Turkish Online Journal of Qualitative Inquiry (TOJQI)
Volume 12, Issue 6, July, 2021: 4811 – 4823

Effects Of Brain Based Teaching Approach On Students' Engagement Among Secondary School Students

Mimi Maya Badri
School of Educational Studies, Universiti Sains Malaysia, Penang
mimimaya.badri@gmail.com

Salmiza Saleh*
School of Educational Studies, Universiti Sains Malaysia, Penang
salmiza@usm.my

ABSTRACT
The purposes of this study are to investigate the effects of using Brain Based Teaching Approach (BBTA) compared to those who followed Conventional Teaching Approach (CTA), in enhancing students' engagement in Food Designing topic among form two students in secondary school in North Malaysia. It also conducted to determine whether there is significant difference of students' engagement in gender. Brain Based Teaching is a method designed towards maximizing student's engagement and focusing on the way the brain is really designed to learn. Student Engagement Inventory (SEI) were used to measure affective and cognitive engagement. This study adopted quasi-experimental design. There were 66 participants, 33 students were considered under intervention group and 33 students were under control group that using Conventional Teaching Method (CTA). The results showed that there is a significance difference between the BBTA group and CTA group with respect to their affective engagement level but not cognitive engagement. It was also found that there is a significance difference between the pre-test and post-test score to their affective engagement level using BBTA. This study also showed that there is no significance difference between male and female student in affective engagement level, in contrast, there is a significance difference between the male and female student with respect to their cognitive engagement level. These findings concluded that BBTA used in experimental group gave better impact on students' engagement level.

Keywords: Brain Based Teaching Approach, Conventional Teaching Approach, student's engagement, Food designing education.

1.0 INTRODUCTION

The 21st century education, which emphasize on the development of skill and knowledge is one of the issues often discussed by global educators nowadays. The key to determine the success of the teaching and learning process is through the implementation of teaching approach that create an interesting and meaningful experience that promote engagement and led to the better student achievement [25]. So that it is undeniable that student engagement is the indicator of successful classroom interaction and performance [57]. Student engagement plays an important role in the education world as it can predict students'performance. Research has shown that student engagement has played a vital role for student achievement, motivation in learning, boredom, disaffection and persistence [2,14,17, 18,32,34,53,62]. Student engagement is also varied by environment by learning and teaching process in classroom [6,27,37,59,61]. Therefore, student engagement determines the quality of their learning attitude because engaging students in the learning process increases their focus, motivation, and self-confidence, thinking ability and experiences meaningful learning process.

In Malaysia context, educational Curriculum in has been transform due to the demand of the global change [26]. Every student has to equip themselves with skill and knowledge in order to face 21st century education. Design and Technology subject is a new subject was introduced in 2018. The suitable teaching approaches are very important in the teaching and learning sessions in school to achieve the learning objectives. Student has to solve problems, generate new ideas, produce or invent products that creative, original, innovative in Food Designing topic classroom. In this matter, students need to increase their ability and focus on teachers teaching. As this subject is still new, teachers who do not use suitable teaching approach will cause of student boredom, participation and less interested in the classroom. An effective teaching approach is needed to develop student

understanding and encourage them to actively participate through meaningful experiences [39]. Many studies using BBTA were concentrated directly on the academic performance especially in science and mathematics subject [5, 46,47]. Hence this study was conducted to determine engagement factor in Food designing topic that affect by BBTA.

2.0 LITERATURE REVIEW

Studies showed that major cause of student lack of motivation and passive in classroom activities due to attitude of student that are not confident and less engagement to the learning process [51,52]. Another cause of the lack of engagement is due to poor teaching methods and approach [19, 3, 64]. In order to overcome this problem, teachers play a vital role to help students to feel welcomed and appreciated to engage themselves in school activities or learning process in the classroom. Therefore, teachers should use active learning method to get the best outcome when teaching a subject [35]. Research has proven that engaging student in learning process increases their performance, motivation, focus, attention and creates meaningful learning processes [2, 30, 62].

Student engagement influenced by the role of environment or climate in the learning of students such as peers, teachers and also method of learning [17]. Student engagement is best known as how meaningful student involve in their learning environment and create positive learning behavior and emotion [54]. It also best understood as student's psychology (mental, cognitive, emotional) investment and effort behaviors toward learning, mastering knowledge or skill, understanding, or any other academic work [38]. These mean that, student's engagement encompasses all the way in which student interact with school or school related activities in their school system. School that encourage student's engagement by practicing effective pedagogical in the learning process. Hence, academic outcomes and development of students is affected by student engagement. School that create positive condition and organize its resources for teaching and learning base on educationally effective practices increase student engagement [29]. So that student can learn under the right condition.

Student engagement consist of three distinct or dimension; Behavioral engagement, emotional engagement and cognitive engagement [12,18,31,63]. Behavioral engagement is defined of student involvement or participation in academic and social activities [12,18,50,63,] as a positive conduct, effort, attention and absence of disruptive behavior [11, 15,16]. Student involvement refers to the active participation in classroom activities, able to follow rules and task and contribute to the classroom learning discussion. Affective engagement or emotional engagement focusing on students' feelings, sense of belonging, or value to their surrounding in school [18,40,50,59,63]. Students shows their feeling such as interest, happiness, sadness or boredom towards peers or teachers and learning activities.

Cognitive engagement, focusing on students' level of investment in learning. Student engagement is a function of both the individual and the construct [12,18,50,63]. To ensure that student perform and engage to these environment teachers have a role help student to feel secure and welcomed to school. Emotional engagement focuses on students' attitudes, positive or negative reaction to the teachers, peers, classmate or any feelings towards class and school [16,58]. Cognitive engagement is defined into two types that are psychological and cognitive engagement [18]. Psychological components include willingness to put in effort to comprehend complex ideas and possess difficult skills. The cognitive component involves self-regulated learning, using deep learning strategies in thinking and studying.

In this study, only cognitive and affective engagement were measured. Cognitive and affective or emotional subtypes of engagement are frequently assessed via student perception and considered less observable than academic or behavioral subtypes [2]. Therefore, the result of the study in cognitive and affective engagement is more accurate compared to the behavioral engagement.

Brain Based Teaching Approach (BBTA) is a teaching method or lesson designed that can facilitate students to learn by optimizing brain function as a whole. Brain based learning focus on how brain learns and it potential in maximizing human learning capabilities [8,9,23]. Brain Based Teaching Approach role changed from conventional learning to an active learning environment. Teachers are required to facilitate the creation of student's new knowledge, skill and understanding. Brain-based teaching leads to all activities to the principles of neuroscience and strategies or methods used with a certain process, best known for its engagement, strategies and principles [8,25].

In Design and Technology subject or Food Designing topic especially, student has to produce product and invent new ideas. The products or ideas should be creative, original, innovative and also relevant to the world change and demand. In order to boost student's engagement, motivation and create active learning environment, teaching method has to be variety, active and effective. Brain Based Teaching Approach is a very practical method, natural, motivating and relatively easy to understand and explain the ways that people like to learn and to develop skill [3,47,48]. Hands-on learning method is one of the methods that mostly used in this subject. This method is directly involved student, by actively encouraging them to do something in order to learn the topic. It is also known as learning by doing. Hands-on method needs a lot of preparations, high in cost and willingness of students. The demonstration will give student the main idea but less emphasis on detail. Furthermore, students need to be prepared and read up the topic to develop and acquire deeper understanding. However hands-on learning would be more effective if it was combined other effective learning method such as BBTA. Therefore, Brain Based Teaching Approach is chosen as a teaching method to enhance student engagement.

Brain based Teaching Approach integrates the engagement of emotions, enriched environments, music, movement, eliminate the fear in learning is an educational approached on how brain naturally learn best [55]. This approach was created interest among the pupil and actively, motivated to participate in the teaching and learning process [47, 48]. The learning activities used in this method were varieties such as videos clip, graphics and pictures, group discussion, individual or group presentation, brainstorming, hands on, reflection presentation and also expose the next topic that will be learn. These activities strongly build relationship among student and student or student and teachers, increased motivation and confidence level. Teaching methods using different styles help increase student engagement and motivate them. Whereas, engagement also gain when students have developed strong relationship with their teachers and peers, teachers hold high expectations and give consistent and clear feedback, task are variable, challenging, interesting and meaningful [17].

In the Conventional Teaching Approach (CTA), students are experienced homogenous teaching approach or learning style as teachers are rushing to cover up the curriculum. The learning process is more teacher-centered rather than teacher as a facilitator. This method leads to boredom, less focus and less participation in activities. Recent studies showed that teachers are still can't determine or use the appropriate approach in teaching causing low student's engagement [49]. Teachers using conventional teaching method in order to catch up the time limited in classroom [56,64].

This study was conducted to determine whether or not there is a significant difference in student engagement among ordinary school students: (i) between those who were exposed to the Brain-Based Teaching Approach (BBTA) versus those who were followed the Conventional Teaching Approach (CTA), and (ii) between males and females cognitive and affective engagement level.

Figure 2 represents the study's conceptual framework illustrating study based on gender regarding two main constructs are affective engagement and cognitive engagement.

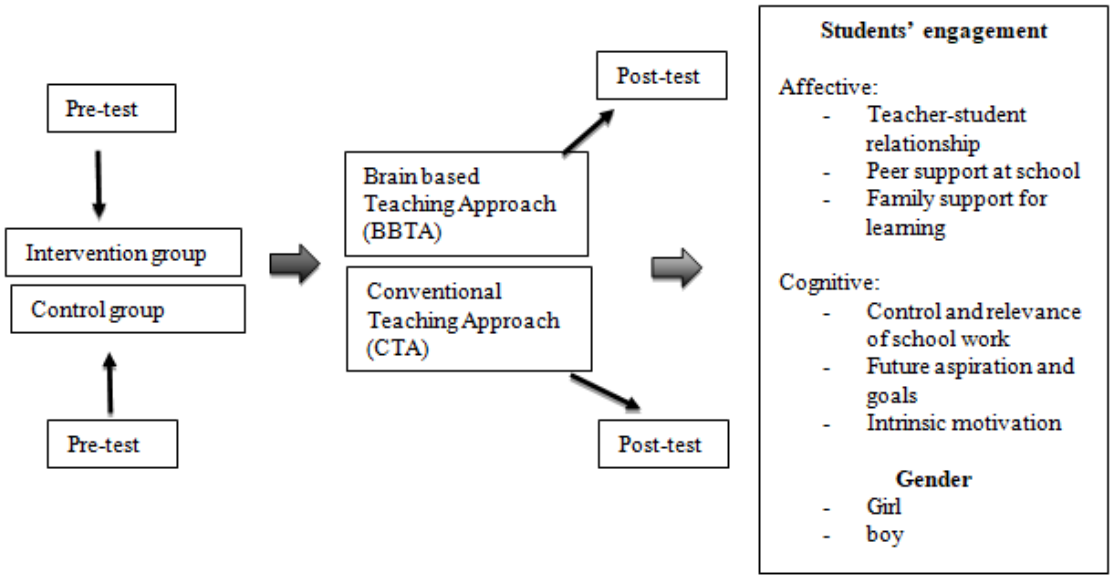

Figure 2: Conceptual Framework of study

The independent variables are Brain Based Teaching Approach (BBTA), Conventional Teaching Approach (CTA) and gender. Whereas, the dependent variable is student's engagement. Two groups of respondents which is intervention group received Brain Based Teaching Approach (BBTA) and the other group was received Conventional Teaching Approach (CTA). Pre-test was conducted before the intervention and the post-test was conducted after the intervention at the same time for both groups.

3.0 METHODOLOGY

The research was conducted using the design of a quasi-experimental approach. The sample was group statistically into experimental group and control group. The sample consists of 66 students: 33 were under treatment group and the other 33 students were under control group. These students were randomly selected from two different schools to present the population of design and technology form two secondary school in northern Peninsular of Malaysia.

Table 1: quasi-experimental design

Group	Pretest	Treatment	Post test
G1	O1	X1	O2
G2	O1	X2	O2

G1: Intervention group

G2: Control group

X1: BBTA – Brain Based Teaching Approach (Treatment)

X2: CTA - Conventional Teaching Approach

O1: Pre-test

O2: Post-test

The experimental group was treated with BBTA module whereas the control group by respective conventional teaching approach. Module of BBTA was developed using Russel Model (1974) and ASSURE instruction Design [44,45]. Lesson plan for BBTA, were validated by three expert teachers who are experienced in teaching the Food Design topic. Teacher involved in intervention was trained to use the Brain Based Teaching Approach before the intervention series. The study involved a teacher who taught the experimental group, and another teacher who taught the control group. Lesson plan and materials were provided to the teachers as they were trained to master the BBTA. Both teachers are female, have similar background in education and teaching experiences.

A pre-test was conducted for both group a week before the intervention. The experimental group was then exposed to BBTA for five weeks lessons, while the control group received the conventional teaching approach. A post-test then conducted a week after the intervention period to get engagement score level. The Brain Based Teaching Approach is a strategy implemented Principles developed by Caine & Caine [8,9,23] via three fundamental elements; relaxed alertness, Orchestrated immersion and active processing. Seven steps in implementing BBTA in classroom were adapted from Salmiza & Azlina (2019) in figure 4 [48].

Student's engagement was measured using an adapted version of Student Engagement Inventory [1]. The student Engagement Instrument (SEI) is a student self-report survey design to measure cognitive and affective engagement. The SEI consists of 35 items that represent six factors: 3 representing cognitive engagement and 3 representing affective engagement. All items were in the form of a five-point Likert scale ranging from 'strongly agree' to 'strongly disagree'.

The SEI items account for the six factors related to engagement, which are Teacher-Student Relationships (nine items), Control and Relevance of School Work (nine items), Peer Support at School (six items), Future Aspirations and Goals (five items), Family Support for Learning (four items), and Intrinsic Motivation (two

items). A value 0.82 Cronbach Alpha was computed showing that the questionnaire has high reliability index and thus suitable for the study.

Figure 4. Seven steps in implementing BBTA in classroom were adapted from Salmiza (2019)

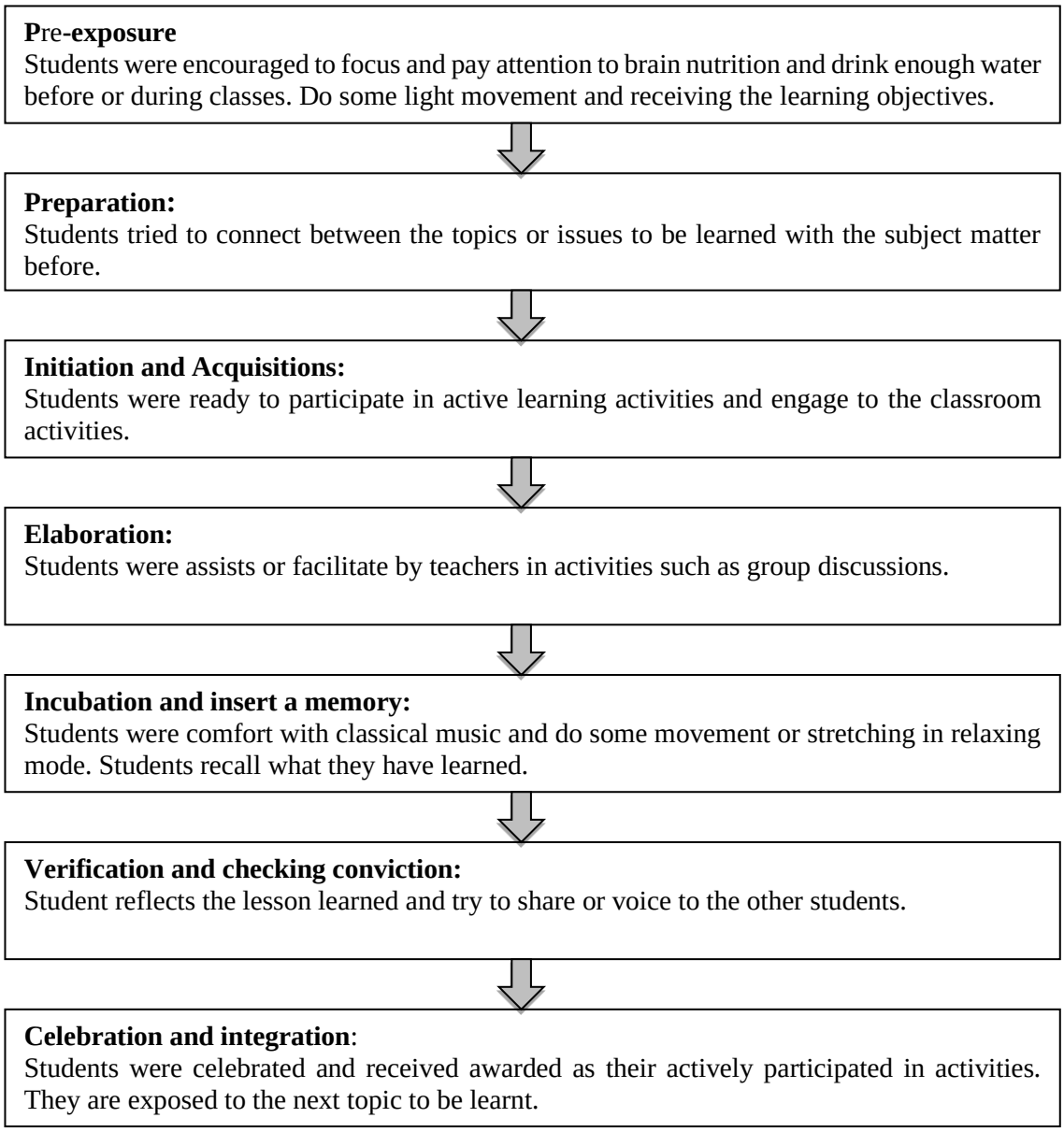

Table 2: Questionnaire in Student Engagement Instrument (Appleton & Christenson, 2004)

Teacher-student Relationship (Affective Engagement)	
3	My teachers are there for me when I need them
5	Adults in my school listen to the students

10	The school rules are fair
13	Most teachers in my school are interested in me as a person, not just as a student
16	Overall, my teachers are open and honest with me
21	Overall, adults in my school treat students fairly
22	I enjoy talking to the teachers here.
27	I feel safe at school
31	At my school, teachers care about students
Control and Relevance of School Work (Cognitive engagement)	
2	After finishing my schoolwork, I always check through to see if it is correct
9	Most of the important things you learn in school
15	When I do my school work, I check to understand what I am doing
25	When I do well in school it is due to my hard work
26	The tests in my classes do a good job in measuring what I am able to do
28	I feel that I have a say about what happens to me at school
33	Learning is fun because I get to improve at something
34	What I am learning in my classes will be important and useful in my future
35	The grades in my examinations do a good job of measuring what I am able to do.
Peer Support at School (Affective Engagement)	
4	Other students here like me as the way I am
6	Other students here care about me
7	Students in my school are there for me when I need them
14	Students here respect what I have to say
23	I enjoy talking to the students here
24	I have some friends at school
Future Aspiration and Goals (Cognitive Engagement)	
8	My education will create many future opportunities for me
11	Going to college after high school is important
17	I plan to continue my education after finishing high school
19	School is important to achieve my future goals
30	I am hopeful about my future
Family Support for Learning (Affective Engagement)	
1	My family/guardians are there when I need them
12	When something good happens in school, my family/ guardians want to know about it.
20	When I have problems at school, my family/ guardians want to know about them
29	My family/guardians want me to keep trying when things are though at school.
Intrinsic Motivation (Cognitive Engagement)	
18	I will learn only when the teacher gives me a reward (reversed)
32	I will learn only if my family/guardians give me a reward (reversed)

The analysis of the study examines the comparison of experimental and control group with respect to their engagement score. Descriptive and inferential statistics were used to analyze the obtained data using questionnaire. The analysis was based on the quantitative data using of SPSS software using Analysis of Variance (ANOVA) to examine the differences between control and experimental group score, pre and post-test score, and gender in term of affective and cognitive engagement.

4.0 ANALYSIS AND DISCUSSION

The analysis of the study examines the comparison of student affective engagement and cognitive engagement in control and experimental group; and pre-test and post-test and gender. Experimental group were treated using Brain Based Teaching Approach (BBTA) whereas the control group is using Conventional Teaching Approach (CTA).

Table 3: Sample distribution by gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Male	20	30.3	30.3	30.3

	Female	46	69.7	69.7	100.0
	Total	66	100.0	100.0	

From the above table, there are 20 male students (30.3%) and 46 female students (69.7%) who participated in the study. 33 students were considered in control group and 33 students under experimental group consists of 10 male students and 23 female students in each group.

3.1 Effects of BBTA approach on student engagement

3.1.1Affective engagement

Table 4: Student Engagement level by CTA and BBTA group

		N	Mean	Std. Deviation
Affective engagement	CTA	33	3.60	.24
	BBTA	33	3.93	.46
	Total	66	3.76	.40
Cognitive engagement	CTA	33	3.51	.43
	BBTA	33	3.68	.31
	Total	66	3.60	.38

Table 4 shows the descriptive statistic for the student engagement level for both CTA and BBTA group. Mean for affective engagement in CTA group (mean=3.60, SD=0.24) is lower to the mean of BBTA group (mean=3.93, SD=0.46). Mean for affective engagement in CTA group is lower compared to BBTA group.

Table 5: Comparison between CTA and BBTA group on their engagement level.

		Sum of Squares	df	Mean Square	F	Sig.
Affective engagement	Between Groups	3.75	1	3.75	27.57	.00
	Within Groups	17.69	64	.136		
	Total	21.45	65			
Cognitive engagement	Between Groups	.99	1	.99	6.95	.01
	Within Groups	18.69	64	.144		
	Total	19.69	65			

Table 5 shows that ‘p’ value for affective engagement is less than 0.05 between CTA group and BBTA group. There is a significance difference between the BBTA group and CTA group with respect to their affective engagement level ($p=0.00 < 0.05$).

Cognitive Engagement

Table 4 illustrates the comparison of cognitive engagement of CTA group and BBTA group. Mean for Cognitive engagement in CTA group (mean=3.52, SD=0.43) also lower than BBLA group (mean=3.60, SD=0.31)

From table 5 it is evident that ‘p’ value for cognitive engagement is less than 0.05. There is a significance difference between the BBTA group and CTA group with respect to their cognitive engagement ($p=0.009 <0.05$).

The differences Student Engagement level in gender

Table 6: Student Engagement level by gender

		N	Mean	Std. Deviation
Affective engagement	Male	20	3.69	.46
	Female	46	3.80	.37
	Total	66	3.76	.40
Cognitive engagement	Male	20	3.72	.43
	Female	46	3.54	.35
	Total	66	3.60	.38

Table 6 shows that, mean for affective engagement of male (mean=3.69, SD= 0.46) is lower than female (mean=3.80, SD=0.37). Whereas, mean for cognitive engagement of male (mean=3.72, SD=0.43) is higher than female (mean=3.54, SD=0.352).

Table 7: Comparison between male and female group on their engagement level.

		Sum of Squares	df	Mean Square	F	Sig.
Affective engagement	Between Groups	.30	1	.30	1.88	.17
	Within Groups	21.14	64	.16		
	Total	21.45	65			
Cognitive engagement	Between Groups	.89	1	.89	6.15	.01
	Within Groups	18.80	64	.14		
	Total	19.69	65			

Table 7 shows the result that there is no significance difference between male and female student in affective engagement level (p=0.17 >0.05), in contrast, there is a significance difference between the male and female student with respect to their cognitive engagement level (p=0.01< 0.05)

Table 8: Student engagement level by pre-test and post-test in the BBTA group

		N	Mean	Std. Deviation
Affective engagement	Pre test	33	3.63	.45
	Post test	33	4.24	.18
	Total	66	3.93	.46
Cognitive engagement	Pre test	33	3.62	.34
	Post test	33	3.75	.26
	Total	66	3.68	.31

From the table above, result shows that mean for affective engagement in pre-test (mean=3.63, SD= 0.46) is lower to the mean of post-test (mean=4.24, SD=0.18). result also shows that, mean for cognitive engagement in pretest (mean=3.63, SD=0.34) where as in posttest (mean=3.75, SD=0.26).

Table 9: Comparison of student engagement level between pretest and posttest in BBTA group

		Sum of Squares	df	Mean Square	F	Sig.
Affective engagement	Between Groups	6.13	1	6.13	50.81	.00
	Within Groups	7.72	31	.121		
	Total	13.85	32			
Cognitive engagement	Between Groups	.25	1	.25	2.71	.10
	Within Groups	6.04	31	.09		
	Total	6.30	32			

Table 9 shows that there is a significance difference between the pretest and post test score to their affective engagement level (p=0.00< 0.05). Whereas, there is no significance difference pre-test and post-test score in cognitive engagement level (p=0.10 >0.05)

In this study, Brain Based Teaching Approach was used as an alternative to help students engage in learning food design topic. Mean for both affective engagement and cognitive engagement in CTA group is lower to the mean of BBTA group. It shows that after BBTA treatment student is more engage compared to the CTA

group who went through the conventional approach. Lombardi (2008), found that brain-based learning strategy incorporates a variety aspect such as multiple intelligences, learning styles and also emotional intelligences. Brain Based Teaching Approach (BBTA) is a natural, motivating, and a positive way that supports and maximizes learning and teaching thereby increasing their engagement that led to their achievement" [48.47,28].

Peer support is one of the factors in affective engagement and has become a crucial factor that has strong influence in student engagement. Sense of belongingness initiate student engagement that based on student-student relationship or peer support at school [20,13]. Students who have more friends have greater opportunities to develop more diverse skill and social has more tendencies to engage in school [36].

There was a significance difference in both affective and cognitive engagement between BBTA group and CTA group. Brain based teaching techniques used in this study help learner to activate brain functions that cope with their learning styles. Learn designing food in a non-threatening environment ensures positive emotions leading to positive attitudes towards the learning process and the learned materials. Learners' interest in the topic and material taught optimizes their learning, and relaxed brain triggers learn. Therefore, providing a relaxing, non-threatening learning environment helps students to stimulate meaningful learning and emotional support that motivate students to learn and engage them to the classroom activities.

Female students obtained higher score in affective engagement compared to male students. This finding is also consistent with result of study by Lam et al. (2012); Ruslin et al. (2014). Female students may associate with their relationship with the teachers. Students shape close attachments to teacher invested emotionally in them. In this study the BBTA teachers is a female teacher. Caring and also emotionally available teachers can have student feelings and attached or engage to the student in the process of learning [41].

This result shows that male is more cognitively engage compare to female. This mean that male students are more emotionally engaged in classroom activities and learning task than the female students This finding is contradict with the result of study by Ruslin et al. (2014) and Lam et.al. (2012). They reported that female had higher levels of engagement in school. However, Wang et al. (2011), found that female and male not substantially differ in terms of classroom engagement. This study shows that there is significance difference in term of gender in cognitive engagement but not affective engagement.

Regarding both affective engagement and cognitive of Experimental group (BBTA group), results indicates that engagement level in post-test is higher compared to the pre-test engagement level. Students were actively participated in various techniques during BBTA class, feel comfortable, free and connected with other students will definitely affectively engage. Gibbs & Poskitt (2010) mentioned that affective engagement is precondition of cognitive engagement. There is significance difference in affective engagement between the pre-test and post-test but not in cognitive engagement.

5.0 CONCLUSION

The study reveals that there was a positive impact of implementation of BBTA in food design topic on student engagement in form two students of secondary school. Techniques in BBTA improve student engagement in classroom. Results shows that male students are more affectively engage compared to female students. This may be due to the students-teacher relationship in learning process. Student engagement is encouraged by teachers who are caring and encouraged participatory and democratic during the class. In this study also shows that students are more engage to the cognitive domain compared to the affective domain.

The strategy of encouraging student engagement contributes to the development of positive school experience and motivation for learning. BBTA provides a very pleasant environment and engage student to the classroom food design activities. It provides enjoy and relax situation in teaching and learning process. It makes student can learn with their unconscious. Students are more focusing on learning activities approach using BBTA that emphasized teacher student relationship. Hence, the implementation BBTA is suitable in design and technology subject especially in food design topic.

REFERENCES

1. Appleton, J. J., (2004). Scale description and references for the Student and Engagement Instrument.
2. Appleton, J. J., Christenson, S.L. & Furlong, M.J., (2008). "Student Engagement with School: Critical Conceptual and Methodological Issues of the Construct." Psychology in the Schools 45 (5): 369–86.

3. Ashraf Atta M. S.S., (2017). Engaging ESP Students with Brain-Based Learning for Improved Listening Skills, Vocabulary Retention and Motivation. Canadian Center of Science and Education. Vol. 10, No. 12

4. Awoloa, S. A. (2011). Effect of brain-based learning strategy on students' achievement in senior secondary school mathematics in Oyo State, Nigeria. Cypriot Journal of Educational Sciences, 2, 91-105.

5. Binu, M.T. & Srikanta, S.S. (2014). Barain Based Teaching Approach- A New Paradigm of Teaching. International Journal of Education and Psychological Research (IJEPR), 3(2).

6. Boaler, J., & Staples, M. (2008). Creating mathematical futures through an equitable teaching approach: The case of Railside School. The Teachers College Record, 110, 608–645.

7. Caine, R. N. (& Caine, G. (1991). Making Connections: Teaching and the Human Brain from.. https://files.eric.ed.gov/fulltext/ED335141.pdf

8. Caine, R. N., Caine, G., McClintic, C., & Klimek, K. J. (2015). 12 Brain/Mind Learning Principles in Action: Teach for the Development of Higher-order Thinking and Executive Function. Corwin Press

9. Caine, R., & Caine, G. (1991, 2003). Taking Connection: Teaching and the human Brain. Association for Supervision and Curriculum Development.

10. Cambourne, B. (1995). Toward an Educationally Relevant Theory of Literacy Learning. The Reading Teacher, 49 (3), p. 182.

11. Connell, M. P., & Wellborn, J. G. (1991). Competence, autonomy and relatedness: A motivational analysis of self-system processes. In M. R. Gunnar, & L. A. Sroufe (Eds.), Self-processes and development: The Minnesota Symposia on Child Development, Vol. 23. (pp. 43–78) Hillsdale, NJ: Erlbaum

12. Cooper, K. S. (2014). Eliciting engagement in the high school classroom a mixed-methods examination of teaching practices. American Educational Research Journal, 51, 363–402.

13. Darensbourg, A. M., & Blake, J. J. (2014). Examining the academic achievement of black adolescents: Importance of peer and parental influences. Journal of Black Psychology, 40,191–212

14. Finn, J., & Zimmer, K. (2012). Student engagement: What is it? Why does it matter? In S. L. Christenson, A. L. Reschly & C. Wylie (Eds.), Handbook of research on student engagement (pp. 97-131). New York: Springer Science & Business Media.

15. Finn, J. D., & Rock, D. A. (1997). Academic success among students at risk for school failure. Journal of Applied Psychology, 82, 221–234

16. Finn, J.D. (1989). Withdrawing from school. Review of Educational Research, 59,117-42.

17. Fredricks, J., & McColskey, W. (2012). The measurement of student engagement: A comparative analysis of various methods and student self-report instruments. In S. L. Christenson, A. L. Reschly & C. Wylie (Eds.), Handbook of research on student engagement (pp. 763-782). New York: Springer Science & Business Media.

18. Fredricks, Jennifer A., P. C. Blumenfeld, and A. H. Paris. (2004). "School Engagement: Potential of the Concept, State of the Evidence." Review of Educational Research 74 (1): 59–109.

19. Fullan, M. (2011). Makna Baharu Perubahan Pendidikan. Terjemahan. Mastuti Isa & Asia Salleh. Kuala Lumpur. Institut Terjemahan Negara Malaysia.

20. Gibbs, R., & Poskitt. J. (2010). Student Engagement in the middle Years of Schooling (Years 7-10): A literature Review Report to Ministry of Education. Retrieved from http://www.educationcounts.govt.nz/publications.

21. Horn, I.S. (2017). Motivated. Portsmouth, NH Heinemann.

22. Ilhamdiah & Kurnia, D. (2013). Post study pre-service practical training programme for TVET teacher students. The Online Journal for Technical and Vocational Education and training in Asia.1(1-17).

23. Jensen, E. (1996). In E. Jenson, Brain-based Learning. Del Mar, Ca lifornia, USA: Turning Point Publishing

24. Jensen, E (1995) Brain Based Learning & teaching. San Diego: Brain Store Incorporated.

25. Jensen, E. (2008). Brain-based learning: The new paradigm of teaching. California: Corwin Press.

26. Kementerian Pendidikan Malaysia, (2013). Pentaksiran Kemahiran Berfikir Aras Tinggi. (Assessing Hots) Melaka: Surya Sdn. Bhd. Kolokium Pendidikan Nusantara UTM-UNM 2018 152.

27. Kelly, S., & Turner, J. (2009). Rethinking the effects of classroom activity structure on the engagement of low-achieving students. The Teachers College Record, 111, 1665–1692.

28. Kok, I. (2010). The relationship between students' reading comprehension achievement and their attitudes towards learning English and their abilities to use reading strategies with regard to hemispheric dominance. Procedia Social Behavioral Sciences, 3, 144-151.

29. Kuh, G.D., Chen, D., & Nelson Laird T.F. (2007). Why teacher-scholars matter. Liberal Education, 40-45.

30. Lam, S.F., et al.,(2012). Do girls and boys perceive themselves as equally engaged in school? The results of an international study from 12 countries. Journal of school psychology, 50(1): 77-94.

31. Lester, D., (2013). A Review of the Student Engagement Literature. National Forum of Applied Educational Research Journal, 31(1/2/2018), 1-8.

32. Libbey, H. P., (2004). "Measuring Student Relationships to School: Attachment, Bonding, Connectedness, and Engagement." Journal of School Health 74 (7): 274–83.

33. Lombardi. J., (2008). Beyond Learning styles: Brain Based research and English Language learners. The Clearing House: A Journal of Educational Strategies, Issues and Ideas,81(5),219-222.

34. Martin, A. (2009). Motivation and engagement across the academic life span: A developmental construct validity study of elementary school, high school, and university/college students. Educational and Psychological Measurement, 69(5), 794-824. doi: 10.1177/0013164409332214

35. McLaughlin, J. E et.al. (2014). The flipped classroom: a course redesign to foster learning and engagement in a health professions school. Academic Medicine: Journal of the Association of American Medical Colleges, 89(2),

36. Morton, B. S. & Chen, R. (2009). Peer and parent infl uences on school engagement among early adolescents. Youth & Society Journal, 41, 3–25.

37. Nasir, N. S., Jones, A., & McLaughlin, M. W. (2011). School connectedness for students in low-income urban high schools. Teachers College Record, 113, 1755–1793.

38. Newmann, F.M., Wehlage, G.G., & Lamborn, S.D., (1992). The significance and sources of student engagement. In F.M. Newmann (Ed.), Student engagement and achievement in American secondary schools (pp. 11-39). New York: Teachers College Press.

39. Rajendran, N. S (2009). Reconstructing the teaching of higher-order thinking. Proc of International Conference on Teaching and Learning in Higher Education 2009 (ICTHLE 2009). Tanjong Malim: Penerbit Universiti Pendidikan Sultan Idris.

40. Renniger, K. A., & Bachrach, J. E. (2015). Studying triggers for interest and engagement using observational methods. Educational Psychologist, 50, 58–69.

41. Reyes, M.R., M.A. Brackett, S.E. Rvers, M. White and P. Salovey, (2012). Classroom emotional climate, student engagement and academic achievement. Journal of Educational Psychology, 104(3): 700.

42. Roorda, D.L., Jak, S., Zee, M., Oort, F.J., & Koomen, H. Y. (2017). Affective Teacher-Relationship and Students' Engagement and Achievement. School Psychology review, 46 (3), 239-261.

43. Ruslin, A., Anis Saleha, Zalizan, M.J., Abdul Razaq, A. & Hutkemri. (2014) Students' engagement by age and gender: A across-sectional study in Malaysia. Middle-East Journal of Scientific Research 21(10)1886-1892.

44. Russel, J.D. (1974). Modular Instruction. A Guide to the Design, Selection, Utilization and Evaluation of Modular Materials. New York: Publishing Company.

45. Smaldino, S.E., Lowther, D.L., & Russell, J.D. (2008). Instructional technology and media for learning (9th edition). Upper Saddle River, NJ: Pearson Education, Inc.

46. Salleh, S. and Subramaniam. L., (2018). Effects of Brain-Based Teaching Method on Physics achievement among ordinary school students. Kasetsart Journal of Social Sciences. https://doi.org/10.1016/j.kjss.2017.12.025

47. Saleh, S., (2012). The effectiveness of brain-based teaching approach in dealing with the problems of students' conceptual understanding and learning motivation towards physics. Educational Studies, 3891), 19-29.

48. Saleh, S. & Mazlan, A., (2019). The Effects of Braib Based Teaching Approach with I-think maps and Brain Gym Approach towards Physics Understanding. Jurnal Pedidikan IPA Indonesia,8(1), 12-21.

49. Sharifah, A.S.S. & Rosna, A.H., (2011). The roles of social support in promoting adolescents' classroom cognitive engagement through academic self-efficacy. Malaysian Journal of Learning and Instruction, 8, 49–69.

50. Shernoff, D. J. (2013). Optimal learning environments to promote student engagement. New York, NY: Springer.

51. Siti Nadia, M. (2015). Theacher's perception on the intergration of HOTS in language teaching. International Journal of Technical Research and Applications, (22, pp 42-44).

52. Siti Ruzita, H., Effandi, Z.& Roslinda, R. (2016). The use of i-think Map and Questioning to Promote Higher Order Thinking Skills in Mathematics. Creative Education 7(7): 1069-1078.

53. Skinner, E. A., & Pitzer, J. R. (2012). Developmental dynamics of student engagement, coping, and everyday resilience. In S. L. Christenson, A. L. Reschly & C. Wylie (Eds.), Handbook of research on student engagement (pp. 21-44). New York: Springer Science & Business Media.

54. Skinner, E.A. and M.J. Belmont, (1993). Motivation in the classroom: Reciprocal effects of teachers Behavior and student engagement across the school year. Journal of Education Psychology, pp;85.

55. Sousa, D. (2004). The ramification of brain research.

56. Sukiman, S., Noor Shah, S. & Mohd Uzi, A. (2012). Pengajaran kemahiran berfikir aras tinggi: Persepsi dan amalan guru matematik semasa pengajaran dan pembelajaran di bilik darjah. Jurnal Pendidikan Sains & Matematik Malaysia, 2(1), 18-36

57. Toyras, D.E. and D.L. Anderson, (2013). Effects of Incorporation Yoga Into A Classroom on Student Engagement During Literacy Lessons.

58. Voelkl, K.E., (1997). Identification with school. American Journal of Education, 105, 204-319.

59. Walker, C. O., & Greene, B. A. (2009). The relations between student motivational beliefs and cognitive engagement in high school. The Journal of Educational Research, 102, 463–472.

60. Wang, M.T., J.B Willet and J. S. Eccles, (2011). The assessment of school engagement: Examining dimensionality and measurement invariance by gender and race/ethnicity. Journal of School Psychology, 49(4): 465-480.

61. Watanabe, M. (2008). Tracking in the era of high stakes state accountability reform: Case studies of classroom instruction in North Carolina. Teachers College Record, 110, 489–534.

62. Yazzie-Mintz, E. (2010). Charting the path from engagement to achievement: A report on the 2009 High School Survey of Student Engagement. Bloomington: Center for Evaluation & Education Policy

63. Yazzie-Mintz, E., & McCormick, K. (2012). Finding the humanity in the data: Understanding, measuring, and strengthening student engagement. In S. L. Christenson, A. L. Reschly, & C. Wiley (Eds.), Handbook of research on student engagement (pp. 743–761). New York, NY: Springer.

64. Zamri, M., & Nor Razah, L. (2011). The Diversity of Oral Questioning Methods in the Teaching of Malay Language: Observation Method. Jurnal Pendidikan Bahasa Melayu, 1, 51-65.