

Impact of Mathematics on Indigenous Students' Decision to Study Accounting

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Abstract: Over the last decade there have been some serious concerns amongst accounting professional bodies concerning the status of accounting education which has exhibited a dramatic decline in the number and quality of students majoring in accounting (Albrecht & Sack 2000; Jackling & Calero 2006; Hardin et al. 2000; Sherman & Tymon, 1997). Research has also been conducted on the representation of marginalized ethnic groups in the accounting profession (Jacobs, 2000; Hammond & Streeter, 1994; Hammond, 1997; Hammond et al., 2007; Holmes et al., 2005; Hooper & Pratt, 1995; McNicholas et al., 2004; Mitchell & Flintall, 1990; and Preston, 2006). However research which concentrated on Indigenous Australians and accountancy are limited to two studies (Lombardi & Clayton, 2006 and Rkein & Norris, 2010). Those two studies have contributed significantly to the literature by empirically demonstrating the Indigenous under-representation. However, both were limited to a very few participants only. Indigenous members of Australian accounting professional bodies are estimated to be nine or ten (Lombardi & Clayton, 2006, and Rkein & Norris, 2010). Due to the lack of literature on the factors that impede Indigenous Australians from studying and/or joining the accounting profession, this study investigates the mathematics factor, and analyses the relevant literature. There are many researchers who studied the relationship between mathematics and students' decision to major in accounting. Since students, universities, accounting professional bodies and researchers see a strong relationship between the individual's mathematics skills and the decision to major in accounting and since Indigenous Australians' performance in mathematics is below national averages, this study suggests that one of the factors that might impede Indigenous Australians from studying accounting is their mathematics level. In addition to examining the available research, this study builds its conclusion on a pilot study that was conducted with Indigenous high school students.

Key words: accounting; mathematics; indigenous

JEL codes: M40, M41, M49

1. Introduction

Australian Indigenous people are the traditional owners and the native people of the Australian continent. They represent 2.3% of the population (455,026 approx) (Department of Immigration and Citizenship, 2008), which is a result of 40% decrease in the population of Indigenous people since the start of the colonization. Indigenous Australians are also identified either as Aboriginal or Torres Strait Islander people. They are the most disadvantaged group on the Australian land; they mostly belong to the lowest socio-economic status. Up to date,

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they are still to be given the same opportunities as their non-Indigenous counterparts, for example: “education, skills and support to find and keep meaningful work, and to build financial self reliance” (Australian Government 2011). Indigenous peoples’ capability to engage in effective governance, financial management and economic participation still needs to be increased significantly (Mcintosh, 2011). According to McIntosh (2011), Indigenous corporations’ failure is high, mainly due to poor governance and poor management. McIntosh (2011) points to the need for accounting education and accountants among Indigenous people, which assist in delivering financial systems, infrastructure and financial leadership.

Although Indigenous people are under-represented in many professions, their representation in the accounting profession is even lower. Further statistics reinforce this view. There are, for example, only ten Indigenous accountants among the 180,000 professional accountants in Australia. Therefore, for non-Indigenous people there is one accountant for every 110 people¹. However for Indigenous people, there is one Indigenous accountant for every 45,502 Indigenous people². With the absence of research on factors that impede Indigenous people from participating in accounting, this study builds on the literature that has investigated factors which impede Indigenous and marginalized ethnic groups from majoring in accounting. It also builds on accounting education literature, which enquired into factors that are considered when a decision to major in accounting is to be taken. Although these two types of literature suggest other factors, this research uses one of the factors that have an impact on students’ decision to major in accounting. This factor is the students’ mathematics skills and their enjoyment of it. Based on the literature, this research concludes that although there are other factors, students’ mathematics skills and enjoyment has significantly impacted their accounting study choice. Consequently, and due to the lack of research on factors preventing Indigenous students from majoring in accounting, this research uses the mathematics variable to suggest it as a possible factor behind the Indigenous under-representation in the accounting profession. This factor was chosen over the other variables, because the Australian literature regarding mathematics is rich and most importantly because Indigenous mathematics is impacted by Indigenous culture.

2. Literature Review

Indigenous and/or marginalized ethnic peoples, not only in Australia, but in the United States, Canada, New Zealand, and South Africa are disadvantaged, influenced and controlled as a result of the accounting discourses and technologies (Gibson, 2000; Greer & Neu, 2009). Previous researchers have discussed the issues that minority groups in the United States, Canada, New Zealand, and South Africa generally face when entering the accounting profession (Greenhaus et al., 1990; Hammond & Streeter, 1994; Hammond, 1997; Hammond et al., 2007; Hooper & Pratt, 1995; Holmes et al., 2005; Jacobs, 2000; James, 2008; McNicholas & Humphries, 2005; Mitchell & Flintall, 1990; Moyes et al., 2000; Preston, 2006; Sadler, 2002). These researchers have found that the following factors³ significantly prevent marginalized ethnic groups from majoring in accounting: Racial discrimination, work task assignments, poor education, cultural differences, low self efficacy and self confidence, distrust, unfamiliar work environment, socio economic status, work values, and mathematic skills (counting and adding).

Canadian Indigenous employees have always faced significant obstacles when trying to entering non-Indigenous organizations. Volume two of the Report of the Royal Commission of Aboriginal Peoples:

¹ Number of non Indigenous people divided by the number of non Indigenous accountants 19,855,287/179,990.

² Number of Indigenous people divided by the number of Indigenous accountants 455,026/10.

³ Further information on these factors can be obtained from a paper that should be published soon titled: The Participation of Indigenous Australians in Accounting Education and Profession: Some Insights from International Comparisons.

Restructuring the Relationship (Royal Commission on Aboriginal Peoples, 1996, p. 937) sheds light on some of these obstacles. The following is a statement made by a Canadian Indigenous:

“How was I [an Aboriginal] supposed to deal with a manager and a system that continually sought to treat me as a child? I have both a Bachelor's and Master's degree, and their tactics included requests that I submit all of my calculations for verification by a supervisor, ostensibly because they couldn't be sure my totals were correct. No other person among my forty-three co-workers was required to do this. They told me that my work was being checked because I grew up on a reserve where nobody learned to add properly”.

As can clearly be seen from the previous statement, a precise indication was given to calculation and adding which according to many researchers has been linked to accounting (Hartwell et al., 2005; Jackling & Calero, 2006; Mitchell, 1985; Parker, 2000; Wong & Chia, 1996). As a result, like other Indigenous and marginalized ethnic groups, Canadian Indigenous people were driven away from a profession that has a perception of a strong relationship with numbers and counting.

In addition, influences on a mainstream students' decision whether to major in accounting or not have also been examined in prior studies. Researchers (Adams et al., 1994; Auyeung & Sands, 1997; Cangelosi et al., 1985; Cohen & Hanno, 1993; Geiger & Ogilby, 2000; Gul et al., 1989; Jackling & Calero, 2006; Lowe & Simons, 1997; Mauldin et al., 2000; Paolillo & Estes, 1982) have examined factors that impact students' study choice of accounting and suggested the followings factors: availability of employment and earnings, perceived job satisfaction, aptitude, interest in the subject, the influence of teachers, friends, and families, perception of the accounting profession as “too quantitative and boring, too number-oriented, and number crunching”, etc.

Sharlee (2008) stated that accounting is a very old subject and argued that the word “account” comes from the Latin words “ad” and “computere”, which mean “to reckon together”. The word “reckon” means “to count up, compute or calculate”. It is important to note here that although most accounting definitions do not specifically mention the term “mathematics”, a perception of a strong relationship between accounting and mathematics cannot be denied (Jackling & Calero, 2006; Hartwell et al., 2005; Mitchell, 1985; Parker, 2000; Wong & Chia, 1996). Nonetheless, most accounting definitions state that accounting requires numerical and analytical skills which are also integral elements in mathematics.

In their study, Cohen and Hanno (1993) suggested that students who chose not to major in accounting did so based on recommendations and advice from people important to them, but more significantly, they perceived it to be too number-oriented and boring. Jackling and Calero (2006) cited that accountants have been typically referred to as “number crunchers” given that book-keeping and auditing work has emphasized or been associated with an emphasis upon numerical accuracy, routine recording and calculation methods, together with attention to detail (Parker, 2000). Yunker et al. (2009) maintained that accounting as a discipline is concerned with accurate numerical measurement of accurately defined operational concepts. Researchers have also asserted that the negative views in accounting as a profession are linked to poor numerical skills (Parker, 2000). These numerical skills are seen as essential for someone to be successful as an accountant (Parker, 2000). Other studies (Mitchell, 1985) have also established a positive relationship between accounting and mathematics, when he demonstrated that a possession of greater numerical ability drives a better performance in accounting. Although they were more specific than others, Wong and Chia (1996) indicated that a higher degree of proficiency in mathematics is associated with a higher performance in financial accounting.

Although the previous studies empirically asserted the relationship between accounting and mathematics, this paragraph allows the reader to hear the students' voice on such relationship. Generally, Students think that a

person has to be good with numbers in order to do accounting. For instance, it was concluded in the study conducted by Eskew and Faley (1988) that university students' success in accounting was attributed to spending more study hours in mathematics and statistics. Other studies have suggested that students' interest in mathematics plays an important role in driving them to accountancy. For example, in their study, Hartwell et al. (2005) indicated that 75% of accounting majors students expressed a high level of interest in mathematics, in comparison to only 43% of other business majors. Such a perception of a relationship between accounting and mathematics was also confirmed by universities through their course structure. Universities require their students to prove efficiency in mathematics to be able to join the accounting course. For example: Pepperdine University requires accounting students to do two core mathematic courses namely, Math 214: Calculus for Business, and Math 215: Probability and Linear Algebra. Charles Darwin University also requires all accounting student to do a statistics class, which complies with the Australian accounting professional bodies' requirement.

According to Yunker et al. (2009), most business schools require their students to do mathematics in basic calculus and matrix algebra. While researchers, such as Clark and Sweeney (1985), and Roy and MacNeill (1967) identified college mathematics and calculus as fundamental areas of study for accountants, others such as Collier and McGowan (1989) reported an association between maths grades and scores in intermediate accounting one. It is important to note that students' performance in high school, first year university level maths scores and second year accounting grades are associated (Negash, 1997). This explains why students' performance in accounting subjects was positively attributed to their mathematics background (Koh & Koh, 1999).

The relationship between mathematics and accounting was attributed to the heavy reliance on "numbers" in both. As a result, students as well as practitioners of accounting should be comfortable with mathematics in general and numbers in particular (Yunker et al., 2009). This was demonstrated in Pritchard et al.'s study (2004), which suggested students who major in accounting and finance have better computational and algebraic skills than students in other business majors. Others such as Negash 1997 also assert the positive influence of mathematical skills on grades obtained in accounting classes. Such a relationship was also confirmed in Smith's study (2005), when he explored a strong relationship between mathematics instructors and their influence on students' decision to major in accounting.

3. Methodology and Analysis

Not only does mathematics influence accounting students' performance: it also impacts on their study choice. The relationship between accounting and mathematics becomes more significant when considering how mathematics might influence students' performance in accounting. Researchers, such as Warsono, Darmawan and Ridha (2009) argued that the use of mathematics rationality simplifies the explanation of why the elements of expenses and assets should receive the same treatment in relation to credits and debits. They also demonstrated that the rules of debits and credits are totally based on mathematical logics and that learning accounting should be based on a mathematical platform. It was also in their study that a perspective of mathematics can be employed to solve crucial issues in accounting principles. Other researchers such as Pincus (1997), suggested that grounding accounting on mathematics can make the understanding process of accounting much easier, including adjusting entries whose debits and credits have often become an object of complaint on the part of the students.

Therefore, based on the arguments presented earlier, a perception of a relationship between accounting and mathematics can be concluded. Accordingly, it is expected that students who perform well in mathematics will do

well in accounting, and those who enjoy mathematics are more likely to choose accounting than those who do not enjoy it. The need to address the relationship between accounting and mathematics is due to the lack of research on Indigenous student's participation in accounting in Australian literature. On the other hand Australian literature is rich regarding these students' performance in mathematics (Cooper et al., 2005; Matthews, 2003; Matthews et al., 2005; Warren & Young, 2008; Watson et al., 2006). Consequently, while the perception of a relationship between accounting and mathematics reflects a reality, students' participation and performance in accounting might be anticipated from their participation and performance in mathematics. Therefore, this study investigates the Indigenous mathematics skills, and, in line with the previous literature, it draws a conclusion on whether mathematics can be one of the factors that impede Indigenous Australians from doing accounting. This study then uses a pilot study that was conducted by the author to explore the reasons behind Indigenous students' under-representation in the accounting profession. In total, nine Indigenous high school students and a career advisor were interviewed using semi structured interview approach.

4. Indigenous and Mathematics

As with education in general, the Australian indigenous students continue to be the most disadvantaged group in mathematics (Cooper et al., 2005). Indigenous students' performance in mathematics is below State and National averages at every level of schooling (Watson et al., 2006) and, for instance, the numeracy achievement of Indigenous students in New South Wales continues to be lower than of non- Indigenous students (Frigo & Simpson, 2008). In Australian mathematics education there are many factors impacting Indigenous students performance in mathematics, but according to Matthews et al. (2005), there are two significant factors: Indigenous students do not see much relevance (if any) in mathematics and mathematic educators do not have much faith in the learning ability of mathematics by Indigenous students. Other factors might be attributed to the inexperienced non-Indigenous teachers who usually, after two years from being at Indigenous schools, still do not know how to teach Indigenous students properly (Cooper et al., 2005). In addition Nakata (2002) stated that Indigenous cultures are viewed as having a very slight need for mathematics in their communities. In addition, Indigenous' poor language proficiency might also play a role. Even though they are bilingual, they are disadvantaged compared to non-Indigenous students, because English is not the language spoken at home. Their "home English" lacks some of the main vocabularies that are commonly used to describe mathematical situations (Warren & Young, 2008). Therefore western mathematics effectively locks out Indigenous students who are unable to speak this language of western mathematics.

Collier and McGowan (1989) state that students need to understand number concepts in order to do well in accounting and that background knowledge in arithmetic and algebra are necessary conditions for good performance in accounting subjects. However, although Indigenous Australian students have mathematical concepts, these concepts are expressed in a different way than the non-Indigenous do (Warren & Young, 2008). As a result, previous research on Indigenous number skills and counting systems indicated that such a system is poor and it lacks the structure for it to be called a system in the first place (Harris, 1987). While Harris (1987) states that ". . . nor is their (Aboriginal) counting comparable to our elaborate numerical system, Brandenstein (1970) stresses that their numbering system did not exceed 3. Blake (1980) went further and claimed that "Australian Aborigines not only did not develop mathematics, but did not even feel the need to count. No Australian Aboriginal language has a word for a number higher than four (Blake 1980).

Blake and Brandenstein were criticized by Harris (1987) who argued that “Statements such as these, which do not even admit five, are not simply misleading they are false”. Both Aboriginal and Torres Strait Islanders are able to count when there is a need to do so. For example, “Haddon in the Western Torres Strait Islanders was given considerable information on numbers including one hundred-Maura, and one Thousand—Kai Gasa (Haddon, 1890, p. 305)”. Additionally, “Tindale bargained with Groote Eylandters, demanding 150 spears which he indicated as 10×15 (10 Fingers $\times$ 15 Sticks). The Groote Eylandters brought him the correct number, 140 of them being tied in bundles of twenty because that was obviously how they preferred to group them” (Tindale, 1925, p. 129).

Harris rejected the claim of the inability of Indigenous people to count and argued about the existence counting “words” if the need arises. Other researchers with similar views to Harris disagreed that Indigenous Australians need words for counting. A study which investigated the number skills of children from two Indigenous communities, namely, the Warlpiri speakers in the Tanami Desert, north west of Alice Springs, and Anindilyakwa speakers from Groote Eylandt in the Gulf of Carpentaria, (Both languages have very restricted vocabularies for numbers, limited to words for one, two, few and many) as well as a group of Indigenous pre-school children from Melbourne, indicated that Indigenous Australian children who speak languages that only have very few words for numbers are still able to count and have similar skills to English speaking Indigenous students (Sim-Jones Janine, 2008).

Others (for example, Lovesy & Fraser, 1999) with extremely different views, contradict all the prior research which attributed the inability to count among the Indigenous societies as due to the lack of words for numbers. This does mean that literacy has no relation with numeracy. Language is very significant as it helps in understanding concepts such as accounting concepts. For example, it has been reported that in many Indigenous languages words such as “expenditure”, “variance” or “budget” do not exist. The concept will not be understood if the word does not exist (Lovesy & Fraser, 1999). Furthermore, Indigenous peoples and their cultures are totally ignored in the Australian mathematics education (Matthews, 2003). As a result, in a state-wide survey conducted by Queensland Studies Authority (QSA), it was stated that Indigenous students are generally two years behind in their understanding of numeracy in comparison with non-Indigenous students (QSA, 2003).

Although Watson et al. (2006) argued that Indigenous students' performance in mathematics is below State and National averages at every level of schooling (Watson et al., 2006), some Indigenous students were successful in mathematics in some schools. Such success for instance was due to: students being culturally inclusive, living in homes where there is strong and/or academic support for school learning, and having great individual teachers who are inclusive and strongly supportive (Watson et al., 2006). Watson et al. (2006) stated, nevertheless, that in schools where there was a clear social division and racism among students (Indigenous/non-Indigenous), Indigenous students have demonstrated poor performance in mathematics. Nonetheless, the major concern regarding Indigenous students' underperformance in mathematics and low numeracy skills is that it prevents them from meeting the minimal mathematical Vocational Educational Training (VET) requirements for apprenticeships and traineeships and entry to university (Brown, 2008) to study accounting or science for example, and limits their access to the benefits that education provides.

5. Students' Interviews

While the literature has suggested a strong relationship between students' enjoyment and performance in mathematics and their decision to major in accounting and their performance in the subject, it also suggests that

Indigenous Australians have a low level of mathematics. As a result this study raised the possibility of this being a major barrier for Indigenous peoples entering the accounting profession. Such a finding is strengthened by data collected from Indigenous high school students on why they did or did not do accounting. For instance some Indigenous students have stated the following *"I do not really like maths, therefore, I did not like accounting...., I am not interested in it."* Another student stated *"I think maths is related to accounting..., so if you are not good with maths, then you will not do well in accounting"*.

A third student stated *"... I think accounting is full of maths, if you good with maths you will be fine in accounting, accounting is all numbers and that is what maths is about"* [sic], while another stated *"... to do accounting you will need maths, but not very good maths; it is probably only kind of basic maths..."*. A fifth student stated *"I have enjoyed accounting, maybe because I am reasonably good with maths and accounting is all numbers"*. While the sixth student stated *"... in my opinion, accounting has a lot to do with maths, at least that what people say, maybe computers does it all now"*. The seventh stated that *"...I think maths certainly has a degree to push some students away from accounting"*. The career advisor⁴ has also contributed to the findings of this research when stating that *"... because Indigenous students do not have the math level required for accountancy, they do not actually think that they can do that area"*.

Irrespective of whether Indigenous people have words for numbers or not, research indicated their ability to count as well as their ability to perform well in mathematics given the right learning environment and conditions such as family, friends, support, etc. Therefore, since mathematics is a major factor that impacts students' decision to major in accounting, Indigenous mathematics skills should be enhanced first, and/or changes to such a perception of a relationship is urgently needed.

6. Conclusion

In the absence of research on the factors that impede Indigenous Australians from participation in accounting, this study has based its argument on the mathematics factor which is seen as a major impediment for students to major in accounting. This study initially reviewed the international literature on marginalized ethnic groups, and secondly the accounting education literature, and found that, in addition to other factors, mathematics was always a major factor impacting on students' decision on whether to major in accounting or not. This study then expanded its review of the literature to confirm the relationship between mathematics and students' performance and their decision to major in accounting. While reviewing the Indigenous mathematics literature, it was found that Indigenous Australians have poor mathematics skills⁵. Therefore, this study then suggested that due to the perceived relationship between mathematics and accounting, mathematics is possibly one of the major factors behind Indigenous students' low participation in the accounting profession. This finding was then supported by interviews from Indigenous students. Although this study was only based on one variable, it is believed that it should encourage researchers in the future to investigate this issue further and use larger samples.

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⁴ Career Advisor is a person that advises Indigenous students on the type of careers that is most suitable to them.

⁵ It is important to note that most of the literature that suggested poor mathematics skills for Indigenous Australians is written by non-Indigenous researchers.

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