Existing ideas and Misconceptions about Natural Selection among Vietnamese Students

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Abstract

This paper aims to investigate the student's existing ideas and misconception about natural selection in Vietnamese. This is a cross sectional survey among biology undergraduate students, including quantitative and qualitative. The instrument for present study was developed in order to measure students existing's ideas and misconceptions using previous questions from Baumgartnerand Duncan. Data collection and data analysis were covered definition, understanding and attitudes about natural selection. The results revealed that 61.4% of biology undergraduate students had misconception and none of the student had the correct concept about natural selection. The proportions of misconception in final year student (35.5%) which was significantly lower than first year students (75.4%). There were numerous existing idea and misconception about natural selection among biology students. Correct understanding about natural selection was high and it was higher in the final year students than first year students. Attitude about natural selection between the final year students and first year students were comparable.Future invention should be conducted to improve learning and teaching about natural selection for Vietnamese students

*Keywords:*Natural Selection, Misconception, Existing Idea, Vietnamese Students.

1. Introduction

Natural selectionisresulting of survival processing for individuals that best adapted to prevailing environmental conditions, theseindividuals produce more offspring and inherit favorable characteristics to the next generation(BISHOP and ANDERSON 1990, Cambell A. Neil 2011). Natural selectionplaysmajor roleinmechanism of evolutionary theory and theory of evolution which is the most significant unique theory in biology education (Dobzhansky 1973, Anderson, Fisher et al. 2002, Gregory 2009). Natural selection is also applied to explain directly almost phenomena related to both organism and human health (Chris, Stephanie et al. 2009). To understand diversity and complexity of organisms, natural selectionknowledge is extremely necessary (Gregory 2009).Therefore, natural selection is taught for all students in worldwide. Understanding natural selection among students leads to better understand scientific principles, concepts, and explains natural phenomena as well as can predict what happened depend on circumstances(Bishop A. Beth 1986).

Previous studies have remarkably found alternative conceptions about natural selection among students in Western countries. Some studies in United States have been reported poor understanding about natural selectionof high school students, university students, and even biology postsecondary instructors(Abraham, Meir et al. 2009, Gregory 2009). It is well known that misconception about natural selection prevalent and the alternative concepts are almost the same across different culture, ethnic groups, class backgrounds (Gregory 2009). For instance, a study among non-major biologystudent reports over 50 % students have naive concept about natural selection(BISHOP and ANDERSON 1990), whileanother study about natural selectionbiology major studentsreports the proportion of misconceptionsis over 70%(Reily 2007). Nehm et al. (2008) found that most students have misconceptions about natural selection and they are not completely explain the natural selection process(Nehm and Schonfeld 2008). Consequently, many studies reported that natural selection should be taught early in the high school as soon as possible (Beardsley 2004, Baumgartner Erin 2009, Wilensky 2012).

In Vietnam, evolutionary theory is taught in grade 12 of high school and biology major in university. Evolutionary theory covers two chapters: (1) The evidence and mechanism of evolution; (2) The history of life on the earth. In general, there are total 10 lessons belong to evolutionary theory in the high school. However, among those lessons, there are two lessons which are (1) Lamarck's hypothesis of evolution and the theory of Darwinian's evolution and (2) the modern synthetic theory of evolution, focus on the contents of natural selection(Nguyen Thanh Dat 2007).

In the university level, the curriculum of theory of evolution is taught for biology major students with two chapters. The first chapter introduce several theories includes(a) Kimura'sneutral; (b') the evolutionevidences; (c') law of evolution; (d')Lamarck's hypothesis of evolution; (e') Darwinian's evolution. The second chapter is divided into three aspects (1) modern theory of evolution; (2) the origin of life; and (3) the origin of human.

Several studies has been investigated aboutmisconception of natural selection among any levels educated students in the Western countries(Abraham, Meir et al. 2009, Gregory 2009, Nehm, Beggrow et al. 2012, Anila 2013).However, a little attention about misconception of natural selection among students in developing countries including Vietnam. We hypothesized that there are numerous misconception about natural selection among biology students in Vietnam.This study aims to investigate the existing ideas, misconception and attitude about natural selection among biology undergraduate students.

2. Methodology

This is a cross sectional survey among biology undergraduate students. Misconception about natural selection was investigated by open-responses paper and pencil. The present study conducted on two classes consist of 88 college students with (57 first years and 31 final year students). Students are all in the School of Education of Cantho University. These students were taught evolutionary theory as beginner and advanced respectively (beginners who were introduced evolution theory and natural selection after one year, concretely in the high school, and advanced were introduced evolution theory and natural selection 3 months before.

2.1. Instrument Design

A paper instrument for present study was combined from previous question instrument: Open-response using Nehm and Reilly question(2007)(Reily 2007) and Baumgartner and Duncanquestion(2009)(Baumgartner Erin 2009) . Our instrument involved 3 parts:the first part is open-response to investigate the existing ideas and misconceptions, the follow parts of instrument is correct answers to measureunderstand the role of natural selection and the final fart is tick one response on Likert-scale to count attitude ofbiology students about natural selection.

2.2. Data Collection

The study collected data from two classrooms of biology major (one class for the first year students and another class for final year students) in Cantho University. Students were selected randomlya day after finishingtheir studying for anothersubjects and they do not know the study instrument before. Study instruments were delivery directly to each student and they were suggested about 25minutes to complete the questionnaires.

Each student used pencil to write down their opinions directly on the questionnaires survey whether they had ever learnt before about the concept of natural selection. The contents of this questionnaire survey: "Please define natural selection to be best of your ability"(Reily 2007).In the second part of instruments, students responded by tick all corrects answer about the role of natural selection directly on the questionnaires. The final part of the investigation comprised a series of questions with Likert-scale response to measure students' attitude about natural selection. Both of the first year students and final year students carried out the same questionnaires survey and employed the same time to finish their task.

2.3 Data Analysis

In arriving to analysis the first part, we correlated Darwinian's ideas and the definition of natural selection in the Vietnamese text book. Base on the seven key conceptions ideas of definition of Darwinian was proposed by Mayer (1982), we were classified these opinions of students with the same or different key concept as we have just mentioned-points. Because students' answers more than one category,so we recorded the students' opinion for three groups. The information of conception was a means of determining which of student's existing ideas or misconception of biology major undergraduate. A coding rubric was developed base on student answers that focus on three different levels are listed below.

(1) Answers provide a clear statement regarding to Darwinians' idea about the concept of natural selection (response exactly four to seven key concepts of natural selection (Mayr 1982)(Mayr 1982).

(2) Answers provide a part of statement regarding to Darwinians' idea about the concept of natural selection (response exactly three and lower key concepts of natural selection (Mayr 1982)(Mayr 1982).

(3)Answers provide clearly a statement not regarding to Darwinians' idea about the concept of natural selection.

In the second part, in each response records, we calculate frequency by Chi-square test of all correct answers from each statement and thenwe compare the difference between first year students and four year students by Chi-square test.

The students attitude about natural selection was investigated by a series of questions with Likert-scale. Each statement was given score and then the level of attitude was described by mean score. The comparison about attitudes between first year and final year students was conductedusing T-test.All data were analysed by SPSS program.

3. Research Findings

Survey result of first question presents the existing's ideas and misconceptions about natural selection among study sample. There is no correct answers the same ideas or clear statement according Darwinian's ideas about definition of natural selection. There were three kinds of existing idea category and seven misconception category group among biology students (Table 1).

Table 1: Existing ideas, misconceptionsand misunderstanding about natural selection among biology students

Existing ideas	Part of statement regarding to Darwinians' idea	- The advantageous variations will gradually accumulate in the population, and less favorablevariations will diminish. - Individuals which have advantageous variable survive and reproduce will higher than other individuals lead to increasing offspring. - Natural selection is a process of differnetial survival of the fittest in a population.
Misconception and misunderstanding		- Natural selection is a phenomena that environmental factors such as temperature, light, moisture, food resources is effectes livingthing and these livingthing have adapted their environment will be survive and develop. - Natural selection is an impaction of environmental changing to organism and individuals selection that have adaptive genotype and allele frequency. -Natural selection is an natural impaction that is mainly causes reject unadaptable species with environmental stabilization . It makes up a new species within different evolutionary dimentions and genetic diversity. - Natural selection is a selection individual adaptation with their environmental condition and to have higher survives rate than the other in this generation. -Natural selection is an environmental impaction on organisim to remain adaptive organisms and inherite to the next generation - Natural selection is a struggle among organism around the world and their environment to complete their body and evolution. - Natural selection is a rejection of individuals that they canot environmental unadaptation when the environmentchanges.

Table 2.Percentage of correct concept about natural selection among biology students.

Variable	Total	First year	Final year	p
Conception				
Partly	34(38.6)	14 (24.6)	20 (64.5)	p < 0.0001
Misconception	54(61.4)	43 (75.4)	11 (35.5)	

Table2provides the percentages of student's opinion about natural selection among biology students of totally 38.6% have partly definition and misconception is about 61.4%. Theproportion of final year students understand partly about definition of natural selection was higher (64.5%) than first year students (24.6%).Thisdifference between final year and first year was statistically significant p<0.000.

Statement	Answers	First year n (%)	Final year n (%)	P value
Natural selection applies to				
	individuals	11 (19.3)	7 (22.6)	0.715
	populations	12 (21.1)	9 (29.0)	0.402
	everything but humans	8 (14.4)	3 (9.3)	0.555
	all organisms	32 (56.1)	23 (74.2)	0.095
	nothing	1 (1.8)	0	
	I don't know	1 (1.8)	1 (3.2)	0.658
The measure of success in nature is				
	age reached	10 (17.5)	8 (25.8)	0.359
	enemies killed	2 (3.5)	1 (3.2)	0.944
	mating opportunities	24 (42.1)	13 (41.9)	0.757
	surviving offspring	18 (31.6)	24 (77.4)	0.001[*]
	food gathered	10 (17.5)	8 (25.8)	0.359
	I don't know	5 (8.8)	0	0.090
Changes result from				
	organisms learn to modify their bodies	7 (12.3)	10 (32.3)	0.023[*]
	genetic material is passed on	27 (47.4)	18 (58.1)	0.338
	supernatural intervention	3 (5.3)	0	
	random mutation	26 (45.6)	19 (61.3)	0.160
	loss of body parts	2 (3.5)	0	
	I don't know	2 (3.5)	0	

The understanding about natural selection among biology undergraduate is showed in Table 3. Perusal table 3 showed that almost amount of correct understanding in final year student was higher than first year students. The proportion of the answer "I don't know" or the wrong answer in the final year was lower than the first year. However, major comparison between the final year and the first year were notsignificantly difference excepttwostatements"the measure of success in nature is surviving offspring"and "the measure of success in nature isorganisms learn to modify their bodies".
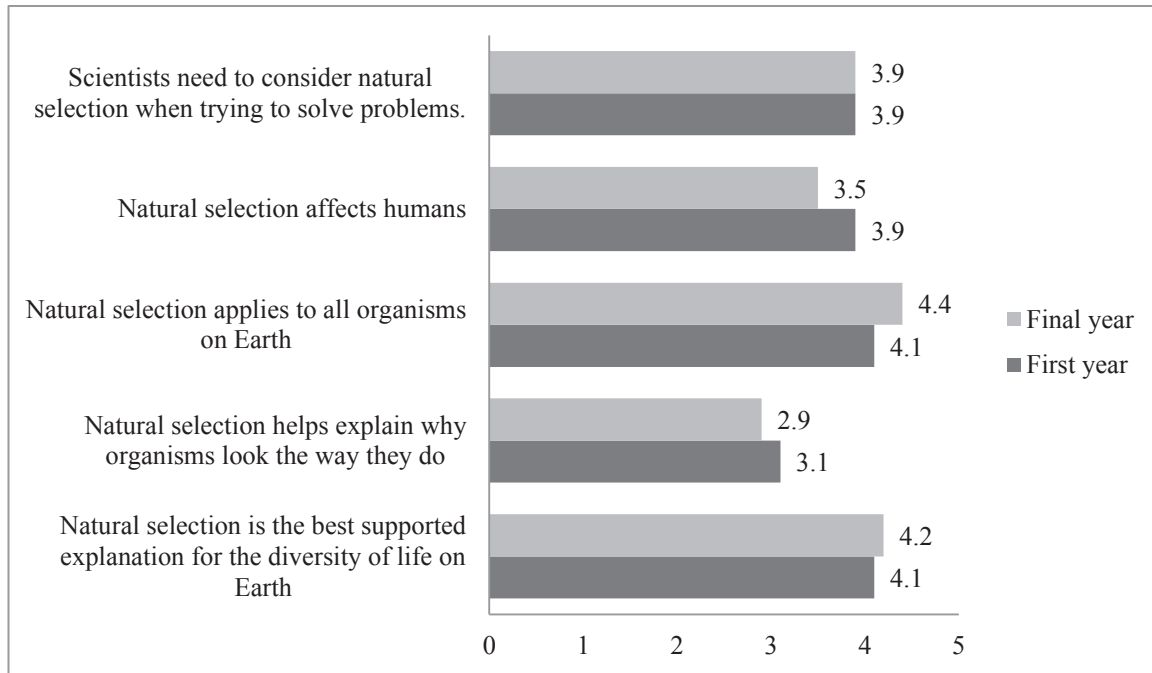
Figure 1: Attitude of student about natural selection

Figure 1 presents the attitudes of biologystudentabout natural selection.Ingeneral, the attitudes about natural selection among biology students were high, which ranges from 2.9 to 4.4. Also it has been seen in Figure 1 thatattitudes about natural selection between the first year and the final year are comparable. For instance, the attitudes about "Scientists need to consider natural selection when trying to solve problems" are the same score and other attitudes statement areas were marginally difference.

4. Discussion

Natural selection is very important for learning and teaching among students especially in biology students. Tothe best of our knowledge, the present study the first study about natural selection among biology students in Vietnam. Our study confirmed various existing's idea and misconception about natural selection (Table1). This is the best evidences to help teachers or lectures who responsibility teaching this course recognize how much their students understood natural selection. It is consistent misconception with previous among biology students in the USA(Reily 2007). This result can be explained by a previous study which demonstrated that misconception about natural selection are not different across countries, region and population(Gregory 2009).

Overall, our result show that there are a little differences to compare the existing' ideas and misconception about natural selection of our students with students in the previous study. To be more specific, the partly understanding the definition of natural selection which reports 38.6% are comparable with Nehm et all 2007 who suggested that in the active class students were employed 37.9%(Erin Baumgartner 2009). However, for the value of people whohandled four keys of conception in their opinion about definition of natural selection was 0%, while previous study namely 3.2 %(Erin Baumgartner 2009). In addition, the percentage of students in our study did not notification one key concept of natural selection which indicates 61.8% are comparable with previous study with 70%(Reily 2007). There are several explanations for this difference. First, this study was conducted in developing countries, which was thought lower education system than developed countries. Second, teaching method in Vietnam is focused on remembering than understanding(Christopher W. Wheeler 2007). Base on that after studying for long time the knowledge of students are almost forget. So selecting suitable teaching and learning activities in order to understand the concept of natural selection is very important. Last but not least, natural selection is a

science concept regarding to theory and practices. But, in Vietnam high school or even university this course is taught by lecturing method, without laboratory for student to observe or research by themselves.

The percentage of misconception in final year is lower than the first year. This lower can be explain by the fact that the contents regarding to natural selection is taught 100 minutes in high school, whereas 1200 minutes in university.In our study, first year students do not have chance to re-learning natural selection, while the final year students have one more time study about natural selection. In addition, the percentage of knowledge of evolutionary theory accounts for 24% totally of biology subject and approximately about 10% of natural selection knowledge in both of high school graduated and entrance university exams. So the final year students study deeply and widely than first year students and they have many opportunities to review the theory of evolution than first year students. The above-mentioned factors show that the knowledge of natural selection is very important for biology undergraduate who will be in charge teaching in the high school.

Understanding about natural selection was high, however, the comparison between first year students and final year students are marginal difference. This problem raises a question about the way of learning and teaching activities of natural selection in Vietnam university because the final year students have more time to study about natural selection. Compare with previous study the amount of correct understanding are not significant difference of students response (Erin Baumgartner 2009).Althoughin past two decades, a growing list of studies have shown students misconception about natural selection.However, students in the Western countries now reduce misconception.The evidence for this result when study this course they had combined learning theory and practice in the laboratory and the result reported that after taking experiments in the Darwinian Snails Lab, the most common was decreased misconception about natural selection. So they suggested that should teaching practice and tools design help student deeply understanding evolution theory from this evidence(Abraham, Meir et al. 2009).

To improve the understanding about natural selection, the attitudes of students about this issue very important. Our observation reported the high attitude understanding about natural selection than first year students. It is not statistically different between first year and final year. This cause is explained by the times of the repeated of learning and the position of student. The final year students have to handle theory of evolution because they will be teaching when they practice in the high school. Comparison attitude of biology undergraduate about natural selection between our students and previous study,with the attitudes score range from 3.0 to 3.6 (Erin Baumgartner 2009).The attitude of students about natural is good, however no one gave correct the definition of natural selection. To explain this reason may be the way of teaching and learning in this course is not sufficient, teaching focus on try to help students remember than understand lead to student easy to forget after gain this knowledge. Another reason is also import that students do not have chances practice in the laboratory and or observation in the real life.

In summary, the present study mention about among biological students in Vietnam. Our finding indicates high proportion of existing's ideas and misconception among Vietnamese students. Understanding the role of natural selection and attitudesabout natural selection between of final year and fist students are comparable. Future intervention should be implemented to improve teaching and learning activities about natural selection in Vietnam.

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