Research Article doi: 10.12973/eu-jer.9.3.1127

European Journal of Educational Research
Volume 9, Issue 3, 1127- 1140.
ISSN: 2165-8714
http://www.eu-jer.com/

Engineering Students' Challenging Learning Experiences and their Changing Attitude towards Academic Performance

Jake M. Laguador*
Lyceum of the Philippines University, PHILIPPINES

Conrado I. Dotong
Lyceum of the Philippines University, PHILIPPINES

Received: April 17, 2020 ▪ Revised: June 3, 2020 ▪ Accepted: June 20, 2020

Abstract: This study determined the challenging learning experiences of engineering students while completing their degree program as factor that might influence to their changing attitude towards achieving higher academic performance. Mixed method of research was utilised in the study considering the total population of 75 graduating students for quantitative and 12 students for qualitative part of the study using focus group discussion. Results showed that engineering students have significantly higher level of positive attitude towards academic performance during their junior level but significantly lower after taking professional courses. Attaining high academic performance still really matters for the engineering students during their junior level but continuously changing their perspective due to encountered challenging experiences while taking the professional courses. Performance in General Engineering courses describes the attitude of the students towards academic performance in personal aspect while professional courses define their attitude in professional aspect. The finding of the qualitative research revealed that there are three themes emerged in the challenging experiences of the engineering students and these are: Abandoned Social Freedom, Survival of the Fittest and Future Oriented Mindset which contributed to the changing perspectives of the engineering students.

Keywords:*Abandoned social freedom, survival of the fittest, future oriented mindset, engineering education.*

To cite this article: Laguador, J. M., & Dotong, C. I. (2020). Engineering students' challenging learning experiences and their changing attitude towards academic performance. *European Journal of Educational Research*, *9*(3), 1127-1140.https://doi.org/10.12973/eu-jer.9.3.1127

Introduction

Engineering degree programs are designed to equip the students with cognitive learning or technical knowledge related to mathematics, technology and allied sciences to better understand how the society can be developed and improved from breakthrough innovations. Meanwhile, affective domain of learning has a significant contribution in the accomplishment of student outcomes (Savic & Kashef, 2013). Engineering is one of the most in demand and attractive degree programs in college as it is considered both rewarding and challenging (Boles & Whelan, 2017). It brings certain level of fascination to every student who dreamt to become engineer in the future. However, the struggle is real and the difficulty of passing the professional courses is beyond control. Zhou (2012) believed that the root of challenges for engineers is thought to be the complexity of engineering practice. Study of Chen et al. (2014) in India found out that most engineering students experienced lack of social engagement and sleep deprivation due to heavy study load. Meanwhile, the study of Baillie and Fitzgerald (2000) is concerned on students at risk from demotivation within engineering courses at Imperial College in London. Meanwhile, Australia is concerned with excessive loss of its engineering graduates which is approximately 54 percent in 2010 which is noted with considerable variation across institutions and sectors (Godfrey et al., 2010) with the same scenario with UK and USA where the number of engineering graduates call for an increase to meet the needs of current global challenges (Boles & Whelan, 2017). Moreover, low course grade is considered one of the factors according to the Geisinger and Raman (2013) as related to attrition of the engineering students based on the literature review including inadequate teaching and advising. Mara et al. (2002) on their study noted that engineering students in the US leave the program due to curriculum overload, poor teaching, and they were discouraged due to low grades.

On the other hand, the challenging experiences encountered during the course of learning in higher education shape the character and transform the attitude and behaviour of students after having gone through with the test of time (Kali

***Corresponding author:**
Jake M. Laguador, Research Center, Lyceum of the Philippines University, Capitol Site, Batangas City, 4200, Philippines.
✉jmlaguador@lpubatangas.edu.ph

Soyer & Kirikkanat, 2019). Learning experiences provide either positive or negative outcome depending on the students' attitude (Ezemba, 2018; Goran & Negoescu, 2015; Pierce et al., 2017). There are negative emotional learning experiences of the students that shape their negative emotions and learning attitude to become demotivated (Lisciandro et al., 2018; Ng et al., 2018). But according to Knight and Eisenkraft (2015), negative learning experience is not always bad as the way other students perceived it. There are negative reinforcements that could also lead to changes in attitude towards positive learning outcomes (Hoadley & Kali, 2019; Manimaran et al., 2016). Changes in the way they perceive things may vary from different phases of their adjustment and adapting the culture unconsciously behind those experiences (Chao et al., 2017; Jones & Bond, 2019; Lent et al., 2015; Zhu et al. 2016). From the study of Ramirez and Dizon (2014) also noted that attitude of the engineering students has subjective element from psychological point of view. It changes overtime and may also vary based on the different degrees of experiences encountered by the students as similar with their interest towards engineering program (Coll & Paku, 2015; Hasni & Potvin, 2015; Mohd Shahali et al., 2019).

The present study is anchored in the theory of Rosenberg (1960) regarding Affective-Cognitive Consistency of Attitude. Rosenberg (1960) proposed that an attitude has an affective component with a positive or negative feeling toward the issue and a cognitive component with beliefs or thoughts about the issue or object. The researchers argued that changes really happened significantly on the attitude of the students which decreases the level of their perspective about the importance of academic performance along the way to the completion of their degree programs. Thus, this study would like to test the null hypothesis regarding the difference on the attitude of second year engineering students towards academic performance when compared their responses after four years in the program. Meanwhile, determining the challenging experience of engineering students as factor to consider in changing attitude towards academic performance was also explored.

Attitude towards academic performance brings the perspective of students on how they keep track of their progress as the result of their struggles in completing the program (Alos et al., 2015; Grohs et al., 2018; Jain et al., 2017). Aiming for high grades in engineering courses is considered an issue in education where students are complacent of getting passing marks due to complexity of the professional courses. Pushing them to their limits is already a challenging part of students' life in engineering programs. This is due to the nature of the professional courses in higher mathematics and engineering sciences where critical and analytical thinking with higher order thinking skills are necessary to be applied (Hugerat & Kortam, 2014; Ramadhan et al., 2019; Widana et al., 2018; Zivkovil, 2016). Improving the high-order thinking plays a significant part in increasing academic achievement (Ozen Uyar et al., 2018). This is where the problem solving skill is being developed as part of their preparation in indentifying contemporary issues and offering solution related to their general and professional courses (Yuberti et al., 2019). Academic performance measures the ability of the students to comply with the school requirements and examination of knowledge and skills with components of character and values. It is believed to play an important role in honing the quality of graduates who are expected to become responsible leaders of the country and who will contribute in the attainment of economic and social development (Alos et al., 2015; Mallari & Bueno, 2018).

This study explored on the changing perspectives of Filipino engineering students from one Higher Education Institution in the Philippines regarding the importance of academic performance. This study specifically described the perspective of the engineering students regarding the importance of getting high academic performance towards personal aspect and professional aspect during their junior level and senior level. The study also compared the responses during their junior level on the importance of academic performance between those who graduated from the engineering program and those who did not pursue engineering; and it also tested the difference between their perspective on the importance of academic performance before (junior level) and after (senior level) taking professional courses among the graduating students.

This study builds from the fact that taking engineering is not for everyone who would like to take college degree. It takes a lot of courage for the students to confront several identified difficulties of the program before they pursue it and reach the end of the finish line towards graduation. The finding of the study is considered significant in understanding the attitude of the engineering students on how they viewed the importance of academic performance and achievement. The study explored on how the attitude changes overtime after experiencing several challenging experiences that shaped their character and personality. These difficulties might become useful for the student development but with utmost consideration on the possibility of sustaining their social relationship and it will not affect their health condition due to sleep deprivation. The manifestation of their maturity lies within their behavior and the way they accept changes as part of learning that transforms attitude towards achieving certain level of performance. It is the goal of every career development program of the HEIs to bring positive outlook towards preparation of the students in developing employability skills where the finding of this study could provide insights in the changing perspective of educational leaders on how to deliver education to the most enjoyable manner of learning experiences.

Methodology

Research Design

This research utilised the qualitative and quantitative-descriptive method of research. Documentary analysis was used to gather and quantify the data and information on academic performance based from the students' final grades in general and professional courses from 1st year to 5th year. Descriptive normative survey method was used to get data from their perspective on the importance of having high academic performance. For qualitative part of the study, narrative analysis was used which is one form of qualitative data analysis that it is often used in narrative inquiry (Butina, 2015). This study specifically utilised a Thematic Narrative Analysis which is one of the four approaches of narrative analysis where the primary focus is the content within the text which aims to arrive at categories and themes.

Sample and Data Collection

The study includes the 72 graduating engineering students during School Year 2016-2017 and School Year 2017-2018. There are 41 graduates during 2018 and 31 graduates during 2017 from four (4) engineering degree programs which include BS Computer Engineering (BSCoE), BS Industrial Engineering (BSIE), BS Mechanical Engineering (BSME) and BS Electronics Engineering (BSECE) of a private university in the Philippines. Graduating students who are transferees (3 students) during third year level are not considered as part of the study. Table 1 shows the total number of engineering graduates per program for 2017 and 2018.

Table 1. Number of Graduates per Engineering Program

Program	2018	2017	Total
BS CpE	4	5	9
BS ECE	4	2	6
BS IE	24	20	44
BS ME	9	4	13
Total	41	31	72

Only those graduating students who started the engineering program in the same university are considered as respondents. These graduating students already answered the same instrument when they were in the second year level. The researcher purposely selected the second year students because they have already experienced the engineering program. Holmegaard et al. (2014) agreed that the students' choice of study is an ongoing process of meaning-making, which continues when the students enter higher education and continuously work on their identities to gain a sense of belonging to their science or engineering program.

For the qualitative part, 12 engineering students served as participants in the study who equally represented the four engineering programs with three (3) respondents each. They were chosen based on their willingness to participate, both regular and irregular students and regardless of sex.

Instrument

The instrument used in the study was a researcher-made questionnaire in English Language which was content-validated by experts in educational psychology, engineering education and measurement and evaluation. A table of specification was prepared to ensure sufficient content coverage on measuring the attitude towards academic performance. The questionnaire utilised a five (5)- point Likert rating scale for data collection ranging from strongly agree to strongly disagree. The 10-item questionnaire for measuring the attitude towards academic performance was divided into two (2) factors: the personal aspect and professional aspect. The instrument was initially administered to 100 marine engineering students who are not part of the study during the 2nd Semester of School Year 2012-2013. It was tested the reliability with Cronbach's alpha value of 0.880 for personal aspect which means that the instrument has relatively high internal consistency; the same result for professional aspect which obtained an overall Cronbach's alpha value of 0.882. The detailed result per item was presented in Table 2.

Table 2. Result of Reliability Test of the Attitude towards Academic Performance Questionnaire

Personal Aspect I believed that having high Academic Performance is important …	**Cronbach's Alpha If item deleted**	**Remarks α>0.8**	**Correlation Coefficient**
1. in monitoring my improvement to fulfill my goal (Conti, 2000)	.854	Good	.719
2. in achieving awards or recognition during graduation (Mitchell et al., 2011)	.870	Good	.513
3. for my parents as a sign of my gratitude for their hardship and efforts (Topor et al., 2010)	.878	Good	.404
4. In harnessing my study habits (Crede & Kuncel, 2008)	.873	Good	.460
5. In uplifting my self-confidence (Parsons et al., 2011)	.879	Good	.381
Overall	**.880**	Good	

Table 2. Continued

Professional Aspect I believed that having high Academic Performance is important …	**Cronbach's Alpha If item deleted**	**Remarks α>0.8**	**Correlation Coefficient**
1. in passing the licensure examination or certification (Montehermoso, 2009)	.877	Good	.631
2. in making good impression to employers of my intellectual ability (Poyrazli et al., 2008)	.848	Good	.758
3. in having a successful career in engineering (Mau, 2003)	.832	Good	.821
4. in finding more employment opportunities from big companies (Robbins et al., 2003)	.823	Good	.862
5. in getting higher salaries and benefits (Neumann et al. 2009)	.899	Good	.538
Overall	**.882**	**Good**	

Scale: α>=0.9: Excellent; 0.80-0.89: Good; 0.70-0.79: Acceptable; 0.61-0.69: Questionable; 0.51-0.59: Poor; 0.5 and below: Unacceptable

Procedure and Ethical Consideration

The total enumeration of the final count of 72 respondents came from the initial number of 141 second year engineering students which are considered as junior level. The second year engineering students answered the questionnaire during the 1st month (June, 2013) of the opening of the School Year 2013-2014 (75) and another set on June 2014 during the School Year 2014-2015 (66). The graduating students after four (4) years answered the same instrument again one month before the end of the School Year 2016-2017 (31 graduates) which was April, 2017 and April 2018 during School Year 2017-2018 (41 graduates).

The academic performance was measured using the General Weighted Average from 1st year to 2nd year (Junior Level) taken as a whole and another data set from 3rd year to 5th year (Senior level) and these were obtained from the records of the students from the Engineering Department with the permission of the College Dean.

Meanwhile, the survey was administered to students to determine their attitude towards academic performance. They were informed regarding the purpose of the study and assured that the data provided in the questionnaire will be treated with utmost confidentiality; will not be disclosed to any third party and will be used solely for the purpose of this study. The initial result of the survey were kept confidential and secured in the records of the researcher and retrieved again after four years to see the difference of their attitude towards academic performance.

Two (2) sessions of focus group discussion (FGD) were facilitated to a group of six (6) students with a total of 12 graduating students using mixed languages of Filipino and English. The first group was interviewed before their graduation in 2017 while the other grouped was interviewed before their graduation in 2018. They were invited to sit in a group at one discussion room in the university library which is conducive for conversation without anyone can hear them speaking from the outside with controlled sound and room temperature. The FGD was started at 3:10PM with the briefing and orientation but officially started at 3:15PM and ended at 3:50PM which run for almost 35 minutes. The remaining 10 minutes served as debriefing. The participants were given simple token of appreciation. Cellular phone was used as audio recorder while the researcher served as the moderator. The following questions were asked: (1) What are the challenging experiences you encountered in engineering?; (2) How did you cope up with these challenges?; and (3) How these challenging experiences changed your attitude and behaviour? Participation of the students in the interview is pure voluntary and those who signified their intention to participate are aware of their rights to stop participating even in the middle of the discussion. The confidentiality of the data provided in the study was fully observed. A separate file was used to record the names of the participants with assigned individual codes.

Analyzing of Data

Arithmetic mean was used to describe the academic performance of engineering students for general engineering courses during 1st to 2nd year level and professional courses during 3rd to 5th year level. Weighted Mean and rank were used to describe the level of attitude towards academic performance. Parametric test was used in the study because the nature of data is normally distributed. T-test was used to determine the difference between those who completed the engineering program and those who dropped, stopped and shifted to another college degree as well as the difference between before and after taking professional courses in engineering. Pearson – Product Moment Correlation Coefficient was used to test the relationship between academic performance and attitude towards academic performance. The given scale was used to interpret the result of the data gathered: 4.50 – 5.00 = Strongly Agree (SA); 3.50 – 4.49 = Agree (A); 2.50 – 3.49 = Moderately Agree (MA); 1.50 – 2.49 = Disagree (D); 1.00 – 1.49 = Strongly Disagree (SD).

For qualitative data, this study gathered the data from two (2) different school years. It utilised the narrative thematic analysis adapted from Creswell (2014) which consist of five stages: (a) organization and preparation of the data, (b) obtaining a general sense of the information, (c) the coding process, (d) categories or themes, and (e) interpretation of the data. To ensure the trustworthiness of the result of the emerging themes, the researchers employed three (3) strategies: prolonged involvement (Guba & Lincoln, 1989), peer debriefing (Spall, 1998), and member checking (Carlson, 2010). The researchers as the dean together with the former department chairperson in the College of Engineering, they had long experiences and observation with the students interviewed. They were involved in majority

of the student activities and gave guidance and direction for the welfare of the students. Aside from this, peer debriefing was also considered as part of the validity measure of the results through asking other chairpersons in the engineering department regarding how the researchers interpreted the findings that could get the same result of their interpretations. Likewise, member checking was also employed in the study through asking again the engineering students for some clarifications from the transcripts if they have something to change or the researchers misinterpreted what they mean about some issues raised during the interview.

Results

Table 3. Academic Performance of Engineering Students in General and Professional Courses

	N	General	Interpretation	Professional	Interpretation
BSIE	9	2.38	Average	2.44	Average
BSME	6	1.89	High	2.74	Low
BSECE	44	2.20	Average	2.34	Average
BSCpE	13	2.16	Average	2.52	Low
Total	72	2.23	Average	2.51	Low

Scale: 1.00-2.00: High; 2.01-2.50: Average; 2.51-3.00: Low

Table 3 shows the academic performance of engineering students in general and professional courses. Mechanical Engineering students obtained High Academic Performance during general courses but obtained low during professional courses while BSCpE obtained an average rating in general education courses but low in professional courses. BSIE and BSECE students both obtained average rating on general and professional courses.

Table 4. Attitude towards Academic Performance in terms of Professional Aspect

Professional Aspect	**Junior Level**	**Senior Level**	**t-value**	**p-value**
I believed that having high academic performance is important …	**M (SD)**	**M (SD)**		
1. In passing the licensure examination or certification	4.68(.15)	3.89(1.32)	5.43*	.00
2. In making good impression to employers of my intellectual ability	4.46(.26)	4.55(.29)	-1.00	.32
3. In having a successful career in engineering	4.52(.33)	3.16(1.32)	13.88*	.00
4. In finding more employment opportunities from big companies	4.42(.26)	3.63(1.58)	31.24*	.00
5. In getting higher salaries and benefits	4.42(.17)	3.43(1.22)	11.07*	.00
Composite Mean	**4.50(.26)**	**3.73 (1.37)**		

*Note: *Significant at p<0.001 (two-tailed)*

Table 4 presents the attitude of the engineering students towards academic performance in terms of Professional Aspect during junior level (M = 4.50, SD = .26) and senior level (M = 3.73, SD = 1.37). Engineering students believed that high academic performance is still important in making good impression to employers of their intellectual ability as revealed by the result of the survey after four (4) years which increases by 0.09 from their junior level (M = 4.46, SD = .26) to senior level (M = 4.55, SD = .29). There was no significant difference, $t(74) = -1.00$, $p = 0.33$ on the attitude of engineering students between their junior and senior level where the computed p-value is greater than 0.05 alpha level.

Meanwhile, the engineering students during their junior level strongly agreed that having high academic performance is important in passing the licensure examination or certifications (M = 4.68, SD = .15). But after four years in the engineering program, it changes their perspective which decreases the mean score (M = 3.89, SD = 1.32) where significant difference exists before and after taking the professional courses as denoted by the computed $t(74) = 5.43$, $p<.001$, therefore, the null hypothesis of no significant difference is rejected.

Meanwhile, they strongly agreed during junior level that having a successful career in engineering is part of having high academic performance (M = 4.52, SD = .33). But the idea changes overtime where at present they are just moderately agree (M = 3.16, SD = 1.32) where significant difference exists on their attitude as indicated by the computed $t(74) = 13.88$, $p< .001$ alpha level.

Engineering students agreed moderately that having high academic performance is important in getting high salaries and benefits (M = 3.43, SD = 1.22) which were previously agreed four years ago (M = 4.42, SD = .17) where significant change on perspective exists, $t(74) = 11.07$, $p<0.001$.

They still agreed that having high academic performance is important in finding more employment opportunities from big companies (M = 4.42, SD = .26) but their perspective on this idea decreases significantly (M = 3.63, SD = 1.58). Significant difference exists, $t(74)=31.24$, $p<.001$, before and after taking the professional courses, where majority of

them do not believe on this view because success for them is not being measured solely by high academic performance especially for engineering.

Table 5. Attitude towards Academic Performance in terms of Personal Aspect

Personal Aspect I believed that having high academic performance is important …	**Junior Level** **M (SD)**	**Senior Level** **M (SD)**	**t-value**	**p-value**
6. in monitoring my improvement to fulfill my goal	4.34(.41)	3.45(1.03)	10.97*	.00
7. in achieving awards or recognition during graduation	4.53(.28)	3.68(1.12)	9.51*	.00
8. for my parents as a sign of my gratitude for their hardship and efforts	4.61(.13)	3.71(.92)	9.39*	.00
9. In harnessing my study habits	3.97(.78)	3.82(.73)	1.03	.31
10. In uplifting my self-confidence	4.38(.41)	3.92(.35)	5.01*	.00
Composite Mean	**4.37(.22)**	**3.71(.84)**		

*Note: *Significant at p<0.001 (two-tailed)*

Table 5 presents the attitude of engineering students towards academic performance in terms of Personal Aspect during junior level (M = 4.37, SD = .22) and senior level (M = 3.71, SD = .84). There was a significant difference, $t(74)=5.011$, $p<.001$) on how engineering students during their second year in the program with high level of agreement in terms of having high academic performance can uplift their self-confidence (M = 4.38, SD = .41) but it decreases significantly after four years (M = 3.92, SD = .35). Furthermore, they strongly believed that academic performance is important for their parents during junior level (M = 4.61, SD = .13) but losses significantly during senior level (M = 3.71, SD = .92) as indicated by the computed $t(74)$ =9.39, $p<.001$ alpha level. Becoming happy and proud of their progress during junior level (M = 4.53, SD = .28) also decreases significantly at the senior level (M = 3.68, SD = 1.12) as denoted by the computed $t(74)=9.51$, $p=.001$ alpha level. Likewise, they agreed that having high academic performance will fulfill their goal of seeing their improvement during junior level (M = 4.34, SD = .41) which varies significantly at the senior level (M = 3.45, SD = 1.03) as denoted by the computed $t(74)$ =10.97, $p<.001$ alpha level. However, harnessing their study habits from junior level (M = 3.97, SD = .78) to senior level (M = 3.82, SD =.73) does not differ significantly as denoted by the $t(74)=1.033$; $p=.31$.

Table 6. Significant difference on the Attitude of Engineering Students towards Academic Performance

Category	**N**	**Mean**	**Std. Deviation**	**t-value**	**p-value**	**Interpretation**
Graduated	72	4.48	.33859	1.33	0.08	Not Significant
Dropped-out	56	4.34	.22914			

**Significant at p<0.05(two-tailed)*

Table 6 reveals the result of the test of difference on the attitude of Engineering Students on Academic Performance between those who dropped-out (M = 4.34, SD = .23) and graduated (M= 4.48, SD = .34) from the program. Overall, there are 66 students who could not able to continue and finish engineering in the university where they initially started but ten (10) of them transferred to other schools and still continue engineering. Therefore, the responses of 56 students out of 66 were considered in the test of differences. Result revealed no significant difference exists, $t(130)$ = 1.33, p=0.08, on the attitude towards academic performance between the two groups.

Table 7. Relationship Between Academic Performance and Attitude of Engineering Students

Junior Level	**Performance in General Courses**	
	r-value	**p-value**
Professional Aspect	0.17	.32
Personal Aspect	0.43*	.007
Senior Level	**Performance in Professional Courses**	
	r-value	**p-value**
Professional Aspect	0.55*	.00
Personal Aspect	.10	.53

**Significant at p-value<0.05 (two-tailed)*

Result of Table 7 showed that those students with higher level of personal perspective on academic performance are also those students with higher academic performance in general courses, $r(70)$ = 0.43, p=.007, while those students with higher views on professional aspect of academic performance are also those students with higher academic performance in professional courses, $r(70)=0.55$, $p<0.001$.

Findings

The findings of the challenging experiences of engineering students from the result of the focus group discussion revealed the three emerging themes: (1) *abandoned social freedom, (2) survival of the fittest and (3) future oriented mindset*. These themes summarized how the engineering program changed their attitude and behaviour towards the program itself and the academic performance.

Abandoned Social Freedom

The engineering students answered when they were asked regarding their challenging learning experiences encountered in engineering, one of the main themes emerged from their responses is the "*Abandoned Social Freedom*". Having less comfort and liberty to do whatever they usually do when they were in junior level is somewhat challenging for them. They felt that they were deprived of their autonomy. This emerging theme was used as a term mentioned in only one available literature from the doctoral paper of Hess (2017) with political implications in the awareness led to the analysis of the problem of moral inversion.

They have experience sleepless nights to complete the activities and exercises in higher mathematics and allied engineering courses. Answering practice sets from the end of the chapter in the manuals consumed almost 3 to 5 hours. They always conduct group study so that they could have someone to ask and inquire if they have encountered confusion in the middle of the problem solving. In the morning, they have to wake up early to study their next lessons for the day. They have to do some advance reading to get some ideas on the lecture. Most of their time is being consumed in completing academic and course requirements. They tend to sacrifice their social freedom (Shnayderman, 2013). They have to limit their common ways of doing things with friends and have to go out from the comforts of their families just to fulfil the requirements of their studies. They tend to compare the engineering program with other college degree programs based on their experience as graduating student; engineering is one of the most difficult degree programs in college because of too many technical problems to solve and projects to submit. They also believed that the final thesis of other bachelor's degree programs is just their final requirement in one course or subject like the undergraduate research which is different from their feasibility study. This is considered their thesis or final requirement for them to graduate. They also thought that they can be an honor graduate if they enrolled in other degree programs, because it would be easier for them to get high academic performance because of their interest and motivation to study.

Motivation has always been part of every success in achieving the goal of education (Taskesen, 2019) while academic performance had been considered as the measure of student progress being used for the selection of honor graduates. In most cases, very few engineering students could able to graduate cum laude compared to other programs in business, arts, humanities and sciences. Although students admitted in engineering programs have higher stanine scores. But due to the level of complexity of the program, graduating with flying colors is beyond their reach because of their low academic performance which most of the time not a true reflection of their intellectual capacity.

Engineering for them is time demanding and time consuming, where they suffered lack of quality time with their love ones to the point that they cannot join anymore with their family to eat during dinner because they have to complete some exercises.

They have no freedom to join extra-curricular activities because they have to attend classes in professional courses where they might miss graded quizzes and recitation if they will participate in other school events. Sometimes, they cannot also join other community activities due to unfinished projects. They have also no freedom to choose for the schedule because they are only enrolled in one section due to limited number of enrollees. They cannot also choose professors, because of limited professors in engineering. They also considered as burden for them the assignment of workload every semester because of the combinations of complicated courses are sometimes placed in the same semester most especially those courses that require individual projects. They cannot play anymore online games or spend much time with social media because they opted to spend their time with their lessons. They also emphasized that their thesis experience can be considered one the most challenging part of their college life because this is the culminating academic requirement. If they cannot defend the thesis on time, they will not able to graduate on time as well.

Survival of the Fittest

Engineering students consider the programs as full of hardships and trials because it really tested the strength of their personality in terms of patience, determination, perseverance and hard work like survival of the fittest. They encountered lots of challenges in terms emotional, physical, mental and financial aspects of being enrolled in the program. They also mentioned that during their general engineering, getting high grades is important for them because they can still perfect the quizzes and major exams, but when they encountered the professional courses, the culture is different and it changed everything.

There are some notions that the academic culture in engineering is quite different compared to other science and liberal

arts programs. They thought that Engineering has a different kind of culture that gave them too much pressure and tension. Since engineering is considered as a hard science program (Zeidler et al., 2005) which has different set of cultures compared to medical and health sciences, as well as social sciences.

They also have some experiences regarding how they already exerted too much effort in studying for the major examinations but still they keep on getting low scores and even failing marks. Sometimes they are already losing their patience in studying for the major exams because they still have not received what is expected. For the four (4) major examinations, they always tried to put much effort to get high scores in the preliminary and midterm exams because they thought that the introductory parts of the lessons are easier than the latter sections of the course.

Sometimes they are also questioning their determination if that is not enough to fulfill their dream to become future engineer because of failing grades and incomplete remarks in the class card.

Future Oriented Mindset

They become more conscious of acquiring relevant professional skills for future employment and licensure examination or certification and having healthy living as engineering students with great maturity and responsibility which described their future oriented mindset (Bochert et al., 2016; Cheng et al., 2012). When they were asked regarding how those challenging experiences changed their attitude and behaviour, it gives them certain level of maturity (Bochert et al., 2016) gearing towards thinking of more opportunities and possibilities. When they were asked regarding how did they cope up with the challenges, they maintain healthy mind and body. They eat the right kind of food to supplement the physiological needs to restore energy, having good night sleep although sometimes less than four (4) hours but during weekend, they see to it that they can sleep more than eight (8) hours. They still find time to make connections with their online friends through social media but devoting limited time to spend personal chats but mostly about academics. They were thinking of their future career after having experienced several difficulties. They have to apply whatever learning they acquired from the university to their employment, so that it would not be wasted. They will still keep on updating their knowledge through attending training and seminar as part of the lifelong learning. They just thought that they were doing all those things for them to pass the licensure exam as their ultimate goal as of the moment after completing all their academic requirements that provided them so many challenges. This is for them to return all the favor to their parents. They believed that they became more matured and future-oriented, because they learned how to take good care of themselves without their parents to guide them. They always keep on remembering the promise they made to their parents that they will graduate engineering on time. They learned how to prioritise their personal responsibilities and submission of too many course requirements with the same schedule of deadlines. Challenging experiences in engineering also brought them to have good time management.

Part of their coping mechanism from those challenging experiences is taking care of their health because for them it is important for achieving their success. Aside from that, diverting their attention from negative emotion to positive views and outcomes of those consequences helps them manage the situation. Engineering students have deeper sense of gratitude to their families especially their parents and they wanted to be of great help after graduation. Filipino values still manifest in the way students understand the situation of their families and wanting to give financial support is still considered part of their obligation. The idea of lifelong learning (Deveci & Tezcan, 2017; Mohovic et al., 2016) can still be seen from their responses as how they see themselves after college. They believe on continuous learning as result of their challenging experiences in engineering as training ground towards achieving higher goals and finding their purpose in fulfilling their mission.

Discussion

The academic performance of engineering students from general courses is considered higher than the professional courses. Due to the nature of general courses during junior level are considered introductory or fundamentals of higher level professional courses, students could grasp easily the lesson and topics being discussed. Faculty members were also given the academic freedom based on their teaching approaches and methodology on how to handle and manage classes that will be suitable to the goal and purpose of the program as well as based on the learning needs and style of the students. It is also a good study to explore if the differences of teachers' personality and way of teaching between general and professional courses will be tested to see how these factors contribute in the academic performance of the engineering students in particular.

The nature of the engineering program also influences the complexity on the approach of learning. Like for example in Mechanical Engineering, the students are being prepared for Licensure examination the same case with Electronics Engineering. But for Industrial Engineering, students are also being prepared for certification exams but it is optional. Industrial Engineering graduates can still be employed even without certifications, the same with computer engineering where these are considered as non-board programs.

There is a consistent feeling and thought in terms of thinking about their academic performance as an important requirement for employers as indicated by no significant difference on the attitude of the engineering students before and after taking professional courses. They still believed that academic performance is a reflection of their past history

as an individual learner being measured by program educational objectives and learning outcomes of the university. Engineering students are also aware of the recruitment process because it is part of their curriculum most especially for the industrial engineering students. Academic performance is being given importance during hiring process. They are aware of its importance as it will serve as basis for initial assessment of fresh graduates as applicants' capability. But most industries accept cadet engineers based on qualification and company-based exams and interviews. Soft skills (Rao, 2014) are considered one the most important assets of the students followed by technical skills over the academic performance. Zebrowitz et al. (1991) noted that employers examine academic achievement on hiring applicants. Alos et al. (2015) also emphasized that academic achievement is one of the major factors considered by employers in hiring workers especially for the fresh graduates. Furthermore, engineering students believed that academic performance is important in landing a good job in the future. Because it serves as one of the bases for hiring, but they know, employers are using other measures in the selection process of the right employees for the job.

Engineering students consider experience more than academic performance as important aspect of learning to face the challenges of the engineering program. Relevant training enhances their analytical, critical and logical thinking skills in preparation for licensure examinations and certifications. Some studies suggest that academic performance is an important measure of success in the licensure exam. Based on the result of the study conducted by Dotong et al. (2019), they found out that correlation exists between the result of Licensure Examination for Mechanical Engineers and the academic performance taken as a whole but not within per area or subject. Meanwhile, from the study of Tamayo (2015) revealed the academic performance as measured by Grade Point Average (GPA) and the correlation of licensure exam showed a mixed result.

It gives the students some sort of confidence if they have good grades; it means that they can surpass the challenges of licensure examinations and certification. Based on shared experiences of other board passers even with low grades can still pass the licensure examination, but still supported with great efforts, determination and perseverance during reviews. It really feels good for them to receive high academic performance in professional courses but it is not anymore expected because of the complexity of the major examinations to pass with large volume of course requirements to submit during the semester where available time for studying is not enough for them to perform all their duties as student to obtain high grades and academic performance. For them, getting high grades in this curricular program in college is really difficult. Because for them, they consider the academic performance before as status symbol, but after four years, it is not the academic performance itself that can be considered important factor in the success of their career but the process on how they attained it that really matters a lot.

Engineering students might not certainly believe that academic performance on one's Transcript of Record will still be considered in getting high salaries and benefits. Instead, job performance will now dictate increases in compensation. They know that the academic performance is only useful during hiring process for initial assessment but later on, job performance serves as basis for promotion and other benefits and privileges.

They have this notion that those employees working in multinational corporations are highly intellectual, meaning with high academic performance and with exceptional track records and experiences. They thought that joining with these kind of companies will require them good academic standing. But somehow, this is true to other organizations with some exceptions but not being considered for most companies. This is because they hire people based on certain level of skills and more on attitude and character not solely based on academics. But this idea is contradicting to one study conducted in Oklahoma, USA by Griffin (2008) stated that larger employers placed greater emphasis on high grades.

The result of academic performance for engineering students still provides certainty or assurance that they are still improving in terms of acquiring new learning and skills from the classroom and other related activities as well as the result of their study habits. If they received low grades, it gives them an idea that they really need to exert more effort to study in order to enhance their academic performance in the next semester. But sometimes they have this kind of anxiety when taking exams even they studied harder the night before the exam which resulted to low grades. Vitasari et al. (2010) noted that students with high level of anxiety have a reduced memory span, lose concentration, and lack confidence, and poor reasoning power. They also believed that no matter how hard they tried to exert efforts on studying, they still received low grades due to complexity of mathematical problem solving and very technical analysis needed in answering some questions in the major examinations.

Academic performance somehow is not anymore the only measure of having self confidence for engineering students because they cannot really achieve it in the program. Some studies claimed in general perspective that those who have higher academic achievement tend to feel more confident; in contrast, those who lack confidence in themselves achieve less (Aryana, 2010; Kirmizi, 2015; Negru-Subtirica & Pop, 2016).

Furthermore, it gives certain level of fulfilment among parents if their children will be receiving high academic performance because they assume that their children are performing well in school. Filipinos have deep sense of gratitude to their parents, that's why students are always involving their parents as much as possible in their academic activities even they are already in college level. Parents' involvement has been defined and measured in multiple ways, including activities that parents engage in at home and at school and positive attitudes parents have towards education (Alos et al., 2015). However, most engineering students already explained to their parents that they should not expect

much about the numerical values of their grades because of the difficulty of the engineering programs. They already told their parents when they are already receiving low grades in major and professional subjects that it is nothing but normal for engineering, because they wanted to make their parents aware that they always doing their best in school for them to be happy.

But other students have feeling of disappointment regarding the results of their major examinations. Sometimes the feeling of frustration results to decreasing number of hours on studying during exams because they take the negative consequence instead of making things positive. They know that they already did their best to get high grades, but still the results of their exams are not convincing and not truly a reflection of their efforts and sometimes they felt really frustrated. Most of them do not expect any more after the exam that they will be receiving high scores because they really find it difficult to memorize formulas. They have to really admit the fact, so that it would be less disappointing. What really matters for them is just to pass the exam.

Some of them wanted to get high scores from major exams but it turns out most of the time, they do not place much expectation anymore because it does not translate their hard work (Holmegaard et al., 2016). It sometimes affects their tendency to do much better because no matter how hard they tried to get the highest possible grade, they still get average or below average. They have other goals rather than seeing their improvement in school through academic remarks and that is using the skills and knowledge for their future career to become more confident in handling situation in the workplace. Skills improvement for them is also an important measure of success, but more than anything is their capacity to face the current challenges of the engineering program.

Moreover, looking into the possibility of differing attitude of students who completed the program against those students who dropped-out and shifted to another college degree leads to understanding better the attitude and reasons for not pursuing the degree they started. Results showed that there is no significant difference on the perspective of engineering students towards academic performance during their junior level between those who graduated and those who dropped-out, stopped and shifted to another degree program. The researchers associated this result in the intervention programs conducted by the engineering department which might influence those students with low level of positive attitude towards getting higher academic performance where some of them continue to pursue and complete the engineering program despite of obtaining failing and incomplete remarks. Several student development programs were conducted during their junior level until fifth year like seminars related to the improvement of study habits and enhancement of generic or soft skills. Critical thinking skills is specifically emphasized and considered as necessary learning skill to produce outcomes for all college students as essential for academic and career success (Ralston & Bays, 2015). There are other inventions conducted like inviting successful alumni during the annual celebration of Engineering Week to give some inspirational message on how they surpassed the challenges of the engineering program as well as the Licensure examination. Group counseling is also part of the program. But in spite of the programs conducted for the engineering students during their junior level, there is 43.75 percent of them still did not continue to pursue their engineering degree which is almost similar to the average of 46 percent of Australia's non-completion rate (Godfrey et al., 2010).

Furthermore, understanding the relationship between the academic performance and the attitude of engineering students towards achieving high performance provides better insight for the educational managers on how to support the career development of the engineering students. They initially have high level of perspective in attaining high Grade Point Average during junior level but they have already less expectation when they reached senior level. This signifies that the academic performance in professional courses is being considered important by the engineering students because they still believe on the benefits it will give them in making good impression to employers with their intellectual ability as well as to their preparation in board examinations and certifications.

Conclusion

Engineering students obtained higher academic performance during their junior level than senior level with considerable decrease in GWA from general to professional courses. Engineering students have high level of perspective regarding their attitude towards having high academic performance in terms of professional and personal aspects. There is a tendency that those students with higher perspectives on setting high academic performance in terms of professional aspect are also those students with higher academic performance in professional courses while those students with higher perspectives on personal aspect are those with higher academic performance in general courses. Students feel some frustration with the result of their academic performance based on their exerted efforts to get high remarks other than just passing grade. The three emerging themes from the challenging experiences of the engineering students include: Abandoned Social Freedom, Survival of the Fittest and Future Oriented Mindset from the following subthemes: Less Comfort and Freedom, More Hardships and Trials, and Great Maturity and Responsibility, respectively.

The result of the study confirmed the idea of Rosenberg (1960) who stated that when the affective and cognitive components of an attitude are mutually consistent, the attitude is in a stable state. Due to the influence of time and space in the case of engineering students, there are some challenging experiences encountered during the completion

of their respective engineering degree programs that leads them to inconsistencies between how they feel and think at the same time. Therefore, it is concluded that changing perspective is significant among the engineering students before and after taking professional courses which influence the change of thoughts and attitude towards academic performance when reaching higher levels in engineering.

Suggestions

The complexity of the engineering program in terms of highly technical courses should not hinder the learners to attain higher goals even when they obtained average or low academic performance. Future researchers may investigate on the effect of low academic performance on self-esteem and efficacy to learn other essential skills. Studies on attrition and retention among engineering students in the Philippines and other ASEAN countries may also be investigated due to the decreasing number of engineering graduates. Similar studies that will examine the problems and challenges of engineering students encountered during internship program using qualitative research may also be considered for investigation. The importance of soft skills may be examined from the perspective of the engineering students. The career development programs of the university in cooperation with the internship office and college department may focus on enhancing the critical thinking skill, analytical skill, system thinking skill, creative thinking skill, problem solving skill as well as communication skill which are part of the 21st century skills that global industries from the fourth industrial revolution require the graduates to possess. Although, it is very challenging for all HEIs to sustain the quality of engineering graduates as well as the other programs to develop their technical skills during this time of pandemic through online learning.

Limitations

This study is limited to graduating students of only one institution of higher learning in the Philippines with two (2) academic years as subjects of the study. It would be better if more engineering schools can participate in the study. In addition, challenging experiences in general aspect were asked from the participants without any specific challenging learning experiences being emphasized. These are some of the areas that can be investigated and enhanced by future researchers.

References

Alos, S. B., Caranto, L. C., & David, J. J. T. (2015). Factors affecting the academic performance of the student nurses of BSU. *International Journal of Nursing Science*, *5*(2), 60-65.

Aryana, M. (2010). Relationship between self-esteem and academic achievement amongst pre-university students. *Journal of Applied Sciences*, *10*(20), 2474-2477.

Baillie, C., & Fitzgerald, G. (2000). Motivation and attrition in engineering students. *European Journal of Engineering Education*, *25*(2), 145-155. https://doi.org/10.1080/030437900308544

Bochert, S., Schneider, S., & Webels, D. (2016). The Kiel maturity model as a future-oriented mindset for sustainable knowledge management processes. *International Journal of Sustainable Economy*, *8*(4), 312-323.

Boles, W., & Whelan, K. (2017). Barriers to student success in engineering education. *European Journal of Engineering Education*, *42*(4), 368-381. https://doi.org/10.1080/03043797.2016.1189879

Butina, M. (2015). A narrative approach to qualitative inquiry. *Clinical Laboratory Science*, *28*(3), 190-196.

Carlson, J. A. (2010). Avoiding traps in member checking. *Qualitative Report*, *15*(5), 1102-1113.

Chao, M. M., Takeuchi, R., & Farh, J. L. (2017). Enhancing cultural intelligence: The roles of implicit culture beliefs and adjustment. *Personnel Psychology*, *70*(1), 257-292. https://doi.org/10.1111/peps.12142

Chen, X., Vorvoreanu, M., &Madhavan, K. (2014). Mining social media data for understanding students' learning experiences. *IEEE transactions on learning technologies*, *7*(3), 246-259. https://doi.org/10.1109/TLT.2013.2296520

Cheng, Y. Y., Shein, P. P., & Chiou, W. B. (2012). Escaping the impulse to immediate gratification: The prospect concept promotes a future-oriented mindset, prompting an inclination towards delayed gratification. *British Journal of Psychology*, *103*(1), 129-141. https://doi.org/10.1111/j.2044-8295.2011.02067.x

Coll, R. K., &Paku, L. (2015). The influence of experiential learning on indigenous New Zealanders' attitude towards science. In M. S.Khine (Ed.), *Attitude measurements in science education: Classic and contemporary approaches* (pp.223-242). Information Age Publishing.

Conti, R. (2000). College goals: Do self-determined and carefully considered goals predict intrinsic motivation, academic performance, and adjustment during the first semester?, *Social Psychology of Education*, *4*(2), 189-211.

Crede, M., &Kuncel, N. R. (2008). Study habits, skills, and attitudes: The third pillar supporting collegiate academic performance. *Perspectives on psychological science*, *3*(6), 425-453. https://doi.org/10.1111/j.1745-6924.2008.00089.x

Creswell J.W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). Sage.

Deveci, T., & Tezcan, F. (2017). Andragogical, pedagogical and lifelong learning orientations of freshman engineering students in a project-based course. *Education for Life*, *31*(1), 69-88.

Dotong, C. I., Hicaro, A., & Laguador, J. M. (2019).Licensure examination performance of mechanical engineering graduates and its relationship with academic performance. *Asia Pacific Journal of Academic Research in Social Sciences*, *4*(1), 7-14.

Ezemba, E. (2018). Adequacy in the implementation of entrepreneurship education in tertiary institutions in Abia State. *African Journal of Educational Research and Development, 11*(1), 240-250.

Geisinger, B. N., & Raman, D. R. (2013). Why they leave: Understanding student attrition from engineering majors. *International Journal of Engineering Education*, *29*(4), 914-925.

Godfrey, E., Aubrey, T., & King, R. (2010). Who leaves and who stays? Retention and attrition in engineering education. E*ngineering Education*, *5*(2), 26-40.https://doi.org/10.11120/ened.2010.05020026

Goran, L., & Negoescu, G. (2015). Emotions at work. The management of emotions in the act of teaching. *Procedia-Social and Behavioral Sciences*, *180*(1), 1605-1611. https://doi.org/10.1016/j.sbspro.2015.02.314

Griffin, S. (2008). Employer demand for college graduates with high grades. *SS-AAEA Journal of Agricultural Economics*, *1*(1), 1-14. https://doi.org/10.22004/ag.econ.113232

Grohs, J. R., Knight, D. B., Young, G. D., & Soledad, M. M. (2018). Exploring academic performance paths and student learning strategies in a large foundational engineering course, *International Journal of Education in Mathematics Science and Technology*, *6*(3), 241-253. https://doi.org/10.18404/ijemst.428175

Guba, E. G., & Lincoln, Y. (1989). *Fourth generation evaluation*. Sage.

Hasni, A., & Potvin, P. (2015). Student's Interest in Science and Technology and Its Relationships with Teaching Methods, Family Context and Self-Efficacy. *International journal of environmental and science education*, *10*(3), 337-366. https://doi.org/10.12973/ijese.2015.249a

Hess, J. (2017). *A Polanyian tack: political implications* (Publication No. 22685) [Doctoral dissertation, Middlesex University-London]. Middlesex University Research Repository. https://core.ac.uk/download/pdf/131241853.pdf

Hoadley C., & Kali Y. (2019). Five waves of conceptualizing knowledge and learning for our future in a networked society. In Y. Kali, A. Baram-Tsabari, A. Schejter (Eds.), *Learningin a networked society:Computer-supported collaborative learning series*(pp.1-21). Springer.

Holmegaard, H. T., Madsen, L. M., &Ulriksen, L. (2014). A journey of negotiation and belonging: understanding students' transitions to science and engineering in higher education. *Cultural Studies of Science Education*, *9*(3), 755-786. https://doi.org/10.1007/s11422-013-9542-3

Holmegaard, H. T., Madsen, L. M., & Ulriksen, L. (2016). Where is the engineering I applied for? A longitudinal study of students' transition into higher education engineering, and their considerations of staying or leaving. *European Journal of Engineering Education*, *41*(2), 154-171. https://doi.org/10.1080/03043797.2015.1056094

Hugerat, M., & Kortam, N. (2014). Improving higher order thinking skills among freshmen by teaching science through inquiry. *Eurasia Journal of Mathematics, Science and Technology Education*, *10*(5), 447-454. https://doi.org/10.12973/eurasia.2014.1107a

Jain, P., Billaiya, R., & Malaiya, S. (2017). A correlational analysis of academic stress in adolescents in respect of socio-economic status. *International Journal of Physical Sciences and Engineering*, *1*(1), 68-71. https://doi.org/10.21744/ijpse.v1i1.14

Jones, M. E., & Bond, M. L. (2019). Personal adjustment, language acquisition and culture learning in short-term cultural immersion. *International Research and Review*, *9*(1),1-57

Kali Soyer, M., & Kirikkanat, B. (2019). Undergraduates' achievement goal orientations, academic self-efficacy and hope as the predictors of their learning approaches. *European Journal of Educational Research, 8*(1), 99-106. https://doi.org/10.12973/eujer.8.1.99

Kirmizi, O. (2015). The interplay among academic self-concept, self-efficacy, self-regulation and academic achievement of higher education L2 learners. *Journal of Higher Education and Science*, *5*(1), 32-40. https://doi.org/10.5961/jhes.2015.107

Knight, A. P., & Eisenkraft, N. (2015). Positive is usually good, negative is not always bad: The effects of group affect on social integration and task performance. *Journal of Applied Psychology*, *100*(4), 1214-1227.https://doi.org/10.1037/apl0000006

Lent, R. W., Miller, M. J., Smith, P. E., Watford, B. A., Hui, K., & Lim, R. H. (2015). Social cognitive model of adjustment to engineering majors: Longitudinal test across gender and race/ethnicity. *Journal of Vocational Behavior*, *86*(1), 77-85. https://doi.org/10.1016/j.jvb.2014.11.004

Lisciandro, J. G., Jones, A., & Geerlings, P. (2018). Enabling learners starts with knowing them: Student attitudes, aspiration and anxiety towards science and Maths learning in an Australian pre-university enabling program. *Australian Journal of Adult Learning*, *58*(1), 13-40.

Mallari, E. G. C., & Bueno, D. C. (2018). Factors affecting the performance in the civil engineering licensure examination: A theoretical perspective.*Institutional Multidisciplinary Research and Development Journal, 1*(1), 1-4.

Manimaran, S., Jayakumar, S., & Lakshmi, K. B. (2016). An education management information system with simultaneous monitoring of stress stimulators for students mental health management. *Technology and Health Care*, *24*(6), 889-897. https://doi.org/10.3233/THC-161250

Marra, R. M., Rodgers, K. A., Shen, D., & Bogue, B. (2012). Leaving engineering: A multi-year single institution study. *Journal of Engineering Education, 101*(1), 6–27.

Mau, W. C. (2003). Factors that influence persistence in science and engineering career aspirations. *The Career Development Quarterly*, *51*(3), 234-243. https://doi.org/10.1002/j.2161-0045.2003.tb00604.x

Mazana, Y. M., Suero Montero, C., & Olifage, C. R. (2019). Investigating students' attitude towards learning mathematics. *International Electronic Journal of Mathematics Education, 14*(1), 207-231. https://doi.org/10.29333/iejme/3997

Mitchell, A. J., Crowfoot, D., Leaver, J., & Hughes, S. (2011). Does the academic performance of psychiatrists influence success in the NHS Clinical Excellence Award Scheme? *JRSM short reports*, *2*(3), 1-9. https://doi.org/10.1258%2Fshorts.2011.011008

Mohd Shahali, E. H., Halim, L., Rasul, M. S., Osman, K., & Mohamad Arsad, N. (2019). Students' interest towards STEM: A longitudinal study. *Research in Science & Technological Education*, *37*(1), 71-89. https://doi.org/10.1080/02635143.2018.1489789

Mohovic, D., Mohovic, R., & Baric, M. (2016).Deficiencies in learning COLREGs and new teaching methodology for nautical engineering students and seafarers in lifelong learning programs. *The Journal of Navigation*, *69*(4), 765-776. https://doi.org/10.1017/S037346331500096X

Montehermoso, J. F. (2009). Correlates of licensure examination performance among marine engineering graduates. *Journal of Philippine Association of Institutions for Research (JPAIR) Multidisciplinary Journal*, *3*(1), 86-97.

Negru-Subtirica, O., & Pop, E. I. (2016). Longitudinal links between career adaptability and academic achievement in adolescence. *Journal of Vocational Behavior*, *93*(1), 163-170. https://doi.org/10.1016/j.jvb.2016.02.006

Neumann, G., Olitsky, N., & Robbins, S. (2009). Job congruence, academic achievement, and earnings. *Labour Economics*, *16*(5), 503-509. https://doi.org/10.1016/j.labeco.2009.03.004

Ng, L. S., Shaari, A. H., & Yeap, C. K. (2018). Negative emotional experiences in second language learning: A study of autobiographical narratives among Chinese ESL learners. *SSRG International Journal of Humanities and Social Science, 5*(4), 11-17.

Ozen Uyar, R., Yilmaz Genc, M. M., & Yasar, M. (2018).Prospective Preschool Teachers' Academic Achievements Depending on their Goal Orientations, Critical Thinking Dispositions and Self Regulation Skills. *European Journal of Educational Research, 7*(3), 601-613. https://doi.org/10.12973/eu-jer.7.3.601

Parsons, S., Croft, T., & Harrison, M. (2011). Engineering students' self-confidence in mathematics mapped onto Bandura's self-efficacy. *Engineering Education*, *6*(1), 52-61. https://doi.org/10.11120/ened.2011.06010052

Pierce, S., Gould, D., & Camire, M. (2017). Definition and model of life skills transfer. *International Review of Sport and Exercise Psychology*, *10*(1), 186-211. https://doi.org/10.1080/1750984X.2016.1199727

Poyrazli, S., Ferrer-Wreder, L., Meister, D. G., Forthun, L., Coatsworth, J. D., & Grahame, K. M. (2008).Academic Achievement, Employment, Age and Gender and Students' experience of Alternative School. *Adolescence*, *43*(171), 547-556.

Rao, M. S. (2014). Enhancing employability in engineering and management students through soft skills. *Industrial and Commercial Training*, *46*(1), 42-48. https://doi.org/10.1108/ICT-04-2013-0023

Ralston, P. A., & Bays, C. L. (2015). Critical thinking development in undergraduate engineering students from freshman through senior year: a 3-cohort longitudinal study. *American Journal of Engineering Education*, *6*(2), 85-98. https://doi.org/10.19030/ajee.v6i2.9504

Ramadhan, S., Mardapi, D., Prasetyo, Z. K., &Utomo, H. B. (2019).The development of an instrument to measure the higher order thinking skill in physics.*European Journal of Educational Research, 8*(3), 743-751. https://doi.org/10.12973/eujer.8.3.743

Ramirez, Y. P., & Dizon, N. C. (2014).Assessment of interest as subjective personal data of engineering freshmen towards their enrolled degree program. *International Journal of Academic Research in Progressive Education and Development*, *3*(1), 195-207.

Robbins, S. B., Wallis, A. B., & Dunston, K. T. (2003).Exploring the academic achievement and career aspirations of college-bound and postsecondary Zulu students. *The Counseling Psychologist*, *31*(5), 593-618.

Rosenberg, M.J.A., & Hovland, C.I. (1960).Cognitive, affective, and behavioral components of attitudes. In C.I. Hovland & M.J. Rosenberg (Eds.), *Attitude organization and change* (pp. 1-14).Yale University Press.

Savic, M., & Kashef, M. (2013).Learning outcomes in affective domain within contemporary architectural curricula. *International Journal of Technology and Design Education*, *23*(4), 987-1004.

Shnayderman, R. (2013). Social freedom, moral responsibility, actions and omissions. *ThePhilosophical Quarterly*, *63*(253), 716-739.

Spall, S. (1998). Peer debriefing in qualitative research: Emerging operational models. *Qualitative inquiry*, *4*(2), 280-292.

Taskesen, S. (2019). Investigating the academic motivations and academic achievements of pre-service visual arts teachers. *European Journal of Educational Research, 8*(3), 857-155. https://doi.org/10.12973/eu-jer.8.3.857

Tamayo, A. M. (2015). Estimating predictors of the Philippine licensure examination for engineering. (Publication No. 2560685) Social Science Research Network (SSRN). https://doi.org/10.2139/ssrn.2560685

Topor, D. R., Keane, S. P., Shelton, T. L., & Calkins, S. D. (2010). Parent involvement and student academic performance: A multiple mediational analysis. *Journal of prevention & intervention in the community*, *38*(3), 183-197. https://doi.org/10.1080/10852352.2010.486297

Vitasari, P., Wahab, M. N. A., Othman, A., Herawan, T., & Sinnadurai, S. K. (2010).The relationship between study anxiety and academic performance among engineering students. *Procedia-Social and Behavioral Sciences*, *8*(1), 490-497. https://doi.org/10.1016/j.sbspro.2010.12.067

Widana, I. W., Parwata, I. M. Y., Parmithi, N. N., Jayantika, I. G. A. T., Sukendra, K., & Sumandya, I. W. (2018). Higher order thinking skills assessment towards critical thinking on mathematics lesson. *International Journal of Social Sciences and Humanities*, *2*(1), 24-32. https://doi.org/10.29332/ijssh.v2n1.74

Yuberti, Latifah, S., Anugrah, A., Saregar, A., Misbah, & Jermsittiparsert, K. (2019). Approaching problem-solving skills of momentum and impulse phenomena using context and problem-based learning. *European Journal of Educational Research, 8*(4), 1217-1227. https://doi.org/10.12973/eu-jer.8.4.1217

Zebrowitz, L. A., Tenenbaum, D. R., & Goldstein, L. H. (1991). The impact of job applicants' facial maturity, gender, and academic achievement on hiring recommendations. *Journal of Applied Social Psychology*, *21*(7), 525-548.

Zeidler, D. L., Sadler, T. D., Simmons, M. L., & Howes, E. V (2005). Beyond STS: A research-based framework for socio-scientific issues education. *Science Education, 89*(1), 357-377.

Zhou, C. (2012). Fostering creative engineers: A key to face the complexity of engineering practice. *European Journal of Engineering Education*, *37*(4), 343-353. https://doi.org/10.1080/03043797.2012.691872

Zhu, L., Liu, M., & Fink, E. L. (2016). The role of person-culture fit in Chinese students' cultural adjustment in the united states: AGalileo mental model approach. *Human Communication Research*, *42*(3), 485-505. https://onlinelibrary.wiley.com/doi/abs/10.1111/hcre.12084

Zivkovil, S. (2016). A model of critical thinking as an important attribute for success in the 21st century. *Procedia-Social and Behavioral Sciences*, *232*(1), 102-108. https://doi.org/10.1016/j.sbspro.2016.10.034