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Relationship Between Students' Engagement with Academic Performance Among Non-Food Science Students Enrolled in Food Science Course

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ABSTRACT
This paper aims to determine the influence of students' engagement on academic performance. A total of 84 non-food science students enrolled in a food science course were chosen to answer the questionnaire. The overall mean of students' engagement was found to be 3.63 (SD = .24). Respondents were found to be more engaged in social engagement ($\bar{x}$ = 3.98, SD = .63), followed by emotional engagement ($\bar{x}$ = 3.96, SD = .52), behavioural engagement ($\bar{x}$ = 3.46, SD = .44) and cognitive engagement ($\bar{x}$ = 2.80, SD = .28). Results showed significant positive relationship between overall students' engagements with academic performance ($r = 0.312$; $p < 0.001$). Two components of students' engagement, i.e., emotional engagement ($r = 0.529^{**}$; $p < 0.001$) and cognitive engagement ($r = 0.391$; $p < 0.001$), both showed positive relationship to academic performance. Multiple linear regression analysis showed that emotional domain contributed to 38.6% of variation on students' performance, hence plays a vital role in students' academic performance.

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Introduction

In higher education, student engagement in classrooms has been associated with desired outcomes, including academic performance, retention, and graduation (Ayub et al., 2017). Student engagement is a multi-disciplinary concept, which consist of behavioural, emotional, and cognitive components. A profound understanding of how these engagements interact would permit instructors to create and facilitate more appealing learning experiences for students (Manwaring, 2017). Students' engagement had become one of the important aspects studied by many researchers (Estévez et al., 2021; García-Martínez et al., 2021; Romano et al., 2021; Gopal et al., 2019). Engagement in learning was related to students' participation in effective educational activities, both inside and outside the classroom (Kuh, 2003; Kuh et al., 2007).–Students who are actively involved in their learning can

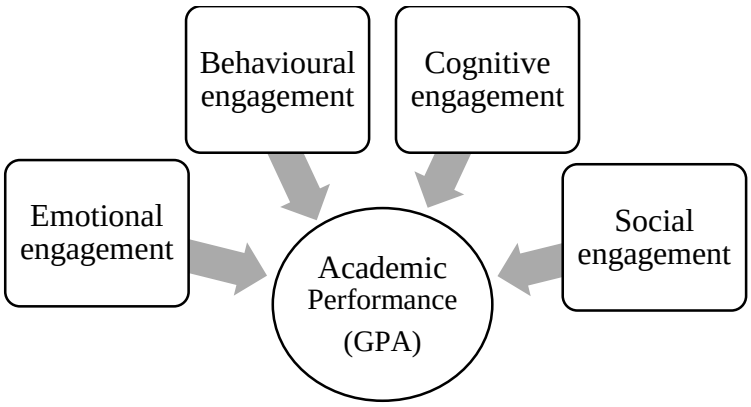
enhance their critical thinking, problem-solving, and grades, as well as apply what they have learned in the workplace (Lee at al., 2019)

Krause and Coates (2008) defined engagement as the extent, where students are engaging in activities with high quality learning outcomes. In other words, students who are not actively engaged will have a risk to fail. Newmann et al. (1992) stated that engagement, as a psychological investment and effort, focuses on learning, understanding or mastering knowledge, skills or to improve academic work. Therefore, engagement emphasizes on students' various patterns in motivation, cognition, and behaviour. Previous studies had shown that engagement was relatively diverse in its definitions and coverage (Fredricks et al., 2004; Reeve, 2013; Sinatra et al., 2015; Durksen et al., 2017; Tas, 2016; Gunuc & Kuzu, 2015). However, researchers have agreed that the concept of engagement is multi-dimensional and encompasses of different aspects, e.g., behavioural, cognitive, and emotional (Appleton et al., 2008; Baron & Corbin, 2012). Meanwhile, Schaufeli et al. (2002) conceptualised engagement as three dimensions, i.e., vigour, dedication, and absorption, while engagement has also been identified into two dimensions, i.e., behavioural and psychological (Willms, 2003; Finn & Zimmer, 2012). Behavioural, as one of the dimensions of engagement, was defined as students' participation in classrooms and school learning activities, such as effort, persistence, and attention (Appleton et al., 2006; Reeve & Tseng, 2011). Conversely, emotional engagement referred to student's feeling of presence in school and valuing learning-related outcomes, lack of anger, boredom, and anxiety (Appleton et al., 2006; Reeve & Tseng, 2011; Salim et al, 2018). Meanwhile, cognitive engagement involves psychological process, which encompasses on how students think, grasp, accumulate and manage the information and how the information affect what were perceived, believed and experienced (Plotnik & Kouyoumdjian, 2008). In addition, cognitive engagement also incorporates memorisation, deep understanding, attention, intelligence, learning strategies, persistence on tasks, information transfer skills, thoughts, perceptions and motivation (Fredricks et al., 2004). On the other hand, social engagement was described as student's level of satisfaction with their friendship relations (Marie, 2006; Din et al., 2016).

The most influential model in student engagement theory was earlier coined by Finn (1989) using participation-dentification model. This was a two-factor model comprised of participation in school and identification with school, deciphering behavioural and emotional dimensions accordingly. Finn (1989) perceived those students who are engaged in class with positive behaviour in learning, active participation, high percentage of attendance and excellent punctuality will likely to develop good academic performance. Over the years, another dimension was added to a three-factor student engagement model; behaviour, emotion and cognition (Fredricks et al., 2004). In addition, Self-Determination Theory, founded by Deci and Ryan (1985; 2000) assumed that the basic psychological needs of students need to be met to enhance student creativity, retention and performance. This theory focuses on students' internal factors such as earnestness, motivation, and engagement to master knowledge. Figure 1 best describes the conceptual framework of the relationship of student engagement to academic performance, which is largely represented in students' Grade Point Average (GPA).

Figure 1

Conceptual Framework Tested in the Study Based on the Four Dimensions of Engagement Proposed in the Literatures



Students' engagement is generally considered to be among the best predictors of learning and personal development (Abubakar et al., 2018). Previous work has demonstrated that engagement can predict students' academic performance (Fredricks et al., 2004), hence identifying students' engagement in academic environment is crucial. Conversely, academic performance has largely been assessed through standardized tests, performance test scores, academic grades, and GPA (Finn & Rock, 1997; Fredricks et al., 2004; Upadyaya & Salmela-Aro, 2013). Significant relationship between engagement and academic performance were shown by a considerable number of studies. A study in 121 United States schools had demonstrated that behavioural engagement and emotional engagement significantly predicted reading performance (Lee, 2014). Similarly, a cross-sectional study among Health Sciences students at University of Malaga, Spain found a comparable association between the students' engagement and academic performance (Vizoso et al., 2018). In parallel, student engagement was positively correlated with academic performance, nevertheless, evidence for causal effects was lacking (Casuso-Holgado et al., 2013). Glapaththi et al. (2019) study which focussed on student engagement in state and non-state universities in Sri Lanka indicated that there was a positive relationship between student engagement and their academic performance. The finding was further supported by Rajabalee et al. (2019) who reported that was a very strong positive correlation between engagement and overall academic performances of students in an online module. A recent study by Bayoumy et al. (2021) showed that there was a relationship between students' engagement with significant effect on academic performance, apart from other variables including facilitating conditions (e.g. engagement-fostering aspects) and students' motivation, which also had similar relationship. Adva (2016) determined the relationship of students' cognitive, emotional and behaviour engagements to academic performance and observed that all three engagements predicted academic performance. Cognitive engagement was also found to be a significant positive predictor for academic performance (Dogan, 2015; Wara et al., 2018). In another finding of Lee (2014), it was observed that students' reading performance was significantly predicted by both emotional and behavioural engagements. Moreover, behavioural engagement was also found to be partially mediated the effect of emotional engagement on reading performance. Another study by Dotterer and Lowe (2011) suggested that cognitive and emotional engagement and behavioural engagement predicted students' academic performance. These findings were supported by Perry et al. (2010) where a combination of emotional and behavioural engagement significantly predicted students' grades. Interestingly, while emotional and cognitive engagement are highly correlated, the study of Manwaring (2017) did not indicate that emotional engagement leads to higher levels of cognitive engagement. On the social dimension, Li et. al (2021) analyzed 1,843 literatures on social relationships and academic performance from 2001 to 2019 and concluded that school engagement was an important mediator between social relationships and academic performance.

In corroboration of the subject considerably described above, this study was conducted to examine the effect of students' engagement on their academic performance. Engagement factors measured were based on emotional, cognitive, behavioural and social engagement. Despite the fact that numerous studies have looked at the link between student engagement and academic performance, only a few have explored all four aspects of student engagement, which were evaluated in this study. Furthermore, past research has indicated that student engagement with academic performance occurs mostly in the school setting, with a few focussed on higher education environment. Moreover, the majority of the literatures also concentrated on pure science disciplines such as mathematics and engineering, rather than applied science fields such as food science. Furthermore, there is a scarcity of research that looks into student engagement in electives as a critical support of curriculum design in an applied science undergraduate programme, therefore this type of research is highly warranted. A novel strategy to cope with the limits of a expanding body of knowledge in the core field while having a restricted amount of educational time is required, and it can be addressed through electives (Agarwal et al., 2015).

Methodology

This study employed a correlational research design to predict the influences of students' engagement towards academic performance. Correlational research seeks to establish a relationship between two or more variables that do not readily lend themselves to experimental manipulation study (Ary et al., 2014). A total of 84 non-food science undergraduate students who were enrolled in Food Science course participated in this study. They were randomly selected from several faculties at a local public university. The non-food science students were selected because this study was to investigate how students in different study programs are able to engage in a Food Science course. The data were collected using a survey questionnaire, which consists of two sections; Section A sought student's demographic background, while section B measured student's engagement. A total of 38 items adapted from Fredricks et al. (2016) were used to measure students' engagement. The questionnaire consists of four dimensions of students' engagement, which are behaviour engagement (11 items), cognitive engagement (9 items), emotional engagement (11 items) and social engagement (7 items). Behaviour engagement measured on (1) students focus, and (2) answering and asking questions during the Food Science class. This dimension also measured whether they will discuss Food Science contents outside the class and easily give up when they do not understand on what have been taught in class. Cognitive engagement measured the extent of students' engagement in learning Food Science, which includes intelligence, mental ability, persistence on task, concentration on the teaching and deep understanding of the Food Science contents inside and outside class. Meanwhile, emotional engagement refers to students' response on how they feel the pleasure of learning Food Science, their curiosity, emotions, and own evaluation in the process of teaching and learning Food Science. Finally, social engagement measured on how students work and help others during learning Food Science class. It also seeks on how they will share their ideas during the class. The data was collected using a 5-point Likert scale in both sections indicating whether they strongly disagreed (1), disagreed (2), undecided (3), agreed (4), or strongly agreed (5) with the statements. Academic performance was calculated based on total score marks at the end of the semester.

Reliability of the questionnaire items were tested in a pilot study which was applied to students who were not involved in the actual study (Table 1). The Cronbach alpha for each dimension ranged from 0.708 to 0.782, which indicated that the questionnaire items used to measure students' motivation were reliable (Cohen et al., 2007).

Table 1

Cronbach Alpha Values for Questionnaire Items Tested in Pilot Study

Construct	Quantity of Item	Cronbach's Alpha
Behaviour engagement	11	0.782
Emotional engagement	11	0.767
Cognitive Engagement	9	0.712
Social Engagement	7	0.708
Overall	38	0.723

The Introduction to Food Science is an elective course offered to first and second year students from different faculties and backgrounds. The course covers different topics in food science subject, which includes food chemistry, food microbiology, food processing, food law, nutrition, and current issues in food science. It is a 3-credit course, i.e., the students are required to attend the class for 3 hours per week. Students' assessments were divided into few tasks such as quizzes, presentations, case study, written reports, and group work activities. Final grades were allotted based on written examinations and continuous assessments throughout the semester.

Findings

For demographic background of the respondents, a total number of 84 respondents consists of 25 (29.8%) males and 59 (70.2%) females participated in the study. Table 2 presents the participants' mean scores with the standard deviations of the sub-scales. This study revealed that the overall mean for the students' level of engagement was 3.76 (SD=.264), which indicated that the respondents are relatively active in their engagement during the class in all engagement dimension. The highest mean is on the social dimension ($\bar{x}$=3.96; SD=.599), which showed that respondents were socially engaged with their colleague in the class. The second highest mean was emotional engagement ($\bar{x}$=3.93, SD=.529) which denotes that the respondents felt presence during the class with positive emotions. They also valued the process of learning Food Sciences using their own evaluation. The two lowest means were behaviour engagement ($\bar{x}$=3.63, SD= .495) and cognitive engagement ($\bar{x}$ = 3.42, SD = .338).

Table 2

Participant's Mean Score and Standard Deviation of Variables Studied

Variables	Mean	Standard Deviation
Behaviour engagement	3.63	.495
Emotional engagement	3.93	.529
Cognitive engagement	3.42	.338
Social engagement	3.96	.599
Students' engagement (Overall)	3.76	.264

Pearson correlation analysis was conducted to determine the relationships between student's engagement with performance. Table 3 indicates a positive relationship between overall engagement with performance (r=0.312**, p<0.01). Similar trend was also shown for emotional (r = 0.529**, p = 0.01) and cognitive engagement (r = 0.391**, p<0.01). In contrast, significant negative relationship was seen between behaviour engagement and performance (r = -0.278*, p<0.05). However, correlation between social engagement and performance was absent.

Table 3

Relationship between Students' Engagement and Performance

	Behaviour	Social	Emotional	Cognitive	Overall
Performance	-0.278*	0.092	0.529**	0.391**	0.312**

Note. **significance level p < 0.01; *significance level p < 0.05

A multiple regression using "Enter" method was performed to predict factors that influence engagement. Prior to this, the assumptions for normality, linearity, homoscedasticity, independence of residuals and sample size were fulfilled. The model summary and ANOVA are given in Table 4. The co-efficient determination was 32.8%, which explained the variation was achieved, and was due to the engagement. Table 4 indicates the influencing factors were statistically significant (F (4,82) = 9.507, p=0.000) at 0.05 level. Therefore, engagement could be a significant predictor for the academic performance. Based on the results presented in Table 5, it was observed that emotional engagement was the only significant factor to academic performance, which contributed to 41.5% of the variance.

Table 4

Model Summary and ANOVA of Multiple Regression for Prediction of Factors Which Influence Engagement

Model Summary				ANOVA					
R	R-square	Adjusted R-Square	Std. Error of the Estimate		Sum of Squares	df	Mean Square	F	Sig.
0.572	0.328	0.293	8.505	Regression	2751.124	4	687.781	9.507	.000
				Residual	5642.717	78	72.343		
				Total	8393.841	82			

Table 5

Coefficient Results of the Multiple Regression for Prediction of Factors Which Influence Engagement

	Un-standardized Co-efficient		Standardized Co-efficient	t	Sig.
	B	Std. Error	Beta		
(Constant)	32.846	13.983		2.349	0.02
Behaviour	-3.435	1.952	-0.168	-1.760	0.08
Emotional	7.942	2.092	.415	3.797	0.00
Cognitive	4.925	3.174	.165	1.552	0.13

Discussion

Engagement is a multi-dimensional construct that is mostly studied in various disciplines, and it requires deep understanding and thorough research (Fredericks et al., 2004; Attard et al., 2011). In this study, the relationship between student engagement, i.e., cognitive, emotional, behavioural and social was analysed in non-food science students enrolled in a food science course as elective to predict academic performance. The students were from different background, various learning style and culture. Therefore, the overall mean for engagement suggested that the student engagement in this study was contrary to one another due to different study programmes and interest towards this course. Thus, by identifying the engagement elements, it will assist the instructors to deeper understand the students towards achieving the learning objectives.

Out of the four dimensions that were studied, social engagement has the highest mean ($\bar{x}$=3.96; SD=.599), as compared to others. This could be due to the different variety of background of students taking the class. As previously mentioned, the students who were enrolled in this class were not from

food science programme. This allows them to associate with other students from other study programmes while taking a different class other than the subjects related to their core field of study. Indirectly, this course encouraged social interaction among students through group activities and assignments. The second highest mean belongs to emotional engagement ($\bar{x}$=3.93, SD=.529) and this portrays the students were attentive, showed interest but not boredom during the class. In other words, the students did not feel insecure, rather in favour for challenges to succeed in class. Meanwhile, two other dimensions, i.e., behaviour ($\bar{x}$=3.63, SD=.495) and cognitive engagements ($\bar{x}$=3.42, SD=.338) showed the least mean scores.

Correlational analysis indicated that academic performance can be determined by overall engagement (r =.312, p<0.01), which supported previous finding by Casuso-Holgado et al. (2013). This is especially true for both emotional and cognitive engagement where positive significant relationship was seen. However, no relationship was observed between social engagement and academic performance (r =0.092, p>0.05). Although students feel engaged socially through class activities, these did not contribute to positive significant relationship to academic performance. It was also shown that only emotional engagement predicted academic performance after further analysis to predict the factors (r =0.529, p<0.05). This result is in agreement with Lee (2014) and Vizoso et al. (2018) who demonstrated that emotional engagement significantly predicted performance. In contrast, Dotterer, and Lowe (2011) and Adva (2016) observed that other than emotional engagement, students' cognitive and behaviour engagements also predicted academic performance. In addition, Lee (2014) also showed that both emotional and behavioural engagements significantly predicted reading performance.

Of all the four dimensions tested in the aforementioned engagement, this study found that only emotional engagement predicted academic performance. This could be due to students' feeling that this course is of different field than other courses they have enrolled, and this could contribute to their high enthusiasm to learn something new. On another note, this course was offered as an elective and this could influence the students to aim for high grades. Nevertheless, the students may have perceived that this course could not assist them in terms of behavioural and social engagement since it does not necessitate active participation, besides having a high number of students in the class. These findings indicate that albeit cognitive, behavioural and social engagement are crucial and was found to be positively predicted the academic performance, this study found otherwise.

Specifically, in Malaysian universities, programmes are commonly structured through core and elective courses. Core courses are encompassed on the subject matter related to the degree pursued, while some leverages are given for students to choose from elective courses offered in other field. It would be interesting to accommodate similar study to other degree or programmes with more participants, including social science-related courses enrolled by science students to perceive if the trend persists. Nevertheless, similar study was not conducted to predict student engagement towards academic performance within the same group of students in courses related to their degree, hence no conclusion could be derived.

Despite the fact that numerous studies have found cognitive engagement to be an essential predictor of academic achievement, this study revealed the opposite. While various approaches to conceptualising engagement have been useful in different contexts, science educators still face a challenge in determining the most accurate way to assess indicators of engagement that have the most direct and observable impact on teaching and instruction in the classroom. The items used for cognitive engagement in the study may not be an actual representative to predict academic performance. Although research has repeatedly demonstrated a strong positive association between student learning and cognitive engagement, it has been challenging to accurately quantify cognitive engagement in the classroom (Chi & Wylie, 2014). This could be because a definition for the concept of cognitive engagement has proven particularly difficult to comprehend.

Conclusion and Implications

The study examined the correlational relationship between student engagement, which includes behavioural, social, emotional, and cognitive engagements, and academic performance, which is a key indicator of how well teaching and learning happens in a classroom in higher educational setting. In many educational research communities, the impacts of engagement, which were broadly defined, encompassing on student outcomes and performance, were investigated, and deemed effective.

Engagement predictor which influenced student's academic performance in Food Science course among non-food science students was found to be emotional engagement. Albeit being tested in a small number of sample and a single course in higher education curriculum structure, which may not necessarily represent educational scenario as a whole, this study helps to identify that one of the components of student engagement, i.e., emotional engagement is an important predictor for academic performance. To elevate students' engagement in this course, the instructor needs to utilize multiple approaches especially in cognitive and social engagements. For instance, through student-centred learning activities and experiential learning through completing of learning tasks and modules. Students' active engagement can be achieved using these strategies, and so learning goals can be obtained.

Findings from this study may imply that educators, policymakers, and researchers to pay greater attention to student engagement and methods to improve it. One way is to have experts and target stakeholder involvement in the development of a scale's content validity and perhaps more importantly, in producing an instrument that is relevant and has a broader applicability. Poorly performing items can be removed to examine if a different pattern of factor may arise, which would necessitate calibration or interpretation of theoretical framework.

It is proposed that educators or course instructors emphasise the importance of what students have learned by interpreting the theoretical definition of engagement correctly and collaborating with researchers who study engagement. This would enable educators to use them effectively in the context of their unique course. Innovative classroom engagement tools can be effectively designed, allowing for easier measurement of actual student engagement. Experienced researchers functioning as tool developers may be able to alleviate the obligation and concern of educators who may misinterpret theoretical concepts and inappropriately incorporate theory-based practises into their courses in order to improve their effectiveness.

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