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Media Communication and Cultural Influence in Chinese Malaysian Students' Career Choice in STEM

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There has been a decline of Malaysian students pursuing STEM courses over the past few decades. The democratisation of higher education since the 1980s has seen intense advertising of higher education in local media, which plays a role in shaping students' career choices. Applying Stuart Hall's theory of Circuit of Culture, a study deploying advertisements, and a survey with intensive interviews has been conducted to understand media and cultural influences on STEM career choice of Chinese Malaysians. Several factors, including media stereotyping nature of jobs of STEM as laboratory-based and practical activities, lack of curation of distinct images and role models in many STEM careers, lack of experiential exposure in daily social settings, fragmentised science communications, and disconnect of Chinese Malaysians from mainstream national development could have contributed to this decline. The study found that there is no distinct dislike towards STEM by Chinese Malaysians. Rather, for them, there are a wide range of careers beyond STEM, with non-STEM careers appearing to be more attractive in terms of career prospects. Alternative discourses and narratives for STEM careers with reimaging of nature of jobs for STEM careers to reconstruct perception towards STEM via the media and science communications could enhance the attractiveness of STEM careers. Additionally, a multi-disciplinary approach to higher education and promotion of specific STEM careers based on market needs could bring STEM closer to students.

Keywords: career choice; higher education; STEM; media; culture

I. INTRODUCTION

In the last few decades, there has been a marked decline of students opting for science streams in Malaysia. In 1970, the government instituted the national target of 60: 40 Science to Arts students ratio policy to set impetus to national development, but the target has not been met till today (Malaysian Education Blueprint 2013-2025, 2013). According to the Ministry of Science, Technology, and Innovation (MOSTI), presently, Pure Science students represent a mere 18% at secondary level; while at tertiary level, in 2020, it was 47.18%, including those from technical and vocational programmes, (*Pembudayaan Sains, Teknologi, Kejuruteraan & Matematik (STEM)*, 2022). **STEM** (the acronym for **Science, Technology, Engineering and Mathematics**) education has been viewed as foundational to economic growth by many countries and has received continuous attention from the Malaysian government (Lee *et al.*, 2018).

Together with legislature, judiciary and executive, mass media is regarded as one of the four pillars of a functioning democracy, playing an instrumental role in modernisation and socio-economic development (Mustapha, 2005) and shaping national agendas. The democratisation of Malaysian higher education since the 1980s has brought about robust growth of private higher education, resulting in a highly competitive student market, with advertising becoming the main student recruitment marketing tool. Local private higher education institutions were among the top national media spenders. Some of the larger colleges spent about a

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million ringgit annually on media advertising. It was an era the media visibility of higher education reached a new height, with its communication likely creating an impact on career choice of Chinese Malaysians who have been their main clientele.

Applying Stuart Hall's theory of circuit of culture, a study deploying advertisements, and a survey with intensive interviews has been conducted to understand media and cultural influences on Chinese Malaysian students in STEM career choice.

II. STEM DEVELOPMENT AND SCIENCE COMMUNICATION IN MALAYSIA

A. STEM Development and its Issues in Malaysia

The term STEM originates from the United States when former US President George W. Bush spearheaded a political agenda in 2007 to improve national competitiveness by investing heavily in innovation through research and development in STEM. It involved many STEM-specific programmes, committees, organisations, research centres/groups, universities, and laboratories (Teo, Tang & Teng, 2022). Subsequently, the trend of emphasising STEM in national development spread around the world (ibid.) and it has become an integrated academic discipline in meeting future social and economic challenges (Kelley & Knowles, 2016).

The term STEM first emerged in Malaysia in the Malaysia Education Blueprint 2013-2025, launched by Prime Minister Datuk Seri Najib Tun Abdul Razak in 2013, to champion STEM to fulfil industrial employment needs and fuel economic development (Malaysian Education Blueprint 2013-2025, 2013, p.4-6). It was at a junction when Malaysia's performance at international assessments in education, namely, Trends in International Mathematics and Science Study (TIMSS) and Programmes for International Student Assessment (PISA), were not satisfactory. Malaysia's performance in TIMSS between 1999 and 2011 had fallen, while in PISA, Malaysia ranked at the bottom third of 74 participating countries, below the international and OECD average (ibid.). The government then hoped to enhance students' and teachers' interest, attitude, and motivation, and their career awareness in STEM fields (Mahmud *et al.*, 2018).

In Malaysia, STEM is conceptualised from three perspectives. Firstly, it is regarded as a field of study like other subjects in schools. Secondly, it is considered as a stream of study. This refers to the enrolling of students at upper secondary level to streams of their choice in Arts or Science/STEM. Thirdly, STEM is also an approach in teaching and learning strategy which involves the application of knowledge, skills, and values of STEM, in an integrated manner to solve problems in the context of life daily, community and environment (Shahali *et al.*, 2017).

According to the above Blueprint, several factors had contributed to the decline in enrolment and quality of student outcomes in STEM: a general lack of awareness among students and parents on the value of STEM learning and its relevance to everyday life (based on a survey conducted by Malaysian Science and Technology Information Centre (MASTIC) in 2008); the perception among students that STEM subjects are harder than Arts subjects to excel in; STEM curriculum places greater emphasis on the content at the expense of practical aspects; inconsistent quality of teaching and learning; and limited and outdated infrastructure such as laboratories, equipment and facilities. The National STEM Taskforce under Academy of Science Malaysia (ASM) also pointed out the decline is due to ineffective teaching methodology, ad-hoc changes in policies and low levels of awareness of the demand for specialised talent (National STEM Movement: Way Forward, n.d.). These depict a multi-facetted nature of STEM education development, subjected to intrinsic and external factors.

El-Deghaidy and Mansour (2015) contend that school culture plays a key role in the integration of STEM at school, requiring collaboration among stakeholders to build a collaborative and supportive STEM community in school, with exchange of experience and regular dialogue between teachers and the administrators. Collegiality is regarded as a positive school culture, which entails shared goals and responsibility for success, continuous improvement, lifelong learning, risk-taking, support, mutual respect, openness, and humour.

Furthermore, according to Tey, Moses and Cheah (2020), parents have a strong influence on both student STEM interest and career choice intention, compared to teachers

who do not have significant influence on both student STEM interest and career choice intention, while friends' influence is limited to student career choice intention, but not on interest. As parents and families are often regarded as the main carriers of culture, this points to culture having a significant mediating effect on one's career choice in STEM.

B. Science Communication in Malaysia

Science Communication is defined as organised actions in communicating knowledge, methodology, processes, or practices of science in settings where non-scientists form part of the audience. It includes mass media presentations, information materials, museums, festivals, events in science, and science online and in social media, but excludes formal science education and fiction (Davies & Horst, 2016). In Malaysia, STEM is also designated as integral to lifelong learning and non-formal education (Shahali *et al.*, 2017) with emphasis on application of STEM in everyday life (ibid., p.126).

In this aspect, the government initiated the National Science Week, a major Science festival event in 1987 to promote public interest in Science and Technology. However, its demise in the 1990s led the government to recede to the back seat in STEM promotion against the backdrop of a rising robust private higher education industry marketing vigorously to students as docile consumers of advertising and promotion campaigns. Nevertheless, the National Science Week has been revived lately.

Various agencies have been set up by the government and private sector to inculcate interest in STEM - chief among them are the National Science Centre/*Pusat Sains Negara* (PSN), established in 1992 by the government with its northern branch in Kedah opened in 2011; and Petrosains in 1998 by Petronas, the national oil company, for public education in science. Other STEM enculturation spaces include the National Planetarium, the National Museum, the national and state zoos, Penang Tech Dome, natural preserves, botanical gardens, aquariums, etc. (Science Outlook 2017, p.171). These were, however, not at the forefront of promotion of STEM influencing youth in their career choice compared to the highly visible mass media. Based on a published survey, the number of visits to these centres had declined from 2002 to 2014 (Science Outlook 2017, p.171), The government has also set up a STEM centre at the University of Malaya and implemented an "Enculturation STEM" program to promote STEM among the youth (Wee, 2022).

In the mass media domain, while there are always prominent sections/programs on sports, entertainment, travel, motor, and lifestyle in dailies and specialised magazines, popular science is largely presented in the form of IT and health sections/programs, driven by commercial priorities, serving to encourage the public to be consumers, rather than creators or developers of technologies through education and training.

There have been several grassroot monolingual initiatives in science communication driven by individuals and organisations (Arujanan, 2020). Some of these projects include a popular student pull-out "Estidotmy", published by *Utusan Melayu*, a national Malay newspaper from 2002 to 2012, with the support of Academy of Sciences Malaysia (ibid., p.552). It has now been revived online, with content covering STEM facts, careers, fun activities, reader's contributions, grassroot innovations, etc. Also, a column entitled "Scientific Malaysian" in Nanyang Siang Pau, a local Chinese daily, was commissioned in 2014 by Wencom, a social enterprise dedicated to higher learning. It was aimed at enhancing public orientation and interest in Science, Technology, and Innovation as well as to popularise STEM education. The column carried thought-provoking feature articles on science and life, brief news branded as Science Short Waves as well as science quizzes, puzzles and activities (Science Outlook 2015, p.101). Another initiative was "Petridish", an English newspaper on biotechnology, circulated among universities, government offices and public places at shopping malls and leading cafeterias (Arujanan, 2020).

These Science communication activities can best be described as sporadic and disjointed in a pluralistic Malaysia. There has not been comprehensive study on their impact on STEM education. It reflects a staggering science communication needing further strengthening and streamlining. For the Chinese Malaysians, there has also been some disconnect between them and the mainstream

development and communication, resulting in them not enjoying the full benefits of government programs.

C. Public Policy, Mass Media, and Career Guidance on STEM

Besides the 60: 40 Science: Arts policy, and the revitalisation of STEM education under Malaysian Education Blueprint 2013-2025, the launch of Multimedia Super Corridor in 1996 has shaped student STEM career choice. The narrative of a forward-looking Malaysia into a new era, with images of eminent IT world leaders like Bill Gates sitting with the Prime Minister, created a euphoria and surge in interest and enrolment in IT and Multimedia related courses, which were viewed as glamourous careers with promising job opportunities. This can be seen in the surge of IT private colleges during that period (Wee, 2002).

On the other hand, although the local media is highly regulated, with the mainstream media owned by the ruling political parties (Wang, 2001), the media messaging on higher education and careers has been generally given free rein. Under the Malaysian Private Higher Education Institution Act 1996, the provision for advertising is limited to penalties on any advertisement that is false, deceptive, offensive, or misleading. There has also been no stated public policy or agenda on career guidance and media's roles in national higher education and human resource development (Wee, 2022).

Additionally, under the New Economic Policy launched in 1970, quota has been imposed on public higher education intake for Matriculation and undergraduate studies for 'bumiputra' and 'non-bumiputra' students, the latter including Chinese Malaysians. This policy has resulted in many Chinese Malaysians opting for private higher education where the fees are much higher, with STEM courses even higher. This has not incentivised Chinese Malaysians from lower-income families to pursue STEM courses at private higher education institutions. Neither has it encouraged these institutions to establish Engineering/STEM schools, which require larger infrastructure and equipment investments (Science Outlook 2017, p.113).

D. Media and Cultural Influence on STEM Career Choice

With the advent of the internet and ensuing digitalisation of media, multiple media platforms have emerged, resulting in its democratisation, with increasing dominance of online media over their flagging print and traditional broadcast counterparts. The mode of media communication has evolved into a two-way interactive mode, with democratisation of journalism and emergence of citizen journalism, giving rise to informal communication and short messaging. For higher education and career, online media has enhanced access to information, changing communication from top-down to peer-sharing among students, parents, and teachers via social media. From an era of lack of information and active information seekers, we enter an age of passive information consumers and incidental fragmentised news readers (Holleufer, 2020). Easy access to information online on science and technology boosts interest in STEM. However, short messaging and incidental information consumption through brief sound bites may lead to fragmentised information and parochial views on careers, which covers a wide scope. Such a scenario poses challenges to STEM promotion.

Student career choices are influenced by many factors, like career prospects, nature of jobs, accreditation and quality of education, influence of significant persons such as parents, teachers, and friends (Wee, 2002). Many of these factors are mediated by attitude and pre-conceived perception and ideas based on one's cultural background. Messaging embedded in culture and mass media in the form of signs represented by text/image/sound and discourses and narratives manifests over a period can become influential culturally (Hall, 1997). Such powers are especially strong when their representations are repeatedly propagated by the media to become a form of propaganda to indoctrinate the masses (Danesi, 2010) in all spheres of life, including career development.

In addition, career is integral to national development, with the state having a stake in it. Against the perception of freedom and democracy in modern bourgeois capitalist society, Althusser (2014) asserts that the state with "its apparatus of Law, State, Ideologies" is an instrument of "domination in its entirety" on the masses by its dominant

class and the mass media represents one of these apparatuses. The agenda to promote STEM via various science communication and enculturation programs can be regarded as a state ideology, which may not be in line with students' aspirations, and their individual interests and values.

Meanwhile, advertisements have been known for their power of persuasion. Advertising is "fundamentally persuasion and persuasion happens to be not a science, but an art" (Grant, n.d.). Advertising is "pervasive with the ability to tap into peoples' innermost motivations" and "invades their conscious and subconscious thoughts with the potential to change, modify or reinforce their attitudes, feelings and decisions" (Tucciarone, 2007). Advertisements derive their power from affective and cognitive dynamics. Affective dynamics create desires, liking, resonate with individual interest and promote self-identification with the brand/product (ibid., p. 29). Cognitive response involves rational argument based on reasons and proofs. "Satisfaction has elements of both affect and cognition" (Grant, n.d.) and arises when it "resonates with need and wants" (Tucciarone, 2007).

Furthermore, behaviour is learned and acquired through direct experience or observation in social settings (Bandura, 1977). "Experiential and physiological influences interact in subtle ways to determine behaviour". Information acquired can lead to positive or negative response depending on the "incentive value" and repeated incentives create reinforcement, leading to automatic response. This applies to awareness on STEM careers in social settings like family, school, and society.

The above demonstrates that there are a host of forces acting on STEM career choice: language as signs represented by text/image/sound with connotation which varies culturally and socially; knowledge in its power in discourse; advertisements in its capacity to persuade; social learning via direct experience or observation; and the state's apparatus in its laws, ideologies, and the state itself over citizens. Thus, the ultimate career "choice" is an outcome of the interplay and contest of these forces. In a bourgeois democracy, there is always competition and negotiation between the social, political, and ideological forces where the ideological ground may shift with the emergence of dominant ideology. More importantly, the mass media often serves as major sites and instruments for these competitions and dominations (Hall, 1997).

III. THEORETICAL FRAMEWORK

Education is a basic human right, as enshrined in the United Nations Charter. However, accessibility to higher education in many developing countries like Malaysia is still much to be desired. Locally, obtaining higher education is often viewed as an achievement for upward social mobility. In the context of one's career achievement, certain symbols, labels, and narratives have evolved since Malaysia's independence to become a significant representation of achievements. Saussure's theory of Signifier and Signified and Foucault's theory of Discourse of Power Relations are employed to study these representations in relations to forces of traditional culture, colonialism, and globalisation as played out in the media.

According to Saussure, language is a social structure which consists of two components: the signifier in the material form of sign as word, image or sound corresponding to denotation or its literal meaning; the signified in the abstract form as the representation or connotation which varies according to cultural and social context. People of the same culture basically share sets of concepts, images and ideas, allowing them to think, feel and interpret the world in roughly similar ways (Hall, 1997). Belonging to a culture basically means belonging to the same conceptual and linguistic universe (ibid., p.22).

Closely related to Saussure's theory is Foucault's notion of knowledge-producing discourse of power relations. Discourse is essentially a cluster of ideas, images and practices providing narratives, a body of knowledge and forms of conduct on a certain topic, in a certain social or institutional context (ibid., p. 6). It manifests its power on the thinking, regulates and controls practice (ibid., p.44,49,303) and imposes authority (ibid., p.42) on our behaviour and decisions.

To frame the above theories and apply them in the context of this media studies of advertisements, showcasing cultural heritage, colonialism, and globalism within the environment of local cultural and higher education policies, Stuart Hall's Circuit of Culture is deployed (Figure 1). Shared meaning or

culture is produced at several sites and circulated through several processes, termed as "Circuit of Culture" (Hall, 1997), with mass media as an important site. The continuous production and consumption of meanings and their interactions give rise to the rules, norms, and conventions of our social life (Hall, 1997), and manifest in our career choices.

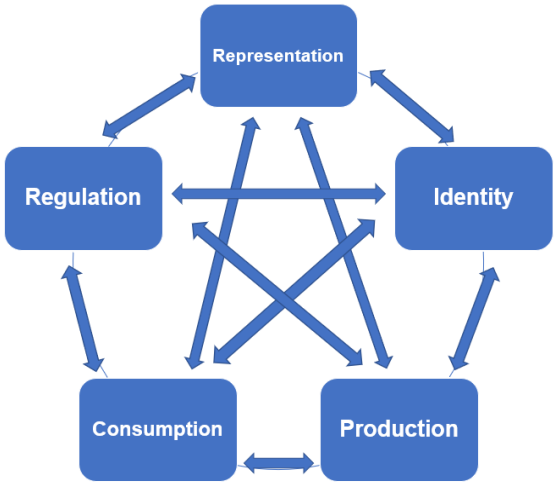


Figure 1. Circuit of Culture by Stuart Hall.

IV. METHODOLOGY

To examine the key media messages affecting career choice in STEM, higher education advertisements in the local Chinese and English press are used. In addition, a survey with intensive interviews serves as a supplement to understand current students' priorities and motivations when making STEM career choices, including any effect on student career orientation during the recent pandemic. The study is focused on West Malaysia. East Malaysia, which has its own mainstream English and Chinese newspapers, has not been included in this study.

A. Higher Education Advertisements

Culture and narratives evolve from epoch to epoch. What is culturally evident today is largely the assimilation of the past as messaging manifests over a period before they can become influential culturally (Hall, 1997). To investigate the impact of media communication on society at large, it is necessary to undertake some archival research. Thus, press advertisements on higher education from 2013-2016 from the Star and Sin Chew Daily, the main media of the Chinese Malaysians, have been selected in combination with a survey and intensive interviews.

Six advertisements have been selected from the above two dailies. The main selection criteria are to ensure a spread across STEM and non-STEM for comparison purposes, and also those with themes close to the heart of Chinese Malaysians. In this study of advertisements, interpretive and critical paradigm approaches to gain insight into their deeper meaning are deployed. Methods used include coding, textual analysis, and critical discourse analysis.

B. Survey and Intensive Interviews

To understand some of the current issues and trends in making career choice in STEM, a survey using Qualtrics has been conducted among higher education students. Local private universities with large Chinese student populations were approached. University of Nottingham Malaysia (UNM) and Universiti Tunku Abdul Rahman (UTAR) agreed to collaborate. At both universities, emails were blasted out to all relevant students. UNM, which is based at Semenyih, Selangor has 3087 students, of which 64% are STEM students and 36% non-STEM. Meanwhile, the student population at UTAR is about 21,000, spread across two campuses in Kampar, Perak and Sungai Long, Selangor, with about 40% STEM students and 60% non-STEM ones. This indicates a rather balance of STEM and non-STEM students at both universities. Students at both universities come from various states of Malaysia. While UTAR is a community-based university catering for those from low-income families, UNM is a branch campus of a UK-based university whose students are mainly from high-income families. This presents a rather balanced spread in their financial background. For UNM, additional efforts were made via personal canvassing on campus, especially at the library. A total of 343 responses have been received, out of which 152 are complete answers.

The survey attempts to find general opinions and views. When there are conflicting viewpoints, such topics are brought into intensive interviews for further deliberations, where an atmosphere for free expression is encouraged. The intensive interviews specifically focus on non-STEM

students to gain an understanding on underlying reasons for their lack of interest towards STEM.

V. DATA ANALYSIS AND DISCUSSIONS

A. Analysis of Higher Education Advertisements

As mentioned, six press advertisements from 2013-2016 from the Star and Sin Chew Daily were selected to delve into the messaging and symbols affecting career choice in STEM.

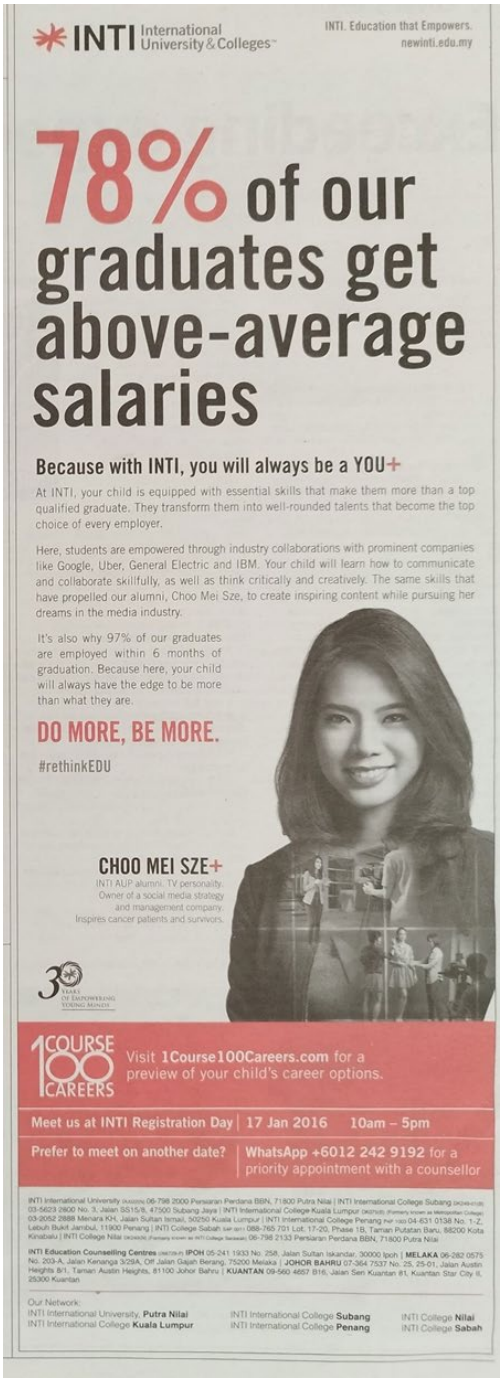


Figure 2. Advertisement I (Date Published: 17 Jan. 2016, Press: The Star).

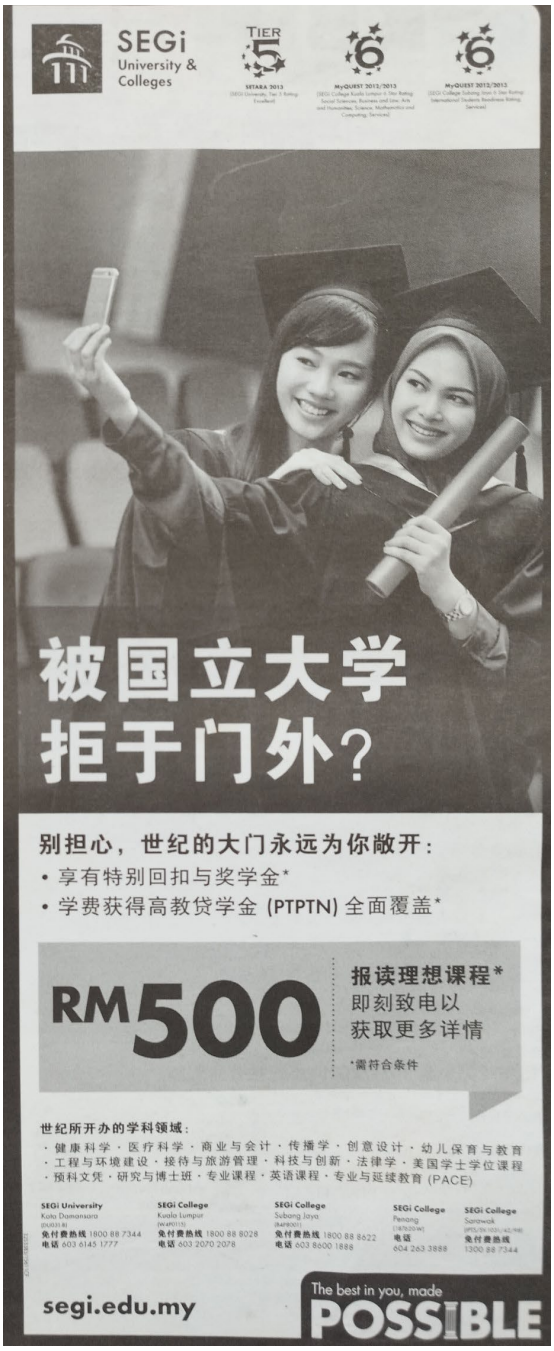


Figure 3. Advertisement II (Date Published: 19 May 2015, Press: Sin Chew Daily).

Figure 4. Advertisement III (Date Published: 16 Jan. 2015, Press: The Star).

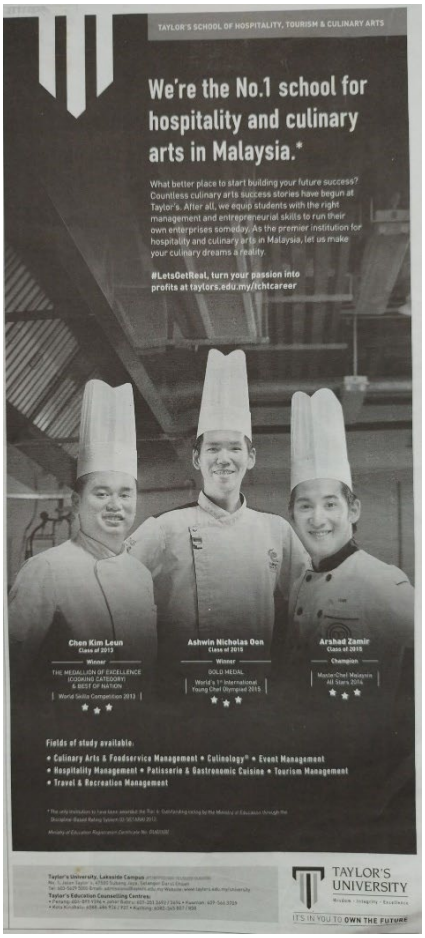


Figure 5. Advertisement IV (Date Published: 17 Jan. 2016, Press: The Star).

Figure 6. Advertisement V (Date Published: 23 Jan. 2013; Press: The Star).

Figure 7. Advertisement VI (Date Published: 16 Jan.2015; Press: The Star).

The above advertisements reflect some of the issues of Chinese Malaysians in higher education: accessibility, cost of higher education and employability. Figure 2 depicts a university claiming 78% of its graduates garner an above-average salary. For many Chinese Malaysians, higher education is regarded as a major investment which must be handsomely rewarded. Figure 3 paints two young female graduates smiling happily, wearing a mortarboard, and holding a scroll in their hands, with a headline "Rejected by Local Public Universities" and offer of rebates and scholarships with a prominent "RM500" sign. The idea of wearing a mortarboard at convocation is many Chinese Malaysians' dream; and failing to enter local public universities for the desired course and higher cost at private ones are their common frustrations. With the rebate sign, this advertisement attempts to compete with public universities to lure students, tapping into students' innermost motivations, with the potential to "change, modify or reinforce their attitudes, feelings and decisions" (Tucciarone, 2007). Due to the need for laboratories and equipment, tuition fees for STEM courses are always higher and thus less attractive for students from low-income families.

Figures 4, 5, 6 and 7 promote courses, namely, medicine, culinary arts, biotechnology, and engineering. The images of a doctor with a stethoscope and white cloak and three chefs with their chef hats for the first two advertisements give typical impressions of these two professions. Their headlines "Fulfil your Dream to be a Doctor" and "The No.1 School of Hospitality and Culinary Arts in Malaysia" invoke the aspiration to become a doctor, a prestigious job in the eyes of Chinese Malaysians; and seeking top-notch education institution which is linked to better career prospects respectively. Figures 6 and 7 promote STEM career in biotechnology and engineering by displaying hands-on activities and laboratory settings, which relate to technical service and maintenance aspects of STEM. Other job domains of STEM in production and manufacturing, management, marketing and trading, and entrepreneurship are not shown here. Repeating such media images could lead to stereotyping STEM as hands-on and laboratory-based, rather than with potential in the world of industries in various jobs in modern technological world as well as in technopreneurship, where sky is the limit in wealth creation. These images give the impression of STEM professionals as back-room workers, which is less attractive for the current generation of youth, compared to the glamorous media images of corporate giants, many of whom are from non-STEM sector such as banking, finance, business, and retail sectors. The non-STEM corporate figures possibly have become role models of current generation of youth. Stereotyping is a process where people are reduced to a few simple, easy-to-grasp and understand characteristics. This is how we make sense of things in the wider categories as natural and inevitable (Hall, 1997). Furthermore, their headlines: "Taylor's University Grooms Talents for Biotechnology Industry" and "Laying Solid Foundation", are more of statements than persuasion, although there is a by-line, "Consistent Top Three in the UK for Engineering Education", proclaiming quality education. Their overall messaging and imaging are not persuasive enough for students to consider STEM careers.

B. Analysis of Student Survey

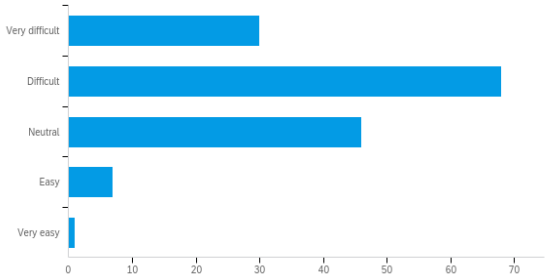
A total of 343 responses have been received, out of which 152 are complete ones with all questions answered and are used in the analysis. 40.6% of them are male, 59.4% female, and 37.4% are Science/STEM students, and 62.6% non-science/non-STEM. Some students from non-STEM fields in Economics and Business have identified themselves as STEM students because their degree is Bachelor of Science.

The survey investigates students' media preference, information-sourcing habits and attitude towards STEM and work. In Malaysia, the Chinese are considered to be hard-working and tenacious. Some of these Chinese cultural values including perception and myths that may impact STEM career choice are also examined:

- Science subjects are tough
- Science subjects and careers are not interesting
- Science/Engineering work is only laboratory work
- Income and career prospect in Science/Engineering fields are not attractive compared to those in business/banking fields?
- Image of engineers and scientists does not blend well with femininity

Below are some of the survey results:

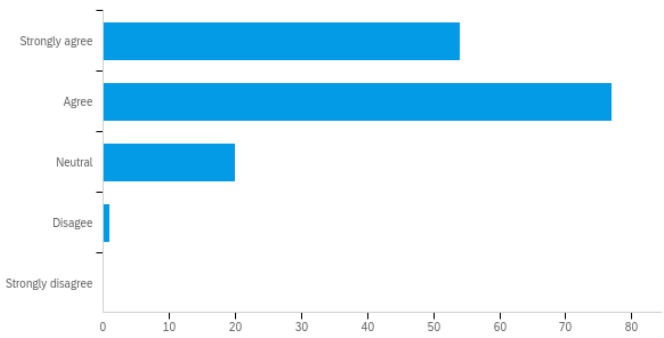
1. *STEM courses are more difficult to excel compared to Non-STEM courses.*



	Total (%)	STEM (%)	Non-STEM (%)
Very difficult	19.7	20.6	18.2
Difficult	44.7	44.3	45.5
Neutral	30.3	27.8	34.5
Easy	4.6	6.2	1.8
Very easy	0.7	1.0	0

Figure 8. Are STEM courses more difficult to excel compared to Non-STEM courses?

Based on Figure 8, a total of 64.4(19.7 + 44.7)% students surveyed consider STEM more difficult to excel. The figures are about the same for both STEM (64.9%) and non-STEM (63.7%). This affirms the claim made by the Government in the Malaysian Education Blueprint 2013-2025 it is more difficult to excel in STEM courses compared to non-STEM ones.

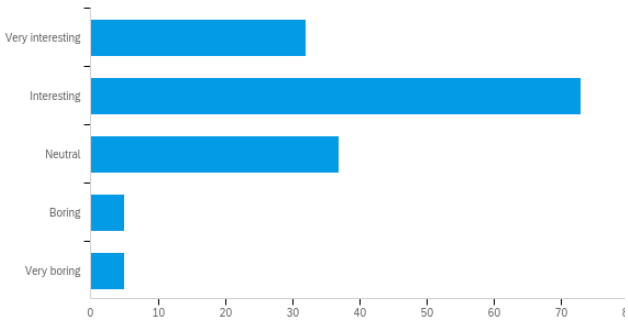


	Total (%)	STEM (%)	Non-STEM (%)
Strongly agree	35.5	20.6	18.2
Agree	50.6	44.3	45.5
Neutral	13.2	27.8	34.5
Disagree	0.7	6.2	1.8
Strongly disagree	0.0	1.0	0

Figure 9. Do you agree that facing and overcoming difficulties are ways for greater success for the future?

However, being difficult to excel may not be a total deterrent to pursuing STEM courses. In Figure 9, many students or 86.1 (35.5+ 50.6)% regard overcoming difficulties as ways for greater achievements. This demonstrates the lingering effect of Chinese traditional culture of overcoming difficulties as a treasured value for achievements. Also, medicine, which has been regarded as a tough course and career, is popular among Chinese Malaysians. Thus, being difficult to excel may not be the main concern of Chinese Malaysians students when choosing STEM careers.

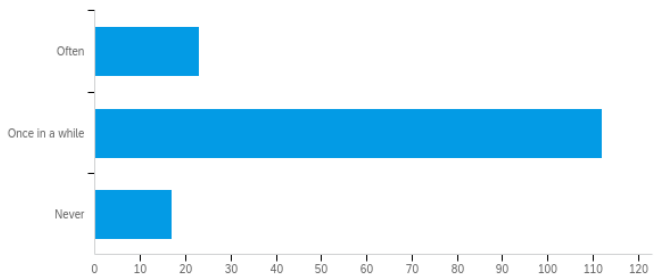
2. *STEM (Science/Engineering) are interesting*



	Total (%)	STEM (%)	Non-STEM (%)
Very interesting	21.1	29.9	5.5
Interesting	48.0	49.5	45.5
Neutral	24.3	18.6	34.5
Boring	3.3	0	9.1
Very boring	3.3	2.1	5.5

Figure 10. Do you find Science/Engineering interesting in general?

A total of 69.1 (21.1 + 48.0)% students surveyed consider STEM interesting, out of which 79.4 (29.9+49.5)% STEM students find STEM interesting while 51 (5.5+45.5)% non-STEM students think so (Figure 10). More STEM students find STEM more interesting demonstrates being interested in a subject could be a reason to choose it as one's career. The fact that half of non-STEM students also find STEM interesting, though they have not chosen STEM shows that there could be factors beyond interest when making career choice such as career prospects, nature of jobs, etc. Interest in STEM could also be beyond the classroom and career, like being interested in nature, health and environment issues and technologies in daily life. There is also a high percentage (81.8%) of non-STEM students who read science and technology occasionally (Figure 11). This augurs well for popularisation of lifelong learning in STEM among the public.



	Total (%)	STEM (%)	Non-STEM (%)
Often	15.1	18.6	9.1
Once in a while	73.7	69.1	81.8
Never	11.2	12.4	9.1

Figure 11. Do you read news/articles on Science online/offline?

3. *Gender bias towards STEM careers*

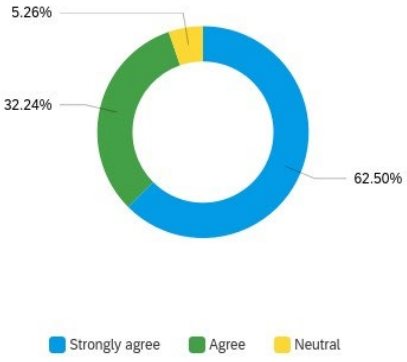


Figure 12. Do you agree Science/Engineering careers are suitable for both male and female?

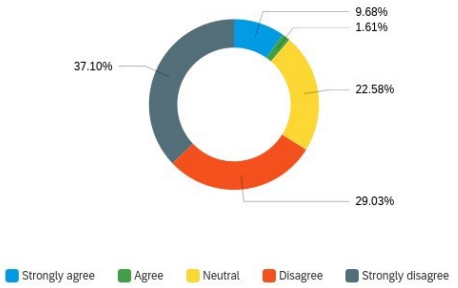


Figure 13. I do not like my future wife/girlfriend to be an Engineer/Scientist (for male participants only).

Based on Figure 12, an overwhelming number, that is 94.7 (62.5+32.2) % of students surveyed consider STEM careers are suitable for both male and female. On the other hand, only a small proportion 11.3 (9.7+1.6)% of male students do not like their future wife/girlfriend to be an engineer/scientist (Figure 13). This indicates generally there is no gender bias towards STEM careers among the students surveyed.

However, a survey by Ministry of Higher Education in 2016 found that compared to non-STEM fields which have twice as many women enrolled compared to men, engineering, manufacturing and construction, agriculture and veterinary courses have less women (Science Outlook 2017, p.113). Thus, there might be some unspoken gender bias towards STEM careers among participants of the survey.

4. *Making right career choices*

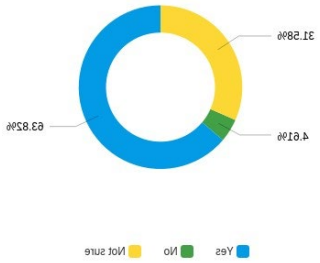


Figure 14. Do you think you have chosen the right course?

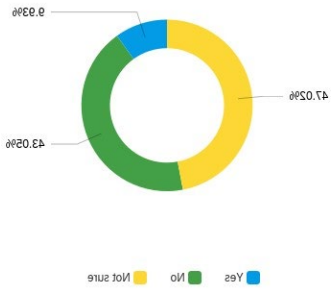


Figure 15. Are you thinking of switching to other careers after graduation?

Figure 14 shows while 63.8% of students surveyed think that they have chosen the right course, 31.6% are not sure whether they have chosen the right course. Meanwhile, 9.9 % are contemplating switching their career upon graduation and 47.0% of them are not sure of switching (Figure 15). Taking Figure 14 and Figure 15 together indicates likely leakage of STEM talents to non-STEM fields upon graduation, as it is normally possible for STEM students to switch to non-STEM careers, but difficult for non-STEM students to switch to STEM careers.

5. *Priorities in life*

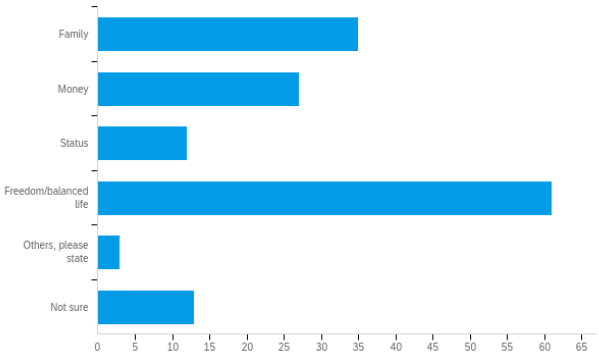
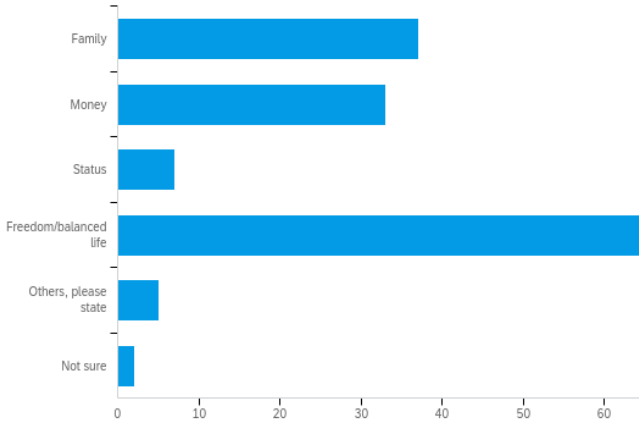


Figure 16. What were your priorities in life before the pandemic?



	Before Pandemic (%)	After Pandemic (%)
Family	23.2	24.5
Money	17.9	21.9
Status	7.9	4.6
Freedom/ balanced life	40.4	44.4
Others	2.0	3.3
Not sure	8.6	1.3

Figure 17. What are your current priorities in life?

Figure 16 and Figure 17 demonstrate whether it is before or after the pandemic, a high proportion (40.4% and 44.4%) of participants view freedom/balanced life as their top priority, followed by family (23.2% and 24.5%) and money (17.9% and 21.9%). This illustrates no major paradigm shift due to the pandemic. The significant desire for freedom/balanced life is not favourable for efforts to increase STEM talents, which involve on-site or regular work or full-time work regimes like those in manufacturing and industries.

6. Influence of advertisements and source of information on career and higher education

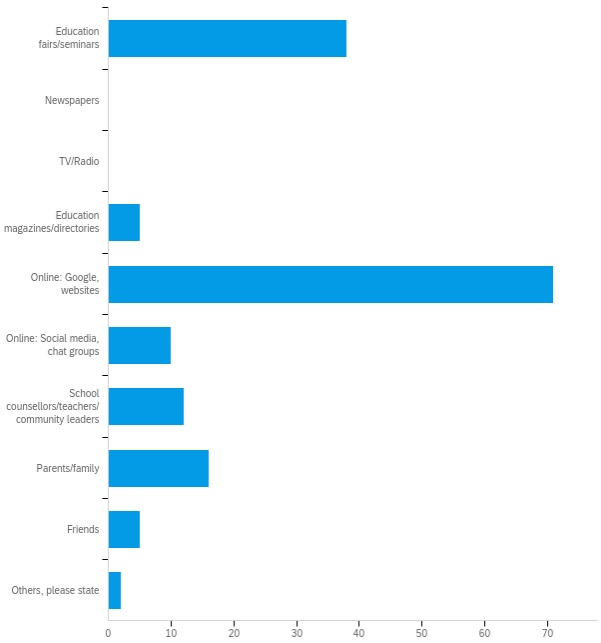


Figure 18. What is your main source of information on career & higher education?

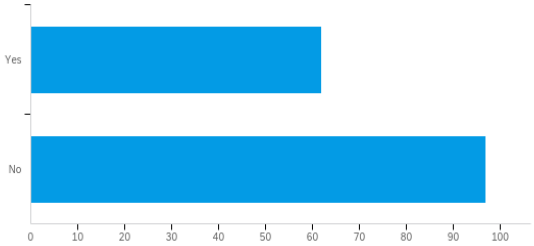


Figure 19. Do you look at or listen to advertisements on career choices?

Figure 18 shows Google and websites are the primary source of information on career and higher education for almost half of those surveyed, followed by education fairs and seminars, while parents/family, school counsellors/teachers, social media and magazines/directors are minor sources. Newspapers and TV/radios are totally not consumed by youth. Meanwhile, a larger proportion of students do not look at or listen to advertisements in making career decisions (Figure 19). Taking Figures 18 and 19 together, it suggests advertisements on online platforms could have some influence, while traditional media like print, TV and radios have no influence at all on youth.

C. Analysis of Intensive Interviews

While the survey is open to all, only non-STEM students are chosen for intensive interviews to understand profoundly why STEM has lost its appeal. Six undergraduates and one postgraduate non-STEM students have been randomly selected from University of Nottingham Malaysia. All of them are female, perhaps due to recruitment by snowballing method, starting with a female.

All of them stated that STEM has not been their field of interest since school days. A few of them said they had difficulty coping with Additional Mathematics. They reiterated the importance of factors like ability to excel, interest in the subject and eligibility for higher education in choosing a career. Most of them said that their parents were supportive and offered guidance but did not interfere with their career choice. This portrays modern Chinese parents are more liberal and less influenced by traditional values. One of them said that her mother encouraged her to drop music which she was keen on, and to choose language instead. She has no regret over the change. Another candidate from Sabah disclosed she sourced information and advice mainly from education agents in Sabah. Yet another candidate thought she was influenced by her relative who is studying psychology at University of Nottingham Malaysia.

Some unfavourable views include “STEM careers are for those who are really passionate about Science”, “Studying STEM is not trendy now”, “Finance and banking sector offers more lucrative jobs with better career prospects”. The first two narratives indicate negative attitude towards STEM. This suggests possible peer influence in choosing career, as youth are at a vulnerable age of wishing to be accepted by their peers. The last statement was echoed by another candidate who pointed out that there are ample lucrative jobs in banking and finance in Singapore. This reveals the current generation with global outlook are eyeing career opportunities beyond Malaysia. One candidate alleged that her cousin, a graduate in biochemistry, could not find a job and ended up working for Shopee. Another candidate lamented that many STEM careers are job and skill-specific, while studying Arts and Business opens more doors and enables a more versatile future. The only postgraduate candidate who studied media opined that scientists need media professionals to publicise their work and commercialise research, emphasising a wide spectrum of career opportunities for media studies. This invokes a rethink on the dichotomy of STEM and non-STEM and points to interdisciplinary approach in higher education in the multi-tasking world of work.

VI. CONCLUSION

Chinese Malaysians inherit Chinese cultures as well as Malaysian and globalisation influences shaded with colonialism in shaping their career development, with mass media and local Science communication playing notable roles in their career choice.

The study found several factor: lack of experiential exposure in daily social settings, media stereotyping nature of jobs of STEM as laboratory-based and practical activities, lack of curation of distinct images and role models in many STEM careers, fragmentised science communications, and the disconnect of Chinese Malaysians from mainstream national development could have contributed to their decline of STEM career choice.

The study found that there is no distinct dislike towards STEM courses and careers by Chinese Malaysians. Rather, for them, there are a wide range of careers beyond STEM to select from, with non-STEM careers appearing to be more attractive in terms of career prospects. Although STEM subjects are found to be more difficult to excel in, there are many respondents who view overcoming difficulties as a way for greater achievements.

Also, there is no paradigm shift in career and work attitude due to the recent pandemic. Nevertheless, nearly half of the respondents viewing freedom/ balanced life as more important than money and status do not bode well for STEM jobs based on structured-schedule and on-site work in manufacturing and industries.

To overcome some of the issues related to STEM career choice, innovative ways integrating degree and non-degree qualifications could be adopted. Besides, as language is polysemic and meanings can be reconstructed, the meaning of STEM can be constructed to be more relevant to successful careers via the mass media to rebrand STEM. Re-construction of image and alternative discourses and narratives like career success stories of STEM graduates and

industrialists who have applied STEM knowledge to create breakthroughs in their career could serve as role models. Examples include national/global champions in glove manufacturing, and the famous "Tealive" bubble tea chain stores which were established by a young STEM graduate using his biotechnology knowledge in formulating drinks. On another note, viewing career choice from the lens of the students by promoting specific STEM careers in line with market demand could bring students closer to STEM.

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