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THE BPM SKILLS LEARNING GAP - A COMPARISON OF INDUSTRY REQUIREMENTS AND SKILLS ACQUISITION

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Abstract

To address the gap between Business Process Management skills required by industry and the skills acquired by higher education students, requires understanding both the skills required and the level of acquisition of these skills. This study investigated skills taught at two levels in university courses relative to industry requirements, and the level to which the skills are transferred to the students as measured by assessed grades. The investigated courses were taught to undergraduate and postgraduate students. The findings show that the courses addressed skills adequately, however, differences were observed between the undergraduate students and postgraduate students, specifically in respect of *Governance* and *Business Process Improvement*. In addition, students were observed to have difficulty in taking a holistic view and seeing the bigger picture in respect of business processes. Implications of the findings are discussed, and future research proposed.

Keywords

Business Process Management, BPM, Skills, Process Improvement, Governance

1. Introduction

Demand for skills in the enterprise systems space which includes Business Process Management (BPM) remains high (Garbutt & Seymour, 2015). However, the gap between what skills are required by industry and the skills acquired by higher education students endure (Ravesteyn, Batenburg, & de Waal, 2008). To reduce this gap, it is insufficient only to compare demand for skills against skills supplied in BPM courses. A deeper understanding of the skills required by industry must be compared to the level of skill acquired by students. The pragmatic way of measuring student skill levels is through summative assessments of examinations and assignments even though these are considered judgmental and final (Taras, 2005). While formative assessments may be more beneficial than summative assessments, they are time-consuming and are by nature dependent on summative assessment (Taras, 2005). Furthermore, understanding is required of what needs to be addressed in the formative feedback. This raises a question of what does the summative assessment show and what areas should be targeted to improve the assessment results? Furthermore, when a course is presented at multiple levels of education and experience, these differences must be considered when compiling coursework.

This study is informed by the study of Garbutt and Seymour (2015) who found that knowledge was insufficiently transferred in the classroom. According to them, this highlights the need for the practical application of theories and methods. They recommend research into enterprise systems education with a focus on business processes.

The problem statement for the study reads as follows: The gap between BPM skills required and BPM skills acquired in the classroom is difficult to address if course conveners are unaware of where to target interventions. Hence a deeper understanding of this gap is needed.

2. Background

The evolution of BPM spans more than thirty years (1980 – 2000s). During this time, it has been described as a critical management practice that aims to improve organizational competitiveness (Da Xu, 2011). It is viewed as a holistic management discipline (Rosemann & vom Brocke, 2015) that attempts to find common ground between business administration and computer science (Weske, 2012). Studies on the evolution of BPM argue that by understanding business processes, organizations are better able to keep up with the dynamic global business environment (Weske, 2007, 2012). The current study adopted the following definition:

> "Business process management (BPM) is a management discipline that focuses on the design of business processes and continuous improvement of the speed, cost, and quality of business operations. BPM emphasizes the documentation of repeatable business processes as the basis for analysis and improvement. This includes both manual and automated business processes" (Cummins, 2009, p. 75).

It is, therefore, an area that focuses on continuous improvement of business processes (Scheer & Nüttgens, 2000; vom Brocke et al., 2011) and has become a core business function that requires an extensive set of skill sets.

To better understand the focus of the study, it is essential to have a clear understanding of the concept of a skillset. The definition of the term skillset has been a source of much debate over the years (Jackson, 2010; Le Deist & Winterton, 2005; Müller, Schmiedel, Gorbacheva, & vom Brocke, 2016). Authors have described skillsets as those aspects that are associated with performing optimally within a particular job, including the attitudes of the team members (Aydinli, Brinkkemper, & Ravesteyn, 2009) as well as a measure of employability used by many Higher Education Institutions (HEIs) (Cox & King, 2006). In the area of information systems (IS), understanding and building competency or skill set requirements has been viewed as critical to organizations who want to carry out their operations efficiently and who want to prevent underutilization of IS (Khairi & Baridwan, 2015; King, 2015).

Research into skillset requirements in IS indicates that there is a need to build skillset integration mechanisms between technical areas such as IS and business areas such as accounting (Sledgianowski, Gomaa, & Tan, 2017). There is also a strong argument that IS professionals such as project managers who are involved in IS development project implementations require personnel that have a variety of skills ranging from technical competencies to business-related competencies (Seidel, Recker, & Vom Brocke, 2013). Concerning the BPM skillset arena, these requirements seem to go beyond those of a business analyst (BA) (Sonteya, & Seymour, 2012). Studies indicate that organizations perceive that skillsets required for BPM are similar to those of the BA. Whereas practically speaking, BAs often need additional skills to carry out BPM effectively (Mathiesen, Bandara, Delavari, Harmon, & Brennan, 2011). Hence, while there are certain BPM skills sets that align with BA skills, there are still additional capabilities that are required to carry out BPM such as process re-design skills (Harmon, 2015; Mathiesen et al., 2011), process execution skills (Harmon, 2015; Mathiesen et al., 2011) and process oriented

thinking (Moormann & Bandara, 2012). BAs with BPM skillsets are referred to as Business Process Analysts (BPAs). Moreover, studies suggest that top managers and people in supervisory positions require BPM and process analysis skillsets (Moormann & Bandara, 2012).

Since BPM is a discipline that covers a wide variety of tasks, from the planning stage where specific process objectives are developed to the actual execution of the process, the professional tasked with having to carry out these tasks also need to have a wide range of competency requirements (Lohmann & Zur Muehlen, 2015). Research suggests that the BPA ought to have strong technical, business and mathematical competencies (left brain thinking) as well as strong interpersonal skills involving aspects of emotional intelligence and being able to communicate effectively with stakeholders (right brain thinking) (Kalpič & Bernus, 2006; Rosemann, 2006; Sonteya et al., 2012).

Within the South African context, studies have addressed how BPM can improve the competitive advantage of organizations by enhancing process efficiency (Siriram, 2012). Other studies have developed BPM management frameworks that improve organizational agility (Haasbroek, 2008; van Rensburg, 1998). Moreover, research in South Africa has also delved into process improvement by understanding actors and transformation processes occurring within a system (Cukier, Kon, & Krueger, 2015). Furthermore, studies on BPM skills in South Africa have tackled the development of competency frameworks for IS practitioners and specifically BPAs (Chakabuda, Seymour, & Van Der Merwe, 2014; Flügel, Seymour, & van der Merwe, 2014; Sonteya et al., 2012), competency frameworks for Enterprise Systems which incorporates BPM skills (Scholtz, Cilliers, & Calitz, 2010, 2012; Scholtz & Kapeso, 2014), analyses of BPM and ERP skills requirements (Wamicha & Seymour, 2016) and a description of skills set requirements for the novice BP practitioner (Garbutt & Seymour, 2015). However, none of these studies sufficiently cover those skillsets that can be developed in BPM courses taught at HEIs in the South African context. Additionally, none of the literature on the South African context targets how these BPM skillsets can be measured and related to industry requirements.

This study uses a set of 15 critical skills that have been suggested for enhancing success in BPM projects according to Gartner (Searle & Cantara, 2013) and are presented in Table 1. These are presented in three streams which are, Transformational Skills, Operational Skills, and Technical Skills. The Transformational skills ensure that there is successful change management; the operational skills are used to identify problems and improve performance while the technical skills are used to build and evolve systems that support process improvement. The 15 skills were recently reviewed and reduced to 12 skills (Searle & Cantara, 2016).

In addition, the study utilizes findings from the “ten principles of good BPM” (vom Brocke et al., 2014, pp. 540–541). These principles cover questions that can be used to guide both BPM practice and research. While each of the principles is equally relevant to this study, space limitations prevented a deeper analysis. Consequently, this study is informed primarily by principle number 4, the Principle of Holism. According to vom Brocke et al. (2014, p. 541), questions that guide the Principle of Holism are: Which factors are necessary and which are sufficient for BPM success? And, What are the measurement criteria for these factors? Based on these questions the research questions asked in this study are: Which skills are supplied to

students in a BPM course? Moreover, given that grades are the measurement criteria, How do the supplied skills relate to industry required skills?

Transformational Skills	Operational Skills	Technical Skills
• Building the BPM Business Case and Vision	• Business Process Discovery	• Solution Architecture and Design
• Project Management	• Business Process Modeling, Analysis and Design	• BPM Technology Product Knowledge
• Knowledge of Organizational Structure and Culture	• Business Process Governance and Process Policy Management	• Agile and Model-Driven Application Development
• Communication	• Process Performance Management	• Business Process Optimization and Simulation
• Organizational Change Techniques	• Constructing a BPM Methodology Toolbox	• User Experience Design

Table 1. 15 Critical BPM Skillsets (Searle & Cantara, 2013).

3. Research Method

To answer these questions, data from the BPM assignments of five BPM cohorts at the University of Cape Town were compared. The five cohorts consisted of three BPM undergraduate (UG) classes (2015, 2016, and 2017) and two BPM postgraduate (PG) classes (2015, 2017). The BPM classes were part of a BPM and Enterprise Systems course at UG level and a Postgraduate Diploma in Management in Information Systems which could lead to an Honours degree at the PG level. Although the BPM course content differed between the levels, the BPM assignments of both courses were identical except for the expectation of a more advanced understanding by PG students. This was enabled by having the UG students working in groups and the PG students working individually. BPM is one of the elective IS courses in the ACM/AIS IS 2010 model curriculum with significant coverage required for Business Analyst, Business Process Analyst and IT consultant career tracks (Topi et al., 2010)

The UG and PG classes were the subject of a Canonical Action Research project (Davison, Martinsons, & Kock, 2004) with three cycles of analysis and intervention in the years 2015, 2016, and 2017. The data in this study were derived from the evaluation phase of the Principle of the Cyclical Process Model for the three cycles. This paper forms part of the Principles of Learning through Reflection phase, specifically in reflecting on the outcomes of the project, reporting on the outcomes, and considering further action while taking into consideration implications for the research community.

Grades of two distinct segments of the courses were analyzed by skill and compared. The first segment was the final examination at the end of the courses, and the second was an experiential learning assignment that was completed by the students approximately one month before the final examination. Grades for both the examinations and assignments were broken down by skill following the relevant marking rubrics.

Average grades were determined for each class and in total for the UG and PG course. Deviations of the skill grade from the course average were determined per course and compared by skill for each course. The grade per skill from the examinations and the assignments were then matched to the Gartner skillset and further scrutinized. This took the form of identifying what

Gartner identified skills were being addressed and which were not. Those that were addressed were then ranked. The following section describes the findings from the analysis.

4. Findings

The findings were observed for both examination grades and assignment grades and compared to Gartner's 15 BPM skills required by industry.

4.1 Examination Assessment

Overall average grades vary per year without a distinguishable pattern. This is noticeable at both levels as shown in Table 2. Although UG grades improved from 2015 to 2017 by 9.6%, they dropped between 2015 and 2016 by 4.0%. In contrast, PG Grades dropped between 2015 and 2017 by 5.0%. As the PG course only runs in alternate years, there is no 2016 PG course.

	UG 2015	PG 2015	UG 2016	PG 2017	UG2017	Average
Examination Grade	53.3%	66.0%	49.3%	61.0%	62.9%	56.8%
Change from 2015			-4.0%	-5.0%	9.6%	

Table 2. Summarized course examination averages per graduate level.

To determine areas where students are deficient or encounter difficulties, examination grades for each skill were ranked according to their deviation from the mean grade for each examination. The results for all three UG classes were aggregated and are presented in Table 3 in ascending grade order for the aggregate undergraduate grades. (For clarity the topics are shown in italics in the following sections). For example, the average grade for the skill, *Governance*, for all undergraduate students (38.7%) is 16.2 percentage points less than the mean of 54.9%. The major deviations from the average for both UG and PG were the skills of *Governance* and *Business Process (BP) Improvement*. However, these were inverse in terms of the examined understanding by students.

	UG - 2015/2016/2017		PG – 2015/2017	
Skill	**Average**	**Delta ▲**	**Average**	**Delta ▲**
Governance	38.7%	-16.2%	77.3%	11.3%
Systems Thinking	45.6%	-9.3%		
Business Process Architecture	47.4%	-7.5%	70.9%	4.9%
Redesign	53.4%	-1.5%		
Compliance	56.1%	1.2%		
Metrics	60.6%	5.7%		
Modelling	65.6%	10.7%		
Improvement	66.4%	11.5%	56.5%	-9.5%
Project Management			59.3%	-6.7%
Average	54.9%		66.0%	

Table 3. Break down per assessed skill per graduate level.

For UG students, *Governance* (▲ = -16.2%) was less understood than *Systems Thinking* (▲ = -9.3%) followed by *BP Architecture* (▲ = -7.5%) and *BP Redesign* (▲ = -1,5%). UG students were observed overall to have an average understanding of *Compliance* (▲ = 1.2%) and *BP Metrics* (▲ = 5.7%) but higher than average understanding of *BP Modelling* (▲ = 10.7%) and *BP Improvement* (▲ = 11.5%). In contrast, PG students had a greater than average understanding of *Governance* (▲ = 11.3%), an above average understanding of *BP Architecture*

(▲ = 4.9%), but a lower than average understanding of *BP Improvement* (▲ = -9.5%). *Project Management* was only examined for PG and shown to be 6.7% below the average grade.

In Table 4 the deviation percentages are broken down for the years 2015, 2016, and 2017 per UG student grade in the same overall ranking as the previous table. Whereas there is a variation between years for most skills, some skills are consistent in respect of deviation from the mean grade. While *BP Modelling* (▲ = 11.7%, 12.9 %, 6.6%) and *BP Metrics* (▲ = 7.1%, 5.5%, 3.6%) are consistent around the mean, *Governance* (▲ = -20.0%, -11.6 %, -17.8 %) is consistently low. Some skills show greater variations between years. *Systems Thinking* (▲ = -1.4%, -10.1%, [-%]), which was not examined separately in 2017, shows a decrease in understanding while *BP Architecture* (▲ = [-%], -15.1%, 2.3%), which was not examined separately in 2015, shows an increasing understanding. *BP Redesign* (▲ = 3.5%, 16.5%, -25.4%) and *Compliance* (▲ = -1.5%, -20.3%, 24.5%) exhibit an inverse trend decreasing and increasing respectively with a net effect of a small deviation from the mean over the three years. *BP Improvement* (▲ = 0.6%, 22.2%, 10.7%) epitomizes the fluctuations of the results, increasing sharply then quickly declining.

Skill	**UG 2015**	**UG 2016**	**UG 2017**	**Overall**
Governance	-20.0%	-11.6%	-17.8%	-16.2%
Systems Thinking	-1.4%	-10.1%		-9.3%
Architecture		-15.1%	-2.3%	-7.5%
Redesign	3.5%	16.5%	-25.4%	-1.5%
Compliance	-1.5%	-20.3%	24.5%	1.2%
Metrics	7.1%	5.5%	3.6%	5.7%
Modelling	11.7%	12.9%	6.6%	10.7%
Improvement	0.6%	22.2%	10.7%	11.5%
Average	53.3%	49.3%	62.9%	54.9%

Table 4. Analysis of assessed grades for UG students per year.

Results per skill for PG student examinations are shown in Table 5. As the 2017 examination had only a single, holistic BPM question, a trend between the two years is not possible.

Skill	**PG 2015**	**PG 2017**
Improvement	-9.5%	
Project Management	-6.7%	
Architecture	4.9%	0.0%
Governance	11.3%	
Average	66.0%	61.0%

Table 5. Analysis of assessed grades for PG students per year.

Using 2015 grades, BP Improvement (overall ▲ = -9.5%) shows a lower level of understanding followed by Project Management (▲ = -6.7%). *BP Architecture* (▲ = 4.9%) with *Governance* (overall ▲ = 11.3%) attaining the highest grade.

4.2 Assignment Assessment

An analysis of the assignment grades using the deviation from the average for each assessed skill reveals fluctuations similar to those observed for the examination grades. As shown in Table 6, average grades for the three measured assignments were similar, although an increasing average

was noticed for the UG students. *Reflection* was consistently the lowest grade (▲ = -10.7%, -11.0%, -28.8%, -16.7% for UG 2016, UG 2017, PG 2017 and Overall respectively). *Organization* and *Master Data* (▲ = -12.6%, [-%], [-%], -15.9%) was the second weakest skill based on assignment grades. Unfortunately, this skill was only measured for UG 2016. While *Process Reporting* (▲ = -1.9%, -17.4%, -8.4%, -9.1%) was consistently below average, *BP Improvement* (▲ = 1.7%, 0.4%, -1,8%) hovered around the average grade. Similarly, writing specific skill was observed to be relatively consistent around the average grade with *Style*, *Spelling*, and *Grammar* (▲ = 2.4%, 0.4%, 0.1%, 1.1%) and *General Presentation* (▲ = 0.2%, 4.1%, 2.0%, 2.2%) marginally above assignment average. *Scoping* and *Stakeholders* (▲ = 3.1%, -1.2%, 7.0%, 3.1%) and *BP Analysis* (▲ = 0.8%, 0.9%, 8.4%, 3.5%) were also close to the average. However, in both cases, PG students showed a higher acumen based on deviation from the average grades. *Introduction* and *Conclusion* (▲ = 8.8%, 4.1%, 2.0%, 5.1%) grades proved to be slightly higher than average overall, however, UG students are seen to be more proficient in this skill. Likewise, *Business Case* development (▲ = 4.5%, 11.6%, 3.2%, 6.6%) was slightly above average with UG students performing better on average than PG students. On the other hand, *Integration* (▲ = 3.8%, 7.9%, 16.4%, 9.5%) was well above average overall with PG students excelling in this skill.

Skill	**UG 2016**	**UG 2017**	**PG 2017**	**Overall**
Reflection / Learnings	-10.7%	-11.0%	-28.8%	-16.7%
Organization & Master Data	-12.6%			-15.9%
Process Reporting	-1.9%	-17.4%	-8.4%	-9.1%
BP Improvement	1.7%	0.4%	-1.8%	0.2%
Style, Spelling & Grammar	2.4%	0.4%	0.1%	1.1%
General presentation	0.2%	4.1%	2.0%	2.2%
Scoping & Stakeholders	3.1%	-1.2%	7.0%	3.1%
Business Processes Analysis	0.8%	0.9%	8.4%	3.5%
Introduction and Conclusion	8.8%	4.1%	2.0%	5.1%
Business Case	4.5%	11.6%	3.2%	6.6%
Integration	3.8%	7.9%	16.4%	9.5%
Average	66.2%	72.1%	70.5%	69.5%

Table 6. Analysis of deviation from average for assignment grades per skill per year.

4.3 Comparison to Industry Required Skillset

Figure 1 depicts the mapping of the examination grades and assignment grades to the Gartner Skillset. *BP Optimization* was one of the skills Gartner subsequently dropped from the list (Searle & Cantara, 2016), however, it proved to be a significant part of the course work. On the whole, the mapping is good. Five skills from the Gartner set (denoted as * and **) were not specifically tested while two skills (denoted as ***) not specified in the Gartner skillset were examined. *Change Management*, *Methodology Toolbox*, *BPM Product Knowledge*, and *Agile Development* are not mappable to examined grades. Conversely, *Systems Thinking* and *Reflection* are not part of the Gartner skillset. The UG and PG grades were then ranked and classified per the Gartner skillset as shown in Table 7.

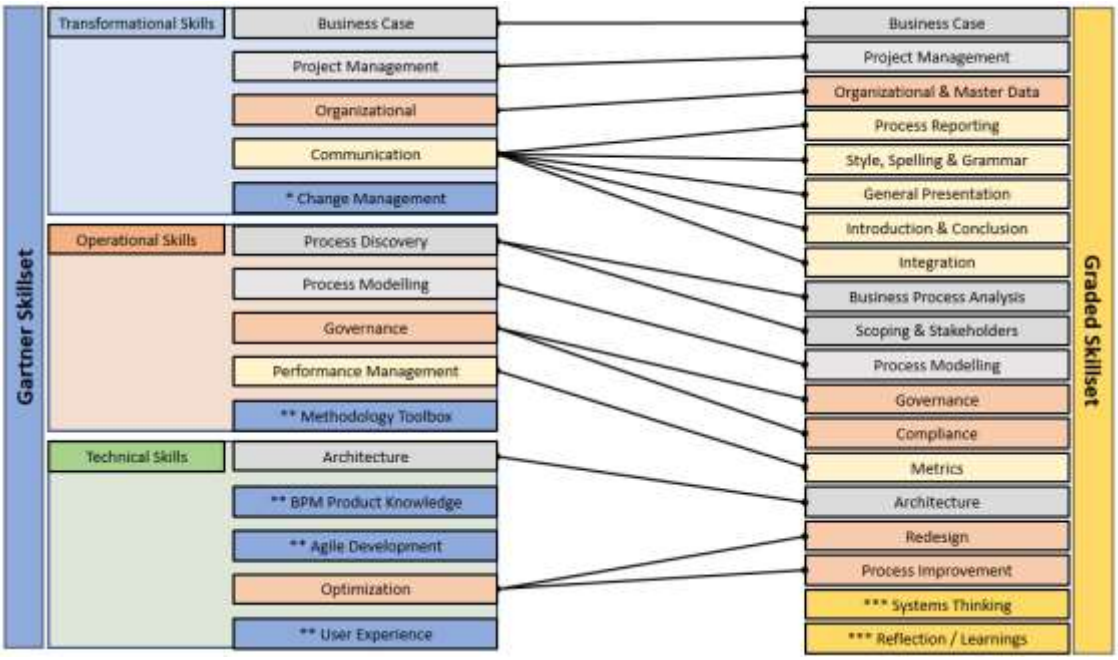

Figure 1. Mapping Gartner Skillset to Examined Grades.

Skill	Skills Descriptions	UG	Rank	PG	Rank
	Transformational Skills	**67.1%**		**68.7%**	
1	*Business Case*	77.2%	1	73.8%	3
2	*Project Management*	-		59.3%	7
3	*Organizational*	53.6%	7	-	
4	*Communication*	70.4%	2	72.9%	4
5	*Change Management*	**		**	
	Operational Skills	**60.9%**		**77.8%**	
6	*Process Discovery*	70.1%	3	78.2%	1
7	*Process Modelling*	65.6%	4	-	
8	*Governance*	47.4%	8	77.3%	2
9	*Performance Management*	60.6%	6	-	
10	*Methodology toolbox*	-		-	
	Technical Skills	**55.3%**		**64.3%**	
11	*Architecture*	47.4%	9	66.0%	5
12	*BPM Product Knowledge*	-		-	
13	*Agile Development*	-		-	
14	*Optimization*	63.3%	5	62.6%	6
15	*User Experience*	-		-	

Table 7. Analysis of Grade by Gartner Skillset.

Not all skills were explicitly tested for the UG and PG classes. For example, *Project Management* was included in PG but not UG and Organizational in UG but not PG. For Transformational skills, *Business Case* (77.2% and 73.8%) and *Communication* skills (70.4% and 72.9%) were high ranked. The two skills (*Project Management*, 59.3% and *Organizational*, 53.6%) that were tested only at single graduate levels were both low ranked. In respect of *Operational Skills*, PG students scored higher than UG students overall. *Process Discovery* (70.1%, 78.2%) was ranked higher, and *Process Modelling* (65,6%) and *Performance Management* (60.6%) was above average. The latter two were not individually examined for the

PG courses. *Governance* (47.4%, 77.3%) is the converse for UG and PG being highly ranked for PG, but low ranked for UG. Only two skills were examined in the Technical Skills section, *BP Architecture* and *Optimization*. *Optimization* (63.3%, 62.6%) for UG was midrange, but low for PG students. *BP Architecture* (47.4%, 66.0%), however, was shown to be lower for both UG and PG. The findings are discussed in the next section.

5. Discussion

The interventions of the action research project in the years 2015, 2016, and 2017 on analysis reveal "no significant difference" (Russell, 1999) with the average overall grade in the 60% range.

In describing skills which can be taught to students in an HEI BPM course, we note that for UG students *Governance*, *Systems Thinking*, and *Business Process Architecture* are the least understood of the examined skills. *Business Process Metrics*, *Modelling*, and *Improvement* are understood the best. However, *Business Process Improvement* is least understood by PG students who understood *Governance* and *Architecture* to a higher level than UG students. *Project Management* was another lesser understood skill. UG students were seen to be more proficient in writing skills. However, as full-time students, this may be a function of the students knowing what the lecturer expects.

In assessing how the supplied skills relate to industry required skills we noted variances when compared to the Gartner skillset. Although the Technical Skill of *Change Management* was not examined separately, it was included in the examination rubric. Methodology Toolboxes were introduced in the course with students encouraged to follow the BP Trends methods (Harmon, 2014) which were examined under the heading of BP Redesign. Similarly, *BPM Product Knowledge* and *Agile Development* were introduced to the students but being enterprise specific, these were out of scope for the course which is technology independent. *Systems Thinking* is not considered by Gartner as part of BPM skill requirements. However vom Brocke et al. (2014) include it in their set of competencies. Similarly, *Reflection* is considered an integral part of learning (Turesky & Gallagher, 2011) and was instrumental in defining the ten principles of good BPM (vom Brocke et al., 2014).

In summary, UG students were observed to have a lower understanding of *Governance* and *BP Architecture* which they did not comprehend holistically. *BP Modelling* and *BP Improvement* were appeared to be easier for them to grasp as these skills may have been more practical and interesting to learn than others. However, with their work-experience, PG students exhibited a better appreciation of *Governance* and the use of structured approaches.

6. Conclusion

This study originated from a need to identify the skills prospective business process professionals can be taught in university courses, how these skills relate to industry requirements, and the level to which the knowledge of the skills is transferred to the students as measured by assessed grades. The assessed skills were determined from examination and experiential learning assignments rubrics, while industry required skills were derived from Gartner's BPM skillset (Searle & Cantara, 2013). The level of skill transfer was derived from grades the students attained in their final examination and an experiential learning assignment.

Findings show that, except for context-specific skills (Principle of Context-Awareness (vom Brocke et al., 2014)), the investigated courses addressed the skills adequately. This produced two significant findings (a) in specific skills the understanding of UG and PG students were inverse, and (b) whereas some skills reflect consistent grades others fluctuate widely. The first case may be attributed to work experience enabling PG students to recognize not only the need for *Governance* but also the challenges of *Improving* existing processes. On the other hand, UG students may have a naïve view of assuming that *BP Improvements* are easy to implement. At the same time due to lack of experience, UG students may not comprehend the need for *Governance*. Additionally, although *BP Redesign* and *BP Compliance* grades were on par overall, they fluctuated widely year on year.

The implication of these findings is that UG students need to understand the reality of the necessity of *Governance* and the difficulties in *Improving business processes*. Conversely, PG students need to be provided with knowledge on how to overcome *BP Improvement* resistance. Based on the Principle of Holism and the lower grades in *Systems Thinking*, holistic thinking needs to be improved in students.

The main limitation of this research stems from the use of a single case. Courses at other institutions may teach change management which could serve to address the observed student shortcomings for process improvements. Likewise, deeper involvement in a similar capstone project may provide novice practitioners with a deeper understanding of the difficulties in bringing about change.

Further research is indicated to explain the identified polar differences between PG and UG students in respect to *Governance* and *BP Improvement*.

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