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## SECONDARY SCHOOL STUDENTS' CONCEPTUALISATION OF HUMAN BODY ORGAN SYSTEMS

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### ABSTRACT

Drawing method along with the written responses of 1<sup>st</sup> year International Baccalaureate Diploma Programme (IBDP) secondary school students was used to determine their understanding of the concepts of human body organ systems. Due to the time limitation, misconceptions were not evaluated in this research. The focus of this research was mainly to determine the frequency of the drawn organ systems by the students to find out their knowledge prior to the upcoming chapter in IBDP Biology curriculum, Topic 6: Human Physiology, so that the curriculum implementation plan can be built considering the data collected in this small-scale research. Spontaneous drawings of students in support with open-ended questions were used in this current research to make qualitative analysis of the students' ideas on human body systems and their functions. The mean age of the students was 18.1 (range 18-19) in this study which did not focus on the gender differences. The participants had studied at various middle schools before they started this high school. Therefore, there was great diversity due to the participants' background however they were all being taught International General Certificate of Secondary Education (IGCSE) Biology in grade 9 and 10 prior to IBDP. It was found that the only organ system among ten of those, which the students reached level 5 was urinary system. They still need further support on digestive, muscular and skeletal systems as well as the lymphatic system.

**Keywords:** misconceptions, biology education, body systems, international baccalaureate, international education

## LİSE ÖĞRENCİLERİNDE İNSAN VÜCUDU ORGAN SİSTEMLERİNİN KAVRAMSALLAŞTIRILMASI

### ÖZET

Uluslararası Bakalorya Diploma Programı (IBDP) 1. yılına kayıtlı lise öğrencilerinin insan vücudundaki organ sistemleri kavramlarını ne ölçüde anladıklarını belirleyebilmek adına yazılı cevaplarıyla birlikte çizim yöntemi kullanılmıştır. Bu çalışmada zaman kısıtlaması nedeniyle kavram yanılgıları değerlendirilmemiştir. Bu küçük ölçekli araştırmanın odağı, öğrencilerin IBDP Biyoloji programı kapsamında yer alan İnsan Fizyolojisi ünitesi hakkındaki var olan ön bilgilerini öğrenebilmek adına çalışmada öğrenciler tarafından çizilen organ sistemlerinin sıklığını belirlemektir. Öğrencilerin insan vücudu sistemleri ve işlevleri hakkındaki bilgilerini nitel olarak analiz etmek için bu çalışmada açık uçlu soruları destekleyen öğrenciler tarafından yapılan organ sistem çizimleri kullanılmıştır. Cinsiyet farklılıkları üzerine odaklanmayan bu çalışmada yer alan öğrencilerin yaş ortalaması 18.1 (yaş aralığı 18-19) olarak belirlenmiştir. Katılımcıların lise öncesi çeşitli ortaokullarda okudukları bilinmektedir. Bu nedenle, katılımcıların geçmişine bağlı olarak büyük bir çeşitlilik vardır, ancak hepsi IBDP'ye başlamadan önce Uluslararası Genel Ortaöğretim Sertifika Programı kapsamında 9. ve 10. sınıfta Biyoloji dersi almıştır. Çoğu öğrencinin, kullanılan değerlendirme ölçeğine göre 5. seviyeye ulaştığı tek organ sisteminin üriner sistem olduğu tespit edilmiştir. Yine de IBDP'ye başlamadan önce sindirim sistemi, kas ve iskelet sistemi ve lenfatik sistem konularında daha fazla bilgi ve desteğe ihtiyaçları olduğu tespit edilmiştir.

**Anahtar sözcükler:** kavram yanılgısı, biyoloji eğitimi, vücut sistemleri, uluslararası bakalorya, uluslararası eğitim

## **INTRODUCTION**

Several studies in literature have already identified some misconceptions in science through all ages and gender in education (Aydın, 2016; Özgür, 2013; Sami, 2013). Students' naïve beliefs (Caramazza, McCloskey, & Green, 1980); or alternative conceptions (Arnaudin & Mintzes, 1985); children science (Gilbert, Osborne, & Fenshman, 1982) different than the scientific phenomenon is called as misconceptions (Fisher, 1985). Additionally, these misconceptions are shown by several studies to be persistent even after the teaching process (Cinici & Demir, 2013; Cinici, Sözbilir, & Demir, 2011; Prokop et al., 2009). Moreover, as stated by Driver, Guesne, and Tiberghien (1985), students' misconceptions have influences on their learning process. If students' misconceptions can be elicited then the meaningful learning can be achieved (Hipkins et al., 2002).

Aydın (2016) found that one of the common misconceptions held in biology is to list liver as an excretory organ. Best known organs by the students were reported as heart, lungs, kidneys, and stomach and they are identified in circulatory system, respiratory system, urinary system, and digestive system correctly by the students (Aydın, 2016). Although the students were good at drawing the digestive system among the other systems, they lack understanding of functions of these systems and their respective organs (Prokop & Fancovicova, 2006). In another study although majority of the students were found to know the organs, they were not able to make any link of these organs with organ systems. For instance, although the students know the bones they were not able to draw skeletal system to show which organ system they belong to (Reiss & Tunnicliffe, 2001). It is also known that although middle school students show understanding of the internal organs, they lack knowledge of how these organs work in organ systems (Özsevgeç, 2007). In several investigations, Tunnicliffe and Reiss used drawing method of children where they asked children "draw what you think is inside your body" (1999, 2001, 2002) which is also accepted as the first instruction in this current research. However, their approach was criticized by Khwaja and Saxton (2001) stating that the type of task can significantly affect results obtained in these studies that Tunnicliffe and Reiss done so far. Khwaja and Saxton showed that if the questions were more specific such as "draw the bones that are inside your body", children would express the concepts in their mind on a higher level. Therefore, this model is agreed to be more appropriate in comparison with Reiss and Tunnicliffe's (1999) general instruction. In this current research two more follow-up instructions from general to specific were given for the students to draw the human body organ systems. Moreover, Khwaja and Saxton (2001) examined only skeletal system whereas Reiss

and Tunnicliffe (1999) showed that majority of the children aged 5-11 reached level 5 on the seven-point scale on their understanding of human skeleton which meant that their knowledge was still incomplete but relative good. Apart from those two investigations it was still unknown whether the specific instruction or general instructions have any effect on children's comprehensive drawings of organ systems. It was also unknown whether the more frequently drawn organ systems show us the organs better understood by the children. Following those two investigations, Prokop et al. (2009) used their instructions for the children considering both Reiss and Tunnicliffe (1999) and Khwaja and Saxton (2001) to examine whether those two types of instructions had any comparable value. They tried to answer the questions "Is there any relationship between levels of drawings of a particular organ system when the children are instructed by two different instructional types?" (Prokop et al., 2008). This was also helpful to find an answer to Donna Farland-Smith's problem rose in a study (2009) that the idea of a single drawing may not reflect the wide range of views that a student possesses was missing from previous studies. There is a real need of combined methods to be able to find out the concepts in the children's minds of a particular phenomenon accurately. And this need of combining two methods together is addressed in this current research by having the children writing up their answers after the drawing session on a short quiz.

Drawing method is considered as a simple research instrument even at the international level. As it was proposed by Prokop and Fancovicova (2006) using combination of drawing method with written responses or interviews would provide more reliable information about children' understanding of scientific phenomena. This current research will differ from the ones already reported in literature in a way that the sample will contain IBDP 1<sup>st</sup> year students (grade 11) to be informed about their conceptualisation of human body organ systems after the International General Certificate of Secondary Education (IGCSE) biology course.

Organ systems, including appearance, location and function of the drawn organs was needed as a requirement of the IBDP Biology curriculum prior to delivering the course so that the students' conceptualisation can be understood accurately. Therefore, the aim of this particular study is to reveal the conceptualisation of human body organ systems of IGCSE students just before they start IBDP. This would help the teachers to prepare academic interventions to be able to build upon students' previous understanding and knowledge.

There is little work in the literature which qualitatively examined how high school students' previous conceptualisation of organ systems in IGCSE biology as they reveal by their drawings of the various human body organs and organ systems, before they start studying in IBDP

biology. Thus, the significance of this study is to fill in this gap particularly in Turkey to inform the biology teachers about students' previous conceptualisation of organ systems. The main aim of this research is to find out the current 11<sup>th</sup> grade International Baccalaureate Diploma Programme (IBDP) students' understanding of "human body systems" in a private high school in Turkey.

## **METHODOLOGY**

This is a small-scale qualitative research. This study relies on a qualitative process while also frequency of drawn organs was calculated to support the data numerically. To explore the conceptualisation of human body organ systems of IGCSE students, spontaneous drawings of students were used to collect data. After the collection of the data from the drawings, a quiz with 3 open-ended questions (Appendix 1) was given to all students to check validity of the interpretation of students' ideas on human body systems and their functions in the drawings. Their ability of drawing was not investigated. Students used their previous experiences and present ideas on their drawings. Students' free responses on a sheet of paper where sufficient space was available for their answers was used. They made their drawings on another A4 size white sheet of paper which was folded for three times to be used against three types of instructions. Then the students were asked to label the four faces of the folded A4 sized white sheet of paper's each page from 1<sup>st</sup> to the 4<sup>th</sup> page. The first page numbered as 1 was used to draw against the first instruction, the second page numbered as 2 was used to draw against the second and the third page numbered as 3 was used to draw against the third instruction. The last page which was numbered as 4 was asked to be used as an identity card. The students wrote their year of birth, gender and names or specific sign for pair-wise comparison later on (Prokop et al., 2008).

The instructions from general (Tunncliffe & Reiss, 1999) to specific (Khwaja & Saxton, 2001) for the drawings given in every 10-15 minutes were as follows;

1<sup>st</sup> Instruction: Draw what is in your body. (Tunncliffe & Reiss, 1999; 2001; 2002)

2<sup>nd</sup> Instruction: Draw the body organs you have in your body in their correct locations.

3<sup>rd</sup> Instruction: Draw the organs of the human body systems.

The scoring rubric for students' drawings was developed through the literature which was used in previous studies (Bahar et al., 2008; Cox, 1997; Dikmenli, 2010a; Guichard, 1995; Kose, 2008; Osborne, Wardsworth, & Black, 1992). These studies in the literature all proved this five-

level categorization rubric useful in similar studies therefore this rubric describes the framework for visual analysis of the students' drawings. The 5-level scoring rubric as shown in Table 1. was used regarding the drawings of the students in this current research.

**Table 1.** Five level categorization rubric used for scoring the students' drawings

<b>Level 1: No drawing</b>	Students did not draw any organs of the system but wrote the name of the system and located the system around the body. Students gave no name of the organs or named the component in the organ such as "blood", "alcohol", "meals" etc... No labelled organs.
<b>Level 2: Non-representational drawings</b>	1 or 2 identifiable organs or silhouettes of the organs are drawn with or without misconceptions.
<b>Level 3: Drawings with misconceptions</b>	Location of the drawn organs are not correct or there are misconceptions seen in the drawing. Organs of the particular system are not linked to each other or partially drawn with misconceptions.
<b>Level 4: Partial drawings</b>	Organs of the particular system are drawn without misconceptions but missing some organs or labels of some parts.
<b>Level 5: Comprehensive representation drawings</b>	Most competent and realistic drawings of the organs and the systems are shown. All parts of the organs/systems are labelled correctly.

As soon as the students complete their drawings, they were given a quiz with open-ended questions for 20 minutes as provided in appendix 1. These questions were taken from the students' IGCSE biology textbook which was used by the biology teachers at the school when they learned organ systems. Although the questions were taken from the textbook which was prepared and written by subject area specialists, content validity was checked by two more biology teachers before the pilot test. A pilot application of these questions was done at the same school with different group of students who have not taken part in the study to check the suitability of the questions. Questions were revised according to the feedback received on the clarity of the questions. Piloting the quiz helped to address the face validity and the reliability of the questions. Since this was not a questionnaire but a short quiz to collect answers from the students, no statistical analysis was conducted to analyze reliability and validity.

### **Data Analysis**

Students' drawings were evaluated against the scoring rubric given on table 1. Percentage frequency of the drawn organs was reported using descriptive analysis. Open-ended questions were evaluated against the answer key and the students' responses were analysed to gather further data on students' knowledge and understanding of the concepts.

Obtained answers from the quiz were used to reveal students' understanding of relevant concepts and to eliminate the possibility that their drawing might have limited them to show their conceptualisation. The frequencies of drawn organ systems were reported in the findings.

### **Sampling**

In this small-scale study purposive sample of 30 secondary school students ( $N_{\text{female}} = 20$ ) was drawn from a private high school in Turkey which offers bilingual national and international curricula to the students where there is limited access to quality education, in a developing city in the eastern part of Turkey. This school, from which the sample was chosen, follows a combined international and national curriculum. It has a preparatory year for English language learning. In grades 9 and 10 all students follow IGCSE programme, and the ones who got at least C level grade are allowed to continue the school in grades 11 and 12, the IBDP. The participants were selected based on the criterion of being rewarded with an IGCSE certificate so that qualified to continue with the IBDP.

Although the school offered two international curricula, IGCSE and IBDP, and one national curriculum there was only one nationality in the school. The school was not an international school however there were currently 7 international teachers; one of whom was teaching IBDP courses. All of the sampled students were Turkish. There was a diverse socio-economic status from privileged to underprivileged by getting financial support from the school foundation. The greatest number of students, 85%, had scholarship since they passed the entrance examination with the desired expectations to be able to start prep class. There was no student accepted to the school without taking the entrance exam or only by tuition without any passing score. As Cinici (2013) proposed the academic achievement level of the students in this current research chosen as sample were mostly same since they all had the centralised exam at and after the 8th grade to get into this secondary school. Their socioeconomic status was stated as mostly moderate. Mean age of the students was 18.1 (range 18-19). However, this study did not focus on gender differences. Four students did not have Biology as an IBDP course, and the participants were studying at various middle schools beforehand. Therefore, there was great diversity due to the participants' background however they were all being taught IGCSE Biology in their secondary school education prior to IBDP for two years.

### **FINDINGS**

Two methods were combined in this research. Written responses (Leach, Driver, Scott, & Wood-Robinson, 1995) and drawings (Reiss & Tunnicliffe, 2001) were gathered to examine

what students know about the organ systems in human body they drew. The research was done during the 40-minute counseling period in May 2014.

As a result, 37 different organs in all 89 drawings were obtained from children aged 18-19. At least 80% of the drawings showed mainly the three organs as lungs, heart, stomach and brain. It was also found for the future studies that students at this age have misconceptions about the location of some organs in human body.

It was found that the 1<sup>st</sup> year IBDP students through the end of their grade 10 biology course in this particular school, the only organ system which the students reached level 5 was urinary system since they learned this both in middle school curriculum of MEB and IGCSE Biology curriculum. And the highest frequency by having 94.43% of the drawings at level zero belongs to the lymphatic system since the details have never been required to be shown in the MEB curriculum and IGCSE Biology curriculum on human body. Some of the students have noted on their drawings that they know there must have been lymphatic system but they do not know what the organs are or where the system must be located on their drawings. There are more students who reached at least the level 4 for urinary, reproductive, digestive, nervous, and respiratory system according to table 2 which was calculated against the 5-level categorization criteria. The students selected as sample in this study have already studied those organ systems in MEB middle school curriculum and IGCSE Biology to some extent. This is the main reason of the higher frequency in higher levels compared to the other organ systems.

**Table 2.** Percentage frequency of the drawn organ systems according to the 5-level categorization

<b>Systems</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Skeletal</b>	78.87	17.77	0	3.30	0	0
<b>Muscular</b>	82.23	13.33	2.20	2.2	0	0
<b>Nervous</b>	15.53	70.03	13.33	0	1.10	0
<b>Endocrine</b>	52.23	46.67	1.10	0	0	0
<b>Circulatory</b>	6.67	85.57	7.80	0	0	0
<b>Lymphatic</b>	94.43	1.10	3.30	0	0	0
<b>Respiratory</b>	3.33	36.70	50.00	6.63	3.33	0
<b>Digestive</b>	0	26.63	48.87	22.2	2.20	0
<b>Urinary</b>	28.90	34.43	20	7.77	5.57	3.33
<b>Reproductive</b>	37.77	30.00	20	7.77	4.43	0

When the quiz papers were checked against the answer key it was found that the most well-known organs listed by the students were stomach ( $N=30$ ), lungs ( $N=29$ ), and heart ( $N=27$ ) as shown in table 3.

**Table 3.** Frequency of the named organs by the students

Organs named as a response to 1 <sup>st</sup> question in quiz	Frequency of responses
Stomach	30
Lungs	29
Heart	27
Small intestine, brain	25
Liver, kidney	22
Mouth	17
Anus	15
Pancreas	13
Nose	12
Vessels/veins/arteries, oesophagus, trachea, ureter, urethra	11
Penis	10
Spinal cord	9
Eyes, vagina, ovaries	8
Gall bladder, urinary bladder	7
Cerebellum	6
Uterus, tongue, ears	5
Testis	4
Skin, arms	3
Spleen, adrenal glands, pituitary gland, thyroid gland, legs, muscle, sperm duct, rectum, feet	2
Hands, teeth, bones, fallopian tubes	1

When the 2<sup>nd</sup> question on the quiz was checked it was seen that although all students ( $N=30$ ) named the stomach, only 11 of them have stated its function correctly. Most of the students ( $N=13$ ) have described the function of heart as pumping blood. Only 10 of 30 students have correctly stated the function of lungs as gas exchange. Function of kidneys were briefly described as “filtering the blood” by only 9 students whereas function of brain was only described by 8 students as generally “controlling the body”. None of the students have decribed the functions of following organs correctly: trachea, vagina, uterus, skin, arms, adrenal glands, pituitary gland, thyroid gland, legs, muscles, sperm duct, rectum, feet, hands, bones, and fallopian tubes. Functions of other organs listed on table 3 were described by less than 5 students.

For the third question which was asking the locations of the organs, 10 students preferred to show the locations of the organs by drawing. However, none of the drawings were found to be accurate representations of the organs. None of the drawings had connections between the organs shown. Some students ( $N=16$ ) have described the locations of organs divided into three locations as upper body parts, middle body parts, and lower body parts whereas 4 students left the question blank with no response at all.

Drawing method and the quiz helped the researcher to reveal some misconceptions from the students' responses. Some students listed tissues as organs since they do not know about the tissue layers covering the organs in detail. Besides many students had misconceptions or missing information about the functions of organs. There are insufficiently described functions of some organs provided on table 4.

**Table 4.** Insufficiently described organ functions

Organ	Function as described by the students
Brain	“Decision making” (incomplete function) “Controls the body”
All organs in general	“All systems work to regulate our metabolism” “To serve the characteristics of living organisms” “To keep me alive”
Stomach	“Digests proteins” (incomplete function)
Liver	“Produces hormones” (confused with pancreas) “Excretory organ”
Lung	“Cleans the blood” (misinterpretation) “Provides oxygen to the body”
Vagina	“Excretion (misconception) and reproduction” “Ovaries are located inside the vagina”
Intestines	“Help to pass the digested materials into blood”
Skin	“To touch”
Uterus	“Help to get rid of faeces”
Gallbladder	“To store the filtered materials”
Urethra	“Storage”
Kidneys	“Absorption” “Cleans the blood”
Large intestine	“Separates the harmful materials”
Ovaries and penis	“Produces reproductive cells”

Six students have responded to the second question which asks for the functions of organs by listing some of the systems' functions instead of describing the functions of organs individually. When these 6 students' papers were checked it was found that all of them wrote circulatory, digestive, reproductive, and respiratory systems. Three of these 6 students have also included the function of excretory system and 2 of them have also included nervous system. Although the question asked them to write the functions of organs, they listed in the 1<sup>st</sup> question,

they wrote the functions of these systems. The interesting point is that they have named only 5-6 systems among 10 systems.

## **DISCUSSION and RESULTS**

In this small-scale research, drawing method along with the written responses of the 1<sup>st</sup> year IBDP secondary school students were used to determine their understanding of the concepts of human body organ systems. Although the misconceptions were detected, due to the time limitation those were not evaluated deeply. The focus of this research was mainly to determine the frequency of the drawn organ systems by the students to find out their previous knowledge prior to the upcoming chapter in IBDP Biology curriculum Topic 6: Human Physiology so that the curriculum implementation plan can be built considering the data collected in this small-scale research. Therefore, this research aimed to help the biology teachers to build upon the students' previous knowledge in a constructivist approach.

The findings of this research somehow support what already have been reported in the literature so far. As Reiss and Tunnicliffe (2001) suggested the endocrine system was seen as the least drawn organ system, pancreas was the commonly drawn organ of endocrine system as seen in 38% of the drawings. Only two students showed adrenal glands in their drawings in this current study.

As reported by Prokop and Fancovicova (2006) organs of skeletal system, endocrine system, reproductive system and muscles were the least frequently drawn organs which were thought that these organs were difficult to draw.

In Aydın's study (2016), heart and stomach were the mostly named organs and they were thought to know the organs of which mostly involved in their daily lives. In the same study when the functions of these organs were asked, majority of the students (89.47%) defined the function of heart correctly whereas all of them (100%) correctly defined the function of oesophagus correctly. In this particular study as shown on table 3, 27 students listed heart as an organ and 13 of those have define the function as "pumping the blood". Therefore, this study shows alignment with the literature findings that the students have not much difficulties to name stomach, lungs, and heart and their functions.

The significance of this study is that it included IBDP 1<sup>st</sup> year students to find out their understanding of the particular concepts. And there is no study reported in the literature including all of these ten organ systems in a single research. However, this research needs to be

improved in the aspect of validity. There are several suggestions to be made for further studies in this area.

Prokop et al. (2007) made a similar research on 702 children aged between 6-16 years from a Slovak elementary school where the elementary school is the one that students go before high school. Each child was given a questionnaire to find out their age, sex, if they bred animals, if they had a personal computer at home and the final exam score for their last biology examination to control for differences between subgroups. The researchers also examined the parents' educational background whether they completed elementary school (Level 1), High school (Level 2) or University (Level 3) to see whether this was one of the factors. The effect of parents' education on children's scores of drawing was significant however whilst the age of children increases the level of knowledge increased. Prokop and Fancovicova (2006) also found that the mostly drawn organs were heart (71.4%), lungs (69.2%) and stomach (56.4%). However, they also supported that the drawings might not always an indicator of their knowledge. There must be another method to test their knowledge. Therefore, in a further research on this particular area the following questions should be given as a questionnaire to be able to control for differences between subgroups, too. Because the students' social relations with the family members or social experiences might also have a role on their knowledge and understanding of particular concepts in biology.

**Suggested Questionnaire Questions:**

Do you have any organ models or toys at home?

Is there a medical doctor at home or in family?

Is there a Biologist in your family?

Educational level of family members at home

The instructions for the drawings must also be more specific as reported by Prokop et al. (2008). He and his colleagues investigated the effect of type of instruction on expression of children's knowledge: how do children see the endocrine and urinary system? Two types of instructions as specific (Khwaja & Saxton, 2001) and general (Tunnicliffe & Reiss, 1999) were used to examine whether the type of instruction has any relationship between the level of the drawing that the children make or not. Each child was given two sheets of paper and asked first "draw what you think is inside your body" (general instruction). After 10 minutes as soon as the children finish their first drawing according to the instruction they were given, researchers asked them "draw urinary system that is inside your body" (specific instruction). When children

finished their second drawing the researchers asked them “draw endocrine system that is inside your body”. They used this system to be able to evaluate whether there was any similar trend between children’s knowledge even after specific instruction.

This particular investigation’s findings along with the findings of Khwaja and Saxton (2001) that the specific instruction allows students make better drawings of a particular organ system. They suggest that if the researcher would like to assess the full extent of the children’s knowledge accurately, this type of specific instruction is more appropriate than general tasks that do not let the children concentrate on a particular phenomenon.

Therefore, particularly for the future research in this area the following specific instructions must also be given for drawings so that the evaluation of any similar trend between students’ knowledge after specific instruction can be done.

**Suggested Special Instructions:**

- Draw lymphatic system and its organs (10 min)
- Draw digestive system and its organs (10 min)
- Draw excretory system and its organs (10 min)
- Draw skeleton system and its organs (10 min)
- Draw endocrine system and its organs (10 min)
- Draw circulatory system and its organs (10 min)
- Draw respiratory system and its organs (10 min)
- Draw nervous system and its organs (10 min)
- Draw reproductive system and its organs (10 min)

This current research was done by a single researcher. Two of the researchers separately and independently must score the drawings until they agree on the level to be awarded (Prokop et al., 2008) for the reliability of the research. However, as a practitioner teacher I was conducting this research on my own without a supervisor or another researcher colleague. Therefore, I had to do all data analyses by myself. This is also shown as a way to increase the validity of the study in a further research.

As it was also observed in this current research, according to Çakıcı (2005) the students’ social and cultural background are effective on their comprehension of scientific concepts to construct meaning. According to their research the authors showed that in science drawings which were accurately drawn also labelled comprehensively. However, it was also stated by Kara et al. (2008) that if the students do not have any knowledge about the concepts, they are

asked to draw then the drawing could not be done or no answers can be given. The authors suggested that the drawing activities should be used in conjunction with interviews to explore students' ideas about the concepts in detail. Therefore, in a further study as a continuity of this small-scale research, focus group interview must be conducted to check students' understanding of the 10 systems and their organs. The interviews must be analysed in detail by conducting content analysis.

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## Appendix 1. Short Quiz

Number:                      Class:                      Gender:                      Birth Year:

Please answer the following questions to show your knowledge.

*Lütfen aşağıdaki soruları bu konudaki tüm bilgilerinizi açığa çıkartacak şekilde cevaplayınız. İstedığınız dilde cevaplayabilirsiniz.*

1. What organs are in your body? (Name the organs and systems)

*Vücudunuzda bulunan organların isimlerini ve hangi organ sisteminde yer aldığını yazınız.*

2. What are the functions of the organs you have just listed above? (Even if you are not sure about your knowledge, you may still write down your prediction)

*Yukarıda yazmış olduğunuz organların vücudunuzdaki görevlerini yazınız. Bilginizden emin değilseniz de tahmininizi yazabilir; dilerseniz yanına not düşebilirsiniz.*

3. Where are the organs you have just listed above located in your body? Name or describe the locations of the organs in your body. (You may support your answer with drawing)

*Yukarıda yazmış olduğunuz organlar vücudunuzda nerede yer almaktadır, yerini tarif ediniz ya da isimlendiriniz. Çizim yaparak cevabınızı destekleyebilirsiniz.*

P.s: your responses will guide me about the knowledge level of secondary school students and misconceptions that they hold. If you do not wish to share your knowledge and/or attend this small research of mine, please fill in the box on top of this paper. Thank you very much.