The Effect of Educational Networking on Students' Performance in Biology

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Abstract: The purpose of present study is to investigate the impacts of incorporating Edmodo as educational network, into a classroom setting on the academic achievement of Biology students based on three types of conceptual level comprises of direct, simple, and complex concept. Researcher intended to seek for the reason of improvement in their achievement test for all the three types of conceptual level. A total of 140 Biology students was selected from three secondary schools which were chosen using convenient random sampling to participate in this study and were divided randomly into two groups. A mixed methods design which involved pretest-and post-test was obtained as quantitative data and follow-up with in-depth interview was obtained as qualitative data. Mann–Whitney U tests were used to analyze students' gain scores. The results indicated that students that were instructed by the instruction with intervention performed a larger on the gain scores of all the three cognitive levels; than those instructed by the conventional approaches. Five themes of reason for the difference on gain score between control group and experimental group were found from interview data which encompass self-paced learning, boredom, complex conceptual understanding, interesting and motivation, extra information and; communication and interactivity. This educational network will permeate all facets of the curriculum as a new paradigm of teaching tools.
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Introduction

There is a social network designed for educators and schools, and the system is closed to the public. This kind of educational-based social networking will be named in this study by educational networking. The one used in this study is Edmodo. Edmodo is a private social networking and micro-blogging platform similar to the services provided by "Facebook" and "Twitter". It is specially built for the teachers and students for them to use in their classrooms. Edmodo is more secure if compared to "Facebook" and "Twitter". It provides opportunity for teachers and students so that they able to conduct private social interaction.

Edmodo was founded by Nicolas Borg and Jeff O'Hara in 2008, technologists working at separate schools in the Chicago area, as a secure microblogging medium for students and teachers. In 2010 Edmodo launched "subject" and "publisher" communities, a digital media library, a help center, and a parent account for communicating with teachers, parents, and students. Founders noticed that they had to block many social network sites from students at the

school due to security and privacy of online communication. As an aftereffect of this issue at the school, authors understood that the result was to make a social medium for instructors and learners so they associate securely and safely. This idea gave birth to Edmodo. Edmodo was started in 2008 and has developed to roughly five hundred thousand clients in 2010 and in 2011 to more or less 2.5 million clients.

The Edmodo system is a closed system as in just certain classes were welcome to partake in the examination which security is connected here contrasted and average social network like "Facebook", "Tweeter" et cetera. The group is created, and it generates the code that will be given to students, the students log in and see only posts from those in the class. The site itself looks similar to "Facebook" (even the color scheme) so students are familiar with how it works. Students jump right in with Edmodo because most already have some experience with the format. Like "Facebook", Edmodo allows you to make multiple connections with professionals and other groups. Edmodo is a good alternative to "Facebook" for more manageable and relevant education or specific to a particular class. There are different characteristics in Edmodo that might be of service, as Edmodo has offers that permit instructors and students to impart notes, connections, and records. In addition, teachers can post assignments, grades, conduct polls and post any item in the Edmodo public domain at any convenient time. Edmodo likewise has offers that permit students to view their evaluations, take an interest in online exchanges and correspond with their educators.

As a result, students will be slowly brought into an educational version of the social networking era, thus the ban in social networking will become a thing of the past. Next, educators need to start to seek out about how to use social networking to allow students to stay in a safe environment, helping them learn and grow. Once the online network security concerns are eliminated, the social network for students will be opened wide and become a wonderful new world of learning.

Background

Although Malaysia is fascinated with social networking, there is a dilemma for the school. Many schools have banned it from the school computer to access "Facebook", "MySpace", "Twitter" and other social networking sites. Behind the ban is for two reasons: First, the students visit their favorite sites during school and this would distract them from actual learning in the classroom; school leaders, teachers and parents are concerned that the social network can lead to negative effects. Wrong friends, may have disastrous consequences, resulting in the reality of bullying, murder, suicide, kidnapping and other negative news heard. Even so, social networking is still an integral part of the lives of most young people, prohibit access to all the social networking sites from school may increase the gap between young people and educators.

Though the teachers and students are now pushing learning beyond the classroom through social networking, the move comes with hurdles. Most of the school authorities block access to such sites within their firewalls. School authorities likewise need to face with lacks of determination and inquiries encompassing security issues, legitimate administration, and digital security when they open their routes to long range informal communication locales. Yet numerous instructors who see the worth in informal communication face critical snags to joining it in their school days. These days, both "Twitter" and "Facebook" are obstructed by numerous school computer systems.

It has still remained skeptical about the benefits of social-networking tools in education, and worry that they open the door to Internet-security and cyberbullying problems. For instance, SNS like "Facebook" is excessive of an intrusion into students' personal and social lives for educators to be using it as an educational method. It is good for collaborative, online education with students, but it is not right to merge their personal, private family world with something required for a class activity.

Now, a movement working to seek for a "student-friendly" social networking site is on the rise. This kind of social networking sites is limited in the field of education and specific areas or school use only, the aim is to enable students to use computers to speak over a system with companions in school.

Although it remains unclear what that means for social-networking tools and sites used solely for educational purposes, there is already one of the most popular social networking sites created just for educational purpose identified as Edmodo. In this paper, this kind of educational social network system (SNS) will be named as educational network in a more suitable and understandable manner.

Separated from that, students face challenge in understanding the cell division subject in Science because of the element of visualization such that students had disarrayed between mitosis and meiosis themes (Bahar, Johnstone & Hansell, 1999). Consequently, A few past studies (Law & Lee, 2004; Tsui & Treagust, 2003; Corn, Pittendrigh & Orvis, 2004) utilized the PC aided direction, and they guaranteed that this system may be of service for visual representation and conceptualization of heredity ideas. A substantial number of earlier studies reported that essential and auxiliary school people have numerous origination issues concerning unit science and heredity (Flores et al., 2003; Lewis and Wood-Robinson, 2000; Marbach-Notice and Stavy, 2000). Former studies have demonstrated that people experience troubles in taking in ideas identified with the cell division process (Kindfield, 1994). Unit division constitutes the premise for heredity, propagation, development, advancement, and sub-atomic science subjects in the science education module. Now that it's been brought up, a greater part of the people or educators assessed subjects, for example, gene, DNA, chromosome, and unit division as troublesome to take in points (Oztas et al., 2003). Explore on people's theoretical understandings regularly shows that, considerably in the wake of being taught, students have misconceptions which are not the same as the experimental ideas (Lewis et al., 2000; Yesilyurt and Kara, 2007). Purposes behind these misguided judgments incorporate students' powerlessness to separate between multiplying (replication), matching (Synapsis), and dividing (disjunction), and in addition, figuring out if or not these methods happen in mitosis, meiosis, or both (Smith, 1991). Further confusions incorporate an absence of understanding of essential terms which is confounding between chromatids with chromosomes, or recreated chromosomes with unreplicated chromosomes, and so forth. (Kindfield, 1994). This is a sympathy toward teachers in light of the fact that unit division procedures are principal to the understanding of development, advancement, propagation, and heredity (Chinnici et al., 2004; Cordero and Szweczak, 1994). Precise arranging of numerous ideas in unit science is reliant on the level of comprehension cell division (Smith and Kindfield, 1999). Assuming that higher instruction educational program creators knew learners' confusions, it could be supportive to get ready

viable educating methodologies. Instructors can assume an essential part in showing experimental ideas and, from a constructivist viewpoint, students ought to procure compelling learning about biotic ideas, for example, unit division.

Misconceptions are often resistant to elimination through conventional teaching strategies (Bahar, 2003; Wandersee et al., 1994). Therefore, new teaching strategies, such as conceptual maps, conceptual networks, semantic features analysis and conceptual change texts (Novak and Canas, 2004; Tekkaya, 2003), are chosen and students' conceptions are taken into account when preparing lessons. Student-centered learning activities should be implemented with a conceptual development towards the scientific concept (Riemeier and Gropengießer, 2008). Thus, employment of educational materials, such as computer technologies (Cepni et al., 2006; Yesilyurt and Kara, 2007) and models (Clark and Mathis, 2000; Pashley, 1994) for teaching the cell division processes should assist these students to concretize abstract concepts.

Statement of Problem

According to the syllabus in the Integrated Curriculum for Secondary Schools (ICSS) of Ministry of Education (2003), the use of technology in teaching and learning is a teaching and learning strategy in Malaysia. Simulation and computer animation is a method to teach science concepts that are abstract and difficult. Information technology has the potential to make learning become more fun and effective. The use of computers is to assist in improving the students' interest in science and improve the effectiveness of teaching and learning science.

The point when another idea that has emerged against their early learning or may be ahead of schedule experience, learners might be challenging to accept, for instance, students experience issues separating between cell division, expansion and separation. They may accept that living things develop in light of the fact that their units get bigger (Berthelsen, B., 1999). The part of unit separation in development is crudely caught on. People feel the idea of Science is challenging to take in on the grounds that they believed that just creating that completes breath. Separated from that, a person likewise will confront issues with the fanciful idea like cell division process et cetera. For certain topics, particularly those concerned with more complex areas, such as cell division, photosynthesis, cell respiration, food chain-webs and evolution, in biology teaching can be difficult (Bahar, Johnstone, & Hansell, 1999; Lawson & Thompson, 1988; Yip, 1998). In the last decade, there have been a number of studies focusing on students' misconceptions about cell division at middle and secondary schools (Kindfield, 1994; Yip, 1998). Pupils and teachers consistently place cell division near the top of these "ladders" of difficulty. It has been reported that cell division processes are poorly understood at all ages and levels of students (Smith, 1991; Lewis and Wood-Robinson, 2000). This theme is taught by beginning with grade school levels. It is additionally recognized by most educators to be a standout amongst the most risky ideas in the science (Oztaş et al, 2004).

Thusly, new and emerging field that should be incorporated in teaching and learning particularly Educational network as a teaching and learning tool in order to increase performance in learning Biology as there are many problems faced by students such as hard to visualize or imagine the process. Despite of that, there were several reasons to introduce this emerging technology into the teaching and learning process. One of it, of course, social networking are becoming popular due to rapid development of information and communication technologies that has brought

changes in various pedagogical, technological applications and processes. Currently, social networks are being adopted rapidly by millions of users most of whom are students with a great number of purposes in mind (Lenhart & Madden, 2007; Selwyn, 2007a). Moreover, studies showed that social network tools support educational activities by making interaction, collaboration, active participation, information and resource sharing, and critical thinking possible (Ajjan & Hartshorne, 2008; Mason, 2006; Selwyn, 2007a). Hence, using social networks in educational and instructional contexts can be considered as a potentially powerful idea simply because students spend a lot of time on these online networking activities.

However, social networks can be detrimental towards the context of education in the form of scarcity of security, privacy and feasibility. For instance, exploitation of a user's private information and distraction of 'pop-up' advertisement. Separated from that, visit rooms, texting stages and informal communication destinations have all been distinguished via scientists as "online situations" where youngsters might be sexually annoyed, prepped by pedophiles, and unwittingly experience savage or explicit materials (Fleming et al. 2006; Livingstone & Helsper 4 2007; Ybarra et al. 2007a; Ybarra et al. 2007b). Therefore, this sort of average informal organization was disgraceful to join as an instructional instrument.

Thus, Edmodo is used as the educational network which provides teachers and students a secure place to connect and collaborate, share content and educational applications, and access homework, grades, class discussions and notifications without any other distraction like ads and irrelevant information but just merely educational related material. Teacher as the moderator can fully control and monitor the page created in Edmodo.

According to the background problems that were discussed, this study will focus on the niche area about using Edmodo as an educational network in teaching and learning towards students' performance based on conceptual understanding of cell division in term of level of thinking order. There are many studies dealing with the effect of SNS on students' achievement. However, none of those studies use educational networks as a tool to ascertain the effect on students' achievement specifically in conceptual understanding.

Objective of Study

Based on the pressing need of the problem that needs to be addressed urgently, the following are the objectives of the study

Thus, the objectives of the study are as follows:

To determine whether there is a significant difference in students' performance between control group and experimental group in understanding of direct concepts in Biology.
   i. To determine whether there is a significant difference in students' performance between control group and experimental group in understanding of simple concepts in Biology.
   ii. To determine whether there is a significant difference in students' performance between control group and experimental group in understanding of complex concepts in Biology.
   iii. To ascertain the reasons of the gain score difference between control group and experimental group on direct concepts, simple concepts and complex concepts.

Method

An explanatory mixed methods design (also called a two-phase model; Creswell, 1994) consists of first collecting quantitative data (paper and pencil test) and then collecting qualitative data (interview) to help explain or elaborate on quantitative results The quantitative some piece of this research is the design used for the research was the quasi-experimental design since the subjects were not assigned randomly to the experimental and control groups (Creswell, 1994).

The basis for this methodology is that the quantitative information and outcomes give a general picture of the exploration issue; more analysis, particularly through qualitative data accumulation, is required to refine, develop or clarify the general picture. The academic achievement of biology students was the dependent variable while the types of instructions (Conventional approach and educational networking adjoin approach) were the independent variables.

Students from three secondary schools who were enrolled in a biology class participated in this study. One hundred and forty students who signed an informed consent form were randomly divided into control and experimental groups. Only data from those students were used in the analysis. The sample used in this study was a convenience random sample which means that the three schools due to time constraint, availability of resources and it's easily accessible to the researcher in the Kuala Lumpur district, Malaysia. Thus, the generalization is limited.

Students of Form 4 biology classes from each school were selected for this research project and divided each class into two groups randomly. The subjects are 140 students who were selected from three schools. Gender issue was not be involved in this study. The subjects were randomly assigned to either the control group (traditional face-to-face instruction) or experimental group (educational, networking as an adjoin of instruction) by using a table of random numbers and applying those numbers to the students in each class. Classes selected without random assignment but each class will be divided randomly into two groups. This method of assignment would not disrupt classroom learning and reduce threats to internal validity. Educational network was used as an additional teaching aid which will be applied after the traditional "face-to-face" instruction (same with control group) on the spot or anytime anywhere. 70 students were assigned to the control group and another 70 to the experimental group. Patton (1990) suggest a minimum sample of eight "in-depth" interviews for each subcategory to reach saturation of main themes. Eight students from the control group and nine students from experimental group students were picked by purposive sampling as participants for interview due to time and cost constraint. Qualitative sampling is especially suited for purposeful sampling, in that researchers are able to select information-rich cases that will fully respond to the questions under study. Along these lines, size and particular cases rely on upon the study's purpose (Patton, 1990).

The data collection instrument was a paper and pencil test which consisted of pre-test in a form of 40 items included objective and multiple choice objective questions. This was conducted for one hour and post- test in a form of objective and multiple choice objective questions which is a randomization of questions from a pre-test questionnaire and was conducted in an hour too. The pretest was done to find out whether the two groups were performing at the same level as to determine the homogeneity of variances by using a Levene's test. Since the resulting P-value of

Levene's test is more than the critical value of 0.05 for all the three conceptual level, it is concluded that there were equal variances between experimental and control group. These both tests were aimed at finding out the performance of students before and after the experiment. Interview in the form of open-ended questions was conducted on the informants after their data have been analyzed. Data obtained from the interviews were transcribed and coded and then analyzed using content analysis to help bring out the reason of difference in biology achievement of students based on cognitive level. The interview covered a range of issues as far as the Educational network was concerned from the students' points of view to look for the reason of contrasts of gain score in the result between control and experimental group.

Validity and reliability of the instruments

Regarding to validity, the content validity of the pretest and post-test was examined and verified by two experienced senior teachers who had been teaching for more than 5 years. Items were discussed with two experienced teachers in the content area and their expert opinions were used to determine and ascertain validity of the instruments after analyzed these questions and affirmed that the content of the test was representative of the coveted test fields. Apart from that, in order to ascertain the accuracy and consistency of the instrument with regard to reliability, the *test-retest* reliability procedure was performed (Suter, 1998). Suter (1998) and Nkpa (1997) also contended that by administering the same instrument again to the same subjects over a period has passed and measurably looking at the outcomes, proof of reliability would be observed. A limited research project with a few subjects (30 Form Five students that shares similar characteristics with the target participant randomly sampled) was undertaken as a pilot study. Participants in the pilot study were required to take the pre-test followed by post-test after two weeks. The purpose of this was to be able to consider information about essential adjustment to the instrument that might come about results from analyses of the pilot study results. Pearson Product-Moment Correlation (*r*) calculated was 0.991 which means highly correlation. The internal reliability among the items on the scale was obtained through Cronbach's coefficient α. Cronbach's coefficient α is a preferred statistic for measuring the internal consistency of test items, which is characterized as "the degree to which test-takers who answer a test item restricted react to different item the same way" (Rankle, Nerve, & Borg, 2003). As stated by Hatcher and Stepanski's (1994) claim, a Cronbach alpha coefficient even low as 0.55 can be accepted for social science studies. The internal consistency estimation for the instrument of paper and pencil test was (using Cronbach's alpha) calculated and found to be 0.636. Thus, the tests fulfilled this criterion. The test was utilized as an instrument for the pre-test and post-test in this study. The instruments for gathering qualitative information, such as interview protocols, were developed by the researcher and validated through an expert panel approach. Pilot tests were conducted with three students to ensure the length and clarity of the interview questions.

Procedure

Before conducting the study, approval was obtained from the Educational Planning Research Development (EPRD), Kuala Lumpur District Education Department and school authority.

A week before the treatment, students who participated in this study took the pretest. In order to keep the sampling process random as well as to block the effect of students' pre-existing

knowledge, students having the same pretest scores were randomly assigned into two groups.

Data revealed that 98% of the students who enrolled in this study had computers connected to the Internet at home and almost an average of 4 hours per day spent on social network. Also, as part of the official curriculum, the students studied Information and communication technology learning (ICTL) since Form 1 and by the time of the study, had acquired the skills and proficiencies necessary to use computers and no training needed to teach on it.

Each class was divided into two groups randomly which consist of control group and experimental group. Control and experimental groups were exposed to 3 consecutive weeks of teaching based on the government syllabus which was handled by the assistance of the subject teacher in schools. A 40 minutes duration representing a period, 5 periods per week was used for the consecutive weeks of teaching. All participants were taught by their own teacher who was briefed by the researcher about the procedure to ensure that the same content was covered and to eliminate the factors other than the teaching mode (i.e. Educational network versus non-educational network) that might interfere with the results.

For the control group, static simulation printed on paper was used as a teaching and learning tool while experimental group will get their simulation video in Edmodo. The control group was limited to "face-to-face" communication while the experimental group was involved in online communication through Edmodo platform.

To ascertain the students' level of achievement, a pretest was given to the student on the topics under focus a week before the treatment. The two groups were provided with similar paper and pencil test on the certain topics involved, which is cell division during the investigation. The paper and pencil test was collected and graded for analysis. Traditional "face-to-face" instruction was used to teach the students that constituted the control group while the other constituted the experimental group will be exposed with an adjoining with educational networking by using 'Edmodo'. The post-test was administered a week after these topics were completed in class lesson. The whole picture of quasi-experimental (quantitative) procedure can be illustrated in Figure 1.

Figure 1: The distribution of sample

Control and experimental groups were exposed to three consecutive weeks of teaching based on the government syllabus which was handled with the assistance of the subject teacher in schools. A 40 minutes duration representing a period, 5 periods per week was used for the consecutive weeks of teaching. To ascertain the students' level of achievement, a pretest was given to the student on the topics under focus a week before the treatment. The two groups were provided with similar paper and pencil test on the certain topics treated during the investigation. The paper and pencil test is collected and graded for analysis. Traditional face-to-face instruction was used to teach the student that constituted the control group while the other group constituted the experimental group had the instruction adjoin with educational networking by using 'Edmodo'. The post-test was administered a week after these topics were completed in class lesson.

On the basis of these achievement test data, the interview section of the study sought to further explore the reason or factor that affecting the difference between the control group and the

experimental group. At the end of the experiment, interviews were conducted by using the instant messaging (IM) applications MSN Messenger or Yahoo Messenger. Therefore, this type of interview referred to as IM interviews. Nine students from the experimental group and eight from control group were selected for interviewing. Selection was based on the student's conceptual understanding in working with the educational network, namely Edmodo and their degree of success in the experimental group while selection of convenience sampling was done for control group. For this purpose, interviews from selected students (N = 17) from both groups will be analyzed. This comprises of three instances (E1, E2 and E3) where their test gain scores showed improvement on direct concept were picked from experimental group, three instances (E4, E5 and E6) where their test gain scores showed improvement for simple concept were picked from experimental group, three instances (E7, E8 and E9) where their test gain scores showed improvement for complex concept were picked from experimental group, and eight (C1, C2, C3, C4, C5, C6, C7, and C8) where their test scores showed improvement of the three types of concept were picked from control group.

The seventeen subjects above were contacted by e-mail or phone and agreed to an hour long interview with the researcher. At the start of the interview, the researchers introduced themselves and explained the purposes of the interview. Then, the researchers ask the prepared questions which are open-ended questions and audio-taped the interview.

Data Analysis

Items are classified into 6 categories based on Bloom's Revised Taxonomy of cognitive domain in 2001, which includes remembering, understanding, applying, analyzing, evaluating and creating. Direct concept was classified as a category of remembering, while the simple concept was classified as a category of understanding. Other categories were classified as a complex concept. These concepts were only for the topic of cell division in biology subject. Frequencies calculated from the data collected by the test line and then measured using the percentage. The difference between pre-test scores and post-test scores of respondents was calculated as gain score. A positive difference between pre-test scores and post-test scores have been interpreted to show a positive performance, no difference between pre-test scores and post-test scores indicated the performance of neutral and negative differences between pre and post test scores test scores indicated a negative performance. The comparative results of academic performance between the control group who undergone traditional "face to face" instruction and experimental group who undergone with education network 'Edmodo' were testified by using Mann–Whitney U to determine the statistical differences at the level of 0.05. Statistically, violations of the assumptions underlying the t-test are more likely to go undetected with small samples. On the other hand, normality of distribution, nor homogeneity of variance for the two groups in the study are not required in the Mann–Whitney U test. The Mann–Whitney U test was therefore used instead of the t-test because of its usefulness with small samples. The Mann–Whitney test was used to seek out if there were any statistically significant differences in the academic performance of the control group and the experimental group for all three types of cognitive level. Comparison of gain score between two groups was used in the result to be analyzed. Gain score was calculated from the difference between post-test and pre-test score. 0.05 significance level was used for all statistical tests in this study. The reason for using more than 0.05 confidence level in this study is to reduce the opportunity to make Type I errors, which means

the difference or association which claims to exist among the people when they do not (Blaikie, 2003).

Data collection methods used were interviews and paper and pencil tests. Before starting to analyze the data, inspection of data had been implemented. The data were screened to detect an incorrect data, missing data and outliers and to test for normality (if the data are normally distributed in the range). Missing data were replaced by the series (the mean substitution method suggested by Tabachnick and Fidell, 2001) if there are any missing data. Outliers (data with values well above or below the majority of other data) were not deleted.

After data screening procedures were carried out to find out missing data, outliers and assumptions of statistical analysis, researcher have found out that there were no missing data detected from the data collected. Outliers were detected for gain score of simple concepts. All the outlying cases were not altered or deleted due to keeping the originality of the data. Furthermore, nonparametric procedures are unaffected by outliers because they typically use only the ranks of the response variable values, instead of the values themselves. The most crucial step of data screening was to observe normality and homogeneity of variance to ensure that the screened data sets met the assumptions for statistical analysis. Shapiro-Wilk test was conducted to examine the normality of distribution for gain score of experimental and control group based on direct, simple and complex concept. The result indicates all of the distribution were not normal (p< o. o5) except for a gain score for the direct concept in experimental group which p-value = 0.095. In order to detect a true difference between the two groups of students, the researcher decided to keep original data, rather than transforming the original data to fix the uncertainty in normal distribution. To test for homogeneity of variance, Levene's test was conducted. Levene's test for equality of variances for pre-test of direct concept, simple concept and complex concept was found to be violated for the present analysis, Levene's test indicated equal variances F (1,138) = 0.146, p =.703; F (1,138) = 0.055, p =.815; and F (1,138) = 0.199, p =.657 respectively.

Quantitative data (e.g., Median, standard deviation, frequencies, percentages) was analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0. Apart from basic descriptive analysis, the main analytical techniques implemented are Mann-Whitney U was used to determine differences in their respective ways between experimental and control groups of gain score. Data obtained from the interviews were transcribed and coded and then analyzed using content analysis to help bring out the reason of difference in the biology achievement of students based on a cognitive level.

Results

Research Question 1

Is there any significant difference in students' performance in understanding of direct concept in Biology between control group and experimental group?

From Table 1, a Mann-Whitney test indicated that gain score for the direct concept was greater for student constituted the experimental group who were undergoing for adjoin with educational networking by using 'Edmodo' (*Mdn* = 7.00) than for students that constituted the control group

who were just involved in face-to-face traditional instruction (*Mdn* = 3.00), *U* = 695.0, *p* =.000, *r* =.62. Therefore, there is a significant difference in students' performance in understanding of direct concept in Biology between control group and experimental group. Hence, the null hypothesis can be rejected.

Table 1: The results of the Mann–Whitney analysis of students' gain scores of the control and experimental groups based on direct, simple and complex concept.

The study group		N	Median	U	Z	p-value
Gain scores for direct concept of group	Experimental	70	7.00	695.0	-7.392	0.000*
	Control	70	3.00			
Gain scores for simple concept group	Experimental	70	3.00	885.5	-6.924	0.000*
	Control	70	1.00			
Gain scores for complex concep the group	Experimental	70	1.00	1769.0	-3.048	0.002*
	Control	70	1.00			

Significance *p < 0.05.

Research Question 2

Is there any significant difference in students' performance in understanding of simple concept in Biology between control group and experimental group?

From Table 1, a Mann-Whitney test indicated that gain score for simple concept was greater for student constituted the experimental group who were undergoing for adjoin with educational networking by using 'Edmodo' (*Mdn* = 3.00) than for students that constituted the control group who were just involved in face-to-face Traditional instruction (*Mdn* = 1.00), *U* = 885.5, *p* =.000, *r* =.58. Therefore, there is a significant difference in students' performance in understanding of simple concepts in Biology between control group and experimental group. Hence, the null hypothesis can be rejected.

Research Question 3

Is there any significant difference in students' performance in understanding of complex concept in Biology between control group and experimental group?

From Table 1, a Mann-Whitney test indicated that gain score for complex concept was greater for students who constituted the experimental group who were undergoing for adjoin with educational networking by using 'Edmodo' (*Mdn* = 1.00) them for the student that constituted the control group who were just involved in face-to-face Traditional instruction (*Mdn* = 1.00), *U* = 1769.0, *p* =.002, *r* =.26. Therefore, there is a significant difference in students' performance in understanding of direct concept in Biology between control group and experimental group. Hence, the null hypothesis can be rejected.

In other word, a significant difference between gain scores has been interpreted to show a difference performance for all the three kinds of cognitive level between control and experimental groups.

Research Question 4

What is causing the difference in the gain scores between control group and experimental group on direct concepts, simple concepts and complex concepts?

The themes and sub-themes of the analyzed and synthesized data from interviews are presented below, organized around the aforementioned research questions. There are several themes that can find out from the interviews as follows:

- Fostering self-paced learning
- Get rid of boredom
- Promote better complex conceptual understanding
- Interesting and motivation
- Exposure to extra information
- Enhance communication and interactivity

These few themes will be elaborate further in the below.

Fostering self-paced learning
The first theme was that technology could foster self-paced learning. Eight out of seventeen interviewees or about 47% of the students commented that they found the technology to be very useful because of its efficiency. For example, three students from the experimental group remarked as Table 2.

Table 2: Excerpts about 'Fostering self-paced learning' from qualitative interviews with participants.

Participant	Interview Excerpt
E1	I can learn at my house or wherever I want to just use my iPad and at any time I want also can learn at my own pace
E2	You can work at your own pace and work established in a way that obviously you can understand... Web lesson also includes some video clips or simulation to see
E3	You can come back again and again until you understand. It is all at your own pace and more interesting than the usual stuff…
E4	Web pages are presented in a way easy to follow that; you can re-read what you do not understand. It is placed in a way in which the content arranged in the appropriate cate
E7	I can learn based on my time and my learning speed which is quite slow…
C4	… sometimes, I could not keep it up with the speed of the teacher's teaching… then, loss finally in nowhere else…
C6	… I cannot play and replay if I cannot get understand about the lesson well… I will fe embarrassing if I keep asking the teacher to explain further.
C8	There is time limit, no matter where you are, who you are, you cannot just learn anyw and anytime you want….

Based on transcribed interview, it is concluded that self-paced learning was one of the factors in the result differences between experimental and control group.

Get rid of boredom

Students comprise of four out of nine in experimental and two out of eight in the control group also indicated that integration of some social media in education setting   helped bring the real world into learning and gave "a more hands-on approach to learning," Hence, boredom in the teaching and learning processes could be eliminated. The followings are the response given by interviewees as Table 3.

Table 3: Excerpts about 'Get rid of boredom' from qualitative interviews with participants.

Participant	Interview Excerpt
E3	It is much more fun than sitting in the classroom and listen... and as a useful addition source of information learning ... I enjoyed the lesson by clicking on the keyboard be it helps me learn more and more interactive.
E4	I'm more interested and like to use social networks (education) to study... Instead of listening to the teacher and almost sleep, and it really is so boring... I think I've learn better from edmodo after teaching the class.
E8	It's quite boring in the class in the new generation of technology… No computer use too plain…
E9	… I'm getting involved in the learning process by using a computer (Edmodo), not j passive listener…
C3	It is very boring by using books, chalk and whiteboard to teach… in this era of technology…
C7	Sometime, I do get sleepy and I don't know what my teacher talking about…

After analyzing all the above interview excerpt, boredom elimination is another factor that can affect the result differences between experimental and control groups.

Promote better complex conceptual understanding

A significant theme that emerged was that the use of educational network enabled diverse approaches to teaching and learning, sometimes in ways that could not be achieved by traditional textbook-based methods. About 41% of the interviewees encompass five from experimental and two from control group cited this argument, and provided examples and a rationale for how educational networks could improve ways of teaching and learning. Using technology to provide concrete examples or visual materials such as animated models and simulations for abstract concepts proved to be effective for student learning, as exemplified in these comments in Table 4.

Table 4: Excerpts about 'Promote better complex conceptual understanding' from qualitative interviews with participants.

Participant	Interview Excerpt
E1	… it is easier to understand, the picture is more than thousand words…
E3	... There diagrams and more to make learning easier…
E4	Animations make the job of understanding easier... There are also some items even g (educational games) website (edmodo) that are not included in the class.
E5	It is easier to understand and be understood as you can see the animation process (ce division) at your own pace and you do not have to listen to the teacher grumble with piece of paper... difficult to imagine than just a piece of some note.
E6	We do not have to do much thinking. It is difficult to understand the process in the classroom and then I lose some while later losses... We can do revision or to find ou from the website (Edmodo) which has an example that can be used. I think it's great.
C2	I really cannot understand the process of cell division due to 'abstract'... Animation c simulation helped me to understand the concept better. I have no problem with direc easy concept which I can learn from the book.
C5	I cannot really catch the whole process especially meiosis…

Therefore, citation from the respondents indicated that complex concept can be one of the reasons for result differences between experimental and control groups.

Interesting and motivation
Another significant theme was that educational network technology could increase student enjoyment of learning and confidence in their ability. About 24% of the students constitute of three from experimental and one from control group cited this reason as to what they found. Many students emphasized using games or other "fun" ways, from virtual reality to simulation and to the Internet.

Table 5: Excerpts about 'Interesting and motivation' from qualitative interviews with participants.

Participant	Interview Excerpt
E1	This approach is much more interesting than learning from textbooks and most of th time…
E6	… And website (Edmodo) is easy to use and I learned a lot more because I find it is more interesting as I play with "Facebook"...
E8	It is more interesting than learning from textbooks... It helped me learn more by simulation… even game (educational game)…
C1	I'm sick of lectures in the classroom, they are important, but the computer should be to add variety of subjects. They are a good way to review and learn, but do not have the interests of the class lesson… meiosis processes give me most problem after all.

From Table 5, In short, interest and motivation in learning were depicted primarily as a cause of result differences between experimental and control groups.

Exposure to extra information
Another salient theme was that educational network provided learning opportunities to enhance knowledge construction beyond regular school lesson and that technology changed the way people learn. One interviewee from each group stated that technology allowed for an easy, fast access to information. Other than easy access to information, they thought that technology could make content easier to understand:

Table 6: Excerpts about 'Exposure to extra information' from qualitative interviews with participants.

Participant	Interview Excerpt
E3	I can find some extra information to make me more clear about the lesson… quite ni
C1	It's all I can get in the class…

From Table 6 above, it is clearly understood that respondent from experimental group can search for more extra information whilst respondent from control group unable to get extra information but just limited to the material given in the class. Hence, extra information became one of the causes of result differences between experimental and control groups.

Enhance communication and interactivity
Communication and interactivity was another important argument for educational network technology integration as cited by four of the interviewees merely from the experimental group. They recognize that the world has become technologically oriented; hence, 'virtual' communication is becoming more important nowadays and communication and interaction undeniably play a crucial role in learning process. Demonstrated that people gave lean toward the alternative communication channels they were using (text, chat, etc.), And recommending that learners are making their own social network to support their learning, tailored to their particular needs and using the technologies which suit them rather than being compelled in point and in the class by means of up close and personal correspondence.

Table 7: Excerpts about 'Enhance communication and interactivity' from qualitative interviews with participants.

Participant	Interview Excerpt
E2	... I can also communicate with teachers or friends (through Edmodo).
E3	… It is also more interactive and has good content.
E5	I like (Edmodo) very much because it is so similar to "Facebook" with all blue face communication... not a barrier here.
E6	... If you do not understand something, you can reply or chat with your teacher.

From Table 7, although there were merely respondents from experimental group who quote about the communication and interactivity factor, it is still one of the crucial points in result difference between experimental and control group.

Following the quantitative analysis, the conclusion was that instruction with adjoin of educational network does improve students' performance in all the three levels of cognitive. The qualitative analysis allows the extension of this conclusion to include the factors of the difference in their achievement test result between experimental and control group.

Discussion

Generally, although both groups showed positive difference between pre-test scores and post-test scores which have been interpreted to show a positive performance, the findings indicate that using the educational networking as integration in teaching of biology has a positive effect on secondary school students. The findings are presented as the effect of the educational networking on students' achievement in Biology's concept. From the results of the group experiments, it is proven that the learning achieved by the experimental group is higher than that of the control group, and moreover the difference is significant for all three concepts, which included direct, simple, and complex concept which is contradicted with findings by *Banquil and Burce* (*2009*) who found a continuing drop of grades among student users of social networking sites. Also, contradiction occurs with Boogart and Robert (2006) who declares that the use of SNSs and "Facebook" detrimental effect on academic performance of student users.

The experimental group that applied the educational network as integration in biology teaching thus achieve better learning than their control-group counterpart that applied merely traditional face-to-face teaching. That is, the educational network presented here is helpful in improving the achievement of biology learning among secondary school students.

There are some factors found out on the causes of the differences of the achievement test between two groups as follows:

As platform of Communication, collaboration and sharing of learning resources and knowledge

Slow learners and introvert students sometimes open up. Educators have widely acknowledged the value of community building and social interaction with and among students, in both face-to-face and online classes (Palloff & Pratt, 2007; Chickering & Gamson, 1987). Beach and Doerr - Stevens (2011) confirms the possibility that social networking sites can have a positive effect on student achievement , stating that the nature of collaborative social networking sites can have a positive effect on the development of civic engagement among students.

There is combination of informative and interesting. By the scenario of simulation teaching activities with its real, vivid, colorful, extremely interesting and attractive, students can really achieve the purpose of entertaining. Furthermore, this educational network used a variety of Web 2.0 tools to communicate and interact, collaborate on projects in a safe environment and create and develop new perspectives in the study. Education network will improve the efficiency and quality of student collaboration. They will have a better meeting of communication and the

ability to share information quickly, and learn to work in teams.

Interactive

Interactive activity undeniably will affect students learning. Astin characterized engagement as the measure of physical and mental vitality that the person dedicates to the academic experience' (Astin 1984) are related to student engagement. They are:

1. Student/faculty contact;
2. Cooperation among students;
3. Active learning;
4. Prompt feedback;
5. Emphasizing time on task;
6. Communicating high expectations; and
7. Respecting diversity.

Many studies show that academic achievement can be added to enhance student engagement, and accordingly, their participation has been identified as a significant predictor of academic achievement (Zhao & Kuh , 2004, p 1332 ; Wise , Skues , & Williams , 2011) . The relationship between academic engagement and academic performance supported by Junco, Heiberger , and Loken (2011). Support for the relationship between student engagement and student achievement in relation to the impact of social networks provided by Hoffman (2009) when he states that one of the positive attributes of social networks is the impact on the affective aspects of the learning environment, and the impact on motivation and student involvement.

Education network can act as an interactive learning multimedia network classroom, you can highlight the bi-directional exchange of teachers and students in teaching activities, both reflecting mastery of teaching, and also guarantee the student-centered approach. First, human-computer interaction, each student can use different learning software according to their needs, and adjust their learning progress according to their own understanding, reading ability, and reaction speed, the same process of teaching, learning progress of each student can be different, in order to achieve the purpose of self-paced, individual learning needs. Second, the interaction of students and teachers, the use of interactive media, teachers and students "dual-channel delivery of information, teachers and students can conduct individual discussions, the teachers through educational network can text or talk to student to answer or enter an answer when the student inquire questions. Educational network also enables the quiz or test to be marked automatically immediately for objective and correct or wrong type of question. Also, according to the students' problem-solving situations, allowing students to redo it again, or the correct answer is displayed by educational network. This rapid feedback learning, improve student learning efficiency.

Apart from that, educational game that exists in the educational network will promote more interactivity. This statement is supported by Annetta *et al*. (2009) who observed that students who played an educational game intended to show heredity ideas were more engaged in their work than a control group. This is same as the findings in an interview stating that they like

about the educational game in the educational network.

Boredom happened when the situation in the class is dull, as sound out by some respondents in the interview. Subsequently, it compared with the discoveries by Çimer, (2004) who found that educators' styles of Biology teaching and teaching techniques and strategies might additionally be factors that influence students' learning in biology.

Self-paced

Apart from that, it promotes self-learning, self-development of teaching ideas shine with the light of the times, independent study, and the cultivation of self-awareness is the basic requirements of the new century education. Teachers to emancipate the mind, let the students to learn, explore and master the teaching objectives. But autonomy is not a hands-off. Teachers should be designed for students learning platform, designed for students learning plan to ensure that students of teaching resources provided situational actively observe and reflect the thinking based on the issues raised. Student autonomy is also reflected in the various functional uses of the interactive media, such as the requirement to repeat the jump to learn, requiring retrieval, demand answers, and so on; may also take the initiative to master the process of learning, in order to complete the learning goal. Autonomous learning more space is greater flexibility, wider room for students' free ride, more conducive to the creation of the talents.

In a traditional classroom, students concentrate on school learning, the learning time and space are greatly restricted. In the educational network, all resources are shared on the network at any time, anywhere, as long as you think it is necessary, you can be free to learn. Besides, there will be continuity in class discussions. This is because the school lesson met only twice a week for about four hour, online chat was used to continue conversations begun in class.

Moreover, it has given students to ask questions without feel stressful. Oftentimes, first-year and/or introverted students are less comfortable asking questions in class. The dynamics of online chat in the Edmodo permit learners to feel more great making inquiries given the psychological obstruction inherent in online communication (Kruger *et al.* 2005).

Promote higher order thinking of abstract concept

Higher order thinking about the abstract concept becomes a component relates with Lazarowitz and Penso (1992) who cited that the biological level of organization and the abstract level of the concepts make learning biology become challenging. This new paradigm of educational innovation can foster cognitive thinking by providing a safe alternative to dangerous, difficult, expensive or specialized experiments; and 'Cleaning' data builds confidence in the analysis. Apart from that, it helps to visualize difficult concepts by using color, varied fonts and text sizes as visual cues, emphasizing the structure of information in the form of simulation. This could also help to focus attention and evaluation of information or assists comprehension. Besides, it is backed by report expressed that unit division technique are defectively comprehended whatsoever ages and levels of learners (Smith 1991; Lewis and Wood-Robinson 2000).

Levine Vygotsky: the individual's thinking is a product of the social and historical context, he claimed, language is a tool system regulating development of thinking, this is very much in line with distributed cognition research, it shows that the individuals who do better in cognitive occurred in the system, the cognitive occurred in the system may include a person, including objects and Technology (Salomon, 1973). Therefore, cognitive thinking is best developed with various mediums incorporated together to get a better result. Furthermore, Jonassen (2000) believes that manufacturing hypermedia products "allows children to construct their own understanding, rather than explain teacher understanding of the world." However, for the learning of new skills, due to join the teacher's understanding or useful, and often essential.

A lot of work is committed to improve the sharing or social thinking media rather than directly promote the individual's thinking skills. However, the higher-order thinking is not only the social activities of individual activities. To promote learner to participate in collective higher order thinking skills (higher order collective thinking) is also a way to teach thinking skills.

Enthusiasm

The researchers had expected that the unconventional teaching mode would motivate the students to learn. The 21st century is the era of Being Digital. The computer network at the core of modern science and technology will provide us with unprecedented opportunities for development and broad prospects, and people, and it is closely linked. Web-based learning arouses learners' interest and motivation in learning; motivation and interest are crucial factors determining learning outcomes (Lucking & Manning, 1996; Richard, 1997). Through successful collaborative activities and knowledge sharing individual cognitive capacities can be amplified and cognitive burden imparted (Richard, 1996).

In other word, it can increase learners' interest and intrinsic motivation for learning and facilitate cooperative or collaborative learning. This theme has been cited by some respondents, such as excerpt from one of the respondents in the experimental group, "And the website (Edmodo) is easy to use and I learned a lot more because I find it is much more interesting as I play with "Facebook"". This statement is reiterating that educational network really enhance students' motivation towards learning.

Conclusion

Now, a movement working to create a "student-friendly" educational networking site is on the rise. This type of social networking sites is limited in the field of education and specific areas or school use, the purpose is to allow students to use computers to communicate through the network with peers in school or class specifically. When teachers and parents feel peace of mind for their kids in using the educational network, they simply cannot let such sites as "Facebook", the social networking service for schools. Hence, it is the best solution to create a specialized social network for educational purpose merely.

We hope the results of this study can encourage more science teachers to incorporate an educational network-based learning environment to enhance instruction. This study provides the first piece of controlled experimental evidence that uses educational network, namely Edmodo in educationally pertinent ways can expand student engagement and improve grades, and

consequently, that it could be utilized as an educational tool to help students reach desired learning outcomes. We provided evidence to infer that people and school were both exceedingly occupied in the learning process through communication and connections on Edmodo. As there is continuing growth in the use of social network with students, it is trusted that this study will propel further controlled studies of educational network to evaluate how this emerging technology can be best used in other subject educational settings.

The study aims at probing for the influences the educational network as integration in traditional instruction may bring for effectiveness in biology classes at secondary schools. After the practice of solid curriculum, some encouraging strong points emerged:

1. Promotes enthusiasm toward learning sciences via simulated processes and it makes individualized learning/ teaching occurs easily among clicks.

2. The repeatable operation powers cognition and help build up biology conceptions more efficiently.

3. Apply the adjoin of educational network in science teaching achieved much better learning than just merely the traditional teaching.

4. It fosters enthusiasm in learning and enhance communication and interactivity.

Today, people have a glimpse through the Internet how to access, control, transmission, and use digital information. Information, digitization means tomorrow will become the people's ability to earn a living, must have basic skills. Therefore, we should strengthen the education network construction, the development of online education to improve the quality of education and teaching, by optimizing the process of education and teaching mode, and train highly qualified personnel, so as to adapt to the needs of the future society.

This method of learning in this study can be classified as blended learning. The future of blended learning will very much depend on the pace of change in school and the level of commitment to doing things differently. Introducing the online components of blended learning does require investment, but the cost savings could be significant in the long term. It also represents a very positive way of targeting learning and development, but it requires sponsorship and commitment at the highest level to really exploit its full potential. On the technology front there are new developments all the time: some will work and others may be more experimental. One of the opportunities for online learning in the future is the development of tablets and mobile devices. Using wireless technology the tablets and mobile devices have the potential to provide mobile access to e-learning content especially Edmodo. The growth of the use of mobiles providing a range of functions means that in time learning could be available via an individual's mobile phone no matter in android or the apple ios operating system. Learning could be adapted from the personal computer to a handheld machine; if this is the case the learning would need to be tailored even further.

Apart from that, flipped classrooms are moving the way educators give guideline by rearranging accepted instructing techniques to captivate students in the learning process. Using technology,

lectures are Utilizing innovation, addresses are moved out of the classroom and conveyed online as an intention to free up class time for interaction and collaboration.

As an intends to coordinate the constructivist model into their classrooms, instructors are currently using innovation to execute a blended learning in technique that movements addresses out of the classroom and on to the internet with a specific end goal to free up class time for collaborative activities. This altered strategy, known as a flipped classroom, joins the profits of direct instruction and active learning to captivate students in the instructional methodology. Flipped classrooms have the opportunity to cause a significant shift in the way instruction is delivered.

Utilizing technology, instructors are presently fitted to give an elective to traditional lecture-based models by executing a blended learning method that consolidates the benefits of direct instruction and active learning to captivate students in the learning process.

Creation of educational network as a supplementary teaching and learning tool is a huge leap of technological evolution in the world of education with no limits. This kind of new evolutions technology must not be limited to only biology education classes, but must be used as teaching tools in any subject areas. Undeniably, its potential use in instruction in science and hopefully that educational network will permeate all facets of the curriculum. Researchers are urged to conduct future research to validate and modify the instructional models tested in this study and retest them in different settings.

References

Ajjan, H., & Hartshorne, R. (2008). Investigating faculty decisions to adopt Web 2.0 technologies: theory and empirical tests. The Internet and Higher Education, 11(2), 71-80.

Annetta L.A., Minogue J., Holmes S.Y. & Cheng M.T. (2009) Investigating the impact of video games on high school students' engagement and learning about genetics. Computers & Education 53, 74–85.

Astin A. (1984) Student involvement: a developmental theory for higher education. Journal of College Student Personnel 25, 297–308.

Bahar, M., Johnstone, A. H., & Hansell, M. H. (1999). Revisiting learning difficulties in biology. Journal of Biological Education, 33(2), 84–86.

Banquil, K., C. Burce, N. Chua, and S. Dianalan, "Social networking sites affect one's academic performance adversely," UST College of Nursing, 2009, pg. 1-42.

Beach, R., & Doerr-Stevens, C. (2011). Using social networking for online role-plays to develop students' argumentative strategies. *Journal of Educational Computing Research, 45*(2), 165-181. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ943239&site=ehost-live&scope=site; http://baywood.metapress.com/link.asp?target=contribution&id=74788460TL43M271

Berthelsen, B. (1999). Students Naïve Conceptions in Life Science. MSTA Journal, 44(1) (Spring'99), pp. 13-19. http://www.msta-mich.org

Blaikie, N. (2003). Analyzing quantitative data: From description to explanation. Thousand Oaks: CA: SAGE Publishers Ltd.

Boogart V, Robert M (2006). Uncovering the social impacts of "Facebook" on a college campus. Master's thesis, Department of Counseling and Educational Psychology, Kansas State Uniyersity.

Cepni S, Tas E, Kose S (2006). The effects of computer-assisted material on students' cognitive levels, misconceptions and attitudes towards science. Comp. Edu. 46(2): 192-205.

Chickering, A., & Gamson, Z. (1987). Seven principles for good practice in undergraduate education. AAHE Bulletin, 39(7), 3–7.

Chinnici, J.P., Yue, J.W. and Torres, K.M. (2004) Students as 'human chromosomes' in role-playing mitosis and meiosis. Am. Biol. Teach. 66, 35–41

Çimer A (2004). A study of Turkish biology teachers' and students' views of effective teaching in schools and teacher education. EdD Dissertation, The University of Nottingham, Nottingham, U.K.

Clark DC, Mathis PM (2000). Modeling mitosis and meiosis, a problem solving activity. The Am. Bio. Teach. 62(3): 204-206.

Cordero RE, Szweczak CA (1994). The developmental importance of cell division. The Am. Bio. Teach. 56(3): 176-179.

Corn, J., Pittendrigh, B.R., & Orvis, K. S. (2004). Genomics analogy model for educators (GAME): from jumping genes to alternative splicing. Journal of Biological Education, 39(1), 24-26.

Creswell, J. (1994). Research design: Qualitative & quantitative approaches. Thousand Oaks: CA, Sage Publications.

Fleming, M.J, S Greentree, D Cocotti-Muller, K.A Elias, & S Morrison. 2006. Safety in cyberspace: dolescents' safety and exposure online. Youth & Society 38 (135-54).

Flores F, Tovar M, Gallegos L (2003). Representation of the cell and its processes in high school students: An integrated view. Int. J. Sci. Edu. 25(2): 269-286.

G. Salomon (Ed.), (1973). Distributed cognitions: Psychological and educational considerations (pp. 188-228). New York: Cambridge University Press.

Hatcher, L. and Stepanski, E. J. (1994) A Step-by-Step Approach to Using the SAS System forUnivariate and Multivariate statistics (Cary, NC: SAS Institute).

Hoffman, E. (2009). Evaluating social networking tools for distance learning. Presented at TCC 2009 Proceedings, Retrieved from http://etec.hawaii.edu/proceedings/2009/hoffman.pdf.

Jonassen, D. (2000). Designing constructivist learning environments. In C. M. Reigeluth (Ed.), Instructional-design theories and models (volume ii): A new paradigm of instructional theory (pp. 215-239). Mahwah, NJ: Laurence Erlbaum Associates, Inc.

Junco, R., Heiberger, G., & Loken, E. (2011). The effect of twitter on college student engagement and grades. *Journal of Computer Assisted Learning*, 27(2), 119-132. doi:10.1111/j.1365-2729.2010.00387.x

Kindfield ACH (1994) Understanding a basic biological process: expert and novice models of meiosis. Sci Educ 78:255–283

Kruger J., Epley N., Parker J.&Ng Z.-W. (2005) Egocentrism over e-mail: can we communicate as well as we think? Journal of Personality and Social Psychology. 89, 925– 936.

Law, N., & Lee, Y. (2004). Using an iconic modeling tool to support the learning of genetics concepts. Journal of Biological Education, 38(3), 118-141.

Lawson, A. E., & Thompson, L. D. (1988). Formal reasoning ability and biological misconceptions concerning genetics and natural selection. Journal of Research in Science Teaching, 25, 733–746.

Lazarowitz R, Penso S, (1992). High school students' difficulties in learning biology concepts. J.Biol. Educ., 26(3): 215-224.

Lenhart, A., & Madden, M. (2007). Social networking websites and teens: an overview. Pew Internet and American life project. Retrieved 22.09.2013, from. http://www.pewinternet.org/~/media//Files/Reports/2007/PIP_SNS_Data_Memo_Jan_20 07.pdf.pdf

Lewis J, Leach J, Robinson CW (2000) Chromosomes: the missing link-young people's understanding of mitosis, meiosis, and fertilization. J Biol Educ 34(4):189–199

Lewis J. and Wood-Robinson C. (2000). Genes, chromosomes, cell division and inheritance - do students see any relationship? International Journal of Science Education, 22, 177 - 197.

Livingstone, S, & E Helsper. 2007. Taking Risks when communicating on the internet. Information, Communication & Society 10 (5):619-644.

Lucking, R., & Manning, M.L. (1996). Instruction for low-achieving young adolescents: Addressing the challenge of a generation imperiled. Preventing School Failure, 40(2), 82–87.

Marbach-Ad, G., & Stavy, R. (2000). Students' cellular and molecular explanations of genetic phenomena. Journal of Biological Education, 34, 200–210.

Mason, R. (2006). 'Learning technologies for adult continuing education'. Studies in Continuing Education, 28(2), 121-133.

Nkpa N (1997). Educational research for modern students. Enugu: Fourth Dimension.

Novak JD, Canas A (2004). Building on new constructivist ideas and Cmap tools to create a new model for education. Proceedings of the First Int. Conference on Concept Mapping, Pamplona, Spain.

Oztas H, Ozay E, Oztas F (2003). Teaching cell division to secondary school students: An investigation of difficulties experienced by Turkish teachers. J. Bio. Edu. 38(1): 13-15.

Oztaş, H., Ozay, E. & Oztaş, F., 2004. Teaching cell division to secondary school students: an investigation of difficulties experienced by Turkish teachers. Journal of Biological Education, Winter2004, Vol. 38 Issue 1, p13-15.

Palloff, R. M., & Pratt, K. (2007). Building online learning communities Effective strategies for the virtual classroom. San Francisco: Jossey-Bass.

Pashley M (1994). A-level students: Their problems with gene an allele. J. Bio. Edu. 28(2): 120-126.

Patton, M. Q. (1990). Qualitative evaluation and research methods. Newbury Park, CA: Sage.

Richard, M. (1997). Selected attitudinal factors related to students' success in high school. Alberta Journal of Educational Research, 43(2–3), 165–168.

Riemeier T, Gropengießer H (2008). On the roots of difficulties in learning about cell division: Process-based analysis of students' conceptual development in teaching experiments. Int. J. Sci. Edu. 30(7): 923-939.

Selwyn, N. (2007a). Screw blackboard. Do it on "Facebook"! An investigation of students' educational use of "Facebook". [Electronic Version]. Retrieved 22.09.2013, from. http://www.scribd.com/doc/513958/"Facebook"seminar-paper-Selwyn.

Smith MU (1991). Teaching cell division: Student difficulties and teaching recommendations. J. Coll. Sci. Teach. 21(1): 28-33.

Smith MU, Kindfield ACH (1999). Teaching cell division: Basics and recommendations. The Am. Bio. Teach. 61(5): 366-371.

Suter W.N. (1998). Primer of educational research. London: Allyn.

Tabachnick, B. G., & Fidell, L. S. (2001). Using multivariate statistics (4th ed.). Needham Heights, MA: Allyn & Bacon.

Tekkaya C (2003). Remediating high schools' misconceptions concerning diffusion and osmosis through concept mapping and conceptual change text. Res. Sci. Technol. Edu. 21(1): 5-16.

Tsui, C. Y., & Treagust, D. (2003). Learning genetics with computer dragons. Journal of Biological Education, 37(2), 96-98.

Wandersee JH, Mintzes JJ, Novak D (1994). Research on alternative conceptions in science. In D.L. Gabel (Ed.), Handbook of research on science teaching and learning. New York: Macmillan pp. 177-210.

Wise, L., Skues, J., & Williams, B. (2011). Facebook in higher education promoted social but not academic agents. In G. Williams, P. Statham, N. Brown & B. Cleland (Eds.), *Changing Demands, Changing Directions. Proceedings ascilite Hobart 2011,* 1332-1342. Retrieved from http://www.ascilite.org.au/conferences/hobart11/procs/Wise-full.pdf

Ybarra, ML, KJ Mitchell, D Finkelhor, & J Wolak. 2007a. Internet prevention messages: Are we targeting the right online behaviors. Archives of Pediatrics & Adolescent Medicine 161 (2):138-145.

Ybarra, ML, KJ Mitchell, D Finkelhor, & J Wolak. 2007b. Online Victimization of Youth: Five Years Later. Journal of Adolescent Health 40:116-126.

Yesilyurt S, Kara Y (2007). The effects of tutorial and edutainment software programs on students' achievements, misconceptions and attitudes towards biology on the cell division issue. J. Baltic Sci. Edu. 6(2): 5-15.

Yip DY (1998) Identification of misconceptions in naive biology teachers and remedial strategies for improving biology learning. Int J Sci Educ 20:461–477

Zhao, C. & Kuh, G. (2004). Adding value: Learning communities and student engagement. *Research in Higher education, 45*(2), 115-138. *doi* 0361-0365/04/0300-0115/0