The Investigation of 6th Grade Student Misconceptions Originated from Didactic about the "Digestive System" Subject

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Abstract

In this study, the misconceptions emerged as a result of instruction were examined from the viewpoint of the Didactic Transposition Theory. To this end, two randomly selected sample groups (n = 33 and n = 31) from the students of two nearby schools in downtown Balikesir were included in the study. It was observed that different knowledge references had been selected according to the targets of the schools and the instructors. As a result, the transpositions of the teachers affected the *Instructed Knowledge*. The differences in the *Instructed Knowledge* affected the *Assimilated Knowledge* of students. Therefore, different misconceptions were observed in each sampling group. In other words, the differences in teachers' transpositions were reflected to the *Assimilated Knowledge* and the misconceptions of students.

Key Words

Didactic Transposition, Digestion System, Misconception.

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Misconceptions might be of didactic, linguistic, epistemological, ontogenic, or cultural origin. In this study, the misconceptions of didactic origin about digestion system were analyzed. In his work, Ozgur (2001, 2004a, b, c) compared pre-and-post instruction misconceptions of French and Turkish among 6th grade primary school students on "Respiratory System." It was observed that the students in both countries had similar misconceptions with other students in their respective countries before the instruction. However, it was found that there were significant differences in the findings on misconceptions of students from the two countries. The misconceptions of the French students on the topic were a homogenous distribution in all the schools. In other words, in French schools, there were not any significant differences in both quantities and qualities among the post instruction misconceptions. On the other hand, significant differences were found in post instruction misconceptions among the Turkish schools. For example, while a type misconception is dominant in school A, different kinds of misconceptions are coming forward in school B. In other words, misconceptions of students had a heterogeneous distribution. The reasons of this difference were not examined in Ozgur's works (2001, 2004a, b, c) and Ozgur and Darley's work (2002).

The findings of Ozgur's studies (2001, 2004a,b,c) and Ozgur and Darley's study (2002) revealed the inquiry of this research. How is it possible that students in the very same educational system have so different misconceptions after the instruction? Accordingly, it has been thought that this evident difference in misconceptions might be the result of different Didactic Transposition processes in primary schools of Turkey (Ozgur, 2004a, b, c).

The misconceptions have been explained with the Didactic Transposition Theory. Didactic Transposition is a theory in which the process of teaching and learning is examined together with and transposition it is accompanied by Chevallard and Johsua (1982) and Chevallard (1991). There are four main types of information the transition in this: Theory, *Scientific Knowledge*, *Knowledge to be Instructed*, *Instructed Knowledge*, and the *Assimilated Knowledge*.

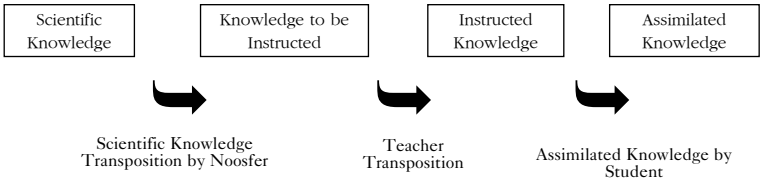

Figure 1. Didactic Transposition Theory Process (Bosch, Chevallard & Gascòn, 2005)

In the Didactic Transposition Theory process, the first knowledge type is *Scientific Knowledge*. Knowledge obtained by scientific research and accepted and published by scientific community compose the *Scientific Knowledge*. The second knowledge is the *Knowledge to be Instructed*. While Chevallard is talking about this knowledge, he points the Education Programs and Teacher Books as references. All the information that is used in the classroom by teachers is the equivalent of *Instructed Knowledge* in the third step of the Didactic Transposition Theory. In this context, the process of the transformation of *Instructed Knowledge* is named as Teacher's Transposition. The last one is *Assimilated Knowledge* truthfulness or falseness of which is not proved, which is unpublished and only exists in the mind of student.

Although it is not accepted as a separate *Knowledge to be Instructed*, the only 6th grade Science textbook implemented by the Ministry of National Education (MEB; Güngör, Dökme, Ülker, Yıldıran, Aydınlı & Baş, 2002), accepted as the real *Knowledge to be Instructed* (Özgür, 2004a, b, c). If the administrators and/or teachers in the schools set the success of their students at the High School Entrance Examination (OKS) as a special goal to themselves, in this case, the knowledge required to answer the questions in the OKS can be accepted as *Knowledge to be Instructed* (Özgür, 2004a, b, c). Finally, the type of *Knowledge to be Instructed* mentioned above comes forward as a phenomenon special to the Turkish Education System.

There can be found internal and external factors that affect Teachers Transposition. Teachers' area of specialization (i.e., science, physics, chemistry or biology) and the year of professional experience can be given as examples to the internal factors. The rating of schools in the OKS and school administrators and/or teachers attitudes toward the OKS can be given as examples to the external factors.

There are many studies about misconceptions conducted in Turkey. While some of these studies deal with general characteristics of the misconceptions (i.e., Yağbasan & Gülçiçek, 2003), some others deal with determining the origin of the misconceptions (i.e., Atılboz, 2004; Bahar, 2003; Bozkurt & Aydoğdu, 2004; Bozkurt, Salman Akın & Uşak, 2004; Çıldır & Şen, 2006; Karaer, 2007; Selvi & Yakışan, 2004; Tarakçı, Hatipoğlu, Tekkaya & Özden, 1999; Tekkaya & Balcı, 2003; Tekkaya, Çapa & Yılmaz, 2000; Temelli, 2006; Yakışan, Selvi & Yürük, 2007; Yılmaz, Erdem & Morgil, 2002; Yürük & Çakır, 2000). There are some studies about remedying the misconceptions (Ateş & Polat, 2005; Ayar Kayalı & Tarhan, 2004; Coştu, Çepni & Yeşilyurt, 2002; Karamustafaoğlu, Ayas & Coştu, 2002; Kurt & Akdeniz, 2004; Özkan, Tekkaya & Geban, 2001; Öztürk Ürek & Tarhan, 2005; Taşkın Can, Yaşadı, Sönmezer & Kesercioğlu, 2006; Tatar & Cansüngü Koray, 2005; Tekkaya, 2002; Tezcan & Salmaz, 2005; Türkmen, Çardak & Dikmenli, 2005). In this study, the answers to the problems of "Is there a relationship between the Transposition Didactic process and Students' post-instruction didactic originated misconceptions?" and "How students' *Assimilated Knowledge* is affected by Teachers Transposition?" are sought.

For this purpose, the hypothesis of "*The differences in the didactic originated, observed misconceptions between the primary school students of the selected schools resulted from the differences of the Knowledge to be instructed accepted as the reference by the teachers in their instruction of the subject and the Instructed Knowledge transposed by them*" was set.

In the last years, there have been many different terms are used as misconception, alternative concepts, alternative framework, preconceptions to describe student's understanding at the sciences (Nakipoglu, 2006). In this study, as Cakir and Yoruk (1999) describe, terms are expressed with misconceptions term students' different origin owner conceptual understandings (Cakir & Yoruk, 1999). In this study, the effects of the *Knowledge to be Instructed* and *Instructed Knowledge* on the misconceptions of 6^{th} year of primary school students about "Human Digestion System" are examined.

Method

The sample for the study included 6th grade students randomly chosen from 2 different schools by 2 science teachers in two different schools at the same location in the city centre of Balıkesir. Although the selected schools are in the same neighborhood with respect to their success, the rates in the OKS are quite different. While School I succeeded in sending 8% of its students to Anatolian High Schools and Science High Schools for the year 2004 and 2,2% for the year 2005, School II, on the other hand, succeeded in sending 29% of it students to the same schools for the year 2004 and 68,2% for the year 2005.

Both teachers are at the same age. They have been educated in Science Teaching Education and have five years of experience. They have also previously taught the digestion system. A pre-test and a questionnaire have been prepared, implemented and analyzed in the study. To prepare the questionnaire, educational studies on digestion and epistemological analysis of digestion were used (Özgür, 2004a, b; Çakıcı, 2005; Teixeira, 2000; Nunez & Banet, 1997; Banet & Nunez, 1997; Osborne et al., 1992; Contento, 1981; Gellert, 1962; Sauvageot-Skibine, 1991; Giordan & Vecchi, 1994; Clement, 1991). The test was administered to 33 students at school I and 31 students at school II before the instruction of the subject. The very same test was used again two months after the students had the instruction of the subject and evaluated as a final test.

The subjects given to the students about digestion were recorded and encoded. *A Knowledge Network Technique* was used to analyze the *Knowledge to be Instructed* and *Instructed Knowledge* (Pelitoglu 2006). As the *Knowledge to be Instructed*, science textbooks for sixth grade students of primary schools of the MEB and the knowledge required to answer the OKS questions were analyzed. As the *Instructed Knowledge* "*the Network of the Instructed Knowledge*" prepared on course records, exam question analyses, and the analysis of questionnaires implemented on teachers were used. To determine the *Assimilated Knowledge,* the analysis of the post-test was used.

Results

Homogeneity was observed about misconceptions in the pre-test among the answers of the students in both schools. Generally, when the *Network of the Knowledge to be instructed* was examined, it is seen that Digestion system is explained through 49 concepts. Four of these concepts are aliments, 18 are anatomy, 10 are mechanic and chemical digestion, and the other 5 are the concepts of other categories. Digestion system is mostly studied anatomically and the physiology of digestion was not much taken into consideration. Significant differences are seen between the two. *Knowledge to be instructed* emphasizes on the concept of digestion more anatomically and mechanically while *Instructed Knowledge II* emphasizes on the concept of digestion more physiologically and chemically. In this research, reference source of *Knowledge to be instructed* is added to Transposition Didactic Theory as a new knowledge. According to the theory, reference of *Knowledge to be instructed* is merely a unique teaching program. However, in Turkey, students are expected to be prepared to exams like the OKS, the University Entrance Examination (OSS), and the Public Services Entrance Examination (KPSS). In conclusion, parallel to sources of the *Knowledge to be instructed,* two different kinds of teacher's types emerged; while one of the teacher types considers the only *Knowledge to be instructed* as a main source for the program, the other considers both the program itself and the knowledge needed to answer the questions of the OKS correctly.

In the post-test, more didactic misconceptions on anatomy and mechanical digestion were found in Sampling I. On the other hand, in Sampling II, didactic misconceptions on physiology and chemical digestion were found more commonly. As indicated in the different sources, some misconceptions are found in the pre-test because of attaching too much importance on the stomach (Bachelard, 1938).

According to these findings the hypothesis "*the differences in the didactic originated misconceptions among the primary school students of the selected schools resulted from the differences between the Knowledge to be Instructed accepted as the reference by the teachers in their instruction of the subject and the Instructed Knowledge transposed by them*" was supported.

Discussion and Conclusions

It is concluded that these differences between misconceptions were resulted from the differentiation in the *Instructed Knowledge* due to the choices of references of the *Knowledge to be Instructed.* This study shows that exams like the OKS introduce a new kind of *Knowledge to be instructed.* Hence, two kinds of teacher types and two different kinds of *Instructed Knowledge* have emerged. This dilemma has affected students' *assimilated knowledge* and as a result different kinds of misconceptions were seen. By suggesting various perspectives, it was observed that Didactic Transposition process has unique specifications according to each country.

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