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ORIGINAL ARTICLE

Science ethics education: Effects of a short lecture on plagiarism on the knowledge of young medical researchers

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Summary

Purpose: *Plagiarism is the most common form of scientific fraud. It is agreed that the best preventive measure is education of young scientists on basic principles of responsible conduct of research and writing. The purpose of this article was to contribute to the students' knowledge and adoption of the rules of scientific writing.*

Methods: *A 45 min lecture was delivered to 98 attendees during 3 courses on science ethics. Before and after the course the attendees fulfilled an especially designed questionnaire with 13 questions, specifically related to the definition and various types of plagiarism and self-plagiarism.*

Results: *Although considering themselves as insufficiently educated in science ethics, the majority of the attendees responded correctly to almost all questions even before the course, with percentages of correct responses to the specific question varying from 45.9-85.7%. After completion of the course, these percentages were significantly ($p<0.01$) higher, ranging from 66.3-98.8%. The percentage of improvement of the knowledge about plagiarism ranged from 9.18-42.86%. The percentage of impairment ranged from 1.02-16.33%, the latter being related to the question on correct citing unpublished materials of other people; only for this question the percentage of impairment (16.33%) was greater than the percentage of improvement (11.22%).*

Conclusion: *Even a short lecture focused on plagiarism contributed to the students' awareness that there are many forms of plagiarism, and that plagiarism is a serious violation of science ethics. This result confirms the largely accepted opinion that education is the best means in preventing plagiarism.*

Key words: education, ethics, medicine, plagiarism, scientific misconduct

Introduction

Among the 3 most serious breaches of the publication ethics - falsification, fabrication of data, and plagiarism - this latter issue is the commonest. Plagiarism is the appropriation of another person's ideas, studies, results or words without giving appropriate credit. How to prevent any kind of plagiarism including self-plagiarism, and how to deal with it, is the constant worry of editors of scientific journals [1-6].

The best preventive measure is education on science ethics, not only for young people under training [7,8], but also on all educational levels and activities [9-12]. This was a good reason for our team to start teaching on science ethics several years ago to graduated medical students [13]. One lecture was on plagiarism, with detailed instructions of what makes a plagiarized article, i.e. use of published and unpublished ideas of others, or words or other intellectual property without attribution or permission [2]. Also, the appropriation of 6 or more words in one row from another article without quotation marks and citing the original paper or paraphrasing ideas without the citation of the source etc.

In this article, we report the level of knowledge on plagiarism of our target population before and after the course was delivered.

Methods

Study population

During 2004-2006, 98 graduated medical students attended 3

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courses on publication ethics. The large majority of attendees (predominantly females) were excellent graduate students; they reported that their knowledge about science ethics was insufficient (Table 1).

Lecture on plagiarism

The programme of the course "Publishing in Biomedicine" included 4 lectures (45 min each) concerning science ethics, one of which was related to plagiarism. This lecture, supported by power point presentation, was aimed to provide as much as possible information on plagiarism.

Questionnaire

An especially designed questionnaire was distributed to the attendees, to be fulfilled anonymously before and after the completion of the course in the classroom. The response rate was 100%. The questionnaire consisted of 13 questions, specifically related to the definition and various types of plagiarism and self-plagiarism.

Statistical analysis

Descriptive methods of statistical analysis (mean, median, N and percentages) were used to summarize the data before and after the course, obtained from the questionnaires. McNemar's x^2 test was used to assess the impact of the education on each question. The statistical package R (version 2.14.1 (2011-12-22); Copyright (C) 2011, The R Foundation for Statistical Computing; ISBN 3-900051-07-0) was used for statistical analyses.

Results

The vast majority of the attendees responded correctly to almost all questions even before the course, the percentages of correct responses to the specific question varying from 45.9-85.7%. After the completion of the course, these percentages were significantly ($p<0.01$) higher, ranging from 66.3-98.8%. Therefore, the percentage of the improvement of the knowledge about plagiarism ranged from 9.18-42.86% (Table 2). The percentage of impairment ranged from 1.02-16.33%, the latter being related to the question No 11 which indicated the necessity to cite other authors if somebody likes to cite their unpublished work, oral presentations, creations, ideas and so on; only for this question, the percentage of impairment (16.33%) was greater than the percentage of improvement (11.22%) (Table 2 and Figure 1).

Table 1. Characteristics of the study group

Characteristics	*N (%)*	*Respondents - N (%)*
Gender		
Male	26 (26.53)	
Female	70 (71.43)	96 (97.96)
No data	2 (2.04)	
Age (years)		
Mean (SD)	33.71 (6.87)	
Median (range)	31.50 (22-54)	96 (97.96)
No data	2 (2.04)	
Grade point average		
Mean (SD)	8.72 (0.59)	
Median (range)	8.67 (7-10)	91 (92.86)
No data	7 (7.14)	
Perception of knowledge of SE		
Sufficient	4 (4.08)	
Insufficient	62 (63.27)	97 (98.98)
Not sure	31 (31.63)	
No data	1 (1.02)	

SE: science ethics, SD: standard deviation

Discussion

Most researchers think that plagiarism is on constant increase lately [14-17], which worries all scientists, and editors of scientific journals in particular [18,19], and several measures to prevent or correct the fraudulent literature are undertaken [20-23]. However, it is thought that a great part of plagiarism derives from cultural differences [24,25], lack of good command of English language [26-29], or simply from unawareness, misconception, or misunderstanding of plagiarism [10, 30-32].

Several reports about the knowledge of young researchers on plagiarism showed that youngsters are unaware about what plagiarism is, mainly because they lacked any formal instruction in research ethics [16]. That is why current emphasis focuses on the need for formal education, including the learning and adoption of the current rules [2,3] as the best preventive measure [29,32-35]. Editors and educators are advised to be proactive rather than reactive regarding prevention of scientific misconduct [10,36-38].

Several studies revealed that the respondents, although expressing strong negative attitude toward other serious breaches of publication ethics (falsification and fabrication of data), were somewhat permissive re-

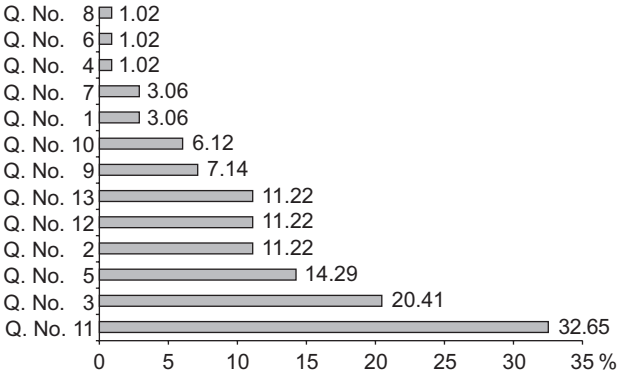

Figure 1. Percentage of incorrect answers regarding plagiarism after a short education. Q: question

Table 2. Changes in the level of knowledge (number of correct answers) about plagiarism after short-term education

	Questions	*N*	*Before Correct responses N (%)*	*After Correct responses N (%)*	*p value**	*Improvement N (%)*	*Impairment N (%)*
1.	It is justified to publish the same article on the same language twice (in two different publications).	98	77 (78.57)	95 (96.94)	<0.01	17 (18.35)	0 (0.00)
2.	It is justified to publish the same article on two different languages in two different publications.	98	48 (48.98)	87 (88.78)	<0.01	41 (41.84)	3 (3.06)
3.	It is not mandatory to put quotation marks when in downloaded text of another author only a few words were changed, and the source cited.	98	49 (50.00)	78 (79.59)	<0.01	34 (34.69)	6 (6.12)
4.	It is mandatory to obtain the permission of the original author for taking over (downloading) figures, photos and tables.	98	84 (85.71)	97 (98.98)	<0.01	12 (12.24)	0 (0.00)
5.	Omitting the quotation marks when the other author's text is cited verbatim is a serious infringement (violation).	98	65 (66.33)	84 (85.71)	<0.01	23 (23.47)	4 (4.08)
6.	The software for detecting authors who had appropriated the parts of the other authors' text does exist.	98	51 (52.04)	97 (99.98)	<0.01	22 (22.45)	0 (0.00)
7.	The copying of some parts (text, figures, tables, schemes) of the author's own published articles without quotation marks and citing the original paper means plagiarism.	98	48 (48.98)	95 (96.94)	<0.01	42 (42.86)	0 (0.00)
8.	The plagiarism is the appropriation of six or more words in one row from another article without quotation marks and citing the original paper.	98	71 (72.45)	97 (98.98)	<0.01	21 (21.43)	1 (1.02)
9.	The plagiarism of the texts is most easily detected.	98	84 (85.71)	91 (92.86)	ns	9 (9.18)	3 (3.06)
10.	The research results previously presented on a meeting and published as abstracts can be republished in the full paper form.	98	72 (73.47)	91 (92.86)	<0.01	23 (23.47)	4 (4.08)
11.	It is not obligatory to put the quotation marks when the other authors' unpublished materials are taken over.	98	69 (70.41)	65 (66.33)	ns	11 (11.22)	16 (16.33)
12.	Paraphrasing of ideas needs the citation of the source (reference).	98	82 (83.67)	87 (88.78)	ns	9 (9.18)	5 (5.10)
13.	It is allowed to omit quotation marks when copying verbatim other author's text, providing that it be written recessed from the margins.	98	45 (45.92)	87 (88.78)	<0.01	38 (38.78)	1 (1.02)

*McNemar's x^2 test, ns = not significant

garding plagiarism and self-plagiarism. It is not known whether this attitude is due to insufficient knowledge about plagiarism, or to moral reasoning of the attendees [10,37,39,40].

All our students thought about science ethics for the first time. We believe that the significant increase in our students' knowledge of plagiarism after lecturing stems from broader understanding of the proper rules for correctly citing and paraphrasing a text. It is unclear why the only significant impairment was related to omitting quotation marks when the other authors' unpublished materials are taken over; this might be due to our failure to convince students to discriminate between right and wrong in this particular item. Therefore,

we claim that extra attention should be paid to the rules of correct citing other people's work in future educational seminars.

Apart from this particular issue, it is evident that even a short lecture focused on plagiarism contributed to the students' awareness that there are many forms of plagiarism, and that plagiarism is a serious violation of science ethics. Since higher levels of understanding are associated with lower levels of fraudulent behavior [16], we hope that our students have learned and adopted the rules of honest scientific writing and, being aware of this, they will self-restrain from any form of plagiarism when writing a research paper.

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