**The Field of Science and Technology (S&T): The Representation of Women in Online Resources**

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**Abstract:** The younger generation has lost interest in science and technology **(**S&T) as it is viewed as boring, mundane, technical and lacking in excitement. It is important to evoke interest among the young in the field of S&T as this will help the country to produce more specialists, scientists, engineers, and other professionals. Inventions such as solar energy, hybrid automobiles, green buildings and inventions are a few examples of how S&T can help build a more sustainable future. This study focuses on whether men and women are adequately portrayed in online resources as this will affect readers mainly the younger generation. Various articles from online resources were analyzed using Critical Discourse Analysis (CDA) to examine language and images to raise awareness about issues of importance of this research. The findings show that there is an unequal representation of men and women in the field of S&T. Thus, necessary steps need to be taken to ensure that there is equal representation of both genders in the S&T field in online resources as this will only lead to positive effects to the society, the nation, and the world as well. Social media has the power to highlight important issues as different sectors of society are brought together through social media. It is hoped that this study will encourage others to acknowledge the countless contributions of women in the S&T field and to focus more attention on the rights of women to be given due recognition for their intelligence and abilities.

**Keywords:** *Equality, online, gender, representation*.

## 1. Introduction

In the past, women were left behind in almost all aspects of life be it economic, and social and it was a rare sight to see any woman being highly educated, wealthy, and holding a high position (Lagarde, 2019) However, fast forward to the present it is evident that this is no longer true for most of the female population. In the past, the fairer sex was mainly relegated to menial work and were at the mercy of the men in their lives. According to the Global Gender Gap Report (2022) presently, there is a steady progression of women being educated at the tertiary level which leads them to be independent and capable of owning property and wealth. What exactly has led to this positive change for females? Generally, when education is being provided to everyone and they are being offered the same opportunities, anyone has the chance to achieve success and become an important pillar of society in the process. Women just like men have the same capacity for success and when the same opportunities for self-development are provided, positive change is inevitable for the former (Seehus, 2021).

Statistics have shown a vast difference in the number of women who attained higher education and have important posts. According to the World Bank, the labor force participation rate in Malaysia among females is 51.6%, and among males is 78% for 2023. Female labor force participation has steadily increased since 1990. There are 167.8 million people in the labor force at present and it is projected to rise within the next 7 years to 169.6 million (Ferguson, Shrove & Lucy, 2023).

If more female students see more exemplary role models of their gender in science and technology, it might trigger a spark of interest in this field (Gonzalez et al, 2020). The younger generation has lost interest in Science & Technology (S&T) or science, technology, engineering, and mathematics (STEM) as it is viewed as boring, mundane, technical, cut and dry, lacking in excitement, and so forth (Harun & Sallehuddin, 2024). Other causes for the lack of interest and participation in STEM include girls having less exposure to activities related to STEM,

underestimating their abilities in this field, and having the fear of being a minority in a field dominated by men. In addition, problems such as brain drain whereby more specialists are going abroad due to a lack of opportunities have led the government to offer lucrative pay to foreign experts (Amir, 2022). Consequently, our country is falling behind in technological advancements and innovations. The question is "Why is it important to evoke interest among the young in S&T?"

It is of the utmost importance to stop the dependence on foreign experts and technology. Instead, the country should aim to produce more specialists, scientists, engineers, and those in the related field, as they are the ones who will come up with great ideas, innovations, and inventions that have a lasting positive impact on the country and the world. Inventions such as solar energy, hybrid automobiles, and green buildings are mere examples of how S&T can help build a more sustainable future for the years to come. Besides that, creating patents for scientific innovations and inventions will also benefit the nation in the long run. Moreover, serious issues looming ahead which include global warming, depletion of natural resources such as fuel, pollution, and so forth require immediate action. Hence, it is apparent to produce more S&T experts in the country. A driving force for national and global economic development is the emphasis on science, technology, engineering, and mathematics (STEM). Hence, everyone must play their role. However, 33% of researchers worldwide are women (UNESCO, 2021). Nonetheless, Table 1 shows a steady rise in registered female STEM professionals but the percentage is relatively low. Table 2 illustrates an increase in the number of higher education students enrolled in STEM studies.

**Table 1: Number of Female Registered STEM Professionals**

|  | 2014 | 2015 |
|---|---|---|
| Dentists | 3,670 | 4,010 |
| Doctors | 16,976 | 17, 468 |
| Engineers | 17,690 | 20, 512 |
| Quantity Surveyors | 1,036 | 1,114 |

Source: MoWFCD, 2015

**Table 2: Number of Higher Education Students Enrolled in STEM-related Disciplines**

|  | 2015 |
|---|---|
| Science, Mathematics &Computer Science | 25,656 |
| Engineering, Manufacturing & Construction | 23,605 |
| Agriculture & Veterinary | 3,327 |
| Health & Welfare | 24,960 |

Source: MoHE, 2015

This study is conducted to identify the gender representation in online resources in the S&T field as this will affect readers mainly the younger generation. They will not be interested in this field and this will be a huge loss as social media will only amplify and reinforce gender stereotypes that women are not as capable as men. When there is a lack of gender representation, it will eventually lead to gender disparities resulting in the emergence of numerous issues which include lack of recognition. This lack of recognition is in terms of the awards, and grants, being awarded to women (Rodriguez & Clancy, 2020). According to the United Nations report (2023), the lack of gender representation will inadvertently hurt the career trajectories of women.

The findings show that there is unequal representation of women in the field of S&T. Ultimately this unequal representation of women will lead to various problems such as the lack of participation of capable and qualified individuals, loss of opportunities for women, intentional discrimination against women, lack of recognition for the meaningful contributions made by women and other adverse effects. Thus, necessary steps must be taken to ensure equal representation of both genders in the S&T field in online resources as this will only lead to positive effects to society, the nation, and the world as well. Park et al (2023) stated that at present, it is dishearteningly apparent that compared with men and boys, women and girls experience and face different harms online. The negative online experience includes online advertising content and algorithmic targeting sexist stereotyping, idealized images of women which lead to negative body images, misogyny, and gender-based abuse, technology-facilitated coercive control, economic and political marginalization, and side-effects of the dehumanization and degradation of women in misogynistic pornography. Among the most disturbing

findings include how women are subjected to being reduced to mere objects and having to experience image-based sexual abuse and silenced in public debate. Moreover, women are also being targeted and judged on their appearance just because of their gender (Park et al., 2023).

## 2. Literature Review

Many studies regarding gender and social media show certain similar characteristics such as discrimination, enforced stereotypes, hate speech, sexual harassment, negative judgments of women, being victimized, objectifying women, expressing stigmas and stereotypes, sexist hate speech used to bully women into silence and to maintain men's privileges and other negative consequences. According to Vlasceanu & Amodio (2022), gender inequality within a society is further amplified with the widely used internet search algorithm.

In a study by Power, Rak & Kim (2020), the findings showed that women were underrepresented in leading North American business magazines. This underrepresentation is due to lower levels of visibility and this may perpetuate long-standing gender status beliefs as it can be considered as a metric of women's lower social status or influence. According to Demirhan & Demirhan (2015), their study found that the patriarchal discourse on the social roles of women is being perpetuated on Twitter. In this study, the patriarchal discourse is categorized into four aspects: the definition of domestic roles for women (being good wife, mother, and housekeeper); the definition of professional roles for women (having an occupation, earning for family, having pink-collar jobs, being well educated and skilled, having intellectual capacity); the definition of physical beauty for women (being beautiful, strong, keeping healthy, having a good appearance and attraction, good clothing); and the definition of moral values for women. Meanwhile, according to Liu & Chai (2023), the images shown of men are more positive than women and the results of their study showed men as professional and knowledgeable while women are depicted as less professional. Moreover, the findings showed that men are objective, independent, creative, initiative, authoritative, and often connected with power and technology, which sees men as order-givers and decision-makers.

Another study found that career women were represented as different than men, whereby the former were victimized, and they were presented as unable to succeed both at work and at home simultaneously. Furthermore, they were also depicted as passive, emotional, and insecure (Galsanjigmed & Sekiguchi, 2023). In addition, according to Lomotey (2020), the complex role of humor in social media jokes only enhances the subtle yet dangerous power of this media in emphasizing traditional gender stereotypes and ideologies.

According to Ostreika et.al. (2021), the young generation finds that study programs in STEM fields are mundane and lacking in excitement. As a result, this led to their lack of participation in STEM disciplines. The waning interest and achievements in STEM subjects among children in K-12 educational settings is a critical stage (Kennedy et al., 2014; Prendergast et al., 2014). Although in modern societies today, there is an increasing need for more people to possess capabilities and skills in science, technology, and engineering it is most unfortunate and disheartening that most Australian students do not have much interest in these areas (Newhouse, 2017). Based on the research by Martínez-Borreguero et.al (2019) due to the lack of a conducive learning environment, secondary school students have negative emotions towards STEM disciplines as these subjects are viewed as uninteresting. The study by Tomperi et.al. (2022) suggests that the low exposure to STEM professions at school and the pervasive stereotypical beliefs that these professions are boring have an impact on the interest of students in these disciplines.

Stereotypes and lack of relevance are the predominant causes that lead to the perception among female students that STEM subjects are boring. The study by Burns, Lesseig & Staus (2016) suggests a waning interest in STEM disciplines among female students particularly in analytical subjects such as physics. According to the research by Desy, Peterson & Brockman (2011), there is a startling difference in attitudes among female students in middle and high school toward science whereby they find STEM subjects to be dull and uninteresting. According to Mayakis and Robinson (2018), female students lack the confidence to pursue a career in STEM disciplines as they perceive them to be male-dominated workplaces. Moreover, as a result of societal stereotypes and self-assessment of achievement they find STEM subjects to be boring. As a result of lower confidence and lack of preference, the majority of female students view STEM subjects to be less engaging

and they generally have a negative attitude towards mathematics as opposed to their male counterparts (Lu, 2019).

Even with the passing of time and the advent of new technology, sexism, and gender domination are still rampant and appear to be ubiquitous. Unfortunately, this has repercussions on women in terms of mislabelling women as weak, inefficient, incapable, and other degrading and dehumanizing aspects that only demoralize women in general. There are negative repercussions that will directly impact opportunities for women in their careers due to societal biases and gender stereotypes. Employers may have unconscious biases that make them less favorable towards female candidates than male ones. Even in the West where women are supposed to be independent and given the freedom to do whatever they want women are still being underestimated and looked down as incomparable to men in terms of intelligence and capabilities.

## 3. Research Methodology

**Figure 1: Fairclough's Dimensions of Discourse and Discourse Analysis**
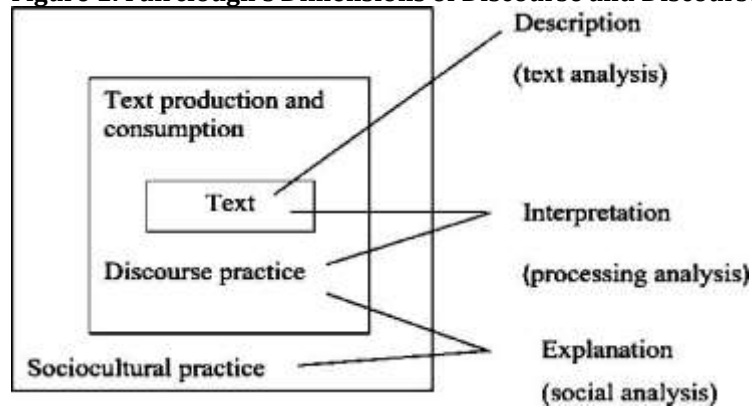


Source: Janks (2005)

This study employs the Critical Discourse Analysis (CDA) based on Fairclough's theoretical framework to analyze language and images of various articles from online resources to raise awareness about issues of importance of this research. Critical Discourse Analysis (CDA does not limit its analysis to specific structures of text or talk) as it is also an application of discourse analysis. Critical Discourse Analysis (CDA) describes a series of approaches by researchers to reveal connotations and draw out the larger cultural narratives that these connotations support by critically analyzing texts and cultural artifacts. Based on Figure 1 above, according to Fairclough (2005), the discourse will be examined in three stages: description, interpretation, and explanation. In addition, this study also uses a purposeful sampling technique whereby the researcher focuses more detail on a certain issue, subject, or phenomenon when a sample is purposefully chosen (Patton, 2002). Participants are not randomly selected as it is also known as selective sampling. The articles are determined based on the content mainly about the success achieved by women in the S&T field. Besides that, since the study focuses on online articles this sampling technique is ideal (Gee, 2005). In addition, the number of online articles to be analyzed will be narrowed down by using this sampling technique.

Moreover, language in verbal or written language (which includes images, symbols, documents, face-to-face talk, and non-verbal interaction) within a particular social context will be analyzed in discourse analysis. Recursive analysis of the online articles particularly on the textual and visual representation will be conducted several times to closely preserve the dynamic and static contents and interconnectivity of the original, "online" advertisement by creating an "offline" copy of an advertisement as the textual and visual representations of online advertisement which are saved in HTML (hypertext markup language) and screen captures (Bergman & Meier, 2004). Furthermore, Fairclough (2001) states that discourse analysis is related to studying a language using a set of theories and methods within a specific context. CDA primarily links to the following aspects: intertextuality (the shaping of text's meaning is shaped by another text), interdiscursivity (borrowing of features of discourses or genres in text or talk), and socio-historical context of formation and interpretations of texts/discourses (Bhatia, 2010).

These categories were chosen as they are related to the field of S&T and are generally associated with men and women in that respective field. Previous research employing CDA often involves a detailed examination of visual aspects (e.g., images, graphics, and multimedia) and textual features. This shows that the analysis of these aspects occurs concurrently. Based on Table 1, a combination of language and images based on the process and societal levels of Fairclough's theoretical framework will be the basis of the interpretation and conclusions drawn (Fairclough, 2001). As one of the pioneering figures in the CDA domain, Fairclough has expanded and developed the theoretical framework of CDA and has several applications in education. He mainly focused on analyzing discourse in the light of sociocultural change and he considers discourse as a social practice to interact actively in social life.

An analysis of printed online advertisements aggregated electronically is conducted by assessing the textual and visual representations (Hartley & Morphew, 2008). These textual and visual representations are maintained by saving them in HTML (hypertext markup language) and screen captures. In this way, this will help preserve the dynamic and static contents and interconnectivity of the original, "online" advertisement by creating an "offline" copy of a commercial whereby a recursive analysis can be conducted several times (Bergman & Meier, 2004). Studies on CDA often involve the simultaneous analysis of the written or textual elements and visual elements (i.e. images, graphics, and multimedia) (Kress &Van Leeuwen, 2006). By using a combination of language and images an accurate interpretation and conclusions can be drawn based on the process and societal levels of the theoretical framework by Fairclough.
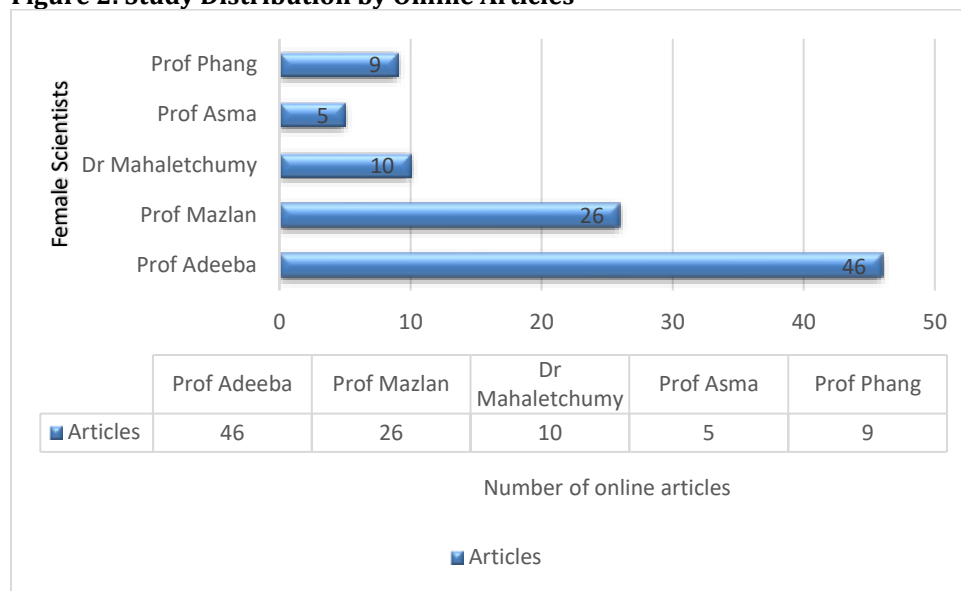
**Figure 2: Study Distribution by Online Articles**



| | Prof Adeeba | Prof Mazlan | Dr Mahaletchumy | Prof Asma | Prof Phang |
|---|---|---|---|---|---|
| ■ Articles | 46 | 26 | 10 | 5 | 9 |

Number of online articles

■ Articles

**Figure 3: Study Distribution by Article Coverage**



| | Prof Adeeba | Prof Mazlan | Dr Mahaletchumy | Prof Asma | Prof Pang |
|---|---|---|---|---|---|
| Local | 28 | 17 | 3 | 4 | 5 |
| International | 18 | 9 | 7 | 1 | 4 |

**Types of Coverage**
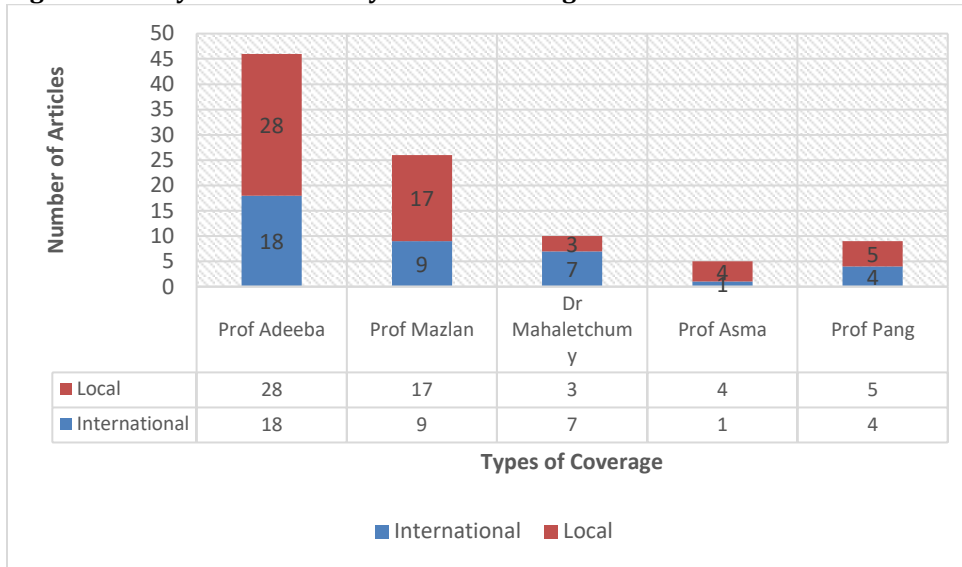
**Table 3: Malaysia's Top Research Scientists 2021**

| Gender Representation | Female | Male | Total |
|---|---|---|---|
| Number of Research Scientists | 6 | 16 | 22 |

Source: (NST online, 29 Sept 2021)

**Figure 4: Renowned Female Scientists in Malaysia**



Source: (Google.com)

## 4. Research Findings

The findings show that there is an unequal representation of men and women in the field of S&T. When there is an unequal representation of gender, it could lead to basic stereotypes being reinforced, lesser opportunities for women, lack of participation of women in the field, a loss of manpower, and it will eventually lead to a loss

of opportunities for women. Based on the online search, in Malaysia, there were less than 10 women found to be outstanding and have made their mark in the field of S&T. According to Malaysia Scientists Rankings in Malaysia 2021 there are currently 22 top scientists in Malaysia whereby the majority were men (Table 3) Among the female scientists in Malaysia chosen in this study include Professor Adeeba Kamarulzaman, Emerita Professor Tan Sri Dr. Mazlan bt Othman, T.S Dr. Mahaletchumy Arujanan, Prof. Datuk Dr. Asma binti Ismail, Professor Phang Siew Moi (Figure 4). Since only 6 were women, this study faces certain resource constraints. The low number of female experts in Malaysia involved in this field is proof that there exists gender disparity. According to Malaysia Scientists Rankings in Malaysia 2024 there are currently 10 top scientists whereby all of them are men.

By utilizing the available information online, it was evident that all these female scientists although each one of them has greatly contributed to the nation. However, there was inadequate coverage of them online. According to Ross (2022), a lack of voice could have a disproportionate effect on women, minorities, and foreign-born scientists. There are clear consequences for the retention and promotion of women in the field of science as there is a well-documented gap in the number of scientific works by women and men in science. Ross (2022) also stated that this is possibly due to the lack of recognition of the contributions of women in science. Unfortunately, men are more likely to be credited with authorship than women in science (Ross, 2022).

However, the male scientists in the world are being given worldwide coverage online and this was mainly because they are the majority as compared to their female counterparts. Hence, the latter will generally be sidelined and not be provided with the necessary coverage about their accomplishments as they will undoubtedly be overshadowed by the remaining majority: the male scientists. According to the Best Scientists in the World 2023 Ranking, out of 30 best scientists in the world only one female scientist was mentioned and ranked number 7 in the world ("Ir.Ts.Dr. Bernard", 2023). In Malaysia, the same scenario repeats itself. In Malaysia, women remain the minority in science and technology. In 2021, there were only a few female scientists listed in Malaysia ("Malaysia's Top Research", 2021). In 2023, the Top Research Scientists Malaysia 2023 (TRSM) by the Academy of Sciences Malaysia was awarded to Ir Ts Dr Bernard L H Saw from the Department of Mechanical and Material Engineering in the Lee Kong Chian Faculty of Engineering and Science. Research scientists in Malaysia whose work has been nationally and internationally recognized and possess outstanding achievements in Science, Technology, Innovation & Economy (STIE) are presented with this award ("Ir.Ts.Dr. Bernard",2023). However, the recognition of being the leading scientist in 2024 according to the AD Scientific Index was awarded to Prof. Saidur Rahman, Head of the Research Centre for Nano-Materials and Energy Technology ("Congratulations to Prof. Saidur", 2024).

Women are not proportionally represented by the online media as often as men. Generally, men are far more likely than women to be portrayed by the media. In addition, women are only featured in a quarter of television, radio, and print news as subjects of news or information. Women represent only 19% of experts featured in news stories and 37% of reporters write stories globally based on a 2015 report (Rattan et. al. 2019). According to Santaniccolo et.al (2023), a gender-imbalanced picture of society will result in this underrepresentation of women.

Today, merely 25% of women are involved in professions related to science, engineering, and ICT. Moreover, there are only about a third of women researchers and students enrolled in STEM fields, with even fewer in the Asian region and the Pacific (Michael, 2024). The participation rate of women in the labor market remains unfortunately low, despite the efforts Malaysia has made to promote women's economic inclusion and to bridge the gap of gender inequality (Low & Loh, 2021). In Malaysia, men who are STEM graduates are more likely to be employed in STEM-related jobs than their female counterparts. However, ironically, in the local tertiary education institutions, women make up a larger proportion of STEM graduates (Michael, 2024).

As society becomes more techno-savvy, public images are being shaped by online media as this medium plays a significant role in shaping these images. Unfortunately, based on the findings of this study female scientists are being underrepresented in the online media. In Figure 2, it is depicted that only a small percentage of articles were written about female scientists. In this study, five renowned female scientists in Malaysia were chosen based on their accomplishments in the field of science and technology and include Professor Adeeba Kamarulzaman (46 news online articles), Emerita Professor Tan Sri Dr. Mazlan bt Othman (26), T.S Dr.

Mahaletchumy Arujanan (10), Prof. Datuk Dr. Asma binti Ismail (5), Professor Phang Siew Moi (9). From Figure 2, it is apparent that female scientists are the minority which explains the low number of online articles related to them.

As illustrated in Figure 3, the stark contrast between the number of local and international online coverage given to these female scientists was indeed evident with a total of 57 and 39 respectively. These female scientists were given more local coverage online than internationally. The study on images of women by Brenner (1999), Yulindrasari & McGregor (2011), Supratman (2012), Su & Asyiek (2015), and Sandhy and Dwiningtyas (2016) (as cited by Gusti, 2022) mainly focused on images of women on popular media, including the concept of beauty, women empowerment, women parenting, motherhood and fatherhood while neglecting more academic and professional areas such as science and technology. Generally, the mass media has consistently marginalized women and often represented men as superior to women (Rattan et.al. 2019).

Although the findings revealed the pictorial representation, visibility, and some activities and roles of both genders possess a certain degree of equality, the fact that male scientists outnumber their female counterparts does lead to an underrepresentation portrayed in online media in terms of social status, achievements, power, and dominance as illustrated in Figure 2. According to Malaysia Scientists Rankings in Malaysia 2021, there are currently 22 top scientists in Malaysia whereby only 6 were women while the majority were men (Table 3). Besides that, the recipients of Malaysia's Rising Star Award for obtaining the top 1% of the Highly Cited Papers published worldwide were 14 national researchers. The information was extracted from the Essential Science Indicators (ESI) from 2005 to 2014 by Thompson Reuters. Articles by the award recipients have been frequently referred to by researchers worldwide in a broad range of fields. However, it is revealed that out of 14 only 2 were female (Figure 4).

Thus, the online media, the government, and the public must make a concerted effort to create more positive images of women in the realm of gender. Since online media also maintains male dominance implicitly as well as explicitly, this will inevitably lead to gender discrimination in the long term with dire consequences to society and women. Hence, necessary measures need to be taken to ensure an equal proportion of representation in online media. This can be realized by highlighting the accomplishments of female experts in S&T and providing ample exposure in the online media.

## 5. Implications For Future Research

To foster innovation and diversity in academic and professional fields, it is vital to involve women in STEM (Idris et. al., 2024). Varied perspectives and approaches to a problem are due to this diversity as it enhances problem-solving and creativity. Besides tapping into a pool of fresh and undiscovered talent, women will also bring a fresh viewpoint when they are included in traditional domains dominated by men.

Numerous measures can encourage more women to become involved in STEM such as the following: the Education Ministry and related organizations can promote STEM in schools and facilitate mentoring programs and direct interactions between female STEM experts and students, implementing appropriate policies to promote STEM, doing regular monitoring, providing quality education, having positive role models that serve as an inspiration, and ensuring that the media actively represent the successful female scientists and experts. All of these measures need the concerted effort of those involved to ensure that female students are exposed to the STEM fields and are encouraged to learn more about these fields.

By implementing these necessary measures several important issues will be addressed such as bridging the gender disparity, fostering gender equality, and lifting the socio-economic status of women while empowering them in the process. Including women in numerous STEM fields will greatly benefit the nation as it is a strategic move towards making great strides in sustainability, innovation, and national development. To create more equal opportunities for women in STEM, the nation should strive to raise the number of women in this field.

**Conclusion**

In conclusion, this study has found inadequate coverage by the news portal on female scientists. It is strongly recommended that more positive portrayals be used and reflected in these news articles which will inadvertently provide the recognition these women rightly deserve for their unwavering commitment and contribution to the society at large. Furthermore, by implementing appropriate policies, the number of women participating in the S&T field not just locally but also globally will rise as it has been promoted as an exciting career opportunity filled with endless possibilities. Gender equality will lead to a better economy. Policymakers need to identify and make the appropriate and necessary changes that could improve the lives of society and not focus too much on gender differences. Societies that value women and men as equal are more productive, prosperous, safer, and healthier as gender equality is a fundamental human right Hence, online media should strive to create a favorable impression of women which will ultimately break down the conventional view about the status and role of women in the society which denies them their rights and recognition for their dedication by using friendly and neutral text to end stigma and stereotypes attached to victims of sexual harassment once and for all.

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