

Lower secondary school students' interest and emotions regarding dissection in schools - a pilot study

Interes in čustva osnovnošolcev v povezavi s seciranjem v šoli - pilotna študija

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Abstract: In the present study, we investigated lower secondary school student's interest and emotions regarding dissection in schools. Self-reported interest and emotions of fear and disgust toward dissection were assessed. In addition to well-known gender differences from prior studies, the author also assessed if age, participation in home cooking of meat and fish or participation in the home slaughtering and butchering of livestock has an effect on these mentioned dependent variables. The results show, that situational interest was predominantly influenced by the students' age. Older students displayed higher interest in school dissections. Individual interest was influenced by grade, gender and by participation in home slaughtering. Emotions concerning dissection were significantly influenced by gender. Situational interest was predicted both by personal interest and negative emotions. From the results, it can be concluded that participation in home cooking and home slaughtering of livestock has no effect on students' interest and emotions regarding dissection, which is somehow contradictory to the statements of other authors who argue that repeated exposure to dissections raises student's interest and lowers negative emotions regarding dissections. Perhaps spatial and temporal dimensions ought to be considered in addition to the level of students' involvement in such activities.

Keywords: animals, dissection, interest, emotions, secondary school students

Izveček: Namen raziskave je bil ugotoviti interes in čustva osnovnošolcev glede seciranja pri pouku naravoslovja in biologije. Učenci so v ta namen v obliki samoporočila ocenili svoj interes za seciranje ter nivo strahu in gnusa, ki bi ga občutili ob tem. V predhodnih študijah so različni avtorji ugotovili, da na ocene interesa in čustev v povezavi s seciranjem v pretežni meri vpliva spol učencev. V raziskavi smo zato ugotavljali tudi, v kolikšni meri se čustva in interes v povezavi s seciranjem spreminjajo glede na starost učencev, njihovo vključenost v gospodinjstva opravila in sodelovanje pri domačih kolinah. Rezultati raziskave so pokazali, da na interes učencev za seciranje vpliva predvsem starost učencev. Starejši učenci so izkazali višji interes za seciranje kot mlajši učenci. Na osebni interes učencev za učenje o zgradbi in delovanju organizmov vplivajo starost in spol učencev ter njihovo sodelovanje pri domačih kolinah. Spol učencev vpliva na izražanje čustev v povezavi s seciranjem. Interes za seciranje je povezan tako z osebnim interesom kot negativnimi čustvi posameznika. Iz rezultatov

lahko sklepamo, da vključenost učencev v gospodinjstva opravila in sodelovanje pri domačih zakolih ne vplivata na interes učencev za seciranje in oblikovanje njihovih čustev. Naša ugotovitev je v nasprotju z razmišljanji in ugotovitvami drugih avtorjev, ki trdijo, da ponavljajoča se izpostavljenost seciranju vzbuja interes in znižuje negativna čustva ob tem. V prihodnjih študijah bi bilo vredno upoštevati tudi prostorske in časovne dimenzije vključenosti učencev v zunanjsolske aktivnosti, ki so povezane s seciranjem živali ter stopnjo njihove vključenosti pri teh dejavnostih.

Ključne besede: živali, seciranje, interes, čustva, osnovnošolci

Introduction

Biology is essentially the study of life and one can hardly imagine a biology classroom without the presence of living organisms (National Association of Biology Teachers [NABT] 2008).

On the other hand, one of the most “controversial” topics of biology are the topics of animal anatomy and physiology that rely on dissection of animals and animal parts.

Dissection however represent the traditional teaching method for animal anatomy, and it has been used in schools since the early 20th Century (Kinzie et al. 1993). Whether to use dissection in schools, particularly in primary and secondary schools is an ongoing debate (DeVilliers and Monk 2005, Hug 2008). While some authors argue that dissection is a viable option for medical students (Cho and Hwang 2013, Houwink et al. 2004, Rizzolo and Stewart 2006), some believe that it must be drastically (if not completely) removed from schools and replaced with alternatives (Hug 2008, Maloney 2005). A lot of alternatives have been developed, mainly due to ethical concerns regarding dissections (Hug 2008). Such alternatives include the use of preserved specimens, three-dimensional anatomical models, books, charts, slides, photographs, films, computer-based simulations, and interactive simulations (DeVilliers and Monk 2005, Oakley 2012).

Studies that favour alternatives to dissection state their beneficial outcomes such as low time, costs (one time usability of animals), better control over own learning, better structure clarity, and absence of odour and body fluids (what can lead to higher emotional responses and also confusion and frustration) (DeVilliers and Monk 2005, Oakley 2012, Predavec 2001). On the other hand, those who defend the use of dissection in schools often state that the experience of alternatives is not the

same compared to real dissections (Offner 1993). In alternatives, students cannot learn practical dissection skills, sensory experience is not the same, visual-spatial thinking is limited and they lack realism (in DeVilliers and Monk 2005).

Allchin (2005) for example argues that no computer guided alternative is appropriate to teach anatomy. Oversimplification or idealized observed structures and diagrams are considered cheating, because not all structures are visible (or are missing) as opposed to the “real thing”. By his opinion, one cannot teach the students virtual respect for life, as the emotions expressed through dissection are directly linked to self-understanding and understanding of the meaning of death and dying. Without that, a full understanding of life is incomplete.

In the American biology classrooms, for example, more than 80 % of middle and high school teachers report using dissections as their selected form of teaching (Osenkowski et al. 2015). In the mentioned study, 48 % of interviewed students would not use an alternative to dissection, 37 % would use an alternative and 15 % were undecided. The high number of students that would use an alternative to dissection should not be neglected. Therefore, it is no wonder that some authors argue that dissection should be an optional rather than compulsory component of the curriculum (Barr and Herzog 2000). Špernjak and Šorgo (2017) on the other hand found, that less than 15 % of Slovenian students, regardless of gender and school level, would like to opt-out from dissection practice. Furthermore, most of the students would like to conduct more dissections.

Disgust and interest concerning dissection are two topics that were until recently scarcely researched (Fančovičová et al. 2013, Holstermann 2009, Randler et al. 2012). Dissection can be regarded as a form of practical work where emotions

of both disgust and fear are present. Either whole bodies, body parts and bodily fluids or excretions cause a certain level of aversion in students.

Disgust is a basic emotion (Ekman 1999) related to avoidance of certain animals, ill humans, faeces, vomit, sexual substances and other harmful events (Rozin et al. 2008). It can be measured as a trait – trait disgust – or as a state – state disgust (Tolin et al. 2006). Disgust sensitive students display higher level of state disgust within dissection activities what can lower their interest in dissection. This can lead to lowered knowledge acquisition and learning skills. On the other hand, repeated exposure to dissections can increase interest and lower the experience of disgust (Randler et al. 2012).

Interest is defined as a psychological state, which in later phases of development, is also a predisposition to reengage content. This applies to in-school and out-of-school learning and to young and old alike (Hidi and Renninger 2006). We can discern between situational and individual (personal) interest (in Abrahams 2009, Palmer et al. 2016). Whilst individual interest is a relatively enduring predisposition to reengage particular contents, situational interest is described as focused attention and affective reaction, triggered in the moment by environmental stimuli, which may or may not last over time (Hidi and Renninger 2006). For the purpose of the present study, situational interest was regarded as a students' reported interest in dissection activities and their approval of such activities. Individual interest was regarded as a personal view about the importance of anatomy and physiology knowledge and skills for (later) life.

Several studies have already examined the role of disgust on students' achievement, anxiety and knowledge with regard to dissection activities. Holstermann et al. (2009) found that students who experience higher level of state disgust during dissection, also perceive their own performance as less good than their counterparts. The same was observed for interest.

When controlling for gender, females display higher level of disgust toward dissection than males, what is not necessarily true for the interest (Holstermann et al. 2012). Females also show less support for dissection activities than boys (Lock 1995; Holstermann et al. 2012, Fančovičová et al. 2013). Regardless of gender, students who own

pets are less supportive of dissections (Fančovičová et al. 2013).

Purpose of the study

With the change of state curricula for lower secondary school science and biology in 2011, which shifted from ecosystem approach to molecular approach, topics of animals' internal structures came into focus. Dissection of live animals (vivisection) and killing of animals for dissection purpose are prohibited in Slovenian schools. Nevertheless, teachers are allowed to use animals and animal parts that can be bought in stores, for dissection (i.e. fish, sea molluscs, animal organs such as pigs heart, kidney). Knowing that more than 40 % of lower secondary school biology teachers are not using dead animals or animal parts in instruction and would rather use alternatives (Nedižavec 2009), the author was interested how students would report their:

- situational interest toward dissection;
- individual interest in anatomy and physiology;
- emotions that accompany dissection activities (i.e. fear and disgust).

Allchin (2005) stated that in a culture where anyone is helping in slaughtering and butchering of animals or anyone who wears a leather and is also helping in skinning of animals, dissection in a school classroom might be redundant. To test this notion the author has, in addition to grade and gender, also assessed if reported home experiences (cooking meat or fish and participating in home slaughter of livestock) influence before mentioned dependent variables.

Material and methods

Sample of research

A total of 113 lower secondary school students from grades seven ($N = 55$) and nine ($N = 58$) participated in the study. Seventh and nine grade students were selected because seventh grade students were learning about ecosystems where majority of the topics were about animals while nine grade students were learning about human

anatomy. Therefore, in mentioned grades, teachers can meaningfully incorporate dissection activities into their teaching. The mean age of seventh grade students was 12.6 ($SD = 0.50$) years and ninth grade students 14.4 ($SD = 0.49$) years. The proportion of male ($N = 54$) and female ($N = 59$) students was slightly different between grades ($\chi^2 = 3.963$, $df = 1$, $p = 0.047$). More than 65 % of students reported that they are participating in cooking meat or fish and 44 % of students reported participating in home slaughter of livestock. More male (59 %) than female (30 %) students reported participating in home slaughter ($\chi^2 = 9.447$, $df = 1$, $p = 0.002$). There were no other statistically significant differences in distributions found (all $p > 0.05$).

Instruments and procedures

Participating students completed a questionnaire about (1) their situational interest for dissection, (2) their individual interest in anatomy and physiology and (3) emotions that accompany dissection activities (fear and disgust). The self-constructed questionnaire included fourteen 5-point Likert-type items ([1] *strongly disagree*, [2] *disagree*, [3] *neither agree nor disagree*, [4] *agree* and [5] *strongly agree*). Items covering the domain of emotions and perceived health issues concerning dissection were negatively worded and were subsequently reversed.

In statistical analysis, first Principal Component Analysis (PCA) with Direct oblimin rotation

Table 1: Principal Component Analysis with Direct oblimin Rotation of the questionnaire items.
Tabela 1: Analiza glavnih component z uporabo poševnokotne rotacije (Direct oblimin).

Item	Principal component		
	I	II	III
I would not mind dissecting in a classroom.	0.845		
Dissection is interesting.	0.736		
I think I would perform well when dissecting.	0.706		
I would learn a lot through dissection.	0.706		
I would like to dissect organisms in my classroom.	0.600		
Knowledge about my body will be useful for my life.		0.802	
I like to learn about structure and functioning of my body.		0.791	
Knowing the animals' anatomy is important for me.		0.749	
Seeing blood makes me sick. R			0.801
When dissecting, I am afraid of harming myself (e.g. cutting myself). R			0.728
Dissection is a disgusting practice. R			0.691
I would be scared if I would have to touch a dead animal or an animal organ. R			0.515
When dissecting, I would be scared of getting infected. R			0.458
Dissection in classroom is unacceptable. R			0.418
Cronbach α	0.84	0.72	0.76
Eigenvalue	4.71	2.22	1.28
% of total variance	33.64	15.86	9.13

R – reversed items

was used in order to extract meaningful principal components (hereafter PCs) (Tab. 1). The KMO (Kaiser-Mayer-Olkin) index of the sampling adequacy test (0.861) and Bartlett's test for sphericity ($\chi^2 = 569.4$, $df = 91$, $p < 0.001$) suggested that factor analysis was appropriate for this dataset. PCs with eigenvalues > 1.0 were considered in further analyses. In order to test the reliability of extracted PCs, Cronbach's α coefficients were calculated and all shown not to be below the accepted limit of 0.69 (Leech 2005). Cronbach's α of the whole questionnaire was 0.83.

According to PCA, three principal components were interpreted. Situational interest about dissection items loaded highest on PC I (5 items). On PC II, items about students' individual interest in learning about anatomy and physiology were placed (3 items). And on PC III, affective factors that accompany dissection activities (fear and disgust related items) were placed (6 items). All three PC explained 58.63 % of the results' variability.

Data analysis

First, Principal component analysis (PCA) was applied in order to reduce the number of dependent variables. Next, the effect of selected independent variables on individual dependent variable was calculated. For that purpose, GLM univariate statistical procedure was used.

As all independent variables were dichotomous, Mann-Whitney U test was used and the effect sizes were calculated using formula $r = z/\sqrt{N}$.

Spearman's correlations (r_s) between individual PCs were assessed, in order to find correlations between students' interest for dissection, their individual interests in human and animal anatomy and physiology and emotional factors that govern their acceptance of dissection.

All the data were analysed using the SPSS for Windows 21.0.0 statistical software.

Results

Results are presented in three parts. First, the results of univariate statistics are shown, followed by the effects of individual independent variable on students' ratings. Lastly, the correlations between individual PCs are presented.

Results of univariate statistics for individual principal component

Results of univariate statistics (Tab. 2) show that grade (age) produces the largest differences in students' ratings on situational interest (PC I). On the other hand, students' individual interest (PC II) is influenced by several factors. While gender and grade produced medium sized effects on students' ratings, participation in a home slaughter had a marginal effect. Interaction between all independent variables was also found for that PC. Students' emotional response toward dissection (PC III) was strongly influenced by gender only.

Table 2: GLM univariate analysis of the effect of independent variables on students' ratings for individual principal component.

Tabela 2: Univariatna analiza vpliva neodvisnih spremenljivk na izbrane odvisne spremenljivke.

Attitude dimension	Type III Sum of Squares	df	Mean Square	F	<i>p</i>	Partial η^2
PC I: Situational interest						
Gender	0.950	1	0.950	0.813	0.370	0.008
Grade	6.891	1	6.891	5.898	0.017	0.057
Cooking	0.623	1	0.623	0.533	0.467	0.005
Slaughter	0.583	1	0.583	0.499	0.482	0.005
PC II: Individual interest						
Gender	5.417	1	5.417	5.900	0.017	0.057
Grade	5.876	1	5.876	6.400	0.013	0.062
Cooking	1.723	1	1.723	1.877	0.174	0.019
Slaughter	3.540	1	3.540	3.856	0.052	0.038
Gender * Grade * Cooking * Slaughter	6.644	1	6.644	7.236	0.008	0.069
PC III: Emotions						
Gender	14.923	1	14.923	22.182	<0.001	0.186
Grade	0.572	1	0.572	0.850	0.359	0.009
Cooking	0.146	1	0.146	0.217	0.643	0.002
Slaughter	0.148	1	0.148	0.220	0.640	0.002

The effect of individual independent variables on students' ratings

Gender had the highest effect on students' ratings about emotional perception of dissection (PC III; Fig. 1A), where females showed significantly more aversion than boys ($r = 0.48$). Females also perceived the importance of human (animal) anatomy and physiology knowledge for life to be more important than males (PC II, Fig. 1A). But the effect of gender on this principal component was low ($r = 0.19$). **Grade** produced statistically significant differences on all three principal components (Fig. 1B). Ninth graders expressed higher situational interest for dissection (PC I, $r = 0.35$; medium effect) and higher individual interest for usefulness of the anatomy and physiology knowledge (PC II, $r = 0.20$; low effect) than seventh graders. Also, seventh graders

perceived dissection emotionally more demanding than ninth graders (PC III, $r = 0.19$; low effect). The only difference in ratings between students with regard to reported participation in cooking meat or fish was on individual interest dimension (PC II, Fig. 1C). Students with reported participation displayed higher individual interest ($r = 0.19$; low effect). No statistically significant differences were found in students' ratings according to participation in home slaughter of livestock on any PC (Fig. 1D).

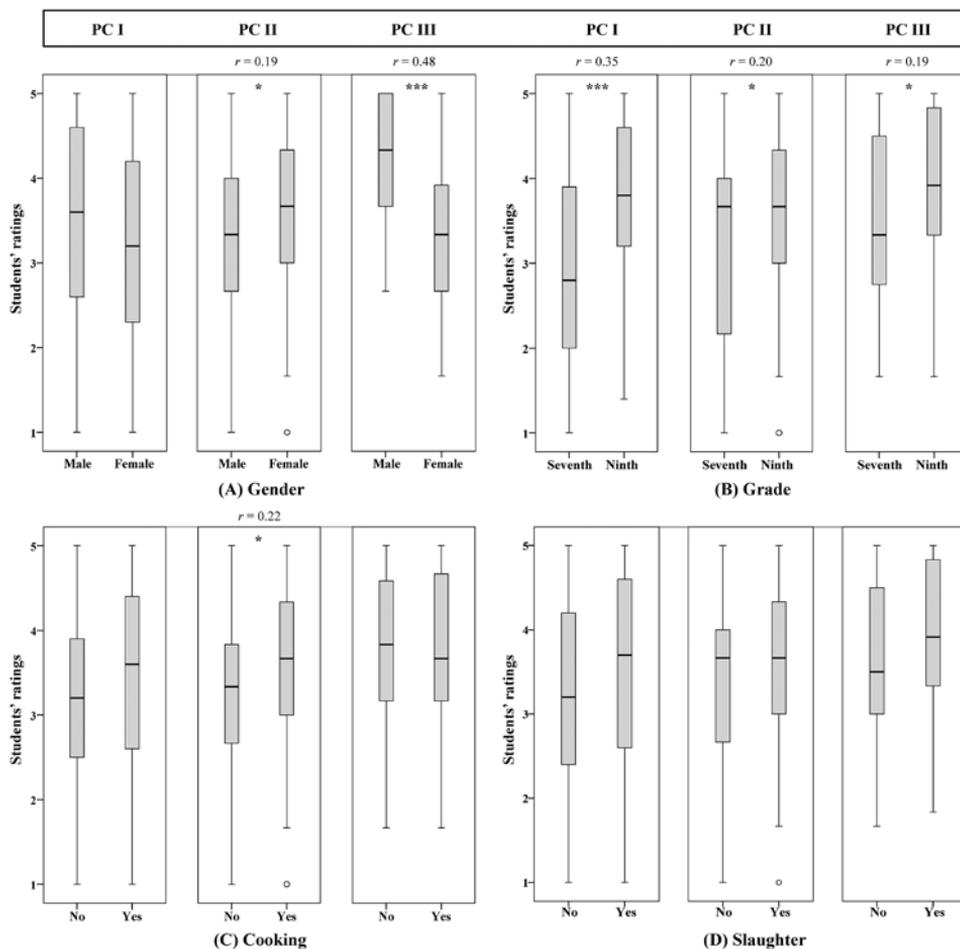


Figure 1: Students ratings on principal components according to **A** - gender, **B** - grade, **C** - reported cooking experiences with meat or fish and **D** - reported participation in home slaughter of livestock (statistical significance was assessed with Mann-Whitney U test; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.01$; r - effect size).

Slika 1: Ocene učencev za posamezno osnovno komponento glede na **A** - spol, **B** - razred, **C** - izkušnje pri kuhanju mesa ali rib in **D** - sodelovanje na domačih kolinah (statistična pomembnost razlik računana z Mann-Whitney U preizkusom; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.01$; r - velikost učinka).

Correlations between individual principal components

Spearman's r correlations were calculated between dependent variables (Tab. 3). Results show the highest correlation to be between students' situational interest for dissection and their expressed emotions. Due to reversed items, the correlation number is positive, meaning the higher the students' situational interest is the less negative is their emotional response. Low correlation was also found between situational and individual interest ratings. No significant correlation was found between individual interest and emotions.

Table 3: Correlations between individual principal components.

Tabela 3: Povezave med posameznimi osnovnimi komponentami.

	PC II: individual interest	PC III: emotions
PC I: situational interest	0.283**	0.572***
PC II: individual interest	-	0.077

Spearman's r : *** $p < 0.001$, ** $p < 0.01$; PC III: EMOTIONS column values are positive due to reversed statements.

Discussion

Present study shows, that many lower secondary school students are willing to study anatomy through means of dissection. The findings correspond with the study of Špernjak and Šorgo (2017), where only a minority of students chose to opt out from dissections. This information should be disseminated to teachers, because many of them do not use dissection activities in their classrooms mainly due to their unfamiliarity with local legislation (Nedižavec 2009) what should also be worked on in the future. Still, a relatively high proportion of students in the present study stated their disapproval of dissection in the classroom. These students also expressed higher levels of negative emotional responses linked to situational interest regarding dissection. Items that assessed students' perceived emotional response were linked to fear and disgust (for example: "*Dissection is a disgusting practice.*" and "*When dissecting, I am afraid of harming myself (e.g. cutting myself).*") Similar results were obtained by Holstermann et al. (2009) and Randler et al. (2012) via assessing the effect of actual dissection activities. The authors argue that disgust eliciting stimuli should be reduced during dissection in order to achieve high interest, as it is known that interest has an important influence on cognitive, motivational and affective processes (see also Hidi and Renninger 2006).

Older students displayed higher interest in school dissections than younger ones, which can be explained by the younger students' preference for studying live animals (Prokop and Tunnicliffe 2010) and their lower interest in internal structures of animals. The author speculates that older student's higher interest of animals' anatomy and physiology is a result of their development. Specifically, the changes in their bodies during puberty, shifts their interest toward studying animal's and their own internal structures and their functioning. It was also found that interest in dissections remains high through the upper high school level (Špernjak and Šorgo 2017).

Although correlations between students' interest for dissections and their general interest about anatomy and physiology were observed, they were low, as opposed to higher correlations between students' interest in dissections and their emotional response. Nevertheless, the former correlation is not to be neglected. As noted by Abrahams et al. (2009), repeated elicitation of situational interest could lead to formation of one's individual interest. Practical work in schools has an effect only if it is well structured and with clear goals what students should gain, which is of particular relevance for dissection activities. Renninger and Hidi (2011) argue that students may experience situational interest when they are exposed to experiences that relate to their individual interests. In this study, students' interest in dissection activities can be

linked to students' personal interest in learning anatomy and physiology. Palmer et al. (2016) found that substantial situational interest can occur if the presented topic is of personal relevance, if it carries a novelty and/or students successfully learn something new. From a constructivist point of view, mentioned can be considered as meaningful learning (Mintzes et al. 1998). But because the correlation between individual and situational interest was low, the statement cannot be completely confirmed.

And lastly, to comment on Allchin's (2005) statement "*that in a culture where anyone is helping in slaughtering and butchering of animals or anyone who wears a leather and is also helping in skinning of animals, dissection in a school classroom might be redundant*". This study found almost no differences between students' ratings regarding situational interest for dissection, nor in the expressed emotions regarding dissection. This finding is somehow contradictory to statements of other authors, who argue that repeated exposure to dissection might raise students' interest and lower their negative emotions regarding dissection (Holstermann et al. 2009, Randler et al. 2012). Perhaps spatial and temporal dimensions ought to be considered in future studies, in addition to assessing of the levels of students' involvement in such activities.

Limitations of the study

The results of this pilot study have confirmed that a link between students' interest in dissections and their emotional response to dissections exists. Furthermore, the link between students' situational interest regarding dissection and their personal interest for anatomy was found. It appears that students' out-of school experiences regarding cooking meat or fish and participating in home slaughtering of livestock do not influence their interest in dissection. However, the later should be reassessed, using a larger sample of students, joint with a more in-depth analyses of students' experiences.

Povzetek

S prenavo učnih načrtov naravoslovja in biologije se pri obeh predmetih obravnavajo tudi teme s področja anatomije in fiziologije. Učenci se pri pouku naravoslovja v osnovni šoli tako bolj podrobno učijo o notranji zgradbi živali. Pri pouku biologije v srednjih šolah in gimnazijah pa je poudarek na razumevanju strukture in funkcije. Ena od učnih metod, preko katere učenci spoznavajo zgradbo in delovanje živali, je seciranje. Slednje se učitelji ne poslužujejo pogosto, kar lahko med drugim pripišemo tudi slabemu poznavanju zakonodaje s tega področja. Vivisekcija ali usmrtitev živali za namen sekcije sta prepovedana, kar pa ne izključuje uporabe materialov živalskega izvora ali živali pri pouku naravoslovja in biologije. Omenjene materiale lahko učitelji kupijo v mesnicah ali drugih živilskih trgovinah in jih uporabijo za seciranje. Ob tem velja poudariti, da lahko čustvi, kot sta strah in gnus, ki ju učenci močno doživljajo ob seciranju, vplivata na kvaliteto njihovega učenja. Predhodne raziskave so pokazale, da je večina učencev naklonjena seciranju v šoli. Sekciji bi se izognilo le 15 % slovenskih učencev in dijakov. Nekateri avtorji menijo, da lahko sekcijo nadomestimo z alternativnimi viri za učenje (3d modeli, interaktivnimi gradivi, knjigami in drugim), ali pa med sekcijo omilimo dražljaje (npr. vonj), na katere bi se lahko učenci odzvali z negativnimi čustvi.

Namen raziskave je bil ugotoviti interes in čustva osnovnošolcev glede seciranja pri pouku naravoslovja in biologije. Učenci so v ta namen v obliki samoporočila ocenili svoj interes za seciranje ter nivo strahu in gnusa, ki bi ga občutili ob tem. V predhodnih študijah so različni avtorji ugotovili, da na ocene interesa in čustev v povezavi s seciranjem v pretežni meri vpliva spol učencev.

V raziskavi smo zato ugotavljali tudi, v kolikšni meri se čustva in interes v povezavi s seciranjem spreminjajo glede na starost učencev, njihovo vključenost v gospodinjstva opravila (obdelava mesa in rib) in sodelovanje pri domačih kolinah. Rezultati raziskave so pokazali, da na interes učencev za seciranje vpliva predvsem starost učencev. Starejši učenci so izkazali višji interes za seciranje kot mlajši učenci. Na osebni interes učencev za učenje o zgradbi in delovanju organizmov vplivajo starost in spol učencev ter

njihovo sodelovanje pri domačih kolinah. Spol učencev vpliva na izražanje čustev v povezavi s seciranjem. Interes za seciranje je povezan tako z osebnim interesom kot negativnimi čustvi posameznika. Iz rezultatov lahko sklepamo, da vključenost učencev v gospodinjstva opravila in sodelovanje pri domačih zakolih ne vplivata na interes učencev za seciranje in oblikovanje njihovih čustev. Naša ugotovitev je v nasprotju

z razmišljanji in ugotovitvami drugih avtorjev, ki trdijo, da ponavljajoča se izpostavljenost seciranju vzbuja interes in znižuje negativna čustva ob tem. V prihodnjih študijah bi bilo vredno upoštevati tudi prostorske in časovne dimenzije vključenosti učencev v zunajšolske aktivnosti, ki so povezane s seciranjem živali ter stopnjo njihove vključenosti pri teh dejavnostih.

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