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The Exposure of Electrical Engineering Field as a STEM Branch towards Technical School's Students in Malaysia

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Abstract

The decreasing interest in Science Technology Engineering Mathematics (STEM) amongst school students has become an issue that requires stern actions to be enforce. The decreasing interest in STEM will directly impacted the decreasing enrollment of students in Higher Learning Institution (HLI) engineering courses. Related to that, the school of electrical engineering Universiti Teknologi MARA (UiTM) Johor branch Pasir Gudang campus is not exempted with the mentioned problem. This decreasing interest in STEM issue may come from the lack of exposure related to the attributes of the STEM field amongst secondary school students. It is crucial to educate and expose these students towards the importance of STEM where they are the potential students for the HLI. Thus, the objective of this paper is to demonstrate the action that have been taken by conducting a webinar in order to expose secondary school students the attributes of electrical engineering as one of the important field in the branch of STEM. A webinar will be conducted that will explain the career, the experience of studying abroad, and the happiness that is related with electrical engineering in STEM. In addition a survey form will be distributed and an online quiz will be conducted at the end of the webinar. From the survey, important results were observed where 85% percent of students is interested to pursue their studies in the electrical field after listening to the webinar related to the career after finishing secondary school. In addition, 97.5% students are interested to further their studies in the electrical engineering field after listening to the webinar the experience of studying abroad after finishing secondary school.

Keywords: Student Enrollment, STEM, Electrical Engineering, Exposure, Attributes

Introduction

The decreasing phenomenon of engineers and the interest of high school students to pursue their higher studies in the engineering field has sparked major concern globally. The major concern can be seen as early as 2007 (Nguyen & Pudlowski, 2007) where skills shortage that is related with the engineering field in Australia is presence. It is noted that, student in

engineering major is experiencing attrition (Geisinger & Raman, 2013). Cybersecurity skill that is related with engineering field was reported to be insufficient in the Europe (Blazic, 2021). These mentioned global issues have become a threat in producing engineers that will eventually halted technological development process. Malaysia is not exceptional from this phenomenon where it is reported that around 500000 scientist and engineers is required around 2020 but currently only 17% is occupying the figure (Ibrahim, 2018). In addition, the statistics of the enrollment of student and the output of student for Science, Technology Engineering and Mathematics (STEM) field in public universities at macro level is depicted in Figure 1 and Figure 2 respectively (Malaysia, 2019, 2020).

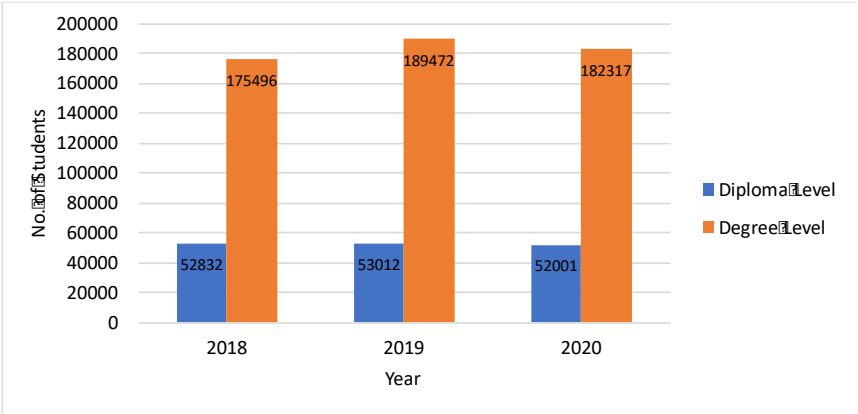

Figure 1: The STEM's courses enrollment in public universities

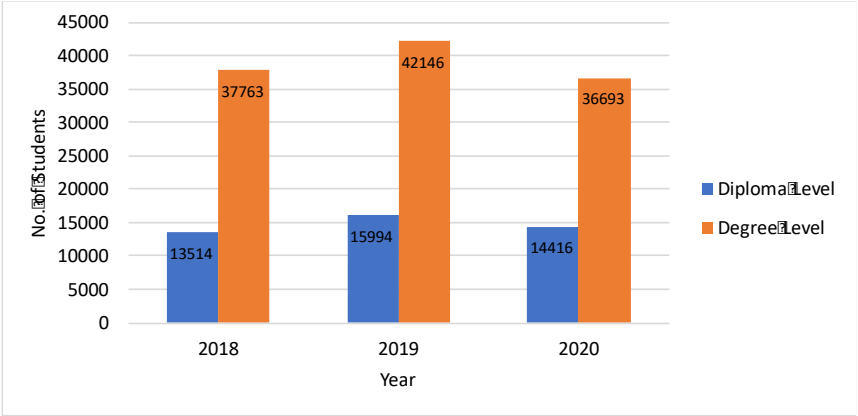

Figure 2: The STEM's courses output in public universities

In Figure 1, there is an increase of student's enrollment in STEM field from 2018 to 2019 for diploma level and degree level that accounts for 180 students and 13976 students respectively. From 2019 to 2020 there is a decline in enrollment where at diploma and degree level the STEM's student's enrollment drop to 1011 and 7155 respectively. The output from STEM's courses is experiencing an increase for both diploma level and degree level from 2018 and 2019 for 2480 graduates and 4383 graduates respectively. Nonetheless, there is a decrease in graduate's output from the year 2019 until 2020 where for diploma level and degree level the output difference is 1578 graduates and 5453 graduates. These figures depicted those inconsistencies exists on the numbers of enrollment and output graduates that can be produced from public universities. These inconsistencies can be a factor that will reduce the demand of scientist and engineers in Malaysia.

In the micro level, the school of electrical engineering (SEE) Universiti Teknologi MARA (UiTM) Johor Branch Pasir Gudang Campus is not exempted from the decreasing students that is registering in electrical engineering field. The school of electrical engineering UiTM Pasir Gudang campus commences its operation in 2014. The freshmen students that are registering for the electrical engineering course is shown in Figure 3. There are two intakes for SEE's student in one year that is being practiced by the SEE. From the figure both intakes are experiencing decreasing in student's enrollment from the year 2016 until 2020. There is a slight increase of freshmen student's enrollment for the first intake in the year 2021. Nonetheless the slight increase does not meet the student's lecturer ratio for the SEE.

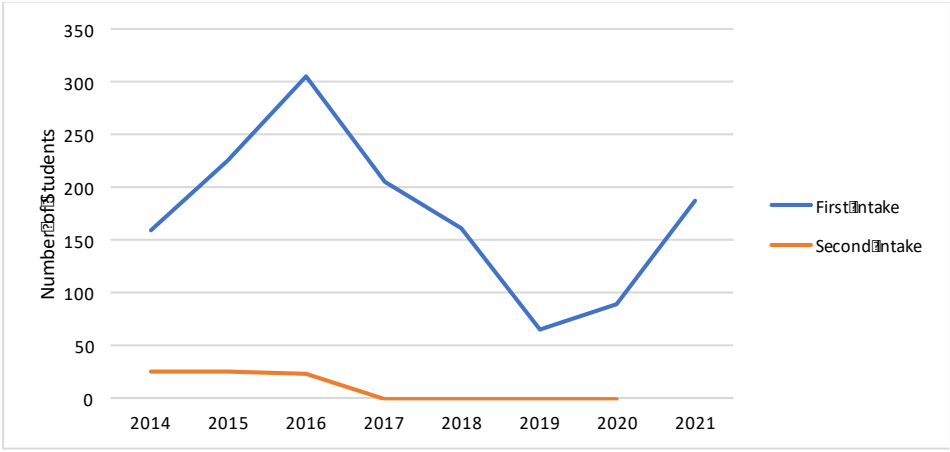

Figure 3: The freshmen intake of Electrical Engineering Students in UiTM Pasir Gudang

It is important to produce sufficient engineers to propel the technological advancement in the digitalized world. In relation to the technological advancement, electrical engineering field can be seen as the main catalyst that will drive technological advancement to the higher level. The involvement of electrical engineering field either directly or indirectly in shaping the world's modern technology can't be denied. It is shown that as loads of technological advancement such as Internet of Things (IoT), automation, renewable energy, logic controllers and many more requires electrical engineering as one of component. In Malaysia, the carrier in electrical engineering field starts after graduated secondary school students enroll to any higher learning institution (HLI) that is offering electrical engineering courses either at diploma level or degree level. Higher learning institution (HLI) plays a pivotal role to produce electrical engineers which eventually contributes towards the mentioned technology advancement. Such goals can't be achieved if the development and producing the human capital in electrical engineering from HLI is at a minimal level.

The decreasing phenomenon of student's enrollment in engineering courses specifically and STEM's courses generally has garnered research interests to investigate the reasoning behind it. Author's in (Saleh et al., 2019) have made a systematic literature review towards the interest and motivation of STEM courses in relation to the decreasing enrollment of students. The findings from the literatures summarizes that interest and motivation plays an important part to be nurture STEM interest among students. Meanwhile reasons suggested in (Straatveit et al., 2017) states that the STEM's introductory subject itself is complicated which opted student's to venture in other less complicated field besides STEM. It is noted that extensive studies in (Ong & Ling, 2020) present that the influence of teachers in Malaysia secondary school is affecting the student's interest to pursuing STEM in universities. In

addition, difficulties of the STEM subject itself demoralize students' interest to pursue STEM at tertiary education level. The same reason of lost interest in STEM is present among Malaysian secondary school in (Mohamed Radzi & Sulaiman, 2018) where STEM students itself feels the subject is difficult hence creates low confidence in to deal with it thus creates doubt whether STEM is beneficial towards the society.

From the available literature, the decrease enrollment in STEM begins with the complicated subjects in the STEM field. The complicated subject in STEM will create less interest among student to further their studies in higher education in the field of STEM and engineering specifically. Eventually, the less interest in STEM will be the root cause of the decrease in STEM enrollment in HLI. In addition, having less interest in STEM decrease the knowledge and awareness and the importance of STEM field and the bright future that STEM field will provide in term of job opportunities. Thus, the objective of this paper is to entice STEM in the electrical engineering field by conducting a webinar to technical school students in Malaysia. As such, the webinar is a talk that is intended to expose to students the career, experience and the happiness in electrical engineering. A survey will be distributed after the webinar to analyze the effectiveness of the conducted webinar and the interest level in electrical engineering field. The webinar and the survey question will be elaborate in the method approach section. The survey results and certain discussion were presented in the results and discussion section respectively. The paper end with several conclusions that have been drawn in the conclusion section.

Method Approach

This section is the method approach that will be conducted in order to instill the importance of electrical engineering through an online webinar. This is divided into two sections. The first section describes the webinar details, such as the title of the webinar, time taken and the medium that were used. Meanwhile, the second section detail out the question survey that will be distributed to the students to measure the effectiveness of the webinar.

a) Online Webinar

Fostering and nurturing the importance of STEM doesn't require forcing as it will create pressure and demotivation. STEM's subject is known for its complicated theory and concept where it requires high determination and motivation to grasp the understanding of the theory and concept. It is useless if students were force with doing extra exercises without knowing what is the future of studying STEM's subject. Thus, the SEE's academic mission unit is organizing an online webinar entitled Electrical Engineering: Career, Experience and Joy that is related with electrical engineering as a part of STEM's subject. Webinar were chosen as the medium of this talk due to pandemic reason. In addition, webinar were recognized as a method that promotes green IT practices and have been adopted before COVID-19 pandemic (Arnfalk et al., 2016).The poster of the webinar is shown in Figure 4. In Figure 4 the webinar will be divided into three section and will be conducted for 2 hours. The first section is the talk on career that is related to electrical engineering. This section dwells on the career that is available and related to the electrical engineering. The purpose of this section is to expose that the STEM field is important and there is a vast of job opportunities that it offered. Moreover, the first section intended to spread awareness that electrical engineering in STEM is closely related where it is required to propel the world in the IR 4.0.

Figure 4: Webinar Poster

The second section meanwhile exposes the experiences that were gained by the speaker while studying electrical engineering overseas. This section objective is to open up the technical school's student mind and perspective that the STEM knowledge and subject in electrical engineering can be acquired in overbroad universities. In addition, this section intends to educate that studying in oversea can develop self-independent and self-motivation to succeed while the exchange of opinion from all people around the world can be achieved. The third section will be presented by the alumni of the SEE in relation to the joyfulness of electrical engineering. This section will elaborate the experience that were gained after the speaker graduated in the electrical engineering field. It involves working experiences, the benefit of STEM and electrical engineering towards solving related issues and the difference between student life and working life after studying in electrical engineering.

b) Webinar Survey

In order to measure the effectiveness of the webinar conducted, a survey was distributed after the webinar. The survey question was structured in accordance to the related sessions. The first section of the survey is targeted on the first section of the webinar where the objectives of the questions were designed to investigate the impression, perception, awareness, and interest in the career the electrical engineering field. Accordingly, the second section is based on the second section of the webinar. The second section of the survey shares the same objective as the first section, but it added with a question that explore the interest and opinion of the school students whether electrical engineering field as one of the branches in STEM has a high potential in Malaysia. The survey is an online form that were constructed using Google form application. An online quiz using Kahoot application will be conducted at the end of the webinar session as a fun activity for the students to test their understanding of the webinar.

Results

A total of 62 students from the technical students attended the webinar but only 40 answered the survey. The survey has recorded a total of 25 male students and 15 female students. The age of the respondents was counted where there are 26 students aged 16 years

old while the others are 17 years old. The first section of the survey that were answered based on the first section of the webinar is shown in Table 1. There are 77.5% that knew electrical engineering field has five disciplines while 6% and 7.5% is not sure and do not know respectively. It's shown from the survey there are 57.5% of the respondent knew the related career in electrical engineering but 27.5% and 15% of the respondents are not sure and do not know the related career in electrical engineering respectively. It is an interesting point where after listening to the webinar, more than half of the respondents (85%) were interested to pursue their studies in electrical engineering but 15% respondents are not sure and none (0%) of the respondents is not interested to pursue their studies in electrical engineering. From these three questions, it is drawn to the attention where the respondents are aware and have some knowledge of the career related to electrical engineering and STEM field. The interest in pursuing were present after listening to webinar which implies STEM field needs to be promoted to high school students in order for them to open up their minds that STEM is important which indirectly nurture their interest in STEM.

Table 1
First Section Answer Survey

Question	Yes	Not Sure	No
Do you know electrical engineering have 5 field of studies before the webinar?	77.5%	6%	7.5%
Before the webinar do you know the career that is related to electrical engineering field?	57.5%	27.5%	15%
After listening to the webinar do you interested to join electrical engineering after finishing school?	85%	15%	0%

The second section of the survey that is related with the second section of the webinar is shown in Table 2. There are two main questions in the second survey where the first question is related to the opinion whether the electrical engineering field in Malaysia will expanding or otherwise. Majority of the respondent (87.5%) answered yes while 17.5% is not sure and there is no objection (0%) of the respondent towards the question. From the respondent answers, it may reflect that from the point of view of the respondents electrical engineering as a branch in STEM is an important field to drive Malaysia towards technological advancement. As for the second question, almost all of the respondents (97.5%) are interested to pursue in electrical engineering after listening to the second session of the webinar only 1% is not sure and none (0%) of the respondent in not interested in pursuing their study in electrical engineering. From the second question, it implies that respondents were intrigued by the talk thus motivated the respondents in pursuing electrical engineering

as a branch of STEM as their career after finishing high school. A further elaboration on the webinar conducted will be discussed in the discussion section with several general questions on the survey.

Table 2
Second Section Answer Survey

Question	Yes	Not Sure	No
Do you think that electrical engineering will be expanding in Malaysia after listening to the webinar?	87.5%	17.5%	0%
After listening to the webinar do you interested to join the electrical engineering field after finishing school?	97.5%	1%	0%

Discussions

As the low interest in STEM field is a worldwide phenomenon, the SEE's academic mission unit have the urgency to promote the electrical engineering field as one of STEM branch towards high schools' students. This webinar is a webinar that promotes to nature and foster interest in STEM and electrical engineering. The webinar was targeted to the high school students in a technical school in Malaysia because they are already in the STEM field. Certain of these students might left out and not interested to pursue in STEM field after finishing high school. This webinar is a small part of exposure and awareness to the graduating high school student what they will gain in STEM if they choose it as their career in life.

Instilling interest in STEM requires different method rather than organizing STEM courses that involves with drilling students with questions workshop. Alternative method such as incorporate music theory with signal processing has been introduced in (Straatveit et al., 2017) towards non-STEM students. In line with (Straatveit et al., 2017), this webinar doesn't involve any question drilling related webinar. It is shown from the survey question that was answered by the respondent, majority (97%) responded that the explanation from the speaker of the first section is easy to understand 3% is not sure as shown in Figure 5. Thus, it signified that prior to drilling workshop on question and concepts, students in STEMS need to be approached with easy program such as awareness. The growth of interest amongst student in STEM can be further strengthened where majority of students agree (95%) that the talk in experience studying oversea should be implemented again in the future as depicted in Figure 6. Indirectly, there is a demand to organize similar talks and program amongst students to further strengthen their interest in STEM.

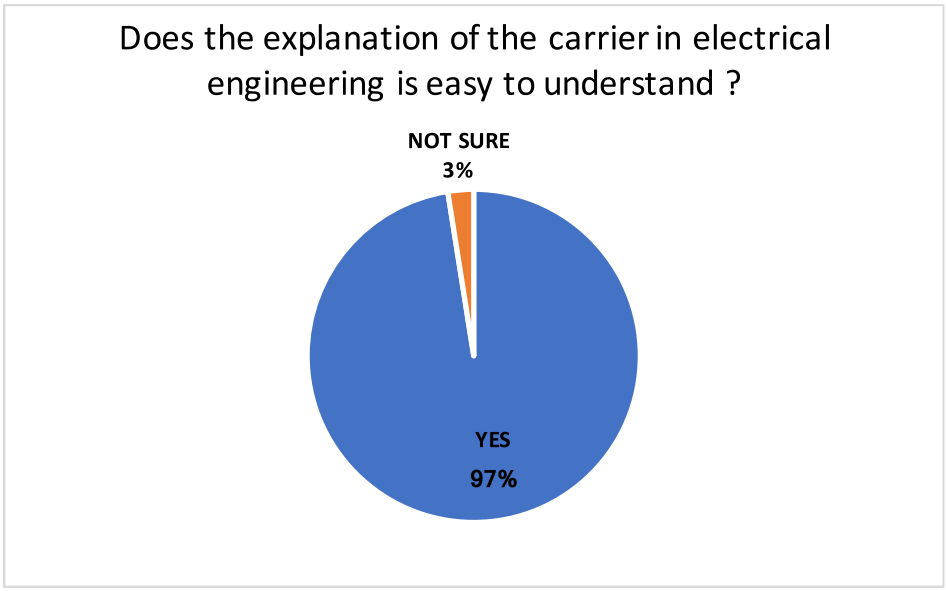

Figure 5: Respondents understanding towards the career talk section

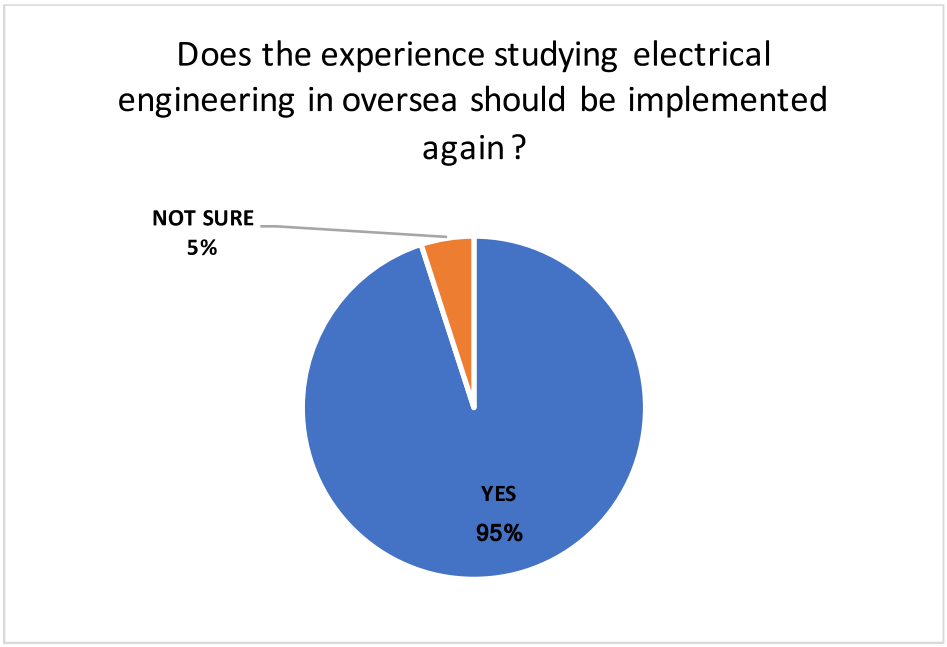

Figure 6: Respondents demand for the reimplementation of the studying electrical engineering experience in oversea

Along the implementation of the webinar there are certain drawbacks that have been encountered. The webinar was implemented during the COVID-19 pre-endemic where certain pandemic regulations need to be adhered. During the webinar two-way communications was hindered and the input delivery maybe not at the maximum because student didn't turn on their web-camera and interactive conversation can't be achieved. This issue is not new in webinar online method (Bedenlier et al., 2021). Such studies have been conducted to investigate and it is believe that during online talk, webinar, and even classes, audio component is sufficient to understand the context of the session (Olson et al., 2012). Even though that is the case, online webinar method provides advantages in terms of remote accessing and the webinar can be access according to own convenience (Tokuda et al., 2016).

In order to measure the effectiveness of the webinar, the survey that were distributed is the only tool that were used for the purpose. The main drawback of the effectiveness measurement is that certain students doesn't answer the survey. Furthermore, in order to strengthen the effectiveness measurement of the webinar, a survey before and after the webinar need to be conducted where it is not conducted in this program and will be the future improvement. In addition, the effectiveness the webinar in order to increase the interest of STEM can only be measured through student's enrollment in engineering programs which it is a long-term result and will be measure in the future.

Conclusion

This paper has demonstrated the implementation of an online webinar in order to instill interest and developing awareness on the importance of electrical engineering field as one of the branches in STEM. This is due to the fact that there are decreasing in enrollment of the electrical engineering students in the school of electrical engineering UiTM Pasir Gudang. The online webinar has somewhat increased the students to further their studies upon finishing high school in electrical engineering field. It is important that awareness program need to be implement continuously in order to foster and nurture the interest in STEM. In addition, the awareness program is needed to prevent the decreasing interest in STEM amongst high school students. The effectiveness measurement of the program conducted can be improve by introducing statistical hypothesis analysis based on the survey conducted.

References

Arnfalk, P., Pilerot, U., Schillander, P., & Gronvall, P. (2016). Green IT in practice: virtual meetings in Swedish public agencies. *Journal of Cleaner Production, 123*, 101-112. doi:https://doi.org/10.1016/j.jclepro.2015.08.063

Bedenlier, S., Wunder, I., Glaser-Zikuda, M., Kammerl, R., Kopp, B., Ziegler, A., & Handel, M. (2021). "Generation invisible?. Higher Education Students' (Non)Use of Webcams in Synchronous Online Learning. *International Journal of Educational Research Open, 2-2*, 100068. doi:https://doi.org/10.1016/j.ijedro.2021.100068

Blazic, B. J. (2021). The cybersecurity labour shortage in Europe: Moving to a new concept for education and training. *Technology in Society, 67*, 101769. doi:https://doi.org/10.1016/j.techsoc.2021.101769

Geisinger, B. N., & Raman, D. R. (2013). Why They Leave: Understanding Student Attrition from Engineering Majors*. *International Journal of Engineering Education, 29*(4).

Ibrahim, M. I. (2018). Malaysia kekurang saintis dan jurutera. *Berita Harian*. Retrieved from https://www.bharian.com.my/berita/nasional/2018/08/461372/malaysia-kekurangan-saintis-dan-jurutera

Malaysia, M. O. H. E. (2019). *Satistik Pengajian Tinggi 2019: Kementrian Pengajian Tinggi*. Retrieved from

Malaysia, M. O. H. E. (2020). *Statistik Pengajian Tinggi 2020: Kementrian Pengajian Tinggi*. Retrieved from Malaysia:

Radzi, M. N. A., & Sulaiman, S. (2018). Measuring students' interest towards engineering in technical school: A case study. *Journal of Technology and Science Education; Vol 8, No 4 (2018)DO - 10.3926/jotse.369*.

Nguyen, D. Q., & Pudlowski, Z. J. (2007). Issues and Challenges in Engineering Education and the Future Outlook of the Engineering Profession in Australia. *Global Journal of Engineering Education, 11*(2).

Olson, J., Grinnell, L., McAllister, C., Appunn, F., & Walters, K. (2012). Towards A Theoretical Model Of The Impacts Of Incorporating Webcams In Virtual Teams. *Review of Business Management System, 16*(2).

Ong, S. L., & Ling, J. P. W. (2020). *Factors Influencing Pre-University Students' Interests towards STEM Programs and Careers.* Paper presented at the 2020 IEEE 8th R10 Humanitarian Technology Conference (R10-HTC).

Saleh, S., Ashari, Z. M., Kosnin, A. M., & Rahmani, A. S. (2019). *A Systematic Literature Review on the roles of Interest and Motivation in STEM Education.* Paper presented at the 2019 IEEE International Conference on Engineering, Technology and Education (TALE).

Straatveit, S. N., Straatveit, A. N., Richards, A., Calderon, A., Arredondo, F., Campbell, G., . . . Tacca, M. (2017, 11-11 March 2017). *Music as the Heuristic Path to Signal Processing Careers.* Paper presented at the 2017 IEEE Integrated STEM Education Conference (ISEC).

Tokuda, L., Lorenzo, L., Theriault, A., Taveira, T. H., Marquis, L., Head, H., . . . Wu, W.-C. (2016). The utilization of video-conference shared medical appointments in rural diabetes care. *International Journal of Medical Informatics, 93*, 34-41. doi:https://doi.org/10.1016/j.ijmedinf.2016.05.007