

Analysis of illustrations concerning human reproduction included in Greek secondary education textbooks

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ABSTRACT

Research with students of different ages show that they hold misconceptions concerning certain aspects of sex and reproduction. Inadequate knowledge regarding sex and reproduction has been linked with risks such as sexually transmitted diseases (STDs) and unplanned pregnancies. Considering that (a) textbooks determine significantly what is learned in school and (b) science textbooks rely largely on illustrations, in this paper we explore illustrations concerning human reproduction included in the Greek secondary education textbooks. Drawing on the results of our analysis we discuss issues such as the absence of pleasure, compulsory heterosexuality, compulsory hetero-patriarchy and lack of contraception information.

KEYWORDS

Human reproduction, textbook analysis, secondary education, illustrations

RÉSUMÉ

Des recherches menées auprès d'étudiants d'âges différents montrent qu'ils entretiennent des incompréhensions concernant certains aspects du sexe et de la reproduction. Des connaissances inadéquates concernant le sexe et la reproduction ont été liées à des risques tels que les maladies sexuellement transmissibles (MST) et les grossesses non planifiées. Considérant que (a) les manuels scolaires déterminent de manière significative ce qui est appris à l'école et (b) les manuels scolaires de sciences reposent largement sur des illustrations, dans cet article, nous explorons les illustrations concernant la reproduction humaine incluses dans les manuels scolaires grecs de l'enseignement secondaire. Sur la base des résultats de notre analyse, nous discutons de questions telles que l'absence de plaisir, l'hétérosexualité obligatoire, l'hétéro-patriarcat obligatoire et le manque d'informations sur la contraception.

MOTS-CLÉS

Reproduction humaine, analyse de manuels scolaires, enseignement secondaire, illustrations

INTRODUCTION

Although people are thought to form a basic understanding concerning human reproduction by the age of 11, research with students of different ages show that they hold misconceptions concerning certain aspects of sex and reproduction such as the reproductive physiology and anatomy (Ampatzidis, Georgakopoulou, & Kapsi, 2019) or contraception (Hamani et al., 2007). Inadequate knowledge concerning sex and reproduction has been linked with risks such as sexually transmitted diseases (STDs) and unplanned pregnancies (Donati et al., 2000; Sydsjö et al., 2006). Focusing on Greece, in a study with postgraduate students two thirds of them failed to name prostate and external female genitalia (Ampatzidis et al., 2019), while only a small percentage of people 16–45 years old seem to have competent knowledge concerning contraception (Tountas et al., 2004). At the same time, Ioannidi-Kapolou's (2004) argues that Greece has one of the highest abortion rates in Europe and a low prevalence of contraceptive use.

Despite the fact that several informal sources, such as parents, peers and media, are thought to support students build understanding on sex and reproduction issues (Milton, 2003) research suggests that most students build understanding on relevant issues mainly through school education (Sydsjö et al., 2006; Westwood & Mullan, 2006). On the other hand, textbooks have a significant impact on teaching and learning, playing a substantial role in primary and secondary school education across the world (Lee et al., 2021). They are considered as a crucial source of knowledge for students and they seem to influence the 'when and how' teaching and learning occur (Chakraborty & Kidman, 2021). Relevant research supports that textbooks seem to play an important role in science classroom in regards to (a) the building of new knowledge, (b) the selection of content and pedagogical strategies (Souza & Porto, 2012) and (c) organizing lessons in ways that meet national curricular standards.

Focusing on the latter, it has been shown that in many cases textbooks *become* the curriculum determining to a large extent, arguably larger than teachers would want, what is taught and learned in the science classroom (Abd-El-Khalick, Waters, & Le, 2008). To support this argument, Weiss et al. (2001) underline that the overwhelming majority of secondary education teachers in USA (over 90%) rely on textbooks when it comes to organize their teaching as well as assign homework. Furthermore, referring to the Trends in International Mathematics and Science Study of 2007, Liu & Khine (2016) note that about 40% of teaching time concerns textbook-based instruction.

Two specific elements of textbooks are important in teaching and learning; the text and the illustrations (Devetak & Vogrinc, 2013). Science textbooks rely largely on illustrations (Liu & Khine, 2016); in fact, as Dimopoulos, Koulaidis, & Sklaveniti (2003) argue, the more recent a science textbook is, the more illustrations it contains. It seems that the visual aspect of teaching and learning is very important in science education since many science concepts are complex and abstract (Devetak & Vogrinc, 2013). Illustrations are powerful tools that help students build understanding of natural science phenomena (Liu & Treagust, 2013); they are considered as natural extensions of text, critical in the communication of sophisticated scientific concepts (Ametller & Pintó, 2002).

Considering the above, we decided to investigate the illustrations included in Greek secondary education textbooks in terms of human reproduction. We have chosen to analyze the illustrations autonomously drawing on (a) the Dimopoulos et al.'s (2003) arguments (i.e. illustrations within science textbooks are autonomous systems of communication, they are rather under-investigated, and students seems to assess them independently from the text) and (b) suggestions that since illustrations are a large and significant part of science textbooks, more

attention must be directed to understanding their independent impact on teaching and learning (e.g. Cook, 2008). Thus, the research question we address here is the following: how is human reproduction represented in the relevant illustrations included in the Greek secondary education textbooks? Our research covers a period from late 19th century to present in order to detect possible differences across decades.

METHODS

Access to old textbooks was achieved through the historic collection of the Greek Institute of Educational Policy, which is a collection of digitalized versions of Greek textbooks from 1820s to 1980s. We used the search engine provided by the collection's website to perform a query for biology and anthropology textbooks of secondary education ('anthropology' was the name of a course included in curriculum from 19th century till 1990s that dealt mostly with human biology – i.e. different organs and systems of the human body). Our query was performed in October 2020 and it resulted in 107 ebooks.

For the first part of our investigation we reviewed these 107 ebooks, along with 6 biology books in use during the school year 2019-2020, in search of sections of human reproduction. The books that we found to include sections of human reproduction formed list-a. During this procedure, we noticed that some books referred to animal or mammal reproduction – or even more generally to sexual reproduction – but human reproduction was not treated as a special subsection; these books formed list-b. Finally, some books did not refer to the reproductive system, even when other systems were described in details – for instance, the author of 'Human Somatology' (Sperantzas, 1966) makes no reference to the reproductive system, although he discusses the skeletal system, the muscular system, the digestive system, the respiratory system, the circulatory system and the nervous system. Of course, we did not further consider books of the latter category.

For the second part of our investigation we identified all the illustrations included in human reproduction sections of books of list-a and the illustrations included in reproduction sections of books of list-b that specifically concerned humans. For instance, in 'General Biology Lessons for the 3rd grade of Lyceum' (Krimpas & Kalopisis, 1977) there is a section about reproduction which deals with sexual (through the example of plants) and asexual reproduction, but human reproduction is not discussed as a special subsection. However, humans are mentioned in some cases and there are two illustration of human eggs being fertilized by human sperm.

We have to note that some of the ebooks we reviewed were different editions of the same book. For example, we reviewed 12 editions of the 'Anthropology for the 2nd grade of Lyceum' (1969, 1970, 1971, 1972, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981). In all such cases, all the editions of the same book included the same illustrations regarding our analysis. Thus, our analysis concerned illustrations included in nine textbooks as shown in Table 1.

The illustrations relevant to our study were treated using a coding scheme informed by one of the instruments constructed and validated within the project 'Biology, health and environmental education for better citizenship' (Carvalho & Clément, 2007). More specifically, our coding scheme draws on the instrument constructed for textbook analysis on the topic 'human reproduction and sex education'; it is a grid constituted by 19 categories divided in several subcategories such as reproductive anatomy, reproduction (reproductive cells, fertilization, embryonic development etc.) STDs and contraception (see for example Bernard,

Clément, & Carvalho, 2007). Both authors coded independently all illustrations and the rater agreement was over 85%.

TABLE 1
The textbooks analyzed

Number	Title	Grade	Reference	Number of illustrations
Textbook-1	Anthropology for the 2nd grade of Lyceum	K11	Aspiotis, 1977	6
Textbook-2	General Biology Lessons for the 3rd grade of Lyceum	K12	Krimpas & Kalopisis, 1977	2
Textbook-3	Genetics for the 1st grade of Technical Vocational Lyceum	K10	Yfoulis, 1978	2
Textbook-4	Anthropology for the 2nd grade of Gymnasium	K8	Aspiotis, 1980	7
Textbook-5	Biology Lessons for the 3rd Grade of Gymnasium	K9	Krimpas, Zouros, Tsakas, & Christodoulou, 1980	2
Textbook-6	Anthropology for the 2nd grade of Gymnasium	K8	Argyris & Kavouras, 1981	5
Textbook-7	Biology for the 3rd Grade of Gymnasium	K9	Gkelti-Douka, Patargias, & Argyris, 1982	4
Textbook-8	Biology for the 1st grade of Lyceum	K10	Kastorinis, Kostaki-Apostolopoulou, Mparona-Mamali, Peraki, & Pialoglou, 2011	21
Textbook-9	Biology for the 1st grade of Gymnasium	K7	Mavrikaki, Gouvra, & Kampouri, 2017	12

RESULTS

As shown in table 2, most textbooks (7/9) include illustrations of different stages of the embryonic development. In some cases, an embryo or fetus is depicted (e.g. Aspiotis, 1980, p. 88), the illustration describes the embryonic development through different phases (e.g. from zygote to blastocyst, see Kastorinis et al., 2011, p. 214) or the illustration focuses on the fetoplacental unit (Aspiotis, 1980, p. 89). In textbook-8 there is a picture of a placenta, without any visible embryo or fetus, that depicts a part of the umbilical cord and the blood vessels within the placenta (Kastorinis et al., 2011, p. 216).

There are illustrations in regards to male reproductive anatomy in most textbooks as well (5/9). Both internal (testicles, prostate) and external (penis) male reproductive organs are depicted and labeled. In textbook-8, apart from two pictures of the male reproductive system there is also a picture of a testicle with details such as the epididymis and seminiferous tubules (Kastorinis et al., 2011, p. 204). On the other hand, illustrations of the female reproductive system are found in less textbooks (4/9). Moreover, only in one relevant illustration the external

female reproductive organs (clitoris, labia) are depicted and labeled; in most cases, the illustrations of the female reproductive systems depict and label only the internal organs (uterus, vagina).

TABLE 2
Frequencies of categories of illustrations of reproduction content

Category/number or textbook	1	2	3	4	5	6	7	8	9
Female reproductive system (internal and external organs)								1	
Male reproductive system (internal and external organs)	1			1		1		2	2
Female reproductive system (internal organs)	1					1			2
Testicle								1	
Sperm	2		1	1	1				1
Spermatogenesis								2	
Oogenesis								1	
Menstrual cycle								1	1
Sperms and egg	1	2	1				1	1	1
Fertilization				1					
Hormones during pregnancy								1	
Stages of embryonic development	1			4	1	2	3	7	5
Placenta								1	
Delivery						1		1	
Prenatal tests								1	
Male and female contraception								1	
Sums	6	2	2	7	2	5	4	21	12

Concerning the gametes, pictures of sperm are found in 5/9 textbooks, while the egg is illustrated only together with sperm just before the fertilization in 6/9 textbooks. There is a single illustration of the fertilization, i.e. an illustration depicting the sperm approaching the egg and entering it to form the zygote (Aspiotis, 1980, p. 85). In regards to the formation of the gametes, only textbook-8 includes illustrations of both the spermatogenesis and the oogenesis.

In textbook-9 there is an illustration consisted of four consecutive pictures that portray the events of the menstrual cycle (oocyte maturation, endometrial apoptosis, ovulation) (Mavrikaki et al., 2017, p. 126). Textbook-8 includes a similar illustration which contains a graph showing the fluctuation of hormones during the menstrual cycle (Kastorinis et al., 2011, p. 207). In textbook-8 is also found a graph showing the fluctuation of hormones during pregnancy (Kastorinis et al., 2011, p. 215).

Finally, an illustration of delivery is found only in textbook-6 and textbook-8. Textbook-8 includes also illustrations of prenatal tests (chorionic villus sampling and amniocentesis) (Kastorinis et al., 2011, p. 221) and the use of men and women contraception methods (condom, diaphragm and intrauterine device) (Kastorinis et al., 2011, p. 226).

DISCUSSION

Reviewing 113 books of biology and anthropology, we note that human reproduction is rarely part of their content. In addition, sections of human reproduction with textbooks seem to be slightly illustrated in general. Few relevant illustrations were identified in nine textbooks – about seven illustrations per textbook in average. However, it is worth noticing that the two more recent textbooks (textbook-8 and textbook-9) include more than half of the total number of illustrations, apparently supporting Dimopoulos et al.'s (2003) claim that modern textbooks use more illustrations compared to the past to communicate science content.

Illustrations of the male reproductive system are found in most textbooks; both the internal and external male reproductive organs are depicted and labeled. On the contrary, the female external reproductive organs are depicted and labeled in only one illustration. This may be associated with Allen's (2004) argument that textbooks focus on the internal organs of the reproductive system seemingly ignoring the pleasure involved; for example, the clitoris is often not mentioned and penis is rarely illustrated erect in relevant illustrations (Allen, 2004). This seems to be also the case for the illustrations we investigated: in only one illustration female external reproductive organs are mentioned and in all illustration of the male reproductive system the penis is depicted flaccid and pendulous.

Thorogood (2000) claims that ignoring pleasure involved in sexual intercourse is part of a tendency to constitute intercourse as a synonym of procreation. When the idea of desire is absent, it is implied that the only reason for someone to be engaged in sexual activity is the creation of children. Moreover, equating sexual intercourse with procreation leads to the development of sexuality that is essentially heterosexual and it is defined in terms of penetration of women from men (Allen, 2004). Curran, Chiarolli & Pallotta-Chiarolli (2009) discuss compulsory heterosexuality in educational context and they argue that it is actually associated with compulsory hetero-patriarchy i.e. the hegemony of male heterosexuals. We may trace elements of this paradigm in the illustrations we investigated: for instance, the sperm is often illustrated per se while the egg is illustrated only with sperms surrounding it or already fertilized to form a zygote. Moreover, in textbook-4 there is no illustration of the female reproductive system. However, female reproductive organs are labeled in an illustration depicting the sperm approaching the egg and entering it to form the zygote (Aspiotis, 1980, p. 85) arguably implying that fertilization is the exclusive role of the female reproductive system.

Finally, textbook-9 is the only textbook to include an illustration of the use of contraception. Although an appropriate use of contraception is important for a healthy and risk-free sexual life, many studies around the world show that limited awareness and misinformation concerning contraception prevail. For example, investigating 1800 men and women aged from 18 to 29 in USA, Kaye, Suellentrop, & Sloup (2009) report that many young adults know little about condoms (30%) and birth control pills (63%), while 27% of women asked thought that birth control pills may lead to health problems and 30% of them thought that intrauterine device may cause infection. Since most students build understanding on sex and reproduction mainly through school education, it seems that promoting the proper use of different methods of contraception should be part of the school education. As a final remark, we note that the percentage of books (8/9) that do not include illustrations of contraception is quite large compared to textbooks from other countries. For instance, investigating 42 textbooks used in secondary education in 16 countries, Bernard et al. (2008) report that illustrations of condoms were involved in all the textbooks researched.

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