SPREADSHEET PROFICIENCY: WHICH SPREADSHEET SKILLS ARE IMPORTANT?

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ABSTRACT

Many academic studies and industry reports have stressed the need for workers to be proficient in spreadsheets. As spreadsheets have hundreds of functions and features, it is useful to know which particular spreadsheet skills are important. Unfortunately, there are few studies that determine the relative importance of specific spreadsheet skills. This research examines, in general as well as in specifics, the importance of spreadsheet skills for accountants. It also determines the knowledge new accountants have regarding detailed spreadsheet skills. The results of this study found that: (1) Recruitment advertisements mentioned the need for Excel proficiency almost 50 percent of the time; (2) The top three spreadsheet skills perceived as important among practicing accountants are 'Lookup and Pivot Table', 'Data entry, format and calculations', and 'Logic'; and (3) The top three spreadsheet skills that newly hired accountants are knowledgeable are 'Data entry, format and calculations', 'Charting', and 'Logic'. The results obtained in this study suggest that aspiring accountants should include 'Lookup and Pivot Table' as part of their portfolio of spreadsheet skills. These results also provide useful knowledge for accountants, employers, and educators in aiding their communications regarding spreadsheets proficiency.

Keywords: spreadsheets, Excel, proficiency, lookup, pivot table

INTRODUCTION

Many jobs nowadays require workers to have spreadsheet proficiency [4, 6]. The meaning of spreadsheet proficiency remains vague, however [3, 13, 23]. There are hundreds of spreadsheet functions [16], and so one wonders what exactly does spreadsheet proficiency mean? Does it refer to knowing how to use: (a) some basic functions, (b) certain specific functions, or (c) all the spreadsheet functions? Many potential employees thought that spreadsheet proficiency referred to just knowing how to use the basic functions, such as data entry, format, and basic calculations [18]. On the other hand, employers can mean otherwise. Such misunderstanding can result in high recruitment costs. For example, organizations can end up recruiting incompetent employees. Also, spreadsheet users who overestimate their proficiency may be over-confident and this can lead them to commit costly errors in their work [19].

It would be useful to clarify what constitutes spreadsheet proficiency because it would enable potential employees to be better equipped for their jobs. Spreadsheet proficiency may not have a blanket definition as it is possible that employers have used it as a relative concept. For example, for clerical workers, spreadsheet proficiency could mean basic proficiency, whereas for accountants or business analysts, spreadsheet proficiency could extend to more advanced requirements such as being able to use pivot table for data analysis. Spreadsheet proficiency, therefore, could be ascribed different meanings, depending on the context of the case. This relative concept sounds plausible as Jelen and Alexander [14, p.1] have estimated that "… close to 50 percent of Excel users leave 80 percent of Excel untouched. That is, most users don't tap into the full potential of Excel build-in utilities". Based on this relative concept, the importance of various spreadsheet skills is likely to depend on the nature of an employee's work.

The purpose of this research is to focus on spreadsheet proficiency for a specific group of professionals – namely, the accountants. The accountants' work has evolved over the years. In the early days, accountants relied on manual record keeping. Today, accountants make use of technology to record transactions, prepare financial statements, and analyze accounting-related information [9]. Accountants therefore need a variety of general as well as in-depth computer skills [21]. Even though prior research has shown that accountants require a variety of computer skills, more recent studies have indicated that spreadsheet skills are among the most important [7, 22, 27]. Theoretically, spreadsheets are a good fit for an accountant's work because they help accountants perform many calculations [17]. Thus, the results pertaining to the importance of spreadsheet skills for accountants are not unexpected. Given the importance of spreadsheet skills, however, not many studies have gone beyond specifying which type of spreadsheet skills are important for accountants.

To broaden our knowledge, this study seeks to answer three questions related to spreadsheet skills for accountants. They are: (1) How important are spreadsheet skills for accountants? (2) What are the relative importance of the various types of spreadsheet skills? and (3) How knowledgeable are new accountants with various spreadsheet skills? To answer these questions, this study is divided into three parts. In the first part, the study coded the technology skill requirements appearing on the recruitment advertisements for accountants. Due to space constraints, recruitment advertisements generally would not elaborate on the specific type of spreadsheet skills. The second part of this study therefore conducted a survey among practicing accountants to determine in detail, the importance of various types of spreadsheet skills. In the third part, a survey was conducted among newly hired accountants to determine their knowledge on various spreadsheet skills. Based on the data collected from the two surveys, an analysis was conducted to determine the difference between the importance and knowledge of various spreadsheet skills. The results obtained would provide useful information regarding spreadsheet proficiency. They could help to determine the readiness of new accountants to use spreadsheets in their jobs. The results could also be used to guide educators to plan and design the teaching of spreadsheets for the accounting curriculum.

LITERATURE REVIEW

Studies on the Overall Importance of Spreadsheet Skills for Accountants

There are several prior studies that have sought to determine the technology skill requirements for accountants. The results from prior studies seem to indicate that the importance of various technology skills have shifted over time. A chronological snapshot view of the results related to these studies are provided here.

During the 1980s, Bean and Medewitz [2] found that programming, software, and hardware, were important, and Wan and Choo [25] found that knowledge on systems development, i.e., systems initiation, design, implementation, and control, was most necessary. During the 1990s, Kaye and Nicholson [15] found that accountants

should have competencies in accounting information systems, expert systems, computer science, management information systems and mathematical programming. Heagy and Gallum [12] identified spreadsheets, accounting systems, database management systems, tele-communications and systems development as important skills, and Van-Meer and Adams [25] found that accountants should have skills in systems development, information technology (IT) applications, internal control, documentation, IT audit, and hardware knowledge. Later, Burnett [5] noted that besides general office IT skills, accountants should be equipped with skills such as security management, project management, network management, e-commerce, and computer programming. Fordham [8] also found that technical IT skills such as digital and wireless communications, as well as Internet security, were important for accountants.

While acknowledging the importance of various technology skills, the results of recent studies on technology skills for accountants showed a distinct trend. They all emphasized that spreadsheets were very important. For example, [1, 7, 21, 22, 27] all found that spreadsheets were among the most important technology skills for accountants. The results obtained from these prior studies were based on the analyses of data gathered from surveys/interviews with practicing accountants or teaching instructors.

There is an alternative method to determine the importance of technology skills for accountants. The method has been used to study the skill requirements of computer professionals and it is based on coding the information on the recruitment advertisements [24]. Employers would normally specify the technology skill requirements on the recruitment advertisement so that they can recruit the most suitable candidates. Researchers can therefore code the recruitment advertisements. To the best of the authors' knowledge, there has been no recent study that used the coding method to determine the technology skills requirements for accountants

Studies Related to Facet Importance of Spreadsheet Skills

Many of the prior studies that examined the technology skills for accountants considered spreadsheets as a general or monolithic construct, without considering the specific type of spreadsheet skills. There are few studies that examined spreadsheet skills at a detailed level. Ragland and Ramachandran [20] is one of them. The study investigated the functional importance of 14 Excel features among public accountants working in the United States and found that the important Excel functions were

basic formula, filter and sort data, vertical (horizontal) lookup, formatting of documents, and If/Then statements. Their study also compared the importance of spreadsheet skills between new hires working at the public accounting firms and a group of accounting students. They found that accounting students underestimated the importance of some of the Excel functions.

Another study that did a detailed research of spreadsheets was conducted by Bradbard and his colleagues [3]. Their study explored spreadsheet usage by management accountants through listing 37 features of the spreadsheet application. They found that there was a high correlation between (a) the features that managerial accountants use and (b) the features that new hires were expected to use. The study reminded future researchers to use spreadsheet features that were most useful to accountants to measure construct such as expertise, importance, or usage, rather than identifying an exhaustive list of spreadsheet features.

Study Related to Spreadsheet Knowledge

According to the authors' knowledge, there is just one published paper related to detailed spreadsheet knowledge among accountants and accounting students. Besides investigating the importance of various spreadsheet skills, Ragland and Ramachandran [20] also compared the perceived knowledge on how to use specific Excel functions between new hires at the public accounting firms and a group of accounting students. They found that there were some statistical differences in the knowledge between the two groups. For example, new hires' perceived knowledge on how to use Excel's basic function, formatting functions, filter and sort data functions, vertical and horizontal lookup functions, pivot tables, concatenate function, and keyboard shortcuts were significantly more positive than the undergraduate accounting students' perceived knowledge on how to use the specific functions.

RESEARCH METHOD

As mentioned earlier, this study comprises three parts. The research method for each part is described in the following sections.

Coding the Recruitment Advertisements

Many recruitment advertisements have migrated to the online platform. Although the newspaper companies still published recruitment advertisements, the number of advertised positions in the newspapers has been dwindling. This study therefore used one of the biggest and

earliest online job portals in Hong Kong, hk.jobsdb.com, to gather the recruitment advertisements. All the recruitment advertisements for accountants that appeared in the job portal in January 2015 were used for this research. Repeat advertisements were excluded. All technology related phrases appearing on the advertisements as skill requirements were coded. The coding was performed by a graduate research assistant with an accounting background.

Questionnaire Survey among Practicing Accountants

The second part of this research is to determine the importance of the various spreadsheet skills based on the perceptions of the practicing accountants. Data for this part of the study were collected using an online questionnaire survey conducted in December 2015. The questionnaire was initially prepared with a detailed set of spreadsheet skills. The study referenced prior studies as well guidebooks to develop the set of spreadsheet skills [3, 10, 11, 20]. To make the questionnaire simple and convenient for the respondents, the study selected 17 skill items. The selection of the skill items was done in consultation with two practicing accountants who used spreadsheets extensively in their work. These 17 skill items were grouped under seven skill categories: (1) Data entry, format, and calculations, (2) Charting, (3) Logic, (4) Lookup and Pivot Table, (5) Financial calculations, (6) Scenario analysis, and (7) Using Solver. The survey requested participants to rate the importance of the skill items using a five-point Likert scale ranging from 1 for 'not important', 3 for 'average importance', and 5 for 'extremely important'.

The questionnaire was hosted on the Qualtrics software. It comprised two sections. The first section requested respondents' demographics information. The second section comprised the skill items. A pilot study was first conducted among five practicing accountants. The purpose of the pilot study was to obtain feedback regarding the clarity of the survey items. The feedback showed that the questionnaire was simple and easy to understand. Only slight changes were made on two skill items to enhance clarity. Table 1 shows the skill items on the final questionnaire.

Prior to conducting the questionnaire survey, the study reached out to the researchers' ex-colleagues and friends working as accountants or accounting managers. There were 27 of them and the researchers requested each to provide referrals to 10 other accountants to participate in the survey. The survey links were then sent via emails to 297 potential participants.

Table 1: Skill Items on the Questionnaire

Category of skills	Measurement items
1. Data entry, format, and calculations	1. Modifying column width and row height.
	2. Freezing panes and splitting the window in worksheets.
	3. Entering basic mathematical functions (add, subtract, multiply, divide, etc.).
	4. Calculating the Mean, Median, Mode and Standard Deviation.
2. Charting	5. Determining the appropriate chart type (eg, column, line, pie, xy) and chart options.
	6. Creating and formatting advanced charts such as stock, surface, donut, bubble or radar
3. Logic	7. Using the OR, AND, NOT functions to evaluate criteria.
	8. Using conditions in formulas with the IF, COUNTIF, and SUMIF functions.
	9. Using an IF function to combine sets of criteria.
4. Lookup and Pivot Table	10. Retrieving data using VLOOKUP or HLOOKUP functions.
	11. Analyzing data using a PivotTable.
5. Financial calculations	12. Using the RATE, NPER, PV, IRR and FV functions.
	13. Calculating principal and interest payment.
6. Scenario analysis	14. Conducting break-even and sensitivity analyses.
	15. Planning scenarios and adding scenarios to a worksheet.
7. Using Solver	16. Creating a solver model and adding or changing a constraint in it.
	17. Using solver for linear programming problems.

Questionnaire Survey among the Newly Hired Accountants

The third part of this research is to determine the perceived knowledge among the newly hired accountants. The sample of newly hired accountants were sourced via the authors' personal contacts. They were a recent batch of accountancy graduates from two Universities in Wuhan, China. They had already found employment as entry-level accountants after graduation.

The survey was conducted in December 2015. Data were collected using an online questionnaire hosted on the Qualtrics software. The questionnaire was divided into two parts. The first part requested demographics information and the second part comprised the skill items. The second part used the same 17 skill items that were used for surveying the practicing accountants (see Table 1). The respondents were asked their knowledge of the skill items and the responses were based on a 5-point Likert scale ranging from 1 for 'no knowledge', 3 for 'av-

erage knowledge', and 5 for 'expert knowledge'. The links to the online survey were sent via emails to 61 of the new hires.

RESULTS

Coding of Recruitment Advertisements

Table 2 shows the coding results. The table shows that 391 recruitment advertisements have been coded and that on average, there were 1.74 IT related phrases in an advertisement. The results displayed have been sorted according to the average number of phrases coded on an advertisement. They show that Excel appeared most frequently – 48 percent of the time. That is to say, Excel was mentioned approximately once in every two advertisements. The other phrases that were frequently mentioned in the advertisements included word processing, MS Office, SAP, and Chinese word processing.

Table 2: Results of Coding

S/no.	Technology-related phrases	No. of ads = 391	
		No.	Average per ad
1	Excel	189	0.48
2	Word processing	114	0.29
3	MS Office	64	0.16
4	SAP	48	0.12
5	Chinese word processing	46	0.12
6	MYOB	37	0.09
7	Presentation software	32	0.08
8	Accounting software	31	0.08
9	Oracle / Access / Database	26	0.07
10	Peachtree	23	0.06
11	IT / Computer / PC	18	0.05
12	Flex	15	0.04
13	Quickbook	11	0.03
14	Outlook	11	0.03
15	Hyperion	10	0.03
16	SUN	6	0.02
	Total	681	1.74

Demographics of Respondents

Table 3 shows the demographics of the survey respondents for part 2 of this study. The survey received 117 complete responses out of the 297 emails that were sent to the practicing accountants. The response rate was

therefore 39 percent. Among the 117 respondents, 60 percent were females, and the majority (85 percent) had worked in accounting for less than 6 years. The respondents were working in various industries such as accounting firms, real estate, manufacturing, IT, financial services, and others.

Table 3: Demographics of the Accountants

Practicing Accountants, N=117	Number	Percentage
Gender		
Male	47	40
Female	70	60
Years in Accounting		
2 or less	40	34
3 to 5	60	51
6 to 9	10	9
10 or above	7	6

Table 4 shows the demographics of the survey respondents for part 3 of this study. The survey received 49 complete responses out of the 61 emails that were sent to the newly hired accountants. The response rate was therefore 80 percent. Among the 49 respondents, 82 percent were females. The majority (84 percent) were working in various industries for 6 months or less.

Table 4: Demographics of the New Hires

New Hires, N=49	Number	Percentage
Gender		
Male	9	18
Female	40	82
Months in Accounting		
3 or less	28	57
4 to 6	13	27
7 to 9	3	6
10 or above	5	10

Facet Importance of Spreadsheet Skills

Table 5 shows the results for the importance of various spreadsheet skills. According to the practicing accountants, the three most important categories of spreadsheet skills were 'Lookup and Pivot Table', 'Data entry, format, and calculations', and 'Logic'. The least important category was 'Using Solver'.

Table 5: Results for the Accountants (N=117)

Excel skills	Importance: Accountants	
	Mean	SD
1. Data entry, format and calculations	4.13	0.71
2. Charting	3.40	1.07
3. Logic	3.90	1.01
4. LOOKUP and Pivot Tables	4.17	1.03
5. Financial calculations	3.21	1.00
6. Scenario analysis	2.96	1.04
7. Using solver	2.70	1.13

Spreadsheet Knowledge for the Newly Hired Accountants

Table 6 shows the results for the perceived knowledge of various spreadsheet skills. The table shows that the three most knowledgeable categories of spreadsheet skills among the newly hired accountant were 'Data entry, format, and calculation', 'Charting', and 'Logic'. The least knowledgeable category was 'Using Solver'.

Table 6: Results for the New Hires (N=49)

Excel skills	Knowledge: New Hires	
	Mean	SD
1. Data entry, format and calculations	4.06	0.72
2. Charting	3.35	0.86
3. Logic	3.10	1.03
4. LOOKUP and Pivot Tables	2.76	1.20
5. Financial calculations	3.09	1.08
6. Scenario analysis	2.57	1.14
7. Using solver	2.27	0.94

Difference in Ranking between Importance and Knowledge

Table 7 shows the difference in ranking between the importance and knowledge for each category of spreadsheet skills. A zero or positive difference implies the ranking for knowledge is equal or better than the ranking for importance, suggesting that under this skill category, respondents are not likely to have problems in ful-

filling the skill requirement. All the skill categories have a zero or positive difference except 'Lookup and Pivot Table'. In the case of the 'Lookup and Pivot Table', there was a negative difference of 4 between the ranking for importance and knowledge. That is to say, for this particular skill, it was considered the most important by the practicing accountants, but the new hires scored below 'average knowledge' on this skill.

Table 7: Difference in Ranking

Excel skills	Importance: Accountants	Knowledge: New Hires	Difference in Ranking
	Ranking (A)	Ranking (B)	(A)-(B)
1. Data entry, format and calculations	2	1	1
2. Charting	4	2	2
3. Logic	3	3	0
4. LOOKUP and Pivot Table	1	5	-4
5. Financial calculations	5	4	1
6. Scenario analysis	6	6	0
7. Using solver	7	7	0

DISCUSSION

The results pertaining to coding of recruitment advertisements show that overall, spreadsheet skills are the most frequently mentioned technology skill requirement in the job advertisements for accountants. Hence, spreadsheet skills are indeed very important. This result is consistent with those obtained in recent studies, even though recent studies used other research methods (eg., surveying/interviewing accounting practitioners or teaching instructors) to determine the importance of technology skills [1, 7, 21, 22, 27]. One important implication of these results is that educational institutions should place emphasis on spreadsheet training for accounting students, if they have not already done so. Also, given that the current research is conducted in a Chinese setting, while prior studies were conducted elsewhere, the results suggest that the importance of spreadsheet skills for accountants is not limited to specific locations.

As an aside, it is interesting to note that in this study, the recruitment advertisements used the phrase Excel rather than spreadsheets. This reflects that Excel is the dominant type of spreadsheet used by the employers. Note that presently, there are other types of spreadsheets available, such as Google Sheets and Numbers.

Given the overall importance of spreadsheet skills, this study conducted a detailed study to determine the importance of various types of spreadsheet skills. The results obtained were similar to those found in Ragland and Ramachandran [20], except that in the current study,

the skills for 'Pivot Table', which were grouped together with 'Lookup', were considered the most important spreadsheet skills for accountants. Other skills that were found to be important in this study, such as 'Data entry, format, and basic calculation' and 'Logic', were also found to be important in Ragland and Ramachandran [20]. Hence, the results of this study pertaining to the importance of various spreadsheet skills for accountants were mostly consistent with those found in Ragland and Ramachandran [20].

This study also determined how knowledgeable new hires were in various spreadsheet skills. The results showed that new hires were most knowledgeable in 'Data entry, format, and basic calculation', 'Charting', and 'Logic'. They had below 'average knowledge' about 'Lookup and Pivot Table'. Recall, however, 'Lookup and Pivot Table' was the most important category of spreadsheet skills considered by the practicing accountants. There was a gap, therefore, between the importance and knowledge for 'Lookup and Pivot Table'. To minimize this gap, the accounting curriculum should emphasize skills on 'Lookup and Pivot Table' when teaching spreadsheets. This will help aspiring accountants to meet the skill requirements on spreadsheet proficiency and better prepare accounting students for their jobs upon graduation.

The results of this study are useful because they provide a clearer understanding on what constitutes spreadsheet proficiency by identifying the specific skills that were deemed important by the practicing accountants. Thus, the results of this study indicated that spreadsheet

proficiency for accountants meant having skills related to basic functions ('Data entry, format, and calculation') as well as skills related to specific functions such as 'Lookup and Pivot Table' and 'Logic'. Future research should continue to explore the meaning of spreadsheet proficiency for workers in the non-accounting sectors. This would help to facilitate better communications regarding spreadsheet proficiency for workers in different areas of specialization.

CONCLUSIONS

To reiterate, the results obtained in this study can be summarized into three main areas. First, the coding results for the recruitment advertisements showed that Excel was the most common technology skill requirement for accountants. Second, the results of the survey among practicing accountants found that the three most important categories of spreadsheet skills were 'Lookup and Pivot Table', 'Data entry, format, and calculations', and 'Logic'. Third, the results of the survey among newly hired accountants showed that the three most knowledgeable spreadsheet skills were 'Data entry, format, and calculation', 'Charting', and 'Logic'. The difference in ranking between the importance and knowledge of the various spreadsheet skills showed that there was a negative skill gap for 'Lookup and Pivot Table'. This implies that aspiring accountants should pay particular attention to the skills for 'Lookup and Pivot Table' to improve their spreadsheet proficiency.

The results of this study have contributed to our knowledge about spreadsheet skills for accountants. They provided clarity and understanding for the meaning of spreadsheet proficiency in the context for accountants. They also identified the areas of spreadsheet knowledge where the newly hired accountants can improve their proficiency. The results obtained in this study can serve as a reference for educators to plan and design their accounting curriculum to better prepare accounting students for their careers.

There are some limitations regarding this research. First, this study coded recruitment advertisements that appeared at a point in time. Caution needs to be exercised when generalizing the results into the future. It is possible that other technology skills may become important for accountants in the future. Second, the use of convenience samples to conduct the surveys in this study was meant for exploratory purpose. Future studies could use more rigorous samples to verify the results obtained in this study. Third, this study measured spreadsheet skills based on the respondents' perceptions of their knowledge. A more accurate measurement of spreadsheet skills would

be to test the actual performance of using the various spreadsheet functions.

In conclusion, this study has noted that the importance of the various spreadsheet skills may vary across jobs. Hence, it is useful for future research to determine the skills required for spreadsheet proficiency in different professions and contexts. This will enable potential employees to understand the skills requirements in different work areas and help them with their skills acquisition and job applications. Individuals and organizations will ultimately reap the benefits of understanding spreadsheet proficiency in different contexts as the workforce will be better equipped with the appropriate skills to enable the workers to perform better in their jobs.

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