Rich picture systems mapping of capabilities and learner journeys

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ABSTRACT

There is growing interest in the application of frameworks such as SFIA for describing and managing competencies for ICT professionals and matching the skills of the workforce to the needs of the business. But there is no common overarching model that maps educational processes to such frameworks. Previous work has described elements of this mapping, but there are large gaps including those between SFIA and tools of education such as learner capability frameworks, graduate profiles and assessment rubrics. In this paper we construct a holistic, rich picture model of ICT professional education pathways. We explore the extent of knowledge and practices within this model and highlight good practice but show that there are several key aspects for which little is understood or articulated. We expect this model to provide a vehicle for further discussion and alignment of industry expectations and educational processes.

Keywords: educational design, capabilities, learner pathways, competencies, learner capability frameworks

1. INTRODUCTION

This paper presents a rich picture model of the landscape of a learner's journey from pre-tertiary all the way through their employment pathway. The model is focussed on the building of learner capabilities throughout this journey and identifies various possible capability building pathways. An attempt is made to give a snapshot of the use of capabilities and to utilise the model to identify gaps in identifying, developing and capturing learner capabilities.

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This Capability Rich Picture (hereafter "Capability Model") attempts to shows where capabilities fit into education and career pathways. It can be used to map what is known for a given discipline. As a case study of the value of this approach, the Capability Model was utilised at the Computing South Island Educators (CSIE) Forum 2018 in order to explore the approach of each institution in this area.

2. MODEL OVERVIEW:

The model is a form of a rich picture (it started out free-hand, but was three times tidied for presentation) which is a component of Soft Systems methodology (Checkland 1988). Bell and Morse (2014) describe how rich pictures are "provide a space for individuals to interact and share insights and a focus towards problem solving - initially at least by sharing in a diagramming process" (p332). The "challenge to the group is

to represent the problem context in which they are engaged… the picture itself is but a reflection of what may be an extensive discourse lasting for some hours, and all the stresses and strains of that discourse as well as conflicts and consensus will be within that picture" (p333).

The model is intended to represent learner journeys – so has both the education (on the left – Figure 6) and workplace pathways (on the right). The various frameworks provide the intersection between those two worlds – graduate profile/learning outcomes, capabilities, and skills frameworks. How are they related? How does this intersection work in practice?

As an example of the types of questions this Capability Model could be used for, we can consider the use in the IT industry of the Skills Framework for the Information Age (SFIA). The SFIA (Skills Framework for the Information Age) Foundation was founded in the UK in 2000, the successor to several skills-assessment initiatives attempting to define the general 'shape' of the IT industry at large. The basis and inherent utility of the SFIA framework is to provide a common context for referring to competencies and skillsets within the realm of Information and Communication industries, despite the variety and complexity of the ever-growing number of potential careers within them. Since 2000, the platform has been continuously updated through consultation and collaboration with its users, to reflect the current state of technological and practical progress. Putting skills frameworks on the Capability Model highlights areas that might be poorly understood: For example, how do they relate to graduate profiles, to capabilities etc? How are skills represented in courses? Are any of the skills frameworks explicitly informing career choices? How does it integrate with constructive alignment? (Biggs 1996, 2014). The model is not intended to give any answers, but to prompt discussion and questions that remain to be answered.

While the flow from left to right for the learner journey does put the educator's side first, it is useful also to read it from the right. Note also that there are alternative routes skipping the formal education structures.

3. MODEL DEVELOPMENT

The model was developed through a series of workshops. The first began as an attempt to understand how a learner capability framework could be used in IT education. The seemingly obvious (in hindsight) realisation that a model should place the learner at the centre of the capability system (Figure 1) was soon followed by the realisation that the model should map the learner journey (Figure 1 lower) and that a slightly different set of factors were at play in the employment end of the journey. At subsequent workshop the whiteboard model was expanded to what we thought at the time represented the whole system (Figure 2). Translating the model to a digital form brought some design principles into play - when reusing elements we were forced to consider whether the concept being represented really was a duplicate or something else (Figure 3). An earlier version of Figure 3 was circulated for comment and altered following feedback. Figure 3 was printed in a large format and used in a workshop with most of the co-authors present. It was heavily annotated (Figure 4) and several different versions were produced as small groups explored aspects of the model (eg Figure 5). These elements we consolidated into Figure 6.

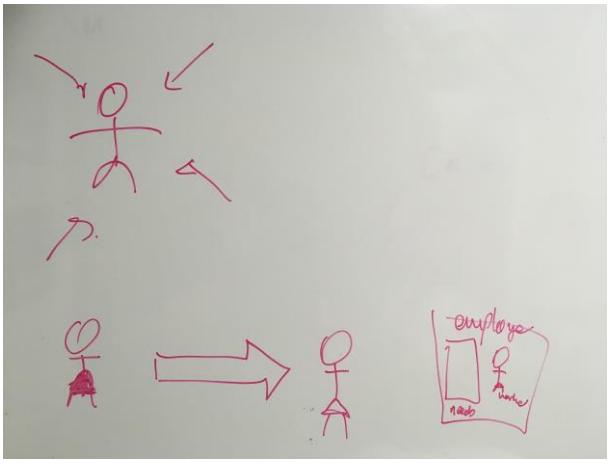

Figure 1: Learner at the centre – whiteboard model

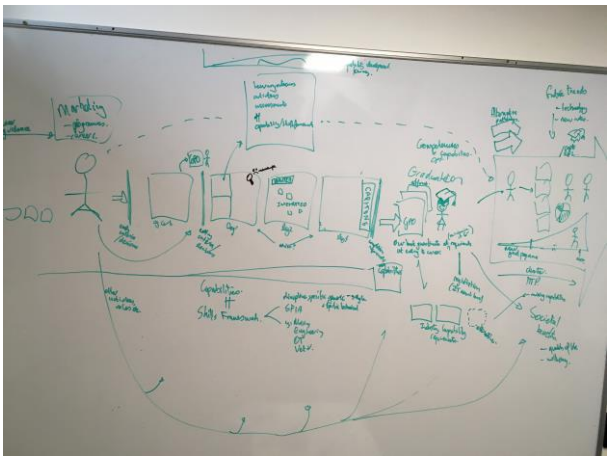

Figure 2: Expanded whiteboard model

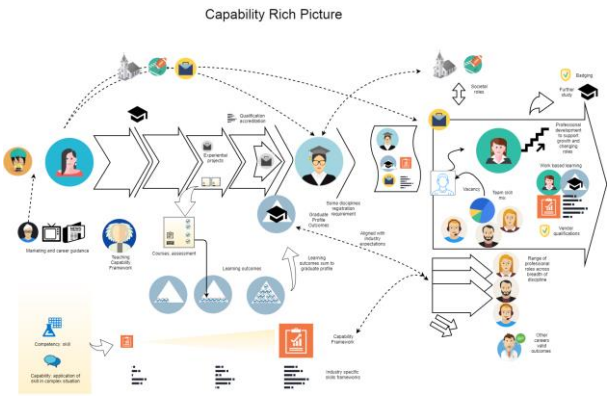

Figure 3: Digital version of the model

Figure 4: Model annotated at the workshop

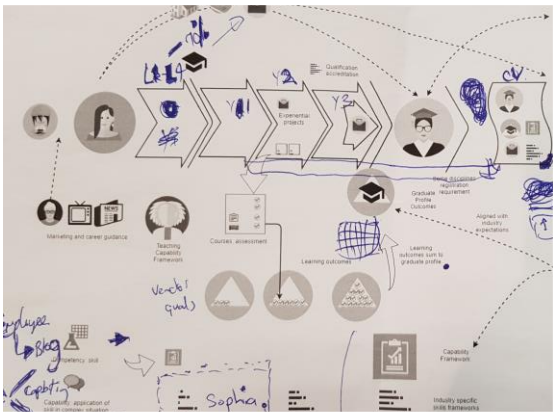
Figure 5: Example of small group work developing the model

4. Model Description

The model demonstrates a learner journey with the normal flow from the left to right (Figure 6).

We start with the learner entering the education process. They have been influenced by marketing and career guidance. There is an open question as to how much those systems have been influenced and informed by capability.

The learner progresses through an education pathway. Here we have represented it as a certificate perhaps with a graduation point and then going on through three more years. That is the four arrows, with the first arrow having the certificate graduation point at the end of it and then the three other arrows representing the three years of the degree.

The courses and the assessments build to complete each year and our usual approach is that the course descriptors for each course will contain the learning outcomes for that course and the assessments to deliver those learning outcomes. Then through the years of the programme those learning outcomes, add up to fill up the graduate profile. That is why it says the "learning outcomes sum to graduate profile". The graduate profile defines the person at the end of the degree. That is education's best attempt to define somebody who is prepared to begin a career in that discipline.

There is a question there as to whether we are actually assessing against the graduate profile. We do not tend to. We think that what we are tending to do is to assume that the graduate profile comes from the summation of the learning outcomes. The graduate profile of the actual degree is perhaps not made explicit to the learners.

Some disciplines also have a registration requirement, such as nursing, which happens in addition to the graduate profile elements. They have to then register as a nurse, following a few more months of work practice or possibly an exam at that point.

This is the education view, which is represented for all learners across the top of the diagram. This is only a part of what they are doing. They are contributing to society or taking part in society and family, as well as other things. This all adds up to who they are at any end point and there's a question about whether or not these things are being captured either in the graduate profiles or in the capabilities. Some people might take an entirely alternative route and not go through this education pathway at all. It could be that they go straight to the workforce but still arrive in the market at the end, being able to put up a list of capabilities and so on.

The learning outcomes that are our usual currency can be aligned with the development of capabilities and can be aligned with industry specific skills frameworks. In ITs case the SFIA framework fits into that that space. The capability framework is usually one that describes both generic and specific competencies - the things that you know how to do. The capabilities are how you do those things in particular when there are unforeseen opportunities or challenges. We have various processes for describing how the graduate profile meets industry's expectations of somebody with that particular qualification entering the workforce in that discipline. That is usually described in terms of the graduate profile.

We have systems for aligning that graduate profile with industry expectations through permanent external advisory committees and liaison committees at time of programme development. These expectations are refreshed in an ongoing way through those committees. There are also moves to align the capability framework with specific disciplines and of course the skills frameworks describe the skills required for particular jobs. There is a bit of an open question about the relationship between both the capability frameworks and the skills frameworks and the graduate profiles.

On the right hand side of the diagram, our graduate is able to prepare their CV which describes aspects of their

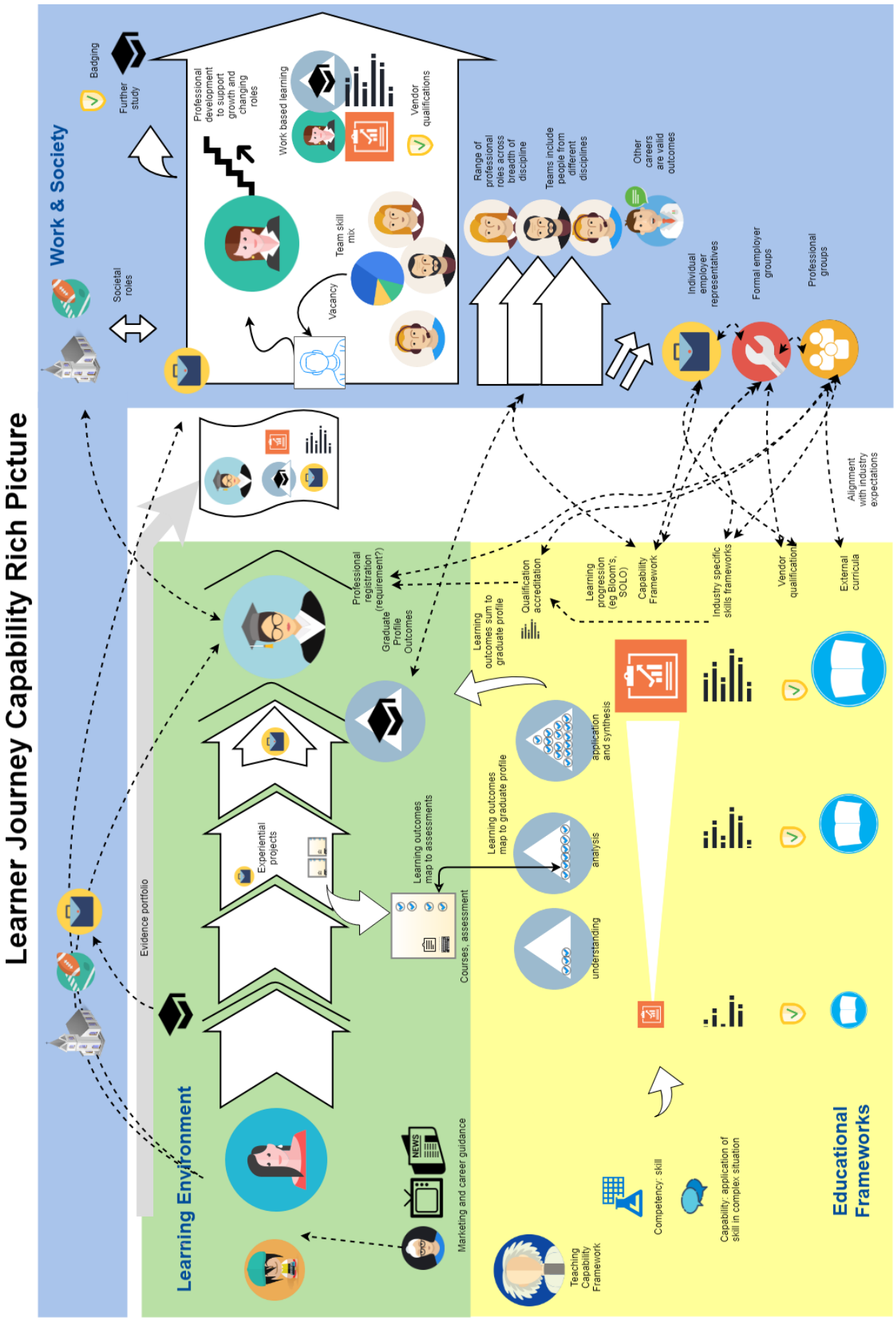

Figure 6: Consolidated model

graduate profile, the capabilities, the skills and ideally a portfolio of work that they've been doing.

How do they get a job from that? Well within the big arrow on the right hand side we're representing the world of work. We can imagine that in that work that the employers have teams and they do an analysis of the teams and the projects that they're working on and identify a of skills gap. Which they describe in terms of a vacancy. Do those vacancies use any of the graduate profile capabilities framework or skills? (This is an interesting question). They do sometimes describe a job as "this would be suitable for a graduate of a BIT (or equivalent)". They describe specific skills. They might say this person needs to have skills in some particular language or technology.

Then there is an imperfect matching exercise between the graduates and those jobs. It's not clear to the authors to what extent employers are using models such as SFIA or capability frameworks or indeed the graduate profiles to actually assess potential employees. Within the workforce people are on a range of professional development pathways, either applied or explicit, to support growth and changing roles. Within that there may be a type of work based learning, either formal or informal, that pulls together capabilities. They will possibly undertake vendor qualifications and/or some sort of badging. They may occasionally pop out of that "world of work" to complete postgraduate qualification. Alternatively, those postgraduate qualifications might be more closely aligned with the work that they are doing through a work based learning process.

Of course that is just describing one particular role that the graduate is doing. The employer is of course interested in a whole pile of different potential roles, which may come from different qualifications or may in fact need to be supported by the same qualification in some sort of generic way. The BIT, for example, supports both programming and infrastructure so the graduate profiles, capabilities and competencies need to be able to describe all of those.

Other careers are valid outcomes. We need to be able to support the whole range of careers that graduates may choose.

This model we have described is very much an instrumentalist view of the purpose of education because just as important is the other societal roles that people fill on the basis of their education. This includes how those wider roles build capability.

5. DISCUSSION

The model described above can be used for explorations of learner journeys through education and on into work environment and the relationship of capability frameworks to these journeys. The sections below explore some focus areas, using the model as a starting point for discussion.

Capture of richness of experience in portfolio: Even though indicative/contextual content is included in courses' descriptors within programme documents, that information is not always conveyed to learners in such a way that they can present what they have done to future employers. In other words there are layers of richness in what learners are doing that we don't necessarily support them in capturing in breadth and depth. How do learners talk to employers about relevant experiences/learning that relates to the employment opportunity? Is it just recall at the point in time or do learners have a portfolio that holistically shows the richness of what they have done. This could allow learners to prepare for a particular job opportunity by profiling evidence of the skills/capabilities that are relevant. Even though the employer may not look at hard copies of this, at least this allows learners to confidently talk about what they have prepared. As educators, do we pass on to learners what we know about the richness of what they are doing in the classroom? For example, Tai Poutini Polytechnic gives the learners a hard copy of the indicative content that makes up the topics/learning outcomes.

Evidence and relevance of life experiences in learning journey: Learners are often participating in other activities (e.g. running sport/club groups, volunteer work, paid employment) outside of their studies that build competencies/capabilities that are useful for future employment. How do they capture the evidence of these skills? Do we capture the evidence by assessing this evidence against possible relevant learning outcomes (RPL type processes), which then contributes to the graduate outcomes? Does the evidence get captured in a parallel "capabilities framework" that provides an output which the learner can use when applying for future employment? Do we assist the learner in assembling a CV (or other related portfolios) that can be presented to a potential employer that outlines these capabilities/competencies. This could include teaching learners how to present this information at potential job interviews.

Mapping beyond compliance: Traditionally learners are not aware of a qualifications' graduate profile. Programmes organise related graduate outcomes into learning outcomes, which inform courses or papers. Learners and academic staff become focused on the papers and specific content instead of the qualification as a whole.

Giving the graduate profile more prominence has the following benefits for learners:

- Making learners aware of how graduate profile outcomes (GPOs) map to course / paper learning outcomes.
- Making learners aware of what the NZQA level expectations are and how this maps to the graduate profile. Higher level equals greater self-management and increasing management of others.
- Learners become focused on the qualification as a whole rather than individual papers or even today's class.

Additionally, there are the following benefits for academic staff of more clearly using the graduate profile:

- Mapping makes learning design easier. Lessons and assessment tasks become easier to map to the

GPO's and fit better within the context of the qualification and level.

- Siloing of specialist subjects is less likely as their place in the qualification as a whole is apparent. For example, current NZQA non-degree IT qualifications map to the SFIA framework. Learners and programme staff get a more focused overview of how the qualification fits within the skill sets, competencies and future capabilities identified by the framework.
- As learners progress and specialise they retain an understanding of how their skills fit within the IT industry and greater employment spectrum.
- Programme staff retain an understanding of where their specific papers / courses fit within IT industry and greater employment spectrum.

Employer expectations: Employers are looking for a variety of soft and hard skills. Learners need to develop a portfolio from both the qualifications and the skills they have developed through life skills. The learners' portfolio needs to demonstrate those hard and soft capabilities obtained from both within the class and outside of the class (e.g. Leader as a Sea Scout). Learners need to look towards the types of skills employers are looking for early within their study so they can align skills to industry expectations. A good approach is adding skills, experiences and industry certifications they see as making them stand out for a future employer.

If employer expectations were to align to an industry standard or frameworks such as SFIA then creating graduate profile outcomes would be easier to align to a job profiles which would map more precisely. Employers could create job roles that are closer to an industry standard and easier to communicate through advertisements and in interviews. Learners would then be able to self-evaluate their suitability for those job roles as well and be able to focus on areas to improve on.

The learner portfolio should reflect both their skills and their ability to learn on the job, Internships offer an opportunity to both learn new skills and work within a work environment. Internships also allow potential employers to see if the learner is meeting expectations and they could feed back into the qualification if there are any obvious skills the employers determine are missing. Feedback could range from being part of an advisory board or a questionnaire/feedback survey. Open and timely feedback from the employers is vital to ensure learners are meeting the expectations. Basic expectations would include working in a professional environment, and professional skills, including time management and teamwork.

Explicit mapping as learning tool: There is an unwritten expectation on educators to incorporate a generic life and professional skill-sets forming a Core Body of Knowledge (CBoK) that supports their specialist skill-sets, and broaden their 'holistic persona'. Mappings between learning outcomes and learner capability frameworks have been done for compliance reasons, but few educators are consciously aware of the link. As such, it is now especially important to treat this mapping as a living document, and explicitly tie it to course documents and associated learning outcomes. This mapping should at the very least be a meta-document attached to the course outline that would assist the course developer/maintainer with CBoK style content direction and course coverage outside of the specialist subject matter. The benefit of this linkage is that educators can potentially improve their classroom behaviour; both specialist topic and holistic content.

It is convenient and useful to include holistic learning in learning outcome assessments. An example of this is having learners blog their labs, or projects. Within this media they can cover their specialist outcomes, but possibly more importantly, showcase their generic capabilities such as non-verbal communications skills, critical thinking, problem solving approaches, and so on. Another tool for showcasing the combination of specialist and holistic capabilities is screencasting. This media allows potential employers to hear the verbal communication skills and evaluate the teaching/help skills of the learner, as well as some of the technical/specialist skills. A collection (portfolio) of these would show the breadth of the learner's technical/specialist skill sets. The sharing of ideas/knowledge/discoveries is also beneficial to learning both specialist and generic skills. Learners benefit from sharing and discussing newfound knowledge.

Specialist/technical skill-sets: we should be presenting a range of specialist skill-sets to learners at the beginning of their learning journey. This range comes from within a framework such as SFIA. Presenting this to a learner at the beginning gives them the opportunity to have an oversight of their chosen specialty, and also the ability to self-manage their progress of their skills acquisition. This will also give the learner a view of alternative specialist options that they can change to, or spend their self-directed learning time developing additional specialist capabilities.

If these approaches are incorporated early on in a student's learning journey, this by default, grows their learning portfolio, and over time, will demonstrate their improved skills; both specialist and generic/holistic.

Other areas that were identified during the workshop process and would be interesting for future exploration are:-

- Portfolio throughout learning journey
- Skills not mapped to learning outcomes
- Career narrowing /decision points widening (3rd year projects to challenge them and widen them)
- Onus on learners to market themselves. - onus on us to expose them to frameworks
- Degree of specialisation
- Changing relationships of competencies and capabilities through learning journey (Figure 7 – initially drawn on the Capability Model but here as separate model of hypothesised relationships)

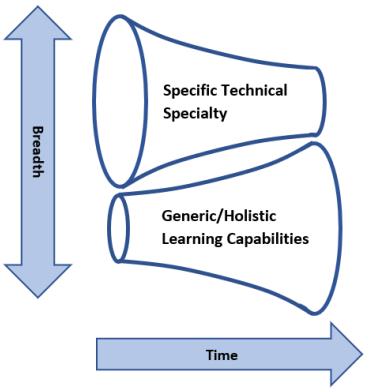

Figure 7: Hypothetical model representing relative contribution of competencies and capabilities

6. CONCLUSION

The model is not intended as representing an ideal world, rather a vehicle for discussion for what is and what is known/not known. It can also highlight differences in approach. For example, in putting it together, it highlighted for us the assumption that GPOs are required for graduation, but we do not actually assess against them. Rather we have the sum of assessments which we hope represent the learning outcomes, which we hope match the GPOs. It highlights other questions – for example how are capabilities informing marketing and career guidance? What is the relationship with skills frameworks? To what extent is education privileging employment, other societal roles and benefits of education? Are these other roles captured in capability? And so on.

We recognise that this model of the capability system is an education centric viewpoint. Further, this model was developed within an Information Technology context and even though it does not specifically limit consideration of multidisciplinary contexts, neither was multidisciplinary tested during model development – so while the model is discipline independent, it is in effect, mono-discipline. It would be useful to explore how the model could be adapted with the following quote as a provocation:

> Students graduate into a transdisciplinary world not a monodisciplinary one; a world of continuous flux, where technical and human factors constantly interact in complex and unique ways. It is a world where unpredictability and change are always in the air and our graduates' capability is most tested when the unexpected happens, an unanticipated opportunity arises, when things suddenly go awry or they are faced with a 'wicked problem' or dilemma". (Scott 2016b)

While the focus of this work is on a learner's education journey to employment, we have been cognizant of alternative (non-formal education) pathways, and the role the graduate in contributing to society (Figure 6). It would be interesting to further explore the role of education beyond the instrumental and a narrow employability in the Capability Model – how are we recognising purpose, integrity, emotions, agency and so on? (Daniels and Brooker 2014, Rooney and Rawlinson 2016).

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