



New graduates' knowledge of Software development works: what they need and how they learn

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Executive Summary

The process of preparing the new graduate software developers (NGSDs) by organizations to become productive team members is a challenging task on the parts of the organizations, likewise, starting job as a NGSDs is incredibly challenging time in the graduates' lives. This is because both the organizations and new graduates are challenged differently as both seek to bridge the gap between the skills taught in educational institutions, and the industry expected skill sets. These challenges coupled with high demand for software-development professionals in New Zealand, and this includes new graduates with a decline in the number of students enrolling in computer Science/Software Engineering in NZ meant that the old strategies, software companies were using to recruit and train staff had to change in order for them to stay competitive. Following the above preliminary knowledge, Jackstones is venturing on improving its new graduate's recruitment and preparation process and need to understand the proper ways to identify the knowledge needs of the new software-development graduates that it recruits and how to train them. This is aimed at positioning the new graduates into talented staff that the organization desires; capable of fitting its culture. Moreover, it is arduous to determine correctly the knowledge needs of the new graduates to work effectively in organizations without understanding this from the view of the organizations and the new graduates.

This study hoped that understanding the knowledge needs of the new graduates and how they learn once hired by organizations will benefit future hiring organizations:

- To recruit, train and retain new graduates that will serve as its intangible assets/increased its competitive advantage in the long term
- To develop new graduates capable of delivering reliable software products
- To guarantee that its employees know what they are doing
- To increase the possibilities of obtaining more serious outcomes for itself and its clients
- To understand/improve its recruitment/training programs for the new graduates
- To lessen its cost and lessen the challenges that it encounters with new graduate recruitment/training.

On the part of the new graduates, it is believed that this study will benefit them:

- To understand/reduce complexities of software development
- To understand the job they actually desire to do (career path)

- To understand different ways to develop software
- To understand specific knowledge to work environment
- To work well within the team and with the customers
- To cope with real/anticipated challenges
- To develop better industry knowledge for future career progression

The issue was investigated through conducting semi-structured interview involving 6 participants out of which 4 were new graduate software developers. The others were an expert software developer and a manager respectively. All interviews were conducted via Skype's call; each lasted between 30 minutes to 1 hour and was audio recorded/transcribed. The data were analysed through thematic content analysis supported by a literature review and taxonomy of the knowledge framework was applied to the data to categorise the types of knowledge found during the investigation.

This case study was conducted on Jackstones, a New Zealand based software development/Information Technology Management Company. It is a large organisation that recruits and develops dozens of software developers annually, and this includes a big number of new graduates. It is an award-winning company whose products and services contribute greatly to the IT sector in NZ.

On one hand, it was found that the organisation faced a set of challenges in enrolling and preparing new graduates each year. It too faced enormous challenges in finding talented graduates to recruit. These were as a result of the decline in the number of students who enrol in computer science and software engineering courses. Furthermore, there is an increase in the number of companies needing the graduates in NZ. On the other hand, the new graduates that it recruits also faced a lot of challenges such as challenges of understanding the project size and complexities, lack of project-related knowledge/uncertainties, pressure due to less time to learn and the need to do the actual work. It was moreover, found that the knowledge the new graduates brought with them were not explored properly by the organization. Further findings were that substantial knowledge gap exists between what the new graduates knew and what the organization needed. A common, example was the lack of soft skills, such as communication and people skills, which contributed to the challenges of training them, etc.

The study concluded by recommending that the organisation places more emphasis on soft skills when recruiting and to recruit on core competencies rather than on knowledge. It should adopt the use of more interns to create rapport with the students and the universities to attract these students before they graduate, and so on.

1. Introduction

Jackstones Limited, a New Zealand based large software development/ Information Technology Management Company is always confronted by the challenges of finding talented software developers who can also suit its culture. It has used the traditional ways of advertising for jobs to recruit graduates and this worked, but it can no longer meet its needs through this source alone. The advent of graduate recruitment programmes means that the organization faced a different environment than they had a few years before because lots of other organisations were competing for the same recruits. On one hand, these challenges have taught the organization that efforts to invest in building software developers' knowledge worth it and should be taken very seriously to produce employees who fit its culture and are not likely to leave immediately, hence its employee retention rates are enviable. On the other hand, finding suitably qualified, experienced and talented software developers are difficult with lots of companies competing for fewer job candidates. In addition the number of students entering the software engineering and computer science degree or related degrees, which it needs the most is going down in New Zealand while the demand for these talents is increasing and has forced the organization to be recruiting more recent graduates. However, the organization was concerned that what the graduates are taught at the undergraduate does not complete what the industry needed. According to Nike Slater, one of the graduates:

“When I first joined my organization the size of the project seemed really big and really hard to get my head around it. I felt so lost, especially at the beginning like I don’t have enough knowledge. How am I going to complete this? Those were the sorts of personal challenges that made me to feel - am I okay to be here? I remembered getting lost lots of times and sitting beside someone more senior to go through stuff, which highlights the little, I knew. But they did tell me that it would be like trying the deep end and just giving it a go.”

Similarly, William James, a recent software developer graduate within six months of start at Jackstones narrated his experience:

“We pretty much started work straight away on the first day, split up into teams. We were two graduates in my team and were given a task to add a dropdown list to an existing project. It took us forever to do it because we did not know how to do it; the code was much more complex than we have ever seen before. So doing one simple thing took us a long time, it was a lot of guess work until we ran out of ideas.”

Dr Jake David, manager at Jackstone explained that recruiting and training new graduates had a lot of challenges:

“First thing we are looking for bright, energetic, engaged and intelligent students who are keen on developing their career in software development, but we are also expecting that they really don’t know what that mean. So when they come on-board they learn how to write code and build few other things, and we know they really don’t always know what they want and what software development is all about, so we know we have to teach them about that too, and we got a reasonable amount of work to do in doing that.”

Dr Jake David was contemplating how he could transform the training of every new graduate Jackstones Limited recruits into talented employee in light of all unfavourable external environments. Specifically, how could he leverage the organization’s knowledge management system to transform the on-boarding process of the new graduates to reposition his organization’s intellectual capital in view of creating sustainable competitive advantage in the long run? Given that the industry expectations vary significantly with what the graduates are taught by the academic institutions, how should Dr Jake and his organization continue to train these available graduates to become the best talents they need? Especially, what is the software-development project-related knowledge the new graduates require and how should they learn?

1.1. Software development industry in New Zealand

According to the New Zealand Software Association, New Zealand has a vibrant software sector. The firm culture of technology innovation and problem solving, and weightless nature of software makes the industry an attractive export industry. In addition, the lifestyle in this country encourages the attraction of highly mobile software developers who could live anywhere they desire (Nzsa, n.d.). Most importantly, New Zealand is internationally renowned for its entrepreneurial, creative and innovative edge. This could be seen in the 2014 Global Innovation Index which ranked New Zealand 18th in the world, (Gii, 2014). Combine these with the ado of recent success stories; software development in New Zealand has rapidly become a beacon of modern innovation. Furthermore, New Zealand’s excellent infrastructure and demographics make it ideal for market testing. New Zealand’s information and communications technologies (ICT) sector is diverse, extending wireless infrastructure, health IT, digital content, payments, geospatial, telecommunications, agricultural engineering,

shipping, logistics, and primary industries, security, defence, virtual reality and entertainment industries (Nzsa, n.d.; Newzealandnow, 2015).

As it stands, the New Zealand IT industry contributes nearly NZ\$20 billion to the national economy (Workhere, n.d.). This figure is likely to rise, given the unrestrained growth of the market, and international demand for what comes out of this region of the globe. The recent calls for the construction of a mini Silicon Valley in New Zealand, signifies demand for skilled software developers is strong in NZ, so employment prospects are really encouraging. There are around 2,300 businesses in the sector employing about 46,000 people and the continuing background demand for staff in the ICT business continues to grow (Workhere, n.d.). This is why IT industry in New Zealand is experiencing a sustained shortage of ICT skills, and it is forcing software companies to bring in migrant workers if not carry out the development overseas because they cannot find local programmers to perform the work.

1.2. Background story of Jackstones

The history of Jackstones dated back a pair of decades ago. Its original intention was to become a trailblazer in the technological innovation in New Zealand. It is headquartered in New Zealand and also holds several offices outside New Zealand, such as in Australia, and so on. It consistently developed with huge experience and achievements in technology in New Zealand and the other nations within its network.

Over the course of the past half a decade, the company had grown from strength to strength to be one of the largest software/IT Management Companies in New Zealand. Presently, its products and services made up nearly 13.4% of the technology sector in the entire country. It plans, builds and operates IT systems and process for business and possesses a wide scope of partnerships with leading organizations in hardware, software and other IT products. As the realization of the works and Technological achievements by Jackstones, it has received numerous numbers of industry awards hosted by organizations like: Microsoft, EMC, HP, CISCO, VMware, and so forth.

Jackstones Limited services support both existing IT systems and processes and custom-designs brand new systems too. It knows that seamlessly incorporating new and improved technologies that deliver tangible benefits often poses some complexity for organisations. Hence it has built proven history in delivering highly complex integration software projects that serve the needs of some of these organizations. As explained by Dr Jake David:

“Our goal is to use our deep technological know-how in order to present a commercial return for our clients. We are aware that cleverly applied information technology causes a demonstrable difference to our customers’ businesses. This encourages our partners and they trust our service scope, and complexity is outstanding, our infrastructure unlikely to change, break, or collapse, and our local knowledge accurately perceptive.”

Within Jackstones’ technology portfolio includes, but not restricted to:

- Custom software development services. It builds and enhances all types of systems for public and private sector clients and had about 870 software developers actively working on these projects.
- IT management, such as information technology procurement, operations, support and management
- Cloud services such as infrastructure offering, platform as a service (paas), and software as a service (saas)

Dr Jake David attributed the success of his organization largely to its unwavering commitment to deliver; great people with inordinate skills, keeping abreast of technology trends, embracing and understanding new disruptive paradigms and how these will impact its clients and its delivery capabilities. He adds that his organization’s expertise comes from more than 5 thousand staff, working in different offices across Jackstones’ network.

1.3. Why common organisational knowledge about software development matters to Jackstone

Software-development work is a knowledge-intensive activity. For Jackstones to be able to deliver innovative, creative software services for its customers, it requires sound knowledge of its employees. This explains why it is very important for the organization that its employees be trained to a standard despite their academic qualifications. These employees form major part of its intellectual capital, which is its unique resource for achieving competitive advantage in environment like New Zealand where IT is booming and competition fierce. In the words of Dr Jake David:

“Developing software is a pretty complex business and getting an outcome from it is quite difficult and everybody having a common understanding of what we do and the ways we work are absolutely critical to getting a good outcome for the customers. But we don’t have one way of building software; we got a thousand different ways to develop software to deliver customer

requirements, so, we have to be able to adapt to all these different ways and not just to be able to work only in one way.”

Dr Jake David emphasised that his organization depends more on intangible assets, such as knowledge of the employees, than tangible. He explains that, software development unlike other trades, require the know-how of the developer and ability to work well within the team and with the customers to achieve the desired outcome. He, however, regretted that some software developers fail to understand that talking to the customers is part of software development. He attributes this myth as the cause of failure of this group of individuals to describe and organize the knowledge required to capture the software specification from the customers. Hence, having common software-development knowledge means the capability to deliver reliable software products than not, which is the hallmark of Jackstones. Without common knowledge of the software, the organization cannot guarantee that its employees know what they are doing or should be doing.

1.4. Recruitment and On-boarding at Jackstones

The Jackstones' graduate recruitment programme involves the organization's Human-resource representatives travelling around the universities in New Zealand to compete with other recruiters in recruiting the best graduate talents available. The organization considers its programme a success. According to Dr Jake David, through this initiative Jackstones had been able to invest in and recruited new graduates to support its operations. However, this is not the only source through which it recruits graduates as its estimated annual new staff intake stands at 600 people. It still recruits graduates via the traditional process of individual curriculum vitae/application submission and more recently via Job fairs. Jackstones' annual new staff intake is huge, especially with about 50 to 70 of the recruits being new graduates with little or no knowledge. This is where it gets sticky for the organization due to the challenges that it faces in meeting the knowledge needs of the graduates to achieve the quality that it desires. According to Dr Jake David:

“... We have a very strong structured graduate programme which brings in 25 to 35 people twice a year and there is really quite a lot of work to make their transition go well. ... So we expect six months or more work that we need to put into them to get them up to speed and to get them to function as part of the team. I suppose we expect them to challenge us, we expect them to engage well with the wider team. We expect that they, like I said won't really understand the job they actually want to do because there are so many roles in the software engineering community, so it will take more of figuring it out.

Also, we expect to be surprised, we have had a lot of graduates that come in and were very good very quickly; I mean those are some of our expectations. “

In her own remark, Ms Helen Gardner, an expert software developer working with the recent graduates at Jackstones explained why it is important for the organization to recruit more talented people to work with:

"We want more talented employees because we are a flat-structured organisation and we envision our mission to supply highly effective high-value IT services to appreciative clients, hence there is a constant flow of projects that stir and draw in people. This leads to low turnover, and that means employed workforce capable of creating some astonishing great work that does not get publicity, and that is okay with us."

She further adds that Jackstones believes in the value of people's expertise and initiative, applied topically and then amplified by company can-perform; hence, attracting the best talents means the company will beat their competitors through its own unique business ideas than otherwise.

In an effort to understand, how the graduates are trained to meet these expectations, Ms Helen Gardner explained:

"When graduates are struggling, we try to advise them not to do things in unique or different ways from every other person, rather to try to see what others are doing and follow the pattern. If the project has an established pattern and habit, we can only get the new graduates to learn that and stick to it rather than working differently within the team. We teach them to learn from others who have done or are doing it, because they have to work well within the team. “

She further explained that graduates were allowed to learn by a bit of trial and error and through observing what others are doing, such as: reviewing modules from the existing systems and getting help from others to interpret the codes. She adds that not understanding the projects the graduates are working on is one of the major sources of frustrations and challenges the graduates experience but having someone to help them understand the code helps.

"Sometimes I looked at codes, but could not understand why things were done the ways they were done, and I needed to ask others why it is the way it was and that's how I learned the modules."

In a related question on the essential knowledge that graduates lack and struggle to learn, Ms Helen Gardner identified soft skills as the major knowledge that graduates are challenged in learning.

“Soft skills are not easy to learn, I guess it is again about being open-minded and keen on learning. The best one can do is to suggest the right things, and it is the graduates that will choose to learn the best practice, like trying to learn new skills and blending with their teams to learn their processes and learning from others doing stuff.”

She valued soft skills as most important knowledge area needed by the graduates and suggests that computer graduates have good technical skills or can pick things up very quickly nowadays; however, she noted that technical skills were more important for the start.

“When I started in the organization 10 years ago, I knew basic programming, but not the technologies they used at the time. I did not have any experience of any of the technologies that I needed to develop the web projects starting from the database up to the middle tier with the front and web tier. So I was faced with picking up more than one technology from scratch at the same time, hence technology knowledge is important for the start. Then I gradually had the opportunity to be more involved in the production support role that exposed me to more than just development and being able to deal with the customers directly.”

Despite these efforts and understanding of the organization’s perspectives, recent interviews revealed issues both in the organization and for the graduates. Given that both organizational and graduates still face challenges on the current approach to recruitment and training of the graduates at Jackstones is it time to review the approach? How could Dr Jake David and his organization understand and support the challenges of the new graduate software developers through their early months? Could they create a more systemised understanding of how new graduate developers build professional knowledge?

2. Introduction to analysis

2.1. The Significance of the problem investigated

The process of starting job as new graduate software developers (NGSDs) is an incredibly challenging time in the life of the graduates, likewise, preparing NGSDs by organizations to become productive team members. This is because both the new graduates and hiring organizations are

challenged differently as both seek to bridge the existing gap between the skills taught in the academic training of the new graduate software developers and the skill sets the industry expects (Rynes, Orlitzky, and Bretz (1997; Cappel, 2001; Lee, Koh, Yen, & Tang, 2002; Stroustrup, 2010). The challenges, and associated coping strategies are of concern to this study, in that they can make or mar how the career of the graduates progresses or how the organizations support their operations. Particularly this study concerns with immediate graduate software developers as it aspires to understand their knowledge needs to be productive organizational team members and how they learn once hired by organisations. This problem has led to all Software developers experiencing common *dejavu* of passing through rookies to experts, at least twice in their careers – firstly, when they enrol in their Information System Development (ISD) studies, and secondly, when the reminder reappears as they take up their first ISD roles within organizations (Begel & Simon, 2008). At both times, the graduates face similar challenges of needing to acquire new or additional knowledge and new learning schemes. Likewise, hiring organizations are faced by the difficulties of properly identifying the knowledge needs of the new graduates and how to train them to become productive within the expected time frame, and this are with each new hired graduate.

Annually, many new students of Information Systems Development (ISD), graduate from universities, and other higher learning institutions and as much makes the immediate topsy-turvy move into the ruthless competitive world of business. By good fortune for some, the journey will be easy, especially if they had already performed some work-based learning like internships and have experienced working in different contexts and environment. However, for the majority of the new ISD graduates, this can be quite challenging due to gaps in knowledge/learning issue as above. In the first place, graduates need profound professional knowledge about methodologies, development processes, development tools and environments, which, if they are lucky, they may have learned some through their formal education. So it is the hope of this study that understanding what the graduates go through from the organisational perspective to meet their knowledge needs holds the solution to resolving this problem for all concerned once and for all. It will benefit both the new graduates and their hiring organisations to understand the knowledge required by NGSDs and how best they should learn given that knowledge needs of ISD professionals change as their career advances (e.g., Kovacs, Davis, Caputo, & Turchek, 2005; Lee, Yen, Havelka, & Koh, 2001). In the words of Heraclitus, change is the only constant thing in life (Muessig, 1969), and the power of his speech is stronger than ever in ISD environments. As learning will never end in this field and therefore, the beginning of the many challenges that the graduates

will face, it is important to understand the knowledge they require and how they should learn. This will help the organization properly manage and support the full potential of the graduates.

The problem leads to inefficient utilization of the company's time, the new graduates' time and resources by extending the employees' man hours once hired through time spent in assuring that they gained the required knowledge to be fully incorporated into the ISD projects' members. Significantly, it places stress and challenges on the new graduates and financial burden and stress on the organizations and has in practice put off some organizations from recruiting new graduates. Rynes et al. (1997) found that organizations recruited larger proportions of experienced workers (rather than new graduates) to the extent that they were growing rapidly and had short-term staffing strategies, older workforces, and fewer dynamic business environments. This could not have been more unreasonably unfair when clearly graduates are unable to acquire that experience without landing the first job. Given the economic and demographic changes that are heightening the importance of employee recruitment and retention (Rynes & Cable, 2003) this is clearly a problem that needs a solution to better the predicaments of both the new graduates and organizations.

It is good that this study has identified this problem, but significantly, it recognised that oftentimes, some problems are best solved from the perspective of those who knew the problem or who are helping those experiencing the problem. This is why the researcher spoke with current and former graduates at different stages of their graduate employment programs to get their understanding for upcoming graduates on what they need to be able to work effectively in organizations when they graduate and how they should expect to learn.

2.2. Justification of the Significance of the Problem

This study thinks that knowing the knowledge NGSDs need and how they learn after graduation, will contribute to quicker, easier and successful transition of the ISD graduates in their new environment. Organizations annually, need to increase or replenish their workforce, due to employees retiring or leaving. In addition, organizations do grow and may need to expand, which may require them to hire more staff. In any event, finding qualified/experienced software developers may be a safe option but not always possible. In such position, the best alternative for organisations is to hire new graduate software developers, to augment their staff shortage. However, hiring and training new graduates have long term advantages

(Rynes et al., 1997). It also has the short term disadvantage which involves the difficulties of properly identifying the knowledge and skills the new graduates need and how they should be trained (McMurtrey, Downey, Zeltmann, & Friedman, 2008). This is tough work, and organizations have different approaches to it based on their socialization processes. According to Ashforth, Sluss, & Saks, (2007) how new graduates are socialized has substantive and symbolic value above and beyond what they really learn. Hence, properly identifying the knowledge needs of the new graduates and how to teach them will go a long way to cut down the time needed to get the graduates up to speed to become productive in their new roles.

The above state of affairs at the moment means after struggling to find and recruit new graduates that had the potentials organizations looked out for. It does not guarantee that the graduates will be successful in meeting the expectations of the organizations within a time frame due to the challenges as above. Not only does this burden the organizations, it partly contributes to the challenges that new graduates and in particular, NGSDs face with being employable. According to Yorke (2006) graduates' employability is a set of achievements- knowledge, intelligence and personal attributes - that make the graduates more likely to gain employment and be successful in their preferred occupation, which benefits themselves, the organizations, the community and the economy. However, employability is rarely obvious and clear (Muhamad, 2012), due to not knowing what the graduates need and how best they should learn. Furthermore, it is challenging to articulate, assess and evaluate workplace learning given that it is implicit, affected by a higher level of unpredictability than found in the classroom setting, and context dependent (Hager, 1997; Hughes, 1998). These hints that understanding what the graduates go through from organisations' perspective to meet their knowledge needs holds the solution to resolving this problem for all concerned and therefore, justifies the need to conduct this study.

2.3. Selected Analytical Frameworks and Justification of their Significance

One of the hypothetical descriptions that can be applied to this study is "body of knowledge for professionals by Iivari et al. (2004), extended to include ISD project knowledge as in figure 1. It combined the work of Freeman (1987), who distinguishes technology knowledge, application domain knowledge, and systems development processes knowledge with organizational knowledge identified by (Jones & Walsham, 1992). The

framework is concerned with actions that Information Systems experts should take when striving to make high-quality systems referred to as an action-oriented body of Knowledge that could inform practice if it was made more accessible (Iivari et al., 2004).

Figure 1: Body of knowledge framework for ISD professionals



Adapted from: Iivari, J., Hirschheim, R., & Klein, H. K. (2004). Towards a distinctive body of knowledge for Information Systems experts: Coding ISD process knowledge in two IS journals

In addition to the framework above, 'Team Mental Model' could also be considered here to analyse the ISD project knowledge. Team mental model refers to an organized understanding of pertinent knowledge that is divided up by team members (Cannon-Bowers, Salas, & Converse 1993; Klimoski and Mohammed, 1994). This is relevant as software-development projects are usually carried out by teams, and the model can be used in predicting team's performance. According to Cannon-Bowers et al (1993) a team is most likely to be effective if it shares four mental models, which includes:

- The equipment model
- The task model
- The team interaction model
- The team model

The Taxonomy of Knowledge by Yim, Kim, Kim, & Kwahk, (2004) could also be used to dissect the data for the knowledge types involved. This consists of three types of knowledge, namely: Know-what, Know-how, and Know-why, see figure 2 for details.

Lastly, inductive approach could be used to analyse the data, especially given that not a great deal is already known about the problem being investigated.

The investigation spent a total of six and half hours interviewing participants made up of four new graduate software developers (NGSDs) in their first six months to about one year of employment at Jackstones; an expert software developer and the manager of software development at Jackstones. The graduates were recruited voluntarily and asked to recall their experiences from the time they started at Jackstones and covered their current experiences.

3. Analysis

3.1. The methodology used to gather and analyse data

3.1.1. Development of the Interview questions

The interview questions were developed using a literature review. The literature review revealed that several of the studies used similar areas and skills in their research instruments. For example, the majority of the studies included a personal skills area which comprises soft skills, team skills, and critical and creative thinking skills. All investigations included programming abilities and other proficiencies. Overall, the review indicated that the skills required by ISD professionals are generally placed into four classification areas: Information Systems main knowledge, proficiencies, business expertise, and personal attributes. In addition, some professionals within my network in ResearchGate.net were asked some of the questions regarding the planned interview for clarifications.

Following the above a comprehensive list of skills were collated and examined before the preliminary interview questions were developed and ran through my supervisor and adviser. Their input resulted in minor changes, which led to the submission made to the Human Ethics Committee (HEC) for approval. This original draft was further adjusted (see the interview questions as contained in Table 3 in the Appendix).

3.1.2. Participants

A total of six participants were interviewed, lasting between 30 minutes to one hour. The initial plan was to recruit a total of eight participants, which would have included two new graduates with at least one to three months experience to capture what they know while it was still fresh in their minds. Unfortunately, due to the timing of this study, this was impossible. So, instead, four recent graduates with six to one year of experiences were recruited and asked to recall their experiences from the time they started at Jackstones and covered their current experiences. All participants were working IT professionals; including programmers, analysts, IT projects leader, etc. The majority of participants were male and only one participant was a female. All the four of the new graduates have a Bachelor's degree, while the expert and the ISD manager in addition to a Bachelor's degree held postgraduate degrees. The age of the participants was predominantly between 25 to 48 years. Job functions varied, although programming (development and maintenance) was their primary tasks (some participants held more than one job functions).

3.1.3. Interview process

The data were collected through semi-structured interviews conducted via Skype's audio call for all categories of participants. Each interview was audio recorded via Pamela, a plugin for Skype and notes taken, with the permission of participants. The notes were used to validate the transcriptions of the recorded data. This ensured that only relevant data were extracted from the recordings of each interview. The categories of participants selected were required to provide different perspectives of both organization and individual ISD graduates at various stages. The new graduates' experiences between zero to one year spanning from the start of their employment to their current experiences, plus several years of experiences of the expert and the manager were captured, compared and analysed for better understanding.

3.1.4. Analytical approach

In the introduction to analysis section, this study suggested a couple of analytical frameworks / an approach that could be applied to the data

gathered. Eventually, the decision of the study was to use an inductive approach to analyse the data. This was because as the data were collected the researcher determined based on the nature of the data and study that it would benefit the study to analyse the data with little or no predetermined theory, structure or framework. The aim was to derive the structure of analysis via the actual data itself. This approach, though comprehensive is appropriate where little or nothing is known about the study phenomenon, as in this case (Lathlean, 2006). Specifically, thematic content analysis approach was used on the data. This choice was favoured because it is the most common approach of data analysis used in qualitative work (Ritchie, Spencer & O'Connor, 2004).

As the data were collected from each interview, it was transcribed on a word document. This was followed by scanning for themes and isolating identified related themes using the text-highlight colour features. These formed the preliminary themes. Realizing these initial themes, the researcher collects together all the words and phrases from all the interviews onto a set with duplicates removed. Lastly, the overlapping or similar categories were grouped jointly through iteration until the final themes emerged (Pope, Ziebland & Mays, 1999). The themes discovered, such as "Task relevant knowledge," "Task evaluation and feedback process," "Project complexities and size," etc., was focused on by looking at the literature to explain the use of the themes better to reflect how participants were using them. These were categorized into three groups, namely challenges encountered; types of knowledge involved and coping strategies used (see Table 2 in appendix for details).

Following the above process, the Taxonomy of Knowledge framework (know-what, know-how and know-why) was applied to organise the findings about knowledge discovered at Jackstones.

Lastly, the knowledge gap that exists between what the new graduates knew prior to starting at Jackstones and what they learned with zero to one-year experience inclusive was summarised as in Table 1.

3.2. Findings

3.2.1. Challenges associated with recruiting and training the new graduates

3.2.1.1. The challenges encountered by the organization

The organization believed that it was important to manage its new graduates' knowledge and learning uncertainties and has programmes in doing so. Its practices in training the new graduates to get them up to expected speed capable of fitting its culture started with the induction of the graduate which covers a whole lot of different activities, ranging from making them aware of what Jackstones is about, what its expectations are, what the rules are, and how it works. The graduates get put into the teams, and assigned support persons, and there was feedback between the graduates of the current year from the graduates of the previous year.

Despite these arrangements, the investigation found that the efforts of the organization have not realized the desired expectations completely.

- **Lack of soft skills:** Jackstones reported issues of lack of understanding by graduates that it needs to be more than just writing the code. It was found the organization faces the challenge of teaching and convincing some of the graduates to change their false belief that the work of software development/engineering does not involve talking to the customers. The organization complained that this issue makes the graduates not to be convenient talking to the customers and therefore, not comfortable defining things and writing things down. It was determined that this problem was absolutely a soft skills issue, and it gives the organization challenges to overcome because soft skills are hard to be taught.
- **The Intake and preparation of a large number of graduates:** It was found that the organization recruited about 25 to 30 new graduates twice yearly. This means that it is faced with the challenges of identifying the individual knowledge needs of these new graduates to understand what each required to learn and how best to match this learning needs with available resources.
- **Starting to train graduates on the technologies they have neither knowledge nor background in which results in longer periods of orientation:** It was found that due to difficulty recruiting enough suitably qualified computer science and software engineers, the

organization sometimes employs graduates from other disciplines who have no software-related background, but who have an interest in writing codes and trained them from scratch. These new recruits pose more challenges to the organization due to the time, and resources needed to get them to the standard that it desires.

- Difficulties getting the talents whom Jackstones want from the universities: Hiring talented individuals is critical to an organization's success. However, in order to hire the well-endowed, the organization must recruit them first. This is a challenging task for Jackstones as it is difficult for it to find enough graduate to recruit. It faces enormous challenges in dealing with this issue as it has no influence or direct control over this, though it would want the situation improved.

3.2.1.2. The challenges encountered by the graduates

As described above, the organization is doing what it thinks and believed serves the best interest of the new graduates that it recruits and trains, especially, the new graduate software developers (NGSDs). However, based on the analysis of the interview data, this study found that its graduates still face lots of challenges. Almost all the four recent graduates felt uncertain about job environment, projects, products, and technologies. They also had ups and downs and faced technical, personal or organizational challenges. Specifically, most graduates reported challenges of:

- Lots of self-learning to prepare for the tasks graduates worked on: This challenge was easy to see as it has a direct link with lack of task-relevant knowledge. There was the need to know, which meant that the graduates had no option but to resort to informal socialization where formal socialization was inadequate or non-existent. An example was found in the response the graduates gave to a question on how well they learn and integrate into ISD projects they work on. In his response, Ian Norman stated:

“I think I have got to a point I don't need to learn much to do projects now, but before I used to get stuck and try several times and needing to steal some time off the seniors to work me through, but I try to limit it as much as I can because they are really busy. Otherwise a lot of it was self-taught, a lot of self-learning in my case.”

- Not having enough time between learning and the need to carry out the task: There was evidence of stress and pressure on the graduates to learn and at the same time meet the deadline. While this was expected, it was felt by the graduates as a challenge that should be resolved to allow them time to learn and work efficiently and not under pressure. An example of this perceived challenge was seen in the graduates' response to a question regarding additional knowledge they need to acquire in order to work more effectively. In response, William James stated that he needed to know more about Model View Controller (MVC) architecture, as almost all his team's projects were based on it. According to him:

"I need more actual training in that area of MVC. I need to get a chunk of the project and work on it for a decent amount of time to understand it better, i.e. from knowing nothing about the project to understanding it very well. Though this is difficult in my team as there is never down time, so not enough time to learn this at work due to the time factor, and I am too busy to learn it after work as well."

- Feeling that the available support is inadequate. Although the graduates admitted getting all the support, they can find attainable in the organization, they felt that the current support system is not enough and needs to be improved. For example, Ian Norman explained his perception of inadequate support:

"There have been sometimes I felt under-supported, but I think generally at all that times I had gotten all the supports that I needed. So it feels like I need support even when all the support that I needed had been given to me."

- A perception that feedback / evaluations of work done are not adequate or standardized: Graduates were of the opinion that the codes that they work on are not evaluated in a formal way. They are concerned because they need to know if the codes they wrote will still be useful soon hence they wanted Jackstone to establish a conventional guideline for feedback and evaluation of their work compared to how it is done. As expressed by Martin Smith:

"I felt there should be some kind of peer review or senior review policy, although I am doing the codes, in the next couple of years will what I did be valid and useful?"

- Lack of opportunity to learn new ways of doing things over established patterns: Some of the graduates reported lacking behind in trending technologies. They blamed this on the nature of projects at Jackstones, which makes rebuilding things from the scratch with newer technologies impossible or unappealing.

3.2.2. Types of Knowledge involved

Knowledge can be defined as a mix of contextual information, experiences, rules, and values. It is richer and deeper than information and more valuable because someone has thought deeply about that information and added his or her own unique experience, judgment, and wisdom (Zack, 1999).

Knowledge management (KM) can be defined as uncovering and managing various levels of knowledge from individuals, teams, and organizations in order to improve performance (Davenport, 1998; Nonaka, 1994). Due to uncertain and unpredictable business environments, Jackstones like most organizations have paid attention to developing a knowledge management system that can provide the basis for its future sustainability and competence (Malhotra, 2001).

Analysis of the Knowledge management operational at Jackstones revealed how the graduates were recruited and trained and the type of knowledge they require during the transition process. To understand this properly "taxonomy of knowledge" framework was applied to the data. According to Zack, (1999), one way of thinking about knowledge is to consider the different types of knowing. Three types of knowing were manifest at Jackstones see figure 2, which consists: 'Know-what', 'Know-how', and 'Know-why' (Yim et al., 2004).

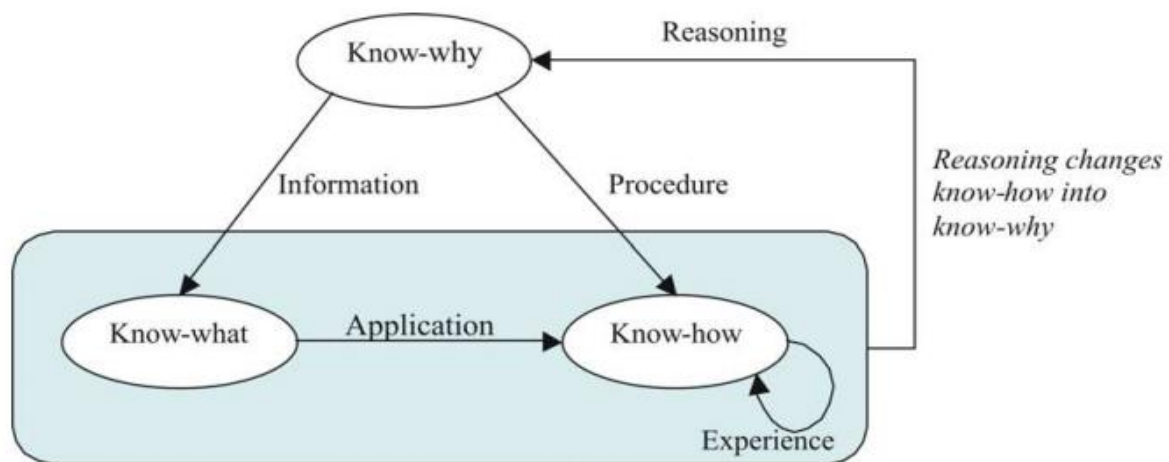
Knowing what often is based on assembling information and eventually applying it and requires the ability to recognize, describe, and classify concepts and things (Zack, 1999). In other words, this is mainly about learning, which is the "change in the behaviour of an organism that are the result of regularities in the environment of that organism" (De Houwer, Barnes-Holmes, & Moors, 2013). New graduates at Jackstones were found to be started with this type of knowledge. At first, the organization assesses them to identify what type of knowledge they possess and what they are lacking. Likewise, the new graduates are made to learn what the organization was about and what it expected, and so on. Both aspects of knowing what from both parties correspondingly provided some form of information. The information was then applied to their knowledge management system to know how to teach (organizational) and learn (new graduates) respectively.

In other words, this was embedded in the socialization process of the organization.

Similarly, this was seen in the way the graduates needed to carry out research and make inquiries from senior developers to gather the information they needed to work on tasks. This is the process of acquiring knowledge, which was applied by the new graduates to know how to do the tasks. This is reality in software development because the natures of the problems solved by software are not defined in an absolute way; it depends instead on the solver's level of experience and expertise (Robillard, 1999). Hence, it demands knowing what in the form of the knowledge needed and what learning strategies to adopt. This process explains why a novice may find a problem ill-defined, while an expert considers it chiselled, because a well-defined goal of reaching the solution is available, but the solver must acquire the necessary knowledge first (Robillard, 1999).

In order to know how, the graduates were found to learn and understand the appropriate sequence of events or possess the capability to perform a particular set of actions.

Figure 2: The Taxonomy of knowledge



Source: Yim et al. (2004). Knowledge based decision making on higher level strategic concerns: system dynamics approach. *Expert Systems with Applications*, 27(1), 143-158.

This stems from the orientation and socialization tactics through which they started to understand procedures, routines, and rules of the organization. Knowing how to do something is fully determined by actually experiencing a situation and provides better knowledge that can lead, for example, to measurable efficiencies in product development and production (Davenport & Prusak, 1998).

It was found that after six months, some of the graduates have advanced in

their understanding and was found reasoning around the know-how capabilities they possess to know why things are done the ways they were done. This was because at this stage, they know what and know how to develop software which, when synthesized through their reasoning processes results in knowing why the organization does what it does. Knowing why is the causal knowledge of why something occurs and is characterized by the capability of reasoning as to whether there are better possibilities (Yim et al., 2004), which was found to help the new graduates to validate that what they know and how they know are not only right but correct and as expected by Jackstones. The combination of know-what and know-how gave the graduates know why on task-related, project-related, and team-related knowledge to ask the right questions both during self-learning research and organizational training and sought better ways to improve what and how they learned.

3.2.2.1. Knowledge gaps

Base on the findings above, there were several knowledge gaps that are not currently being addressed by the academic training of the new graduate software developers studied. These knowledge gaps were determined through the knowledge the new graduates possessed the capabilities of soon after they were employed versus things that they struggled to do that they needed to acquire new knowledge for in order to carry out their roles at Jackstones. See an "as is/to be" in Table 1, which summarises these knowledge areas.

Table 1: A summary of an “As Is” versus “To Be” knowledge gaps found at Jackstones

Knowledge types	Summary of As-Is Knowledge (learned by new graduates from the Universities)	Summary of To-Be Knowledge (required by new graduates at Jackstones)
Technical	<p>Fewer web development technologies/ techniques such as html, css,</p> <p>Tools like Eclipse, Bluej, etc.</p> <p>Java as core language</p>	<p>Most web technologies/techniques such as advanced css, JavaScript/fremeworks, .NET, MVC, version control, pattern, etc.</p> <p>Tools like visual studio, Netbeans, Jira (project control and monitoring), etc.</p>

		Need to learn C#, and other Microsoft technologies, etc.
Soft skills	No soft skills like talking to customers, etc.	Soft skills - Communication and people skills like talking to customers, proactive behaviours, etc.
Project /Learning/ documentations	Thin projects knowledge, Research for practice projects, Generic projects, little or no documentation	Large/ complex projects, project control and monitoring, Research for real-life projects, Industry specific projects, project constraints, updates and new feature documentations, etc.
Organizational/ outcomes	Institutional culture, outcomes for grade	Jackstones' organizational culture, Knowledge about who knows what, outcomes for Jackstones, outcomes for customers
Team	Less team work	Constant team work, deal with team culture, engage well with the wider team, Work with mentors, etc.
Application domain	Uncertainty of what software development really mean/career path	Certainty of most concepts/ ways of building software and understand the job they actually want to do (career path)

3.2.3. Coping strategies over the challenges found

3.2.3.1. Coping strategies of the organization

These were found to be how the organization is currently coping with some of the challenges that it encountered.

- In regard to lack of soft skills in communicating with the customers, Jackstones is working hard to convince the new graduates at the start that it is only a myth to think that software developers do not have to talk with the customers. It achieves this by arguing that without talking to clients the developers will not define their specifications correctly.

- Regarding the intake and preparation of a large number of graduates, the organization copes by recruits from universities and career fairs using its human-resource services. These graduates are then trained with the help of mentors within its graduate programme.
- It was also found that, in order to compensate for difficulties in getting the talents whom the organization wants from the universities, it hires and trains graduates from other disciplines who have no software-related background, but who have an interest in learning to work in this field from scratch.

3.2.3.2. Coping strategies of the new graduates

At Jackstones, the new graduates while recalling their experiences was found to have faced and overcame many challenges. Each challenge, they somehow devised a strategy to cope with. For example, Nike Slater explained how he overcame “lack of task-relevant knowledge.”

“Personally, I overcame this challenge through talking to other graduates and finding out what they experienced starting new and asking some of the members of my team what life was like for them when they started. I just needed to reassure that it is fine not to know lots of stuff when you started, but it will come just through practice. So it has been rather, I suppose a mental challenge for me getting used to that and being okay with that.”

Furthermore, the graduates’ challenge of feeling that their codes were not properly reviewed or evaluated which part of their uncertainty was due to lack of experience on how the organization measures this process without a written guideline. According to Martin Smith, he overcame this challenge by raising the concern with his manager who personally reviewed some of his works and gave him convincing feedback that resolved his challenge.

Another common challenge faced by all the graduates was “Project complexities and size.” They said that to understand the actual product which they have been working on was their biggest challenge. The common word used by the graduates to describe this challenge was that the projects were big and hard to understand compared to projects they did at the universities. In a statement by William James regarding this challenge, he explained:

“I overcame this challenge simply by talking to people and trying to understand different parts of the project through their knowledge and

reviewing similar projects done for other clients. I also spent time over the project on my own and worked on more and more features to understand the project's features better."

This challenge led to a further challenge of not being able to find an answer sometimes within the team as Ian Norman reported and had led him to seek for help outside, regarding a problem to do with Bluetooth's networking.

"Someone in my team recommended that I asked someone completely from a different team, so I went to that person and he was able to help me solve the problem."

Still on "project complexities," Nike Slater reported pressure coming from specific project characteristics. He described a project as his first big project and said that the project was on production environment used by actual customers and users where things could go wrong on a nightly basis, and pretty hard to catch. He ended up spending lots of late nights working on and making sure the project was running, so there were a lot of self-inflicted challenges of staying up during the nights to work because he had no choice. He overcame this challenge by proactive behaviour (sheer perseverance) and, more self-learning and doing stuff outside of work that he probably would not have done.

Issue of feeling that the available support is inadequate was also found as explained above. In dealing with this challenge too, the new graduates formed coping strategies, in the words of Ian Norman:

"The times I felt under supported, all I normally did then was to rise up my hand and say I don't think I can do this in XYZ of time, or I have started doing this but I don't know what I should do next. Then someone can help me and guide me as to what to be doing."

Note, the above findings are not exhaustive, for details of other findings that could be explored see the themes discovered via the thematic content analysis in Table 2 in the Appendix.

4. Recommendations and conclusion

Given that both Jackstones and the new graduates still face challenges on the existing approach to recruitment and training, below are some of the approaches that this study deems improving will help both parties realize their expectations and reduce their current challenges as the organization move forward.

- Support: although a support system already exists in the organization, but the graduates reported this as being inadequate, this study thinks that creating an intentional support system in addition to the existing one aimed at monitoring when and why graduates feel extra supports are needed. This will provide tailored support that could be specific to the particular task or project the new graduates are working on.
- Learning and working under pressure: Again, despite the socialization process in place at Jackstones, it is in the opinion of this study that it needs to modify this system to separate its orientation period entirely from its socialization process. Whereas orientation typically occurs in a new graduates' first week to a month on the job, the organization needs to remember that socialization takes much longer (Wanous & Reichers, 2000). Rushing new employees into their work roles without attending to the socialization process is not an effective practice and can lead to these employees' feeling unprepared, unsupported as in above.
- Lots of self-learning to prepare themselves for the tasks they worked on: Well, learning in itself is not the main issue here, but self-learning. The organization should not forget that its aim is to train the new graduates to fit into its organizational culture, in addition to brilliancy. Hence, not providing adequate learning support for the graduates that drives them to self-learn through external resources is a risk. So this study recommends that the organization should create resources that it could point the new graduates to learn from. This could be through selection of resources, which are compatible with the needs of the organization.
- The perception that feedback/evaluations of work done are not adequate or standardized: This can be resolved by providing simple guidelines in the form of policy and procedures for those evaluating the work of the graduates to follow and adhere to. These will help the graduates to know what to expect and convince them that they are doing what will benefit the organization and their career in the future rather than guessing.
- The need to learn new ways of doing things over established patterns: While constituted pattern helps the organization to stick to standards, it is recommended that the good knowledge that the graduates brought with them be explored by providing them the opportunity to experiment. This could turn out to improve the ways the organization innovates. Hence it is suggested that some form of trial work spaces be provided that could aim at exploring the untapped talents of the new graduates rather than refocusing them in doing the same thing as everyone with the organization does. The emphasis here is that

monotony kills interest, so the organization is encouraged to explore ways to engage the creative ideas of the new graduates while tactically directing them towards their goals.

- Intake and preparation of a large number of new graduates: This is a challenge that is implicit in nature, in that it is directly dependent on tacit knowledge of the organization to be able to identify the needs of the graduates easily to teach them naturally without encountering challenges in doing so. Therefore, it is suggested that the organization should review its current method of accessing the knowledge needs of the new graduates to improve it. It could even hire consultants to handle this task to reduce the challenges it exerts on the organization. Hence it will be the responsibility of the consultant to deliver the needed talented graduates in exchange for payment.
- Starting to train graduates on the technologies they have no knowledge on or a background in (longer period of orientation): This is a special case as the organization applies this strategy to augment the qualified graduates it needs. The study suggests that Jackstones reviews its future plans in using this approach after other improvements. If it still finds this beneficial, then it should design a teaching programme specifically for this group and automate it to reduce the cost while optimizing it to train the recruits to the standards it desires.
- Lack of soft skills by the new graduates, (including inability to communicate with customers, etc.): This study suggests placing much more emphasis on the soft skills of new graduates, such as communication skills, work ethics, and so on when recruiting should resolve this problem. More importantly, the organization should recruit on core competence instead of on knowledge.
- Difficulties in getting the talents whom the organisation wanted from the universities: There was no information found within the organization to suggest that it recruits interns. Hence, it is suggested that the organization should start early to win the hearts of potential talents from the universities by recruiting them as interns when they are still progressing in their undergraduate studies rather than waiting until they graduate. If the Interns had the best experience with organisations, they served under; they are more than likely to return there for full-time jobs when they graduate. This will mean talents that the organization needs not to spend extra resources on attracting. In addition, for the realization of recruitment of quality graduates, Jackstones should vigorously promote academic institution attachment programmes for both its staff and potential recruits.

In conclusion, a lot of knowledge gaps exist between what the graduates knew prior to being employed at Jackstones and what they learned within a period of six months to one year to be productive. While this study cannot generalize these knowledge gap findings given that they are context bound, it will recommend for the future graduates to borrow a leaf from these findings as they are more than likely to be related to what may obtain in other software-development companies, especially those that share akin expertise as Jackstones. On the part of the organizations, this study hopes Jackstones and other potential organizations facing similar challenges should adopt and implement some of the recommendations suggested above to resolve their problems.

Finally, this study will not fail to acknowledge that there are limitations to the investigation. It recognizes that the opinion of four graduate software developers is a small sample size. Again, this adds to the reason it is difficult to generalize the findings. Furthermore, some of the findings were based on the recall of the past knowledge of the new graduates; hence it would have been better to interview graduates that were within one to three months in the organization, rather than asking those that have passed this stage to recall their experiences.

5. Bibliography

- Ashforth, B., Sluss, D., & Saks, A. (2007). Socialization tactics, proactive behavior, and newcomer learning: Integrating socialization models. *Journal of Vocational Behavior*, 70(3), 447-462.
- Begel, A., & Simon, B. (2008). Struggles of new college graduates in their first software development job. *SIGCSE Bull. ACM SIGCSE Bulletin*, 40(1), 226-230.
- Cannon-Bowers, J. A., Salas, E., & Converse, S. (1993). Shared mental models in expert team decision-making. In N. J. C. Jr. (Eds.), *Individual and group decision-making: Current issues* (pp. 221-246). Hillsdale, NJ: Lawrence Erlbaum.
- Cappel, J. J. (2001). Entry-level IS job skills: A survey of employers. *The Journal of Computer Information Systems*, 42(2), 76.
- Davenport, T. H. (1998). *Working knowledge*. Boston: Harvard Business School Press.
- Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Boston: Harvard Business Press.
- Houwer, J., Barnes-Holmes, D., & Moors, A. (2013). What is learning? On the nature and merits of a functional definition of learning. *Psychonomic Bulletin & Review Psychon Bull Rev*, 20(4), 631-642.
- Freeman, P. (1987). *Software perspectives: The system is the message*. Boston, United States: Addison-Wesley Longman Publishing.
- Gii, (2014). Country Ranking. Retrieved from <https://www.globalinnovationindex.org/content.aspx?page=data-analysis>
- Hager, P. (1997). *Learning in the Workplace. . Review of Research. National Centre for Vocational Education Research*. Leabrook: South Australia.
- Hughes, C. (1998). Practicum Learning: Perils of the authentic workplace. *Higher Education Research & Development*, 17(2) 207-227.
- Iivari, J., Hirschheim, R., & Klein, H. (2004). Towards a distinctive body of knowledge for Information Systems experts: Coding ISD process knowledge in two IS journals. *Information Systems Journal*, 14(4), 313-342. doi:10.1111/j.1365-2575.2004.00177.x

- Jones, M., & Walsham, G. (1992). *The limits of the knowable: organizational and design knowledge in systems development*. In Proceedings of the IFIP WG8. *Working Conference on The Impact of Computer Supported Technologies in Information Systems Development* (pp. 195-213). North-Holland Publishing Company.
- Klimoski, R., & Mohammed, S. (1994). Team mental model: Construct or metaphor? *Journal of Management*, 20(2), 403-437. doi:10.1016/0149-2063(94)90021-3
- Kovacs, P. J., Davis, G. A., Caputo, D. J., & Turchek, J. C. (2005). Identifying competencies for the IT workforce: A quantitative study. *Issues in Information Systems*, VI(1), 339-345.
- Lathlean, J. (2006). Qualitative analysis. In K Gerrish, & A Lacy (Eds.), *The research process in nursing* (417-433). Cambridge, MA: Blackwell.
- Lee, S., Koh, S., Yen, D., & Tang, H. L. (2002). Perception gaps between IS academics and IS practitioners: an exploratory study. *Information & Management*, 40(1), 51-61.
- Lee, S., Yen, D., Havelka, D., & Koh, S. (2001). Evolution of IS professionals' competency: An exploratory study. *Journal of Computer Information Systems*, 41(4), 21-30
- Malhotra, Y. (2001). Expert systems for knowledge management: crossing the chasm between information processing and sensing making. *Expert System with Application*, (20) 7-16.
- McMurtrey, M., Downey, J., Zeltmann, S., & Friedman, W. (2008). Critical skill sets of entry-level IT professionals: An empirical examination of perceptions from field personnel. *Journal of Information Technology Education: Research*, (7)1, 101-120.
- Muessig, R. H. (1969). Change the Only Constant. *Educational Leadership*, 26, 543-46.
- Muhamad, S. (2012). Graduate employability and transferable skills: A review. *Advances in Natural and Applied Sciences*, 6(6), 882.
- Newzealandnow, (2015). Information technology. Retrieved from <https://www.newzealandnow.govt.nz/work-in-nz/nz-jobs-industries/information-technology-jobs>

- Nonaka, I. (1994). A dynamic theory of organisational knowledge creation. *Organization Science*, 5(1), 14-37.
- Nzsa, (n.d.). About the nzsa. Retrieved from <http://nzsa.org.nz/about/>
- Pope, C. Ziebland, S & Mays, N. (1999). Analysing qualitative data. In C. Pope & N. Mays (Eds), *Qualitative research in health care* (pp. 75-88). London: BMJ Books
- Ritchie, J. Spencer, L. & O'Connor, W. (2004). Carrying out qualitative analysis. In J. Ritchie Lewis (Eds) *Qualitative research practice* (pp. 219-262). New York: Sage Publications.
- Robillard, P. (1999). The role of knowledge in software development. *Communications of the ACM* 42(1), 87-92.
- Rynes, S. L., & Cable, D. M. 2003. Recruitment research in the twenty-first century. In W. Borman, D. Ilgen, & R. Klimoski (Eds.), *Handbook of psychology: Vol. 12. Industrial and organizational psychology* (pp. 55-76). Tampa, Florida: John Wiley.
- Rynes, S. L., Orlitzky, M. O., & Bretz, R. D. (1997). Experienced hiring versus college recruiting: Practices and emerging trends. *Personnel Psychology*, (50), 309-339.
- Stroustrup, B. (2010). Viewpoint what should we teach new software developers? Why? *Communications of the ACM*, 53(1), 40-42.
- Wanous, J.P., & Reichers, A.E. (2000). New employee orientation programs. *Human Resource Management Review*, (10), 435-451.
- Workhere, (n.d.). Software development in New Zealand. Retrieved from <http://www.workhere.co.nz/industry/software-development/about>
- Yim, N. H., Kim, S. H., Kim, H. W., & Kwahk, K. Y. (2004). Knowledge based decision making on higher-level strategic concerns: system dynamics approach. *Expert Systems with Applications*, 27(1), 143-158.
- Yorke, M. (2006). Employability in higher education: what it is, what it is not learning and employability. *The Higher Education Academy*, (1) 2-20.
- Zack, M. H. (1999). Managing codified knowledge. *Sloan management review*, 40(4), 45-58.

Appendix

Table 2: The final themes after reduction of the categories in the initial coding

Categories	Final Themes
Challenges encountered	<ul style="list-style-type: none"> • Poorly perceived feedback/evaluation of work done • A lack of task-relevant knowledge • Individualized socialization - (No guidance - guesses what knowledge is important). • Inadequate support from the organization • Project size and complexities • Organizational culture and environment. • Uncertainty due to a lack of experience and knowledge • Need formal project control • Stress and pressure • Pressure coming from specific project characteristics • Difficulty evaluating pressure experienced. • Difficulty identifying knowledge needs of the new graduates • Difficulty with finding talented new graduates
Types of Knowledge involved	<ul style="list-style-type: none"> • Knowledge repository and the development of mental models. • New project knowledge (project control and monitoring) • Team identification process • Team culture (collaborative-oriented) • Organization facilitated collaboration • Task-related knowledge • Project constraints and other project-related knowledge • Team-related knowledge • Organizational knowledge and domain knowledge • Knowledge about who knows what • Documentation related knowledge (Explicit knowledge entry by graduates) • Soft skill, knowledge, e.g. communication and people skills • Technical knowledge • Application domain knowledge
Coping Strategies identified	<ul style="list-style-type: none"> • Feedback • Trial and errors • Lots of research / self-learning • Identify big picture • Help from mentors • Organizational support (formal socialization) • Peer support / Social networks (internal - external expertise)

- Individual facilitated collaboration
- Knowledge repository
- Informal and individualized socialization
- Some support from Project Manager
- Individualized socialization and proactive behaviours
- Growth mind-set (Comfortable with low level of pressure)
- New graduates recruitment
- High retention rate
- New graduate recruitment programme/career fair

NB: All questions highlighted in yellow colour in table 3 below were probing questions

Table 3: Actual questions asked during the interviews

Questions to William James (new graduate)	
1.	Describe the first couple of weeks that you turned up for work in this organization
	When you said you started work straight away, how did you know what to do?
	So did you get help doing that?
	How was the task you performed evaluated and what was the feedback?
2.	Tell me about the knowledge that you have learned here not taught at the University and which aspects of knowledge helped you to work effectively in ISD projects?
3.	Tell me about your first ISD project here, how long from your start date before it; how did you adapt for it and what was your role in it?
4.	Besides knowledge you currently possess, what additional knowledge do you think that you should acquire in order to work more effectively on ISD projects
5.	How well do you learn and integrate into ISD projects you work?
6.	How are/were project deliverables assigned to members of your team and what sorts of project documentations have you and your team produced?
Questions to Nike Slater (new graduate)	
1.	Describe the first couple of weeks that you turned up for work in this organization
	Where they information given to you to read at the start?
2.	Tell me about the knowledge that you have learned here not taught at the University and which aspects of knowledge helped you to work effectively in ISD projects?
	What do you know about your team?
3.	Tell me about your first ISD project here, how long from your start date before it; how did you adapt for it and what was your role in it?
4.	Besides knowledge you currently possess, what additional knowledge do you think that you should acquire in order to work more effectively on ISD projects

5. How well do you learn and integrate into ISD projects you work?
What are the resources at your disposal to learn?
6. How are/were project deliverables assigned to members of your team and what sorts of project documentations have you and your team produced?
How do they determine your strength?
Questions Ian Norman(new graduate)
1. Describe the first couple of weeks that you turned up for work in this organization
How was the edited work evaluated?
2. Tell me about the knowledge that you have learned here not taught at the University and which aspects of knowledge helped you to work effectively in ISD projects?
What are the resources available to help you learn and how is your organization helping you to learn?
During the time that you have little or no experience did you feel well supported?
3. Tell me about your first ISD project here, how long from your start date before it; how did you adapt for it and what was your role in it?
4. Besides knowledge you currently possess, what additional knowledge do you think that you should acquire in order to work more effectively on ISD projects
5. How well do you learn and integrate into ISD projects you work?
6. How are/were project deliverables assigned to members of your team and what sorts of project documentations have you and your team produced?
What if the person that is available does not have the required knowledge for the project?
Questions to Martin Smith(new graduate)
1. Describe the first couple of weeks that you turned up for work in this organization
What were the likely things that you asked your mentor for help at that early stage?
Where there some documents given to you to read?
2. Tell me about the knowledge that you have learned here not taught at the University and which aspects of knowledge helped you to work effectively in ISD projects?
3. Tell me about your first ISD project here, how long from your start date before it; how did you adapt for it and what was your role in it?
4. Besides knowledge you currently possess, what additional knowledge do you think that you should acquire in order to work more effectively on ISD projects
5. How well do you learn and integrate into ISD projects you work?
6. How are/were project deliverables assigned to members of your team and what sorts of project documentations have you and your team produced?
1. What were/are the major challenges you have faced in ISD projects since you joined this organization and how did you overcome the challenges?
2. What advice will you give to future undergraduates in terms of what they need to know and how they should learn prior to seeking for a role in an ISD project team within organizations?
Questions asked to the Expert Software developer (Ms Helen

Gardner)

1. How long have you worked with new ISD graduates here and how well do newcomers learn and integrate into an ISD project?

2. What advice do you usually give to struggling newcomers?

3. Could you tell me about your transition from novice to expert and how well do you learn and integrate into ISD projects you work?

So how did you know what to build?

So do you think that the graduate program would have help facilitate your learning if it existed then given that the length of time that graduates takes to be productive is less than you did?

4. What essential knowledge/information is needed to be an effective ISD project member?

5. How do you acquire this knowledge/information?

Since these skills are important it would be good if the grads could get help on knowing how to learn or don't you think so?

What about coding convention, procedure manuals, and policy?

6. What sorts of assistance did you receive from the organization?

Questions asked to the Manager (Dr. Jake David)

1. What do you expect when hiring fresh graduate software developers and What are the key issues that your org encounters when employing new graduates?

2. What are the practices or policies that you apply to train new ISD graduates to get up to the expected speed to fit into the teams?

3. Could you think back to the last graduates that you employed and tell me what happened?

4. Why is having common knowledge of software development important to your organization?

5. What is it that you want to improve with the transition process of your new ISD graduates?

6. How do you ensure/encourage senior ISD staff to help the new graduates meet their work expectations without worrying about being seen as disturbing them and how do you review your expected progress of the new graduates?

Common questions asked to all participants

1. What were/are the major challenges you have faced in ISD projects since you joined this organization and how did you overcome the challenges?

2. What advice will you give to future undergraduates in terms of what they need to know and how they should learn prior to seeking for a role in an ISD project team within organizations?

For details of authorization to conduct this study, see Human Ethics Committee (HEC) Approval Documents

About the author

Prior to enrolling into Master of Information Management (MIM), in 2014, which this case study concludes, Kelechi C. Ofoleta holds a Bachelor of Science (BSc), in Computer Science/Information Systems obtained from Victoria University of Wellington (VUW), New Zealand in 2013.