knowledge by: engaging in tasks that directly develop and fine-tune knowledge and skill for carrying out professional tasks, and fine-tuning the ways in which they do this by sharpening professional vision and making professional artefacts. Most importantly, students learn for knowledgeable action by engaging with the core aspects of professional practice, and also by tackling hard, hidden and rare aspects of professional work.

Thirdly, engagement in professional practices is inseparable from production of different kinds of professional artefacts. Any attempt to make rigid parallels between authentic workplace tasks, particular kind of objects that teachers choose for guiding students’ learning and particular kinds of artefacts that students produce would oversimplify professional practices and learning. Nevertheless, some correspondences that emerge from the

juxtaposition of the objects and artefacts in our study are worth noticing (Table 3). The emerging pattern shows that learning of the core aspects of professional practice primarily engages students in the production of cultural artefacts, with only the *making* tasks being an exception. In contrast, tasks that evolve around the unusual (hard, hidden, rare) objects involve conceptual and epistemic artefacts and often draw on constellations of different artefacts. For example, pre-service teachers’ learning to teach the hardest curriculum topics is inseparable from careful planning (i.e., conceptual design artefacts) and production of teaching resources (i.e., complex practice artefacts).

Table 3: The strongest correspondences between the kinds of objects and kinds of artefacts

Objects of tasks	Core aspects of professional practice	Hard, hidden or rare aspects of professional practice
Doing: Fine-tuning professional skill and knowledge	<i>Key specific skills and/or knowledge</i> Cultural action artefacts Cultural practice artefacts	<i>Hardest elements of professional practice</i> Cultural action artefacts Cultural practice artefacts Conceptual design artefacts
Seeing: Shaping professional vision	<i>Core inquiry frameworks</i> Cultural practice artefacts Cultural action artefacts	<i>Hidden elements of professional vision</i> Conceptual analytical artefacts Cultural practice artefacts
Producing: Making professional artefacts	<i>Production of everyday professional artefacts of, or for, practice</i> Conceptual design artefacts Cultural practice artefacts Cultural action artefacts	<i>Production of generic artefacts for professional use</i> Epistemic artefacts Conceptual analytical artefacts Conceptual design artefacts Cultural practice artefacts

Note: The main kind of artefact that is associated with each object is in bold

Our research has significant practical implications for the design of tasks that students are asked to tackle in their professional preparation programs. As we have seen, different task designs lead to students working on different kinds of artefacts – cultural, conceptual and epistemic. In turn, this has implications for the specific capabilities they develop. The range and balance of tasks and artefacts should align with the intended character of the program. By this we mean that some programs prioritise the student’s ability to ‘hit the ground running’ in a specific (kind of) workplace – to be *work-ready*. Some programs prioritise the abilities needed move smoothly between diverse workplaces. Other programs emphasise the importance of capabilities needed to analyse unfamiliar situations and make recommendations for action – to be *work-knowledgeable*. Others again stress the importance of linking professional knowledgeability with skilful embodied action – being *work-capable*. Our research reveals clear parallels between cultural, conceptual and epistemic artefacts, on the one hand, and ‘work-ready’, ‘work knowledgeable’ and ‘work capable’ graduates, on the other hand. Good program design often involves finding acceptable trade-offs between competing educational goals. Concretely, this can mean creating the right mix of tasks that involve students working with cultural, conceptual and epistemic artefacts. Our research helps identify and distinguish between such artefacts, thereby putting useful tools into the hands of program design teams.

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