RESEARCH

Pharmacy Students' Ability to Identify Plagiarism After an Educational Intervention

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Submitted August 02, 2013; accepted October 05, 2013; published March 12, 2014.

Objective. To determine if an educational intervention in a doctor of pharmacy (PharmD) degree program increases pharmacy students' ability to identify plagiarism.

Methods. First-year (P1), second-year (P2), and third-year (P3) pharmacy students attended an education session during which types of plagiarism and methods for avoiding plagiarism were reviewed. Students completed a preintervention assessment immediately prior to the session and a postintervention assessment the following semester to measure their ability.

Results. Two hundred fifty-two students completed both preintervention and postintervention assessments. There was a 4% increase from preintervention to postintervention in assessment scores for the overall student sample ($p < 0.05$). The mean change was greatest for P1 and P2 students (5% and 4.8%, respectively).

Conclusion. An educational intervention about plagiarism can significantly improve students' ability to identify plagiarism.

Keywords: plagiarism, pharmacy education, healthcare education, educational intervention

INTRODUCTION

Academic misconduct, including plagiarism, is an important issue across all disciplines, including healthcare. *Webster's Collegiate Dictionary* defines plagiarism as "the act or instance of stealing or passing off the ideas or words of another as one's own."^{1,2} Plagiarism can be further classified into several different types, including direct, mosaic, and self. Direct plagiarism involves the word-for-word copying of text without acknowledging the source.³ Mosaic plagiarism can be defined as the taking of words, phrases, and/or ideas from a source with only a slight change of wording and without properly recognizing the source. Self-plagiarism can be defined as the dual or redundant use of one's own work without proper acknowledgement.

The rates of plagiarism in the health professions fields and health professions education are surprisingly high.⁴⁻⁹ An evaluation of 198 second-year medical students who

wrote an essay for a medical informatics course found that only 9% did not plagiarize any portion of their submission. The same evaluation revealed the median rate of plagiarism for all submitted assignments was 17%.⁴ Additionally, a survey of 18 nursing schools reported that 1%-28% of nursing students engaged in behaviors that could be classified as plagiarism, including copying from written and Internet sources without citations, falsifying a bibliography, and turning in assignments completed by another person.⁵ Another survey showed that 60% of nursing students admitted to copying ideas without giving credit to the original author and 57% of the students had copied word for word from a source without citation.⁶ The incidence of plagiaristic behaviors in other health professions was not significantly different. Student perception of the severity of various types of plagiarism also affected outcomes, with more severe behaviors (as identified by students) reported less frequently.⁵

The problem of plagiarism extends beyond students in academia as cases of plagiarism have also been reported in pharmacy faculty member applications and medical fellowship applications.^{7,8} In 1 study, 15% of the articles retracted in drug-therapy publications were cases

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classified as scientific misconduct by plagiarism.⁹ There is a connection between unethical behavior during undergraduate training and unethical behavior in professional settings, indicating a need to address these issues early in student education.¹⁰

At the academic level, the reasons for why students plagiarize vary and may be intentional or unintentional. Students may not have a comprehensive understanding of plagiarism or methods to avoid plagiarism, such as proper note-taking or proofreading skills, or they may not understand the seriousness of plagiarizing.¹¹⁻¹⁵ In one survey of pharmacy students, most were aware of a school policy related to plagiarism, but they knew little about the content of the policy. Most of the pharmacy students found many behaviors acceptable that the survey authors considered unacceptable. Examples of these behaviors included inventing references when the student had forgotten to document the source, using someone else's words without referencing them properly, and including material downloaded from the Web in an assignment without including a reference.¹⁶ Also, 71.9% of the pharmacy students in this study stated they would not report a classmate they suspected of plagiarism.¹⁶ The data from this and other studies suggest that increased education about plagiarism and its consequences might help to deter it.

Research in undergraduate and graduate students outside of the health professions realm has shown some benefit to educational interventions deterring plagiarism. Marshall and colleagues found that participation in an interactive online seminar decreased the amount of plagiarism as detected by software.¹⁷ In addition, a study by Dee and colleagues demonstrated that an educational assignment on plagiarism helped to decrease the occurrence of plagiarism in undergraduate students because of increased knowledge on the topic of plagiarism.¹⁵

Only 2 studies on the effectiveness of different interventions designed to prevent plagiarism in health sciences education have been reported. An undergraduate online health alliances course provided students with online resources related to plagiarism and created a grading rubric for a written assignment that emphasized the avoidance of plagiarism.¹³ Students in the course were able to identify most types of plagiarism but not all. Of the online plagiarism resources provided to students, the grading rubric was the most reviewed resource (91%).¹⁸ Student submission of assignments with directly copied and pasted information without proper citations decreased compared to previous semesters. One master of public health program found that using the plagiarism detection software Turnitin (Warburp Pincus, Oakland, CA) aided in monitoring for plagiarism but did not serve to prevent it. However, implementation of

a plagiarism seminar in the curriculum decreased the rate of plagiarism as detected by the software.^{17,19}

A clear link between awareness and prevention of plagiarism in the health professions field has not been determined yet. The above studies indicate that improved awareness from educational intervention has benefit to an undetermined degree; however, neither of the studies used educational interventions as their primary focus. The Wingate University School of Pharmacy (WUSOP) curriculum does not include a formal discussion on plagiarism, but students are taught how to properly cite resources. Because there is no formal discussion, WUSOP wanted to assess and educate students on identifying plagiarism. Based on the need to determine the parameters of a successful educational intervention, the primary objective of our study was to determine if an educational intervention seminar would increase pharmacy students' ability to identify plagiarism. The hypothesis of this study was that an educational intervention on plagiarism would increase the scores of the postassessment compared to the preassessment.

METHODS

Faculty members created 10 cases that each described a situation involving methods used for completion of an assignment or project (Appendix 1). Students were asked to assess each case and determine if plagiarism was committed. A committee of faculty members and the external consultant who created the education intervention reviewed the assessment instrument to ensure cases represented common, identifiable types of plagiarism. This ensured construct validity. Cases depicted a variety of plagiarism types, including direct plagiarism, self-plagiarism, and mosaic plagiarism. The 10-case assessment and informed consent were then combined into a survey instrument and approved by the Wingate University Research Review Board. The assessment was delivered using Logic eXtension Resources (LXR) testing software (Applied Measurement Professionals Inc, Georgetown, SC).

During the first week of the fall 2012 semester, all P1 through P3 students were given the opportunity to voluntarily complete the preassessment during a preselected class and participating students provided informed consent. The preassessment included the same questions for all students; however, they were randomly ordered by the LXR software. The preassessment was administered to the students during similar time slots to avoid student communication about the preassessment. Students accessed the preassessment using their individual student ID number and were given 15 minutes to complete it.

After completing the preassessment, all students were asked to attend a Plagiarism Educational Seminar

during the first week of the fall 2012 semester. The seminar was led by an external consultant who was a Writing Center faculty member at Queens University of Charlotte with a master's degree in journalism and an extensive history of researching, teaching, and evaluating plagiarism at the university level. The seminar included PowerPoint slides to educate students on the elements of plagiarism, ways to avoid plagiarizing, and possible consequences of inappropriate attribution. Two hundred twenty-seven students from WUSOP's main campus attended the seminar. The seminar was recorded and viewed by all 33 students enrolled on WUSOP's Hendersonville campus within the same week.

To assess the effectiveness of the Plagiarism Educational Seminar, a postassessment was administered. On the first day of class of the spring 2013 semester, P1 through P3 students in preselected classes were asked to retake the same assessment they completed the previous fall. Again, all students received the same assessment cases but in random order as determined by the LXR software. The postassessment was also voluntary and participating students filled out an informed consent. Students were given 15 minutes to complete the postassessment. In addition to the original plagiarism cases, students were asked if they attended the Plagiarism Educational Seminar during the fall semester to ensure that only those students who attended the seminar were included in the final analysis. Student identification numbers were removed from the results of the preassessments and postassessments before being reviewed by the committee to ensure anonymity.

Data were exported from the LXR software for analysis. Significance was set at $p < 0.05$. A repeated measures t test determined the difference for each group (P1, P2, and P3 students) before and after the educational intervention. Paired sample t tests using SPSS, version 21 (IBM, Armonk, NY) were performed to compare the preassessment and postassessment scores for each group.

RESULTS

All P1, P2, and P3 students ($N=284$) were invited to participate in the preassessment, plagiarism intervention, and postassessment. Of the eligible population, 260 (91.5%) students completed at least 1 portion of the study. Eight respondents were excluded for either not consenting to participate or not completing both assessments, resulting in a sample size of 252 (88.7%). The study sample consisted of 102 P1 students (40.5%), 90 P2 students (35.7%), and 60 P3 students (23.8%). The differences in class sizes were attributable to a planned phased increase in entering class sizes. The response rates were 97.2%,

90.2%, and 85.5% for the P1, P2, and P3 students, respectively. Demographic information was not collected during the assessments, but data regarding the general student population for comparison to other PharmD degree programs is summarized in Table 1.

The mean scores for the students' ability to identify plagiarism measured by the preassessment and postassessment were 77.8% and 81.8%, respectively. There was a 4% increase ($p < 0.05$) in the overall scores between the preassessment and postassessment for the student sample (Table 2). The mean change was greatest for students in their P1 and P2 years with a 5% and 4.8% change, respectively. The students in the P3 year had 1.1% increase in their overall scores, which was not significant. Although the correlation between preassessment and postassessment scores was significant for the overall sample and students in their P1 and P2 years, the correlation was not significant for P3 students (Table 3). The results for the paired t test analyses are provided in Table 3.

There were 2 cases that most respondents did not answer correctly on the preassessment or postassessment or that resulted in the largest mean change in correct responses between the preassessment and postassessment, indicating improvement in identifying this type of plagiarism (Table 4). The other 8 cases only had a minimal ($< 3\%$) change in scores between the assessments. Students had the greatest improvement in their ability to recognize self-plagiarism (36%) with this change being greatest earlier in the curriculum. The respondents had the greatest challenge in identifying plagiarism that involved using quotations for a large amount of plagiarized text. Students missed a case where they placed a large amount of text in quotations but did not cite the source properly. Although there was a 7.1 % increase in students' ability to identify this form of plagiarism in the postassessment, only one-third (33.2%) of students were able to identify it.

DISCUSSION

This study investigated the effectiveness of an educational intervention in a PharmD degree program on pharmacy students' ability to identify plagiarism. A significant

Table 1. General School Population Demographics

	P1 Students	P2 Students	P3 Students
Mean age in years	22	22	24
Age range in years	20-43	20-44	20-48
Female students, %	57.5	58.3	64.6
4-year degree completion, %	54.7	50.5	49.4

Abbreviations: P1=first year; P2=second year; P3=third year.

Table 2. Pharmacy Students' Performance on an Assessment of Their Ability to Identify Plagiarism

Participant Groups	Post-intervention, Mean (SD)	Pre-intervention, Mean (SD)
All participants (N=352)	81.8 (10.7)	77.8 (11.0)
Third-year students (n=60)	81.2 (10.7)	80.1 (11.0)
Second-year students (n=90)	80.5 (11.1)	75.7 (12.1)
First-year students (n=103)	83.3 (10.1)	78.3 (9.6)

increase was seen in students' ability to identify different types of plagiarism. Significant gains were seen in P1 and P2 students' scores, whereas only a small but insignificant gain was seen in P3 students' scores. This is consistent with earlier-year students having less baseline knowledge and exposure to plagiarism compared to advanced-year students.

Ten case scenarios about different types of plagiarism were incorporated in the assessment. Students' responses to 2 of the 10 cases, self-plagiarism and direct plagiarism, deserve special mention. In general, students demonstrated the least amount of awareness about these 2 forms of plagiarism. Of the 252 students who completed the assessment cases about direct plagiarism and self-plagiarism, only 26.1% demonstrated awareness of direct plagiarism prior to the educational intervention and only 45.8% demonstrated awareness of self-plagiarism.

Students at all levels gained the greatest amount of knowledge from the case that focused on self-plagiarism. Of the 3 student groups, the P1 students almost doubled their awareness about self-plagiarism with a gain of 47.6%. A significant gain of 31.1% in P2 students' scores and 23.4% in P3 students' scores was seen. Students were not aware prior to the intervention that they could not re-use their own documents without appropriate self-attribution or use the same document for multiple assignments. This misconception also permeates into literature as 28% of articles retracted from publications from 2000-2011 based on error were because of duplicate publications or self-plagiarism.⁹

Of all the types of plagiarism addressed in this study, students demonstrated the greatest amount of difficulty grasping the concept of direct plagiarism, specifically related to citing large amount of text. Prior to the educational

intervention, only 26.1% of the 252 students demonstrated awareness about direct plagiarism, which represented the lowest preassessment case score of all 10 cases. Students were unable to identify improper citation resulting in direct plagiarism. After the educational intervention, about one-third (33.2%) of students improved their awareness about this form of plagiarism and proper citation. This also represented the lowest postassessment case score of all 10 cases. Students displayed insufficient knowledge on the correct citation process in order to avoid plagiarism, indicating this form of plagiarism may be unintentional and may be improved by education on proper citation. Most students were able to correctly identify other types of direct plagiarism; however, few were able to identify a citation error. Targeted education about proper citation to avoid direct plagiarism needs to be included in educational intervention programs.

Students' awareness about direct plagiarism improved after the educational seminar. Interestingly, an increase in scores was only seen in P1 and P2 students (14.6% and 6.6%, respectively). Consistent with their advanced level in the curriculum and more exposure to information about plagiarism, the P3 students' baseline scores on cases involving direct plagiarism were higher and did not improve significantly after the intervention.

To address academic honesty in general, many colleges and universities have instituted honor codes that have imbedded penalties for misconduct such as plagiarism. The effectiveness of honor codes and penalties on reducing the incidence of plagiarism have not been established in the literature; however, providing some form of concrete intervention, such as live or Web-based education programs specifically designed to educate students about plagiarism, can be effective.^{11,15,17}

Table 3. Comparison of Performance on Preintervention and Postintervention Assessments

	Percent Change, Mean (SD)	95% Confidence Interval of the Difference		P
		Lower	Upper	
Overall sample	4.0 (13.1)	2.4	5.6	<0.001
Third-year students	1.0 (14.9)	-2.8	4.9	0.6
Second-year students	4.8 (12.9)	2.2	7.5	<0.001
First-year students	5.0 (11.9)	2.7	7.4	<0.001

Table 4. Individual Results for Selected Cases with Type of Plagiarism

Case Type	Correct, Pretest, %	Correct, Posttest, %	Change, %
Case 5 - Direct plagiarism ^a			
Overall	26.1	33.2	7.1
Third-year students	36.7	31.7	-5.0
Second-year students	27.8	34.4	6.6
First-year students	18.4	33.0	14.6
Case 6 - Self-plagiarism ^b			
Overall	45.8	81.8	36.0
Third-year students	58.3	81.7	23.4
Second-year students	44.4	75.5	31.1
First-year students	39.8	87.4	47.6

^a Case 5: Direct Plagiarism or Plagiarism of Words. "In writing a paper, you have difficulty rewording a paragraph from the same textbook so put quotation marks at the beginning and end of the paragraph and include a footnote for the textbook at the end of the sentence."

^b Case 6: Self-Plagiarism. "A student on rotation is required to complete a journal club presentation. The student runs out of time and decides to present a journal club completed on a previous rotation. All of the material in the presentation is appropriately referenced and the student only uses his own work."

A limitation of our study is that it has not been clearly established whether an increase in knowledge about plagiarism reduces its incidence. However, several studies have documented that students' lack of understanding about plagiarism was a potential reason why students plagiarized.^{11,16,18} Dee and colleagues found that an online tutorial intervention reduced the incidence of plagiarism in undergraduate students.¹⁵ Because our study was only conducted at 1 institution, it is unclear if results will be applicable to all health professions programs. While definitive conclusions about preventing plagiarism cannot be made, the findings of improved plagiarism identification after an intervention are consistent and may help to lay the foundation for future research on reducing the incidence of plagiarism. Another limitation relates to the size of the standard deviations in relation to several of the means reported. Additional diagnostics were conducted and confirmed that the data were normally distributed and not overly affected by outliers. Small standard deviations can be attributed to the smaller sample size. Repeating this study in subsequent years or using other methods to increase the sample size would help with this limitation.

CONCLUSION

Educational interventions need to be implemented early on in the pharmacy curriculum in order to have the greatest impact, and they need to specifically address self-plagiarism and proper citation to avoid direct plagiarism. While specific ways to deter plagiarism were not identified, an educational intervention seminar significantly improved students' abilities to identify plagiarism. An intervention such as an educational seminar can

improve pharmacy students' awareness about the different types of plagiarism. Students may require more in-depth training about certain types of plagiarism such as direct and self-plagiarism and proper citation methods.

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Appendix 1. Case Example

You are writing a paper on a new drug recently FDA approved. During your research you find a review article that discusses the findings from major clinical trial for the newly approved drug. In your paper you include a sentence from the review article that discusses the clinical trial findings and put quotation marks at the beginning and end of the sentence. You cite the clinical trial that was evaluated in the review article but you do not cite the review article.

- A. Plagiarism
- B. Not plagiarism