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## A bee model proposal in understanding of the endocrine system

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### Abstract

In this study, the effect of the developed bee model on learning success of endocrine system is investigated in comparison with traditional teaching method in science and technology program's second year students of Samsun Educational Faculty. An endocrine system success test (ESST) is applied pre and post-test to both groups. The comparison of success between two groups is done by t-test and it revealed that the experimental group instructed using bee model is more successful ( $t=8,382$ ,  $p < 0,05$ ), and also provided with better and permanent understanding of the subject, than control group. Furthermore, students state satisfaction in application of modelling.

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*Keywords:* Science education; teaching method; model; modeling; endocrine system.

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### 1. Introduction

Science and technology teachers have to constitute area sufficiency in various fields, since science is one of the most important areas of combining disciplines of different science branches as physics, chemistry and biology at first. These areas, in principle, are subjects of physics, chemistry and biology and also include all applications and educational method associated with the different subject. Therefore, it is extremely important that the candidates of educational science and technology have to be raised as teachers who have got area's knowledge and a vast point of view. This is very important for primary education students in order to understand and look through lens of science. Understanding science is an important component of using acquired knowledge in daily life and for the individuals equipped with science intelligency, it would be easy to understand and interpret various concepts of science. It is known that students have difficulties in understanding and application of science subjects in general and for some of the subject in particular. Endocrine system is one of the subjects which is difficult to understand. As a matter of fact, Tekkaya and her colleagues (2000) have revealed that the subject of endocrine system (hormones) with the highest proportion of 37,5%, in comparison to other biology subject, is the most difficult subject to be understood by the

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students. Güneş and Güneş (2005) also claim that the subject of endocrine system is among the subjects which are difficult to understand in their study. However, understanding and meaningful learning of endocrine system is very important. Because meaningful learn of endocrine system will provide with understanding of both nervous system and many other physiological events. According to Ausubel (1968), “meaningful learning is improved via association of present and early information”. Consequently, meaningful education of endocrine system will affect understanding of many other biology subjects. One of the most important processes of education and instruction environment is that teacher’s use of relevant instruction method and technique in relation with the subject. Method is expressed as the way consciously selected and followed in solving a problem or to conclude an experiment (Oğuzkan, 1993). However, technique can be described as a way of practise of an instruction method or whole of class activities. Method can be seen as a design; however technique is an application (Demirel, 2000). Although it is known that a range of instruction methods and techniques have to be used for a high-quality instruction, many teachers still prefer direct instruction method. However, various instruction and educational processes could be established in order to provide well understanding of science subjects and meaningful learning. One of the processes which can change the instruction-education environment is to constitute a relevant instruction model for the subject. In science literature modelling is whole operation starting out from available information to explain or to make clear an unknown event, and end product of modelling is characterized as a model (Harrison, 2001; Treagust, 2002). According to Justi and Gilbert (2002), one of the most significant functions of modelling is to simplify the complex facts. Modelling in science research is very important for foundation of a hypothesis or describing a scientific event (Gilbert, 1995). Modelling and models still take an important part in science literacy (Gilbert and Boulter, 1998). Their significant roles in education lead to many studies in science education (Bent, 1984; Cherif, Adams and Cannon, 1997; Erduran, 2001; Gülçiçek, Bağcı and Moğol, 2003; Harrison and Treagust, 1996 and 1998). Since studies by Tekkaya and her colleagues (2000), and Güneş and Güneş (2005) suggesting the subject of endocrine system is difficult to understand by student, it has to be focused on what could be done to improve their meaningful understanding. For this purpose, an example of model is developed. This model is called “Bee Model”. This developed model is adapted to the subjects of endocrine system.

The main aim of this study is to determine the readiness level of class II educational science students on endocrine system and to reveal whether this developed Bee Model exposition method will improve understanding of the subject. It is also aim to transform this complex subject, which may lead students to memorise vast amount of information available, into a visual environment and, to create an instruction and education environment where students themselves can do and experiment during learning process. In this case, students are allowed to look at the subject from different angles and use their creativeness to form their own models.

## **2. Material and Method**

The study is carried out on students second year at Ondokuz Mayıs University, Educational Faculty, Educational Sciences and Technology. A total of 59 student participated to the study. Of these 29 students formed the experimental group and the rest 30 were control group. Before the study an endocrine system success test (ESST) is applied as pre-test to both groups. A week after teaching the subject the ESST is applied as post-test. The ESST test was prepared by experts consist of 30 questions. Cronbach alpha confidence co-efficiency is calculated as  $r=0,79$ . The result of ESST is analysed by statistical program SPSS 11.5. Bee model was applied to experimental group and tradational instruction method was applied to control group for explanation of endocrin system.

Bee model which was prepared according to Van Driel and Verloop (1999)’s descriptive scientific model has been applied to experimental group for instruction of endocrin system. During 2 lessons time bee model is explored and determined basic characteristics with samples. Flower symbolized “gland”; Bee “blood”; Honeycomb “target organs”; Honey “hormon”; and number of Honeycombs are filled with honey (hormon) symbolised the amounts of hormones (excessive, normal or deficiency) and their effects. Afterwards tradational direct instruction method has been used for explanation of endocrin system to all student in four lessons time.

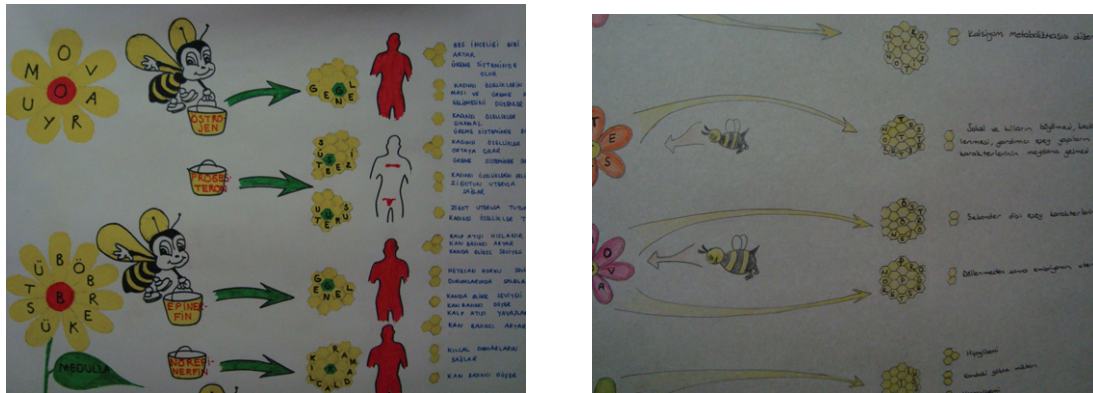


Figure 1. Two samples models which formed by students

Each groups improved their own model and all models have been investigated by other students and lecturer to select the best model. Then, the students of experimental group used these models to understanding of endocrine system. Later, the students discussed among them to criticize each others. In addition, the written and verbal opinions of student on this method are taken and evaluated.

### 3. Results

According to results of pre and post-tests, there was no level differences between experimental and control groups at the begining ( $t=1,955, p > 0,05$ ). The comparison of success between two groups is done by t-test and it revealed that the experimental group instructed using bee model is more successful ( $t=8,382, p < 0,05$ ), and also provided with better and permanent understanding of the subject, than the group instructed with only traditional methods. The diffences given in table 1 and figure 2 and 3 are in favour of experimental group. The results obtained from pre-test and post-test, t and p values have been given in table 1.

Table 1. Pre-test, post-test average of experimental and control groups, t and p values.

Tests	Grup	Number of Student	Average	Standart error	t	p
Pre-test	Control	30	49,21	11,37	1,955	0,056
	Experimental	29	55,74	14,20		
Post-test	Control	30	58,34	11,33	8,382	0,000
	Experimental	29	81,89	10,20		

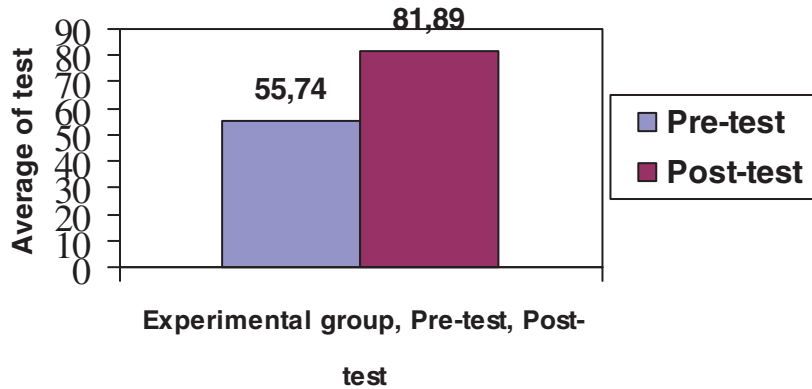


Figure 2. Pre-test, post-test success of experimental group.

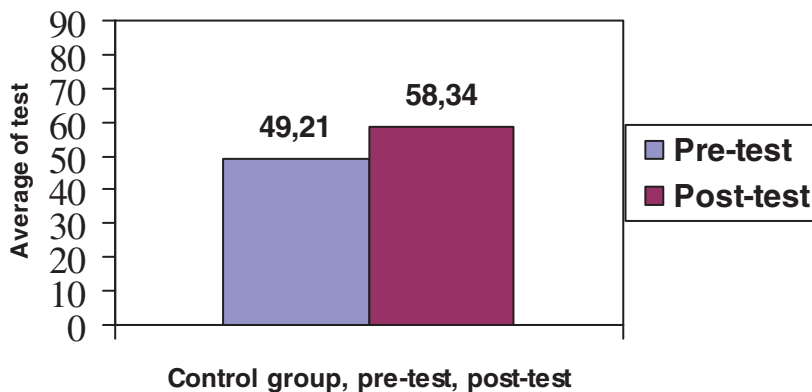


Figure 3. Pre-test, post-test success of control group.

#### 4. Discussion and Conclusion

Models are scientific and mental activities which are used to ease understanding of seemingly complex events by humans (Paton, 1996). An unfamiliar fact is explained by a familiar fact by imitations via modelling. It can also concretise the abstract concepts in student's mind, provides much easy understanding and attracts student's interest as well as participation. As an interdisciplinary and positive branch, the science has the feature to analyse unknown pieces by its empiric and analytic characteristics. Pure science is a scientific branch which has been formed by endeavours to understand natural events and to rule the nature. For this reason, meaningful learning can be provided by using models in science and thus students can develop a thought in understanding of their environment and life.

According to Yaman and Soran (2000), and Tekkaya and her colleagues (2000), biology as an important and indispensable part of science education is practised as teacher-centric and the subjects are mostly taught far from practise, based on theoretical knowledge and depending on textbooks by blackboard-chalk method. According to

Güneş and her colleagues (2006), students see the biology as a course to be memorised and display a reluctant and unwilling attitudes towards monotonous and teacher-centric classes. Therefore, various instruction methods should be use to provide student participation into the course. For this reason, we have endeavoured to constitute an original modelling in order to help students to explore their creativity and to investigate the influence of this model. When the results are examined, it is seen that the experimental group, that of the bee model activity is practised, have comprehended more this difficult subject, the endocrine system. This is confirmed in comparison of experimental and control group by applying t-test ( $t=8,382$ ,  $p < 0,05$ ). Furthermore, when questionnaire and interview results of experimental students about the method is analysed, it appears that most of the students state satisfaction in application of modelling and require use of modelling in other courses or subjects. Students also stated that endocrine system is a difficult subject but by means of the application of modelling, they better understood the subject even without rote learning, but united with subject, and learned with enjoyment within the group study.

Students expressed that the bee model was very successful and provided meaningful learning. Most teacher candidates of educational science were also claimed that they will certainly use the bee model in their future professional life and expect to be very useful for students of primary education. Furthermore, students expressed that they like the bee model very much since it helped to discover their creative thought, to carry on very pleasant group studies, to see even reluctant student to precipitate in group study and forming creative activities. As a result, we are of the opinion that the bee model is very relevant in meaningful learning of one of the difficult subject of science, the endocrine system. We also think that similar studies should be maintained in order to evaluate the effect of modelling in understanding of other science subjects. Lastly, we presume that introduction of many new opinions about the instruction-education process trigger student to meaningful and enjoyable learning of science subjects.

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