

ORGANIC FUN

By

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1.0 Introduction

Organic Chemistry is an important component in the *Sijil Tinggi Pelajaran Malaysia* (STPM) (Malaysian Higher School Certificate) as well as the Sijil Pelajaran Malaysia (Malaysian Certification of Education) Chemistry syllabus. It is also one of the most difficult sections for students to comprehend and master. Students normally face problems in identifying the functional group of a given organic compound as well as constructing its molecular and structural formulae. Nevertheless, construction of molecular and structural formulae of organic compounds is an essential basic skill in organic chemistry. In order to acquire higher order thinking skill like predicting reaction products, evaluating and assimilating the numerous organic reactions and synthesizing reaction paths, students need to possess basic skill of constructing molecular and structural formulae of organic compounds. As a result of this, many students withdraw themselves from organic chemistry as they cannot even handle the most basic skill. Learning organic chemistry thus becomes a difficult, tedious and boring task for the students.

Traditional method of teaching emphasizes on rote learning whereby students memorize the molecular and structural formulae of organic compounds. Some better students are able to identify and recognize the different functional groups and observe a general pattern. However, only a minority of the students are able to do so. Majority of the students still wonder in bewilderment searching for the answers. Is there a more effective and fun way of teaching the students to construct molecular and structural formulae of organic compounds? The answer is yes!

Organic Fun is a game which incorporates card game with construction of molecular and structural formulae for organic compounds. Through this game, students are able to acquire the basic skill of molecular and structural formula construction in a fun way. In addition to that, Organic Fun enhances communication among the students and promotes group learning.

An action research was conducted in 2007 to study the impact of Organic Fun towards teaching and learning of molecular and structural formula construction among upper six science students.

2.0 Objective and Aim of the Study

The objective of Organic Fun was to improve on my teaching practice by introducing Organic Fun among students of one of the Science Upper 6 Form

(U6S1) class at SMK St. Thomas, Kuching during the teaching of Organic Chemistry topic. Specifically, this research aims to:

1. determine the impact of Organic Fun in promoting group learning in U6S1 classroom.
2. find out how does Organic Fun help the U6S1 students in acquiring the skills in constructing molecular and structural formulae.
3. investigate how does Organic Fun enhance higher order thinking skills among U6S1 students.
4. explore how does Organic Fun provide a fun way of learning for U6S1 students.

3.0 Research Questions

The research questions for this study are:

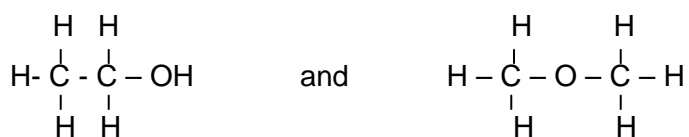
1. What is the impact of Organic Fun in promoting group learning in U6S1 classroom?
2. How does Organic Fun help the U6S1 students in acquiring the skills in constructing molecular and structural formulae?
3. How does Organic Fun enhance higher order thinking skills among U6S1 students?
4. How does Organic Fun provide a fun way of learning for U6S1 students?

4.0 Theoretical Basis and Premise of Organic Fun

4.1 Molecular and structural formula

Molecular formula of an organic compound shows the actual number of each type of atom present (Clugston & Flemming, 2000; Tan, 2005), for example the molecular formula of ethanol is C_2H_6O . A problem arises because the molecular formula of methoxymethane is also C_2H_6O , hence molecular formula does not distinguish between these two compounds.

Structural formula provides more information because it specifies exactly which atoms are bonded together (Clugston & Flemming, 2000; Tan, 2004). The condensed structural formulae of ethanol and methoxymethane are CH_3CH_2OH and CH_3OCH_3 respectively. However, the CH_3CH_2 group in ethanol is sometimes written as C_2H_5 . Expanded structural formula can also be drawn to show the bonds between atoms or group of atoms; hence ethanol and methoxymethane are displayed as:



The structural formulae constructed in Organic Fun game are condensed structural formulae whereby ethanol is displayed either as CH_3CH_2OH or

C₂H₅OH. To display the structure of CH₃CH₂OH, three cards are needed, while two cards are used to construct C₂H₅OH as shown here.



4.2 Bloom's taxonomy

In 1956, Benjamin developed a hierarchy of intellectual behavior important to learning and mastering a concept. This became known as Bloom's Taxonomy for educational objectives which is still an integral part of educational objectives today, incorporates cognitive, psychomotor, and affective domains of knowledge. These levels or taxonomy suggested are build on one another (Kinnes,1998 -2008) in order to organize information from basic factual recall to higher order thinking. In the same vein, Prado (2008) proposed that the lower levels require less in the way of thinking skills and as one moves down the hierarchy, the activities require higher level thinking skills as shown in Table 1.

Table 1 : Bloom's Taxonomy for Educational Objectives

Level	Competence	Skills Demonstrated	Verbs used for objectives
Lowest level	Knowledge	Observation and recall of information; knowledge of dates, events, places; knowledge of major ideas; mastery of subject matter	define, memorize, repeat, record, list, recall, name, relate, collect, label, specify, cite, enumerate, tell, recount
	Compre-Hension	understanding information; grasp meaning, translate knowledge into new context; interpret facts, compare, contrast, order, group, infer causes, predict consequences	restate, summarize, discuss, describe, recognize, explain, express, identify, locate, report, retell, review, translate
	Application	use information, use methods, concepts, theories in new situations, solve problems using required skills or knowledge	exhibit, solve, interview, simulate, apply, employ, use, demonstrate, dramatize, practice, illustrate, operate, calculate, show, experiment
Higher levels	Analysis	seeing patterns, organization of parts, recognition of hidden meanings, identification of components	interpret, classify, analyze, arrange, differentiate, group, compare, organize, contrast, examine, scrutinize, survey, categorize, dissect, probe, inventory, investigate, question, discover, text, inquire, distinguish, detect, diagram, inspect
	Synthesis	use old ideas to create new ones, generalize from given facts, relate knowledge from several areas, predict, draw conclusions	compose, setup, plan, prepare, propose, imagine, produce, hypothesize, invent, incorporate, develop, generalize, design, originate, formulate, predict, arrange, contrive, assemble, concoct, construct, systematize, create
	Evaluation	Compare and discriminate between ideas , assess value of theories, presentations; make choices based on reasoned argument, verify value of evidence; recognize subjectivity	judge, assess, decide, measure, appraise, estimate, evaluate, infer, rate, deduce, compare, score, value, predict, revise, choose, conclude, recommend, select, determine, criticize

(Source: Adapted by Prado (2008) and Joyce (2007) from Bloom's Taxonomy)

Organic Fun is designed with different levels of difficulty, each level of difficulty promotes different types of thinking skills as suggested by Bloom. As the level of difficulty increases, higher order thinking skills are enhanced whereby students are encouraged to analyze, synthesize and evaluate the molecular and structural formulae formed in the game.

4.3 Group work

Group work is recommended to enhance learning in the classroom (Damon, 1984; Kutnick, 1994). For Kutnick, "Small groups are arranged to enhance co-operation and allow for individual achievement through group incentives, with each member equally accountable for some part of the group's achievement" (p.13). Other than that, the educational benefits of peer interaction are multiple. According to Damon (1984), interaction among peers plays an important role in group learning because:

They speak to each other on a level that they can easily understand; they speak directly in plain language to each other; they take the response of another child more seriously; and the communications between children are much friendlier as compared to the corrective advice from an adult, which may be emotionally threatening.

Damon (1984) further illustrated that group work fosters pro-social behaviour. Within controversy and debate, there are elements of disagreement, argumentation and rebuttal (Johnson & Johnson, 1994). In other words, students are engaged in high-order elaborative interactions. By learning to manage disagreement and conflicts, students develop their social and communication skills.

4.3 What is Organic Fun?

Organic Fun is an innovation designed to enhance the skills of molecular and structural formulae of organic compounds among the students. The game consists of two sets of cards, Set 1 and Set 2, containing 64 cards and 96 cards respectively, such as shown here.



Set 1



Set 2

For each of the Set 1 card, the partial formula of a compound is typed on one side of the square, for example CH₃, Cl, NH₂ and C₆H₅. 48 of the 96 Set 2 cards display the partial formulae of organic compounds while another 48 cards show the corresponding 3-dimensional model. For example, CH₃ is displayed as:

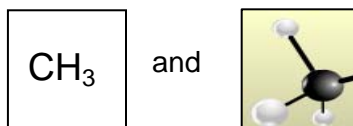


Table 2 and Table 3 show the number of cards needed for Set 1 and Set 2. Set 1 is suitable for both Form 6 and Form 4/5 students while Set 2 is more suitable for F4/5 students.

Table 2: List of Partial Formula and Number of Cards Needed for Set 1

No.	Partial Formula	Number of cards	No.	Partial Formula	Number of cards
1	CH ₃	6	10	HO	4
2	C ₂ H ₅	6	11	COOH	4
3	*C ₆ H ₅	6	12	*NH ₂	2
4	*C ₆ H ₄	4	13	Br	2
5	C ₂ H ₄	4	14	Cl	2
6	CH ₂	4	15	Br ₂	2
7	H	4	16	Cl ₂	2
8	H ₂	4	17	COO	2
9	*CO	4	18	C ₂ H ₃	2
TOTAL NUMBER OF CARD: 64					

* Cards taken out for Form 4 and Form 5 students. Total number of cards played at Form 4/5 level is 50 cards

Table 3: List of Partial Formula/ 3-D Model and Number of Cards Needed For Set 2

No.	Partial Formula	Number of cards	No.	Partial Formula	Number of cards
1	CH ₃	6	8	Br	2
2	C ₂ H ₅	6	9	Cl	2
3	C ₂ H ₄	4	10	Br ₂	2
4	C ₂ H ₃	2	11	Cl ₂	2
5	CH ₂	4	12	CH ₃ COO	2
6	H	4	13	HO	4
7	H ₂	4	14	COOH	4
TOTAL NUMBER OF CARD: 48 cards x 2 = 96 cards					

** Note: Set 2 consists of 96 cards (48 cards for each of the partial formula and 3-D model)

4.3.1 General information and implementation of Organic Fun

Organic Fun is an exciting and challenging game as the game will turn out to be different each time the students play the game. This is because there are four levels of difficulty and the numbers of combination possible at each level are numerous. This game can be used during lesson as revision tools or enrichment activity. It could also be used by students during sit in, outside lesson or science club activities. The most important thing is that the students enjoy the learning process and at the same time having fun. Take note of the following while implementing the game:

- This card game can be played either during lesson or outside lesson. It should be introduced to the students towards the later part of organic chemistry as students need to know at least 4 to 5 functional groups.
- The game will be more interesting if students form small groups of two or three to play against each other. A combination of advance learner, moderate learner or novice learner in a group is recommended as it will promote intellectual discourse and collaborative learning among the groups and within the same group.
- Teachers will intervene if there is any doubt or problem about the formula constructed. Students are encouraged to refer to text book or reference book during the game to confirm their answers.
- Set 1 should be played by novice while Set 2 is recommended for more advance learners.

4.3.2 Rules and regulation of Organic Fun

The basic rules and regulations of memory card game are applied in all four levels of difficulty of the Organic Fun game. The details of rules and regulations are displayed in Appendix A. Examples of molecular or structural formulae that can be constructed using two or three cards are shown in Table 4. Molecular and structural formulae for all the functional groups in the STPM and SPM Chemistry syllabus could be constructed in this game.

Table 4: List of Functional Groups and Possible Combination of Cards

No.	Functional Group	Possible Combination of cards	
		Two cards	Three cards
1.	Alkanes	<div style="display: flex; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">CH₃</div> <div style="border: 1px solid black; padding: 2px 5px;">CH₃</div> </div>	<div style="display: flex; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">CH₃</div> <div style="border: 1px solid black; padding: 2px 5px;">CH₂</div> <div style="border: 1px solid black; padding: 2px 5px;">H</div> </div>
2.	Alkenes	<div style="display: flex; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">CH₂</div> <div style="border: 1px solid black; padding: 2px 5px;">CH₂</div> </div>	<div style="display: flex; gap: 10px;"> <div style="border: 1px solid black; padding: 2px 5px;">C₂H₃</div> <div style="border: 1px solid black; padding: 2px 5px;">H₂</div> <div style="border: 1px solid black; padding: 2px 5px;">H</div> </div>

3.	Haloalkanes	C_2H_5 Cl	CH_3 CH_2 Br
4.	Hydroxyl	CH_3 OH	C_2H_3 H_2 OH
5.	Amines	C_2H_5 NH_2	C_2H_4 H NH_2
6.	Carbonyl (aldehydes and ketones)	-	CH_3 CO H or CH_3 CO C_6H_5
7.	(i) Benzene	C_6H_5 H	C_6H_4 H H
	(ii) Mono- substituted benzene ring	C_6H_5 Cl	C_6H_5 CH_2 OH
	(iii) Di- substituted benzene ring	C_6H_4 Br_2	Cl C_6H_4 Br or Cl C_6H_4 CH_3
8.	Carboxylic acids	CH_3 COOH	CH_3 COO H
9	Ester	-	CH_3 COO C_6H_5
10.	Amides	-	CH_3 CO NH_2
11.	Acyl chlorides/ bromides	-	CH_3 CO Br
12.	Amino acids	-	NH_2 CH_2 CO_2H

4.3.3 Level of difficulty and type of thinking skill involved

One special feature of this memory card game is that there are four levels of difficulty (See Table 5). Students can choose the level of difficulty according to their abilities and they can advance to higher level once they are

familiarized with the lower level. This allows the students to learn at their own pacing and they can regulate their own learning. For Level 1, only lower order thinking skills of the Bloom's Taxonomy (1956) are involved, as the students proceed to higher level of difficulty, higher order thinking skills like analysis, synthesis and evaluation are promoted.

Table 5: Level of Difficulty and Type of Thinking Skill Involved

Level of Difficulty	Description	Type of thinking/cognitive skills involved
1	Matching of molecular formula with 3-dimensional model – suitable for novice	Knowledge - recall and matching
2	Constructing formula using two 3-dimensional model cards – each time every player is allowed to open two cards and they must construct the formula with two cards – suitable for elementary learner.	Knowledge, comprehension, application, visualizing, evaluation
3	Constructing formula using two cards – each time every player is allowed to open two cards and they must construct the formula with two cards – suitable for moderate learner.	Comprehension, application visualizing, analysis, synthesis and evaluation
4	Constructing formula using three cards- each time every player is allowed to open three cards and they must construct the formula with three cards – suitable for advance learner.	Comprehension, application, visualizing, analysis, synthesis and evaluation

5.0 Methodology

This is an action research carried out to improve on my teaching practice by introducing Organic Fun among students of U6S1 in Organic Chemistry. The participants in this study were 19 students from the class of U6S1 in year 2007. During data collection, the students formed four groups consisted of 6, 6, 4 and 3 students respectively. They were free to choose their group in this game. I did not interfere with the formation of group because I wanted them to feel comfortable with their friends.

One of the groups was chosen to do the audio recording. The group chosen for audio recording had three pair groups; each of the group had two students. This group was chosen because the students were of mix abilities. I was interested to see the interactions among them. This group is shown in the following picture.



The group chosen for audio recording (there were 3 pair groups)

There were three instruments involved in this research, namely the researcher, the Organic Fun card game and Student's Response Form. Data generated by the researcher were photographs, transcriptions of audio record and interview sessions. The Student's Response Form (See Appendix B) consisted of two questions. Question 1 contained 7 Items pertaining to the characteristics of Organic Fun. Students were required to give their responses according to a scale of 1-10. A score of 1 means 'very poor', while a scale of 10 denotes 'very good'. Question 2 was an open ended question aiming to elicit students' general opinion about the game.

After I went through the responses given by the 19 students I was particularly interested with the answers given by three students Lina, Yeap and Yen Yen. Therefore, interviews were arranged to probe further explanation. Lina was chosen to be interviewed because she has given a score of 10 for all the 7 items in the Student's Response Form. Yeap was from another class taught by other Chemistry teacher. He happened to be around during data collection and he asked for my permission to join the game. He was interviewed so that I could obtain feedback from other class. Yen Yen gave different opinions about the game. She was not very happy with the rules and the way the game was played.

Data obtained from this study were analysed. Firstly, the response given by the students for Question 1 of the Response Form were analysed using descriptive statistics to determine the mean score for each of the item. Answers to the open ended question were studied to look for pattern, similarities and differences. Transcription was done for both the audio record and the interview sessions to obtain more information.

6.0 Results and Discussion

6.1 Impact of Organic Fun in promoting group learning

The results obtained from this study agree with Damon (1984) and Kutnick (1994) that group work enhances learning in the classroom. Item 6 and Item 7 of the Student's Response Form had a high mean average score of 8.25 and 8.31 respectively (see Table 6). This implies that most of the students agreed that Organic Fun allowed them to learn from their friends through group work and encourages them to argue and discuss with their friends during the game.

Table 6 : Average Score of Each Item From the Students

No.	Description	Average score n= 19
1.	Organic Fun: helps me to learn to construct molecular and structural formula of organic compounds	7.94
2.	stimulates my thinking skill by playing the more difficult level.	7.81
3.	strengthens my concepts on molecular and structural formulae.	7.81
4.	improves my memory	7.44
5.	let me learn in a fun way.	7.56
6.	allows me to learn from my friends through group work..	8.25
7.	encourages me to argue and discuss with my friends during the game.	8.31

Answers for the open ended question show similar response. Two of the responses for Question 2 are displayed below:

your friends:

Can discuss with friends and can learn more effectively.

It is fun. It stimulates our brain to think of naming of difficult compounds, like phenylmethyamine. It also makes us to learn efficiently by getting correct from my friends other than correcting my friends, too. I get to argue with my partner, too, in a constructive manner. Yes, I would introduce it to my friends.

During the game, students were also required to give the typical reactions of the compounds constructed. In order to evaluate and confirm the answers, the students argued, supported, corrected each other's mistake constructively, interacted with each other within the group and between the groups. Transcription of the audio recording reveals that the interactions involved were multi-directional, this is one of the advantages of Organic Fun as traditional classroom practice does not promote such interactions between the students.

Data from the interviews shows that the Organic Fun game has changed and improved my practice in classroom by making the class less stressful, promotes interactions among students. As mentioned by Lina:

"... because it is a game not like in the class we study very formal it is just a game and then we can learn about organic compound indirectly, we treat it as game not very stressful. Besides that we also can interact with friends, then we can discuss...." (Interview transcription/ Lina)

Through the game, Lina also felt that it encouraged her to learn more and her group members also read reference books to confirm their answers. She said:

" Actually before I play this game my organic is very poor then after I play this game, it will encourage me to learn because if I play game I don't know what it is I don't know how to say what is the reaction it is , how it react with other compounds or solvent, then it will encourage me to learn more, and then beside that our group also read out reference book to learn and we discuss together." (Interview transcription/ Lina)

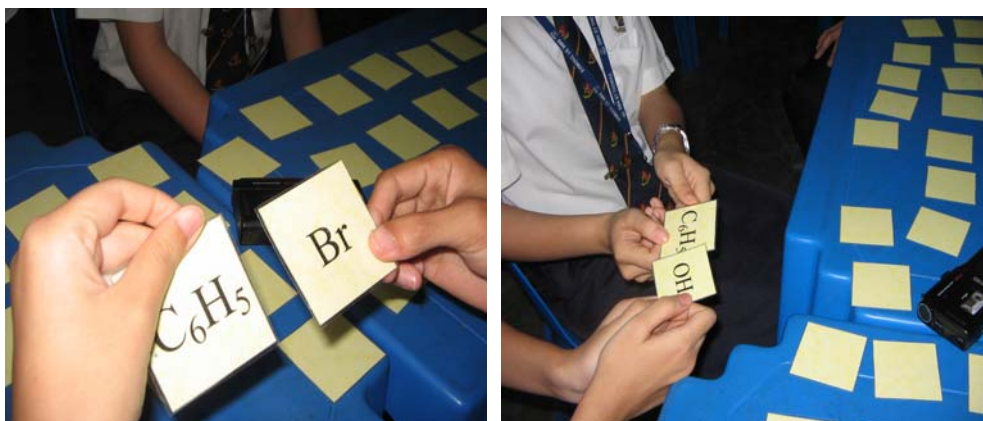
Yeap had similar thought too. He felt that the game was another form of group study for revision and allowed him to learn thing together with friends. For him, organic fun is:

"...fun because we can actually learn thing together with our friends, and actually to me this is another type of group study, when there is discussion going on especially when you have partner playing together..."(Interview transcription/ Yeap)

6.2 Construction of molecular and structural formulae

The students involved in this research responded that Organic Fun helped them to improve their skills in constructing molecular and structural formula as a high average score of 7.94 was obtained for Item 1 of the Student's Response Form. Item 3 which has an average mean score of 7.81 supported the finding that Organic Fun helps the students to improve their skills of molecular construction. The audio record and photographs taken also

indicated that construction of molecular and structural formulae by the students had taken place during the game as shown in the following pictures



Yeap in his interview mentioned that:

"... we have to picture the molecular structure in your head, then we start to construct in the game and then beside that we have to know how to name of the chemical compound you have formed this can actually help."(Interview transcription/ Yeap)

The above transcription reviews that during the game the students visualized the molecular structure in their minds and then constructed the molecules using the cards. Answers to the open ended question further support the conclusion that Organic Fun helped the students in recognizing, constructing and strengthening concepts of molecular structure of organic compound.

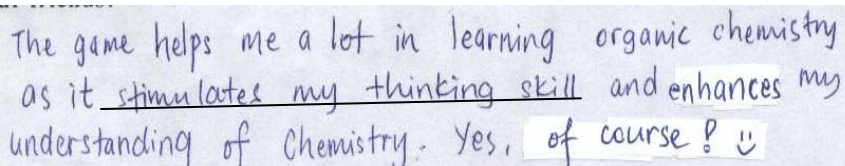
-can learn more about constructing molecular formulae.

make me strengthen the concepts of molecular structure and structural formulae.

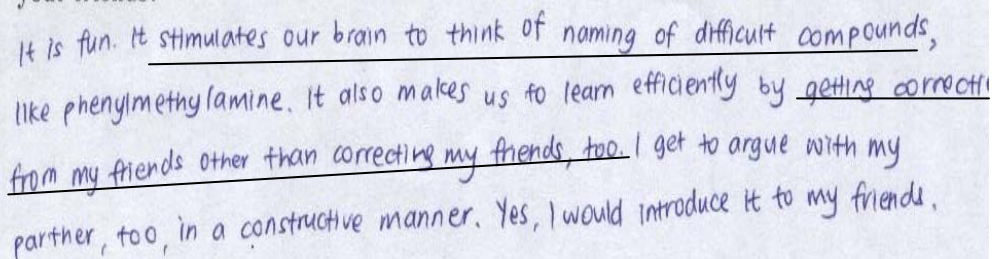
6.3.1 Enhancement of higher order thinking skills among students

One of the advantages of Organic Fun is it promotes higher order thinking skills as all the students involved were playing at level three and level four of difficulty. Verbs correspond with verbs described by Bloom (1956) as higher

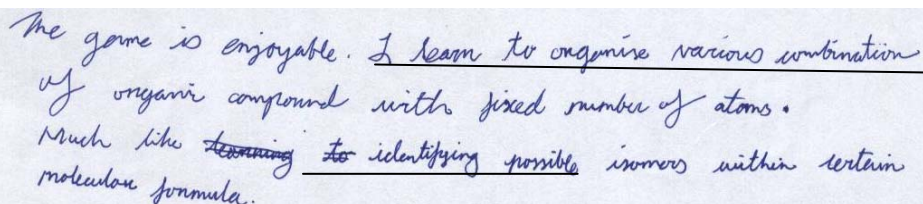
order thinking skills such as “*argue, correct others, thinking creatively, organize, identify*” were used by the students. Sample answers to the open ended question which show that Organic Fun enhanced higher order thinking skills of the students are given here.



The game helps me a lot in learning organic chemistry as it stimulates my thinking skill and enhances my understanding of Chemistry. Yes, of course! :)



It is fun. It stimulates our brain to think of naming of difficult compounds, like phenylmethanamine. It also makes us to learn efficiently by getting correct from my friends other than correcting my friends, too. I get to argue with my partner, too, in a constructive manner. Yes, I would introduce it to my friends.



The game is enjoyable. I learn to organise various combination of organic compound with fixed number of atoms. Much like learning to identifying possible isomers within certain molecular formula.

Item 2 of the Students Response Form has a high mean score of 7.81, this strengthens the conclusion that Organic Fun stimulates students' thinking skill by playing at the more difficult level.

6.3 Organic Fun: A fun way of learning

From the above discussion, I realized that Organic Fun had an impact towards my teaching practice as it makes my class livelier, enhances interactions and communication, promotes higher order thinking skills among the students as well as encourages peers learning among the students. Most importantly, I noticed that students in my class were having fun and they were more motivated to study. Students' responses towards Item 5 of the Student Response Form has a mean score of 7.56. Further more, almost all the answers for the open ended questions mentioned that Organic Fun is fun and interesting. Some of the answers are shown as following.

your friends:
This game is fun and interesting way to help improve our organic chemistry. It also makes me think that learning organic chemistry is not as hard as I thought. Yes, I will introduce this game to my friends.

your friends:
Yes, Very fun, will encourage me to learn organic compounds.

During the interview, both Lina and Yeap expressed the same feeling towards Organic Fun. They both felt that the game was fun and interesting. Lina mentioned that:

“...this is an interesting way of learning, because rather than reading through the book can actually play the game.” (Interview transcription/ Lina)

While Yeap said this:

“I think this Organic Fun game is quite fun because we can actually learn thing together with our friends,.... this is an interesting way of learning, because rather than looking, reading through the book can actually play..... overall very fun.” (Interview transcription/ Yeap)

7.0 Conclusion and Limitation

I found that Organic Fun is a versatile game as the rules and regulations of the game could be adjusted and modified depending on the ability and creativity of the students. This study shows that:

- (1) Organic Fun has promoted group learning in U6S1 classroom.
- (2) Organic Fun helped the U6S1 students in acquiring the skills in constructing molecular and structural formulae.
- (3) Organic Fun enhanced higher order thinking skills among U6S1 students.
- (4) Organic Fun has provided a fun way of learning for U6S1 students.

Reference



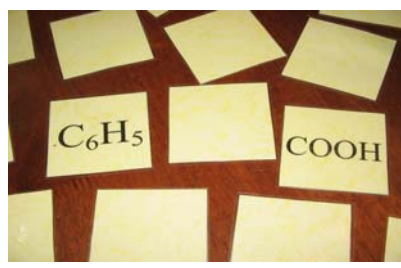

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Appendix A

Rules and Regulation of Organic Fun

The basic rules and regulations of memory card game are applied in all four levels of difficulty of the ORGANIC FUN game. The details rules and regulations are:

<p>Level 1 – Matching game</p> <ol style="list-style-type: none"> 1. Each player/ group of player is allowed to open two cards (one partial formula and one 3-D model) for each turn. 2. If there is a matching pair, the player will collect the cards. The player is then allowed to have another turn until he/she cannot find a matching pair. 3. The game will end when all the cards are collected. The player who collected the most cards is the winner. 	
<p>Level 2 – Constructing Structural Formulae using 3-D model</p> <ol style="list-style-type: none"> 1. Each player/ group of player is allowed to open two cards for each turn. 2. If the two cards can combine to form a structural formula, the player will collect the cards. For example model of CH₃ and Br. The player is required to call the name or the functional group and/or the typical reactions of the organic compound constructed. 3. The player is then allowed to have another turn until he/she cannot find a right combination. 4. The game will end when there is no more combination. The player who collected the most cards is the winner. 	
<p>Level 3 – Constructing Molecular/ Structural Formulae using 2 cards</p> <ol style="list-style-type: none"> 1. Each player/ group of player is allowed to open two cards for each turn. 2. If the two cards can combine to form a molecular or structural formula, the player will collect the cards. For example C₆H₅ and COOH. The player is required to call the name and/or the typical reactions of the organic compound constructed . 3. The player is then allowed to have another turn until he/she cannot find a right combination. 4. The game will end when there is no more combination. The player who collected the most cards is the winner. 	
<p>Level 4 – Constructing Molecular/ Structural Formulae using 3 cards</p> <ol style="list-style-type: none"> 1. Each player/ group of player is allowed to open three cards for each turn. 2. If the three cards can combine to form a molecular or structural formula, the player will collect the cards. For example C₆H₅, COO and CH₃. The player is required to call the name and/or the typical reactions of the organic compound constructed. 3. The player is then allowed to have another turn until he/she cannot find a right combination. <p>The game will end when there is no more combination. The player who collected the most cards is the winner.</p>	

Appendix B

SMK ST THOMAS
STUDENT RESPONSE FORM – ORGANIC FUN[®] GAME

Class:

1. Please rank the following descriptions about the game according to the scale (1 -10) given below.

1	2	3	4	5	6	7	8	9	10
Very poor					Very good				

I think the **ORGANIC FUN[®]** game:

No.	Description	Please fill in the box
1.	helps me to learn to construct molecular and structural formula of organic compounds	<input type="text"/>
2.	stimulates my thinking skill by playing the more difficult level.	<input type="text"/>
3.	strengthens my concepts on molecular and structural formulae.	<input type="text"/>
4.	improves my memory	<input type="text"/>
5.	let me learn in a fun way.	<input type="text"/>
6.	allows me to learn from my friends through group work..	<input type="text"/>
7.	encourages me to argue and discuss with my friends during the game.	<input type="text"/>

2. Describe, in general your opinion about the game. Would you introduce this game to your friends?