The effect of protein synthesis game in the class on the students’ understanding of protein synthesis subject

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Abstract

Protein synthesis is a difficult subject to be learned by students. The aim of this study is to determine the effect of the activity of protein synthesis game in the class, on the students’ understanding protein synthesis subject with this activity. It was applied in Balıkesir University Necatibey Education Faculty with 59 students at Science Teaching department. The students’ level of understanding the subject of protein synthesis were defined with “Understanding Protein Synthesis Test” including 10 questions. The data obtained were analyzed on SPSS 17.0. According to the results of analysis, in experiment groups there is a meaningful difference between the pre-test and post-test achievement scores which are positive for post-test and it appeared that there is a meaningful difference between experiment groups and control groups which are positive for experiment group. In conclusion, it has been defied that the activity of protein synthesis is very effective on teaching.

Keywords: Protein synthesis teaching, the game activity, biology teaching

1. Introduction

Meaningful learning is defined as a person’s creating of information by associating new information with his or her already known concepts and statements. To be practised as meaningful learning, it is necessary for students to correlate between concepts (Ausubel,1968). But the difficulties, blocking the concepts’ being learned meaningfully, have been attributed to two reasons as the organization degree and the degree of abstractness of these concepts (Lazarowitz & Penso,1992).

As untouchable, unobservable concepts and processes are abstract, they’re more difficult to be perceived and learned by students. Likewise, because protein synthesis includes a few unobservable and interdependent mechanisms, it is a subject that is poor to be understood by students (Fisher,1985; Lewis & Wood-Robinson, 2000). In one of the surveys about biology subjects, which students evaluate as difficult from 36 headings of subjects, genetics subjects including protein synthesis are at the third place among the most difficult subjects to learn. In another survey, protein synthesis subject has been defined as the sixth the most difficult subject to learn among

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thirty subjects. Moreover in another survey, it has been determined that from the top ten biology subjects defined as difficult, seven of them are genetics subjects (Bahar, 1999; Tekkaya, 2001; Bahar, 2002). It has been determined that students lack information on understanding the relationships between gene-protein synthesis and protein synthesis-organisms’ phenotypes. Additionally, although students are able to establish a connection between genes and protein synthesis, it has been deduced that gene concepts need to be developed (Venville & Treagust, 1998). Biochemical processes like transcription and translation which are given in books as two-dimensional are difficult to be conceptualized by students (Concannon & Buzzetta, 2010).

In teaching of an abstract concept, it is known that the more sense organs the activity of learning addresses, the better and more permanent learning is practised (Demirel, 2002). Ertepınar emphasizes that while teaching such subjects as protein synthesis which are difficult to learn and more molecular, it is quite important to give a place to the activities which help students to conceive events in their minds. Besides, it has been defined that using only traditional methods in teaching causes the teaching process’s not succeeding the wished level of achievement and not practising the conceptual learning enough (Aydoğdu, 1999; Karamustafaoğlu, 2002; Balcı, 2005). It has been remarked that instead of direct narration, in these untouchable, unobservable to directly naked-eye and occurring in cell subjects, it will be more effective doing animations, using visual materials to allow students to imagine the subjects and doing activities in which students can participate actively (Altun, 2011; Günsel, 2012). It takes place in Yakışan’s experiments’ results that for students to be able to imagine the subjects correctly in their minds it is not enough to make a monotonous teaching done with not only traditional methods but also modern methods. Learning is more effective and more permanent when teaching is done in this way.

In teaching of complex and difficult processes, one of the methods to concretize the subject is role playing. Role playing is the animation of characters’ properties and feelings in the plays (Macgregor, 1996). It is a students’ animating of an event or a circumstance adapted into a different personality. In such methods, communication relies on behaviour and movement instead of words. And it is used in practising comprehension and upper cognitive domain behaviours of learning (Aydoğdu, Keleş & Uşak, 2006).

Role playing, imitations and plays have started being used in Social Sciences education and in past a few years in Sciences education. In this way, students will not be given an opportunity to learn by heart and a high-level learning will be carried out. Because according to the experiments done, usage of suitable material during lessons provides students’ remembering %50 of taught. Also, students’ directly participating and being active during the lesson provides students’ remembering %70 of taught (Silberman, 1996). Therefore, teaching environments which provides students’ doing activities about biology will not only increase the students’ interests in biology but also make it possible to use students’ these information in their daily life in their future (Aşçı & Demircioğlu, 2007).

The aim of this study by the activity of protein synthesis play in the classroom is to define the effect of play on students’ understanding levels of protein synthesis.

2. Method

2.1. Research model

In this study, from quantitative research methods, pre-test-post-test comparative method with experiment-control group has been used. In the experiment, to define the equivalence of test group and control group students and development according to the method, pre-test before practice and post-test after practice has been carried out. “Protein Synthesis” subject has been narrated to control group during three lessons period with traditional method by researchers. Then, the same subject after some concepts and processes of protein synthesis has been summarized to test group in the same period with the usage of Ong’s (2010) adapted activity called “A play of Protein Synthesis in the Classroom”.

2.2. Universe and sample

The universe of the experiment has been constituted by students of Balıkesir University Necatibey Education Faculty studying at Science Teaching Department. Sample is 56 third-year students studying at the same department. Control group of the test is 22 morning students and test group is 34 night students.
2.3. Means of data collection

As a means of data collection in this test Protein Synthesis Understanding Test (PSUT) which is about protein synthesis subject has been used. PSUT consists of 10 questions testing basic concepts and processes of protein synthesis. For validity of these questions, the ideas of the instructor of the lesson, lecturers of the subject and teachers have been gathered. The experts have declared that the test was valid for testing the concepts about protein synthesis. Before narrating the subject to test group and control group, PSUT has been practised as pre-test and after narration as a post-test.

2.4. Analysis of data

In this test, experimental design with control group, in which pre-test and post-test have been practised, has been used. To analyze data, SPPS 17 program has been used. To testify the effect of practised one by one, pre-test and post-test points of each group have been evaluated in itself. In this process, interrelated measurements t-test is used. To be able to compare the practised teaching methods, the differences between independent groups t-test and control and test group post-tests have been evaluated.

3. Findings

In the control group used design with pre-test and post-test, to testify the experimental process’s efficiency, firstly it should be investigated that whether there is a meaningful difference between the test and control group students’ pre-test points. Unrelated testings’ t-test results, made with this aim, are given on Table 1.

| Teaching Situation | N  | X     | SS  | t    | P   |
|--------------------|----|-------|-----|------|-----|
| Morning Group (Control) | 22 | 27.364| 13.78| -.211| .833|
| Night Group (Test)   | 34 | 28.118| 12.53|      |     |

When Table 1 is examined, in protein synthesis subject teaching process, there is not a meaningful difference between pre-test average points of test group for which protein synthesis activity used and control group for which traditional method has been used (p>0.05). According to the this result, students in test group and control group had similar cognitive beginning characteristics about protein synthesis before the experiment.

| Teaching Situation | N  | X     | SS  | t    | P   |
|--------------------|----|-------|-----|------|-----|
| Morning Group (Control) | 22 | 54.090| 19.72| -2.92| .007|
| Night Group (Test)   | 34 | 67.205| 9.16 |      |     |

When Table 2 is examined, in protein synthesis subject teaching process, there is a meaningful difference positive for test group between post-test average points of test group for which protein synthesis activity used and control group for which traditional method has been used (p<0.05). While the average post-test points of students in control group is 54.090, this rate has been found as 67.205 in test group. Accordingly, protein synthesis play activity method has been more effective in test group than traditional method in control group.

4. Result and discussion

In teaching of the subjects like protein synthesis, some studies stat that using charts solely is useless (Banet & Ayuso, 1999; Pashley, 1994). In a study conducted by Tekkaya and his friends in 2001, protein synthesis subject has been defined as the sixth the most difficult subject to be learned among thirty subjects. In a study carried out by
Saka (2006), it has been defined that students remembered some information about protein synthesis from biology lesson they got at second year at university but they could not make a correlation between the information they remembered.

In this study, when in test group in which a play activity of protein synthesis subject was used, learning has occurred better. Furthermore, students in test group stated that in the play activity during the lesson they got more fun and the lesson became more interesting for them than students in control group.

The most important goal of science education is to provide the meaningful learning. Consequently, in order to accomplish this goal it is important to use activities in which students take part actively such as playing game while teaching abstract process.

References

Altun, A., Çelik, S., & Elçin, A. E. (2011). Genetik mühendisliği, biyoteknoloji ve molekül biyolojile ilgili rehber materyallerin öğrenci başarısına etkisi. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 40, 21-32.

Aşçı, Z. & Demircioğlu, H. (2007). Çoklu zeka teorisi üzerine geliştirilen ekoloji ünitesinin, birinci sınıf öğrencilerinin başarısına ve tutulmaları olan etkileri. ODTÜ Fakültesi, OÜoram Bölümlü, Ankara. Retrieved from http://www.erg.sabanciuniv.edu/ok/2004 bildiriler/Zihau%20Asc%20A. kdad.doc (07.08.2007).

Ausubel, D. (1968). Educational psychology: A cognitive view. New York: Holt, Rinehart and Winston.

Aydoğu, C. (1999). Kimya eğitiminde laboratuarın önemi, laboratuar teknikleri ve uygulamaları, Hacettepe Üniversitesi Eğitim Fakültesi, Denizli.

Bahar, M. (2002). Student’s difficulties in learning biology: Reasons and solutions. Kastamonu Eğitim Fakültesi Dergisi, Cilt 10, (1).

Bahar, M., Johnstone, A.H. and Hensell, M.H. (1999). Revisiting learning difficulties in biology, Biological Educational, 33, 2, 84-86.

Balcı, S., Çakıroğlu, J. & Tekkaya, C. (2005). 8. Sınıf Öğrencilerinin Fotosentez ve Bitikillerde Solunum Yanılgıları ve Düzeltmede Kavram Değerlendirme Sonuçları, XIV. Ulusal Eğitim Bilimleri Kongresi Pamukkale Üniversitesi Eğitim Fakültesi, Denizli.

Banet, E., & Ayuso, E. (1999). Teaching Genetics At Secondary School: A Strategy for Teaching About the Inheritance Location of Information. Science Education, 84 (3), 313-352.

Concannon, J., & Buzzetta, M. (2010). Students conceptualizing transcription and translation from a cellular perspective. Science Activities, 47, 83-88.

Demirel, Ö. (2002). Planlamadan değerlendirmeye öğretme sanatı. Ankara: Pegem A Yayınım.

Ertepınar, H., Demircioğlu, H., Geban, Ö., & Yavuz, D. (1998). Benzeşme ve Bilgisayarlı Öğretimin Mol Kavramını Anlamaya Etkisi, III. Ulusal Fen Bilimleri ve Matematik Öğrenme ve Bu Bilimlerinde Ortaöğretimde Oluşan Çözümler Konusundaki Kavram Yanılgıları ve Bu Yanılgıları Çözme Teknikleri İle Giderilmesi, V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, ODTÜ, Ankara.

Keleş, O., Uşak, M., & Aydoğdu, M. (2006). İlköğretim 8. Sınıf Fen Bilgisi Dersi “Genetik” Ünitesi DNA Watson Crick Modelinin Sınıf İçi Uygulanaraklarla Kavramların Öğrenme Başarısına Etkisi. International Journal of Environmental and Science Education, 1 (1), 53 – 64.

Lazarowitz, R. & Penso, S. (1992). High school students’ difficulties in learning biology concepts. Journal of Biological Education, 26 (3), 215-224.

Lewis, J., & Robinson, C.W. (2000). Genes, Chromosomes, Cell Division and Inheritance- Do Students See Any Relationship?, International Journal of Science Education, 22(2), 177-195.

Macgregor, C. (1996). Yaratıcı bir çokçuk yetiştirme. (Cev. Ersin Soylu), İstanbul: Mert Matbaacılık.

Pashley, M. (1994). A-Level students: Their problems with gene and allele. Journal of Biological Education, 28, 120–126.

Saka, A. (2006). Fen bilgisi öğretmen adaylarının genetik konusundaki kavram yanılgılarının giderilmesinde 5e modelinin etkisi. Hacettepe Eğitim Fakültesi Dergisi, 1, 145-150.

Tekkaya, C., Özkan, O., & Sungur, S. (2001). Biology concepts perceived as difficult by turkish high school students. Hacettepe Eğitim Fakültesi Dergisi, 1, 145-150.

Venville, G.J., & Treagust, D.F. (1998). Exploring Conceptual Change in Genetics Using Multidimensional Interpretive Framework. Journal of Research in Science Teaching, 35 (9), 1031-1055.

Yakışhan, M., Yel, M., & Mutlu, M. (2009). Biyoloji öğretiminde bilgisayar anımsanmalarının kullanılarak öğrencinin başarı üzerine etkisi. Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi, 10(2), 129-139.