Trained In Science-Base Field: Change of Specialization among Educated Women in Malaysia

Suhaida Mohd Amin [1], Nurulhuda Mohd Satar [2], Su Fei Yap [3]

[1] Faculty of Economics & Administration, University of Malay
suhaidama@gmail.com

[2] Faculty of Economics & Administration, University of Malay
nurulhuda@um.edu.my

[3] Faculty of Economics & Administration, University of Malay
g2yss@um.edu.my

ABSTRACT

The theoretical model for economic development states that development in science and technology is the key to increased productivity. Upon realizing this, the Malaysian government has targeted 60 to 40 per cent of students for Science to Arts field at the tertiary level of education. However the rate of participation in science-based programs hardly achieved 60 percent even after more than four decades of efforts taken and incentives given by the government. Despite the policy's under-achievement, this article aimed at examining another dimension of the issue. It sets to explore to what extent would Science based graduates remained working in the same field after their graduation. Given that female has been dominating the enrolment in tertiary education while low rate of female participation in the labor market is recorded, this study focuses on women who have completed their tertiary education. Based on data collected through survey on educated women, this study found 36.9% of women who have graduated with science-based degree opted to non-science type of job. The study also found that those who opted out experienced difficulty in finding a job and earned less than those who remained in the same field. Unsurprisingly, these respondents found that knowledge acquired from their tertiary education is less helpful in their career advancement. The findings highlighted the under-achievement of the policy implemented by the government.

Keywords: *scientist, educational migration, educated women*

INTRODUCTION

Specializing in certain fields of study enable people to develop a specific set of knowledge and skills related to a functional area or also known as specialization. In Malaysia, the Ministry of Education has divided the field of study into five categories namely science, technical, ICT, social sciences and education (MOE, 2010, 2012). At the secondary school level, a student is classified as a science student if they take at least two elective courses in the science field whereas arts students are those classified as non-science students (Phang, Abu, Bilal Ali, & Salleh, 2012). At the tertiary level, the faculty affiliation will determine the areas or specialization of the study.

In 1969, the Malaysian government has set a target to achieve a 60-40 percent composition of students in science versus arts field at tertiary level of education. This policy aimed at producing more scientists, engineers, doctors and technicians who would be highly specialized for the development of various economic and social sectors, in line with the increase in population and quality of life. It continues to be emphasized in every five-year development plans because it is believed that the supply of manpower in science and technology can further develop the economy sectors such as agriculture, industry and trade (Hussin & Zakuan, 2009). Based on the aspiration to achieve the status of a developed country by 2020 where

Malaysia would needs more expertise, the formulation of this policy is to provide an adequate manpower in science and technology.

To ensure the success of the plan, the Higher Education Planning Committee has set a transition ratio of the projected enrolment of students in science and technical compared to arts students. It gradually began in 1970 with a ratio of 45% of students in science and technical to 55% of students in the arts. The Committee has recommended that the projected enrolment, especially at the level of upper secondary education and higher levels in the ratio of 60% in science and technical and 40% in the field of arts (Hussin & Zakuan, 2009).

However, Phang et al. (2012) reported that until 2012, the percentage of student participation in science-based programs has never even achieved 60% implying the underachievement of the government effort. Another important concern, besides the underachievement of the policy, is the declining academic performance of students in science subject. Based on the Trends in International Mathematics and Science Study Report in 1999, 2003 and 2007, the science and mathematics scores of students aged 14 years have been declining.

There is however an equally serious issue concerning the composition of science-arts trained Malaysians namely the withdrawal of science-based trained graduates from science related jobs. There is a dearth of research looking at the choice of occupation among these graduates in which those who are trained in the field of science and technology are no longer contributing their expertise when they get into the labor market. This issue magnifies the underachievement of government's aim to increase the number of scientists in the country.

Research objectives and focus

In this paper, the term *changed in specialization* is emphasized to reflect those educated women with science based educational backgrounds who change to a non-Science field when entering the workplace. Therefore, the objective of this study is to examine to what extent women graduates who specialized in Science would remain in the same field when they enter the working world. This study also examined whether the selected field is in accordance with their interest and how the respondents view their career prospects when choosing the field of study.

Subsequently, this study also tried to examine the implications of such decision on job search, career path, income and career development. While the central focus is put on the failure to achieve the national education policy of a 60% student participation in science and technology programs, we argue that the decision to choose non-science based jobs among science graduates further amplify the problem.

The scientific and technical fields are generally dominated by men. However, there is an increase in the number of female students in technical and vocational institutions. Besides, the number of females in related fields such as engineering, architecture and medicine has also increased (Daud, 1999). Recently, women have been dominating the enrolment in tertiary education (Suhaida, 2013). As the Millennium Development Goals (MDGs) emphasized the empowerment of women, this study will focus on women with tertiary educational attainment in Malaysia and examine their choice of career.

Literature Review

Human Capital Theory suggests that education or training raises worker productivity by imparting useful knowledge and skills, thus raising workers' future income by increasing their lifetime earnings (Becker, 1962). Because of the positive association between wealth and human capital, capability of people can be increased through education and training (Theodore, 1961). Human capital theory explains that schooling and training are a form of investment that can enhance skills and competencies (Mincer, 1962). For that reason, the differences in educational background and skills acquired will influence income level.

In ensuring Vision 2020 could be achieved, the investment in education at all levels is highly encouraged. The emphasis is on investment in higher education and to enhance student participation in science and technology. This is because the stock of human capital in the field was used as an indicator of a developed country (OECD, 1998). Besides, employers regularly voice out their concern about current or future shortages of science and engineering graduates and occasionally threaten to relocate R&D activity to other countries, where the supply is more abundant (Noaillya, Webbinka, & Jacobs, 2011).

According to Ministry of Education statistics from 1981 to 2010, the percentage of high school students in the sciences has never reached the targeted ratio of 60:40 (Phang et al., 2012). The main problem is the participation of students in science and technology is not encouraging enough (Phang et al., 2012) and this issues is also common in other developing countries (Harris & Farrell, 2007; Noaillya et al., 2011).

According to Phang et al. (2012), the Malaysian government has enacted the existing policy and introduced a range of policies and educational plans and taken a variety of approaches to overcome the shortage of students in science. However, target is still unreachable.

Meanwhile, the only support from families to their children in choosing Science and technology field comes in the form of encouragement. For examples, most families will involve in the early stages to select the field of study when students enter upper secondary school (Hassan, Awang, Ibrahim, & Zakariah, 2013). According to Hussin and Zakuan (2009), students in science and technology said that their own interests and ambitions had led them to choose the field of study. The selection of field also varied between urban and rural areas. Compared to those living in rural areas, people in the urban area are much more exposed to career information, which plays an important role in determining the chosen field of study at the tertiary level.

Semeijn, Boone, Van Der Velden, and Van Witteloostuijn (2005) highlighted that personality features have an effect on labor market outcomes, net of traditional human capital variables (e.g., study results) and individual domain preferences (e.g., study fields). Individuals pursuing their studies and career in science are influenced by five main driving factors namely family background, socioeconomics of the family, community background, school background and personality or attitude. Gender is another factor contributing to the field preference. According to Hussin and Zakuan (2009), female students showed negative attitudes towards science and science-related careers.

At tertiary level, four issues have been identified related to students' participation in science and technology. The first issue is the ability of higher education institutions to improve the accessibility and participation of students in terms of quantity and quality, and the second is the resource allocation for improving teaching and learning quality. Also discussed are the performance of students in secondary schools to prepare for higher education, and the fourth issue is related to the students' interests as well as courses related to science and technology (Hussin & Zakuan, 2009).

The Manpower Development Model is the model used by developing countries including Malaysia to forecast the number of places that will be offered to the students at the tertiary level. However, the disadvantage of using this model is the occurrence of a mismatch between production of graduates with job opportunities. According to Hussin and Zakuan (2009), the mismatch will form a few phenomenon. Mismatch problems will contribute to unemployment or not getting a suitable job. If graduates are employed in jobs not matching their education qualification, underemployment occurs. Consequently, in order to facilitate job search after graduating, students must ensure that their choices in the field of study will meet the employers' demands (Yussof, 2008).

When entering higher education, women constitute the majority in many countries, and yet it seems that at each consecutive stage, from graduation to PhD to full professorships, more and more women prefer to drop out (Müller, Castaño, González, & Palmén, 2011). Furthermore, when starting to work, most females have jobs not related to their qualification. As a result, they cannot utilize their abilities and education properly (Chaudhry & Jabeen, 2010). The main worry is that those women would have spent at least five years of their lives being enrolled in tertiary level within their specialized field, cannot fit in with their own life expectations, facing direct consequences in terms of individual well-being and life circumstances besides a loss of transferability of skills (Mora, 2010).

METHODOLOGY

According to Sue and Ritter (2007), if the sample size is large and widely distributed geographically, online survey is a convenient option. Besides, online surveys work best in closed populations where the potential respondents are known to have access to email and the internet. It is also relevant with Malaysia's statistics showing that those who are more educated are frequent users of internet (MCMC, 2013). Therefore, according to Krejcie and Morgan (1970), to represent Malaysia sample size should be 384 of women in the science and technical field.

Based on the statistics of graduates in the labor force (DOSM, 2011), there are 525.3 thousand employed women working with degree level. To represent this large population, this study utilized respondent from Tracer Study (Subsequent) 2008/2009 done by the Ministry of Education Malaysia (MOE). The Ministry has supplied email addresses of 7,716 females from those who participated in their study.

Respondents were approached via email and those who wanted to participate in the survey needed to click on the link provided in the email. Since the purpose of the study was to see whether those who are in science remain in their field, descriptive analysis was used. In addition, the respondents also answered an online questionnaire in the form of a Likert scale with a value of 1 for strongly agree and 5 strongly disagree on questions related to selection of the field of study and how it impacts respondents.

FINDINGS

From 7,694 valid email addresses, 1,171 emails were bounced and 30 respondents did not qualify as respondents (because they did not have the characteristics required). As 45 respondents opted out, only 6,448 respondents received the online questionnaires. From this figure, only 943 (14.6%) educated women have completed the questionnaires (848 working, 95 not working).

However, when examining each respondent by field of study, few of them have changed their field when pursuing their studies to a higher level. To avoid biasness, only those respondents with degree qualification have been analyzed (the analysis has excluded those who pursued their study). The drop-out rate is determined based on respondents' field of study while studying at the university with the selected field and occupation when starting a career.

Those who took a degree in pure science, technical and Information and Communications Technology (ICT) are classified as graduates from the science field. Table 1 shows demographic information of 268 educated women who were analyzed.

Table 1: Respondent background

	Frequency	%
Ethnic		
Bumiputera	232	86.6
Chinese	29	10.8
Indian	5	1.9
Others	2	0.7
Field of study		
Science	109	40.7
Technical	92	34.3
ICT	67	25
Marital status		
Never married	105	39.2
Married	161	60.1
Others marital status	2	0.7
Age group		
25 – 34 years	254	94.8
35 – 44 years	14	5.2
Total	268	100

A total of 109 women (40.7%) of respondents majored in pure science, 92 women (34.3%) in technical while 67 women (25.0%) majored in ICT. As reflected in the racial composition of Malaysia the respondents were dominated by the bumiputera, 86.6% from the total respondents. The majority of respondents consist of those between the age of 25 to 34 years (94.8%) and those who are married (60.1%).

In order to find out whether the respondents change their specialization while working, they were asked whether their current career was in parallel with their field of study. To further confirm their answer,

the respondents were also asked to state the name of their career. Table 2 shows that 36.9% of graduates from science remarked that they do not consistently work in the same field of their studies. Among those in the science-based, the highest number of respondents who have changed to other fields when working are Pure Science graduates.

Table 2: Field of study and field of work

In the same field?	Field of study while bachelor degree							
	Science		Technical		ICT		Total	
	n	%	n	%	n	%	n	%
No, I change	50	45.9	22	23.9	27	40.3	99	36.9
Yes, similar	59	54.1	70	76.1	40	59.7	169	63.1
Total	109	100.0	92	100.0	67	100.0	268	100.0

Table 3 shows a comparison of the suitability of personality, confidence that their chosen fields of study have a good career prospects in the future, the relevance of studies with work process, level of difficulty in getting a job, worthwhile salary and confidence in career advancement among educated women who remain in their field compared to those who changed to other fields.

A summary of the findings are as follows:

i. **The chosen field of study suited to personality:** Table 3 shows that 142 (84.0%) of respondents who continued in the same field when working stated that their chosen field of study is consistent with their personalities. Only 8.9% from those who remain in science field said the opposite. 18.2% of the group that changed to other field when working, feel that their personalities are not in accordance with the chosen field of study.

ii. **Field of study is chosen because the career prospects are bright**: Data for this variable seems consistent with previous ones. Those who remain in their field have better percentage (78.7%) in believing that they have bright career prospect. 21.2% of those who have changed their fields disagree with that statement.

iii. **Field of study helps to facilitate the process of work**: The analysis shows that 95.9% of respondents who remained with the field of study agreed that what their study helps them in the workplace. Implication of exchange field, only 46.5% benefited from their studies and 28.3% were found facing difficulties in managing their work.

Table 3: Comparison between those who change and remain in their field of study while working

	Not change field		Change field	
	f	%	f	%
The chosen field of study suited to personality				
Agree	142	84.0	69	69.7
Not sure	12	7.1	12	12.1
Disagree	15	8.9	18	18.2
Total	169	100.0	99	100.0
Field of study is chosen for bright career prospects				
Agree	133	78.7	54	54.5
Not sure	21	12.4	24	24.2
Disagree	15	8.9	21	21.2
Total	169	100.0	99	100.0
Field of study helps facilitate process of work				
Agree	162	95.9	46	46.5
Not sure	4	2.4	25	25.3
Disagree	3	1.8	28	28.3
Total	169	100.0	99	100.0

	Not change field		Change field	
No problem finding a job in field of study				
Agree	119	70.4	43	43.4
Not sure	24	14.2	16	16.2
Disagree	26	15.4	40	40.4
Total	169	100.0	99	100.0
The salary offered in field of study is worthwhile				
Agree	93	55.0	36	36.4
Not sure	36	21.3	26	26.3
Disagree	40	23.7	37	37.4
Total	169	100.0	99	100.0
Working in field of study could advance the career				
Agree	141	83.4	45	45.5
Not sure	19	11.2	28	28.3
Disagree	9	5.3	26	26.3
Total	169	100.0	99	100.0

iv. **No problem finding a job in field of study**: among women who remained with their field, 70.4% did not have a problem in finding a job compared to only 43.4% among those who changed fields. Change to the other fields also resulted in 40.4% respondents having difficulties in finding a job

v. **The salary offered in field of study is worthwhile**: The data showed that those who remain in the field still have an advantage of worthwhile earnings compared to those who have changed to another field when working. However, only 55.0% of respondents among those who remained in the field agreed with this statement; the others are undecided and disagree. Those who have changed their field of study showed a lower percentage, only 37.4% agreed that the income received is worthwhile

vi. **Working in field of study face no problem to advance career**: 83.4% of educated women in the science and technical that remain in the same field stated that they have no problem in expanding their careers. For those who have changed field, only 45.5% have no problem while the other 26.3% indicated difficulties expanding their careers in the future

Discussion

The main findings of this study showed that many of the women were indeed trained in science-base have changed their field. More than a third of respondents have changed to other areas of their specialization and it is hard to ignore the numbers. Changing from their specialization of study still occurs even if they have solid interests in Science and technology and they are confident of a bright future for their careers. This means that interest of the respondent and confidence about the future of their areas is not enough to sustain them in the chosen field of specialization.

The study also found that graduates in science who change into another field face a difficult situation to find a job and earn a salary that is worthy of their qualification. This is certainly related to the change of field which created difficulties in finding a job and having to compete with those existing job seekers in the market. Their skills in science and technical fields probably are not required by the employer and lack of knowledge in the field of arts will impact them in the form of a lower salary than what they actually deserve.

Similarly, when they have started working, what they have learned in higher education institutions previously are less helpful in developing their careers. Maybe, more needs to be learned through experience. This result is consistent with Chaudhry and Jabeen (2010), emphasizing that educated women can utilize their abilities and education properly only if they get jobs according to their subjects or fields.

However, the change in specialization is not happening only in Malaysia. For example, Australian teachers revealed another trend of the high level of uncertainty among younger and early-career of teachers about whether to remain in the teaching profesion. Nearly half of the surveyed respondents were unsure whether they would still be teaching in five years' time (Harris & Farrell, 2007). For that reason, according to Mora (2010), judgment of the graduates are usually inconsistent and could make people reconsider their choices whether they have made the right choices several years ago.

CONCLUSION

All individuals are free to choose the type of work they will undertake. However, when people who are educated in science shift to other areas, the government's intention to add more experts in science and technology will be further away from the target. Accordingly, as the government is trying various measures to increase enrolment to 60% of students in science, many of those who are indeed in science dropped out from the field.

Most women who originally were educated in science change to the field of education (such as teachers and lecturers) and administration (an officer in the government without specializing in the field). Some even work with lower positions than their qualifications as clerks, assistant officers, technical assistants, sales assistants, and office secretary.

What is essential to be highlighted in this study is that Malaysia is facing a harder situation to achieve its target of 60% in science and technology because those who were trained have changed to different fields outside their specialization. This means that the government's desire to produce more skilled workers by 2020 becomes a difficult task. Further studies should evaluate why the women have changed their field. By finding out why they have changed their specialization, the government could prevent the drop-out situation.

REFERENCES

Chaudhry, I. S., & Jabeen, T. (2010). Factors and Constraints Affecting Labour Force Participation of Postgraduate Women: The Case of Bahauddin Zakariya University Multan, Pakistan. *Oeconomica*, *55*(3), 18–42.

Daud, N. M. (1999). Women's participation in scientific and technical fields in Malaysia. *Intellectual Discourse, 7*(2)*,* 197-214.

DOSM. (2011). *Statistics of Graduates in the Labor Force Malaysia*.

Harris, K.-L., & Farrell, K. (2007). The Science shortfall: An analysis of the shortage of suitably qualified science teachers in Australian schools and the policy implications for universities. *Journal of Higher Education Policy and Management, 29*(2)*,* 159–171.

Hassan, R., Awang, H., Ibrahim, B., & Zakariah, S. H. (2013). Seminar Kebangsaan Kali ke-4 Majlis Dekan Pendidikan IPTA 2013. In UIAM (Ed.), *Memacu pelan transformasi pendidikan : peranan IPTA dalam membantu meningkatkan kuantiti dan kualiti Pendidikan Aliran Sains dan Teknikal di Malaysia* (pp. 1–17). Selangor, Malaysia.

Hussin, S., & Zakuan, N. (2009). *Dasar Modal Insan (60 : 40 dalam Sains dan Teknologi) / Human Capital Policy (60: 40 in Science and Technology)* (1st ed.). Kuala Lumpur: Tinta Publishers.

Krejcie, R. V, & Morgan, D. W. (1970). Determining Sample Size For Research Activities. *Educational And Psychological Measurement*, *30*, 607–610.

MCMC. (2013). *Internet Users Survey 2012*.

Mincer, J. (1962). Labor Force Participation of Married Women : A Study of Labor Supply. In *Aspects of Labor Economics* (Vol. I, pp. 63–106).

MOE. (2010). *Laporan Kajian Pengesanan Graduan Susulan 2008/09 (Tracer Study Follow-up Report 2008/09)*.

MOE. (2012). *Laporan Kajian Pengesanan Graduan Susulan 2011 (Tracer Study Follow-up Report 2011)*.

Mora, T. (2010). Why do higher graduates regret their field of studies? Some evidence from Catalonia, Spain. *Education Economics*, *18*(1), 93–109.

Müller, J., Castaño, C., González, A., & Palmén, R. (2011). Policy towards gender equality in science and research. *Brussels Economic Review*, *54*(2/3), 295–316.

Noaillya, J., Webbinka, D., & Jacobs, B. (2011). Should the government stimulate enrolment in science and engineering studies? *Applied Economics Letters*, *18*, 371–375.

OECD. (1998). *Human Capital Investment : An International Comparison*.

Phang, F. A., Abu, M. S., Bilal Ali, M., & Salleh, S. (2012). Seminar Majlis Dekan Pendidikan IPTA (Seminar on Dean's Council of Public University Institution). In *Faktor penyumbang kepada kemerosotan penyertaan pelajar dalam aliran sains (Factors contributing to the decline in student participation in science)*. Johor Bahru, Johor.

Semeijn, J., Boone, C., Van Der Velden, R., & Van Witteloostuijn, A. (2005). Graduates' personality characteristics and labor market entry an empirical study among dutch economics graduates. *Economics of Education Review*, *24*(1), 67–83. doi:10.1016/j.econedurev.2004.03.006

Sue, V. M., & Ritter, L. A. (2007). *Conducting Online Surveys*. Sage Publication.

Suhaida, M. A. (2013). 1st International Conference On Human Capital and Knowledge Management. In *Shortage phenomenon among educated and skilled labor in Malaysia*.

Theodore, W. S. (1961). Investment in Human Capital. *The American Economic Review*, *51*(1), 1–17.

Yussof, I. (2008). The 2nd International Conference on Educational Economics. In *Shortage of skilled workers in Malaysia's economy : A mismatch phenomenon*.