A Qualitative Study of STEM Graduate Majors' Copyright Knowledge and Educational Experiences

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abstract: This study examines whether graduate students in STEM fields at an R1 institution understand copyright law. Thirty graduate students participated in semi-structured interviews related to copyright and ownership. This study revealed that these students often conflate issues around copyright and plagiarism and have little understanding of their own ownership over the materials they create. This study was modeled on a previous study conducted with undergraduate students and provides a foundation for continued investigation.

Introduction

While many studies examine graduate students' understanding of the ethical implications of copyright, there is still a lack of robust literature exploring students' awareness of ownership over the material they create and their own copyright ownership rights. To address this need, this research focuses on STEM graduate students' understanding of copyright in various scenarios and prepares a foundation for continued investigation. In this study, researchers conducted semi-structured interviews with graduate students in STEM fields at University of Illinois Urbana-Champaign institution, including those in professional programs such as Medical School or Veterinary Medicine. The interviews focused on two case studies concerning copyright law around the ownership and use of photographs created by a student or found on a website. This study was modeled on a previous study conducted with undergraduate students.

portal: Libraries and the Academy, Vol. 25, No. 2 (2025), pp. 389–408.

The authors identified eight themes from the interviews:

1. Students understand ownership but are confused about copyright.
2. Students often conflate the terms "copyright" and "plagiarism."
3. Most students understand there is some difference between for-profit use and non-profit use.
4. Students have some basic knowledge of copyright-related subjects, including fair use, creative commons licensing, open access, and the public domain.
5. Students who encounter copyright-related information as part of personal work or hobbies seem to recall more copyright information.
6. Students are often unaware of the importance of protecting their copyright and ownership of the works they create.
7. Students provided with copyright training retain accurate information.
8. Students express strong interest in receiving copyright-related education in their graduate program.

Academic librarians empower our students to understand their rights as content creators and researchers both within the classroom and without. STEM graduate students create many works and may own their own copyright for lab research notes, academic papers and publications, graduate level theses and dissertations, as well as works created in the course of teaching. This study demonstrates that while graduate STEM students create and own copyright, they are confused about their ownership and authors' rights. As such, it is important to ensure STEM graduate students understand their rights as creators, the nuance of copyright law, and how to protect their work as they shape their future careers.

Literature Review

General Copyright Information

Several recent studies have been conducted in higher educational institutions internationally and domestically, demonstrating that some graduate students are unaware of an array of copyright topics regardless of their geographic regions. Fifteen Chinese chemistry graduate students in a Chinese university were interviewed in 2017 about their awareness of copyright when using information.[1] The interview results indicated that six of the interviewees expressed that they had never heard of the copyright-related topic of open access.[2] When respondents were asked how to obtain journal articles that lacked full-text access, these students indicated various methods including requesting copies from friends at other universities or overseas and seeking help via online forums.[3] However, they might lack awareness that the ways they obtained the articles could constitute a copyright violation. Similarly, Ashiya Ahmadi and Sharad Kumar Sonkar, in their 2015 study, examined the level of copyright awareness among 129 doctoral students at Babasaheb Bhimrao Ambedkar University in Lucknow, India. They found that 50 percent of the students were unfamiliar with the idea that permission should be obtained from the copyright holder before using their work.[4] In fact, permission is not always required under some copyright exemption that favors users, such as the fair use doctrine. Relatedly, the paper explicitly concluded that those doctoral students had a

shallow level of awareness regarding the fair use of copyrighted materials.[5] Studies on the assessment of copyright knowledge were conducted in the United States as well. In a 2016 survey, 60 engineering graduate students from the University of California at Los Angeles were asked about their awareness level concerning intellectual property (IP), including areas such as copyright.[6] Of this group, 32 percent of the students surveyed were unable to provide an answer to the question, "What is copyright?"[7] In 2021, Nancy Sims interviewed graduate authors from various US universities about their experiences with Creative Commons licensing. They discovered that, out of four respondents, one had no knowledge about the concept of licensing before starting their research.[8]

Unearned Confidence

While some suggest that graduate students lack familiarity with copyright topics, other studies demonstrate that some students exhibit confidence yet possess only rudimentary understanding of this subject. In a 2014 study, an open-ended questionnaire was disseminated among 500 students, including 50 graduates of the Kwame Nkrumah University of Science and Technology in Ghana.[9] The results demonstrated that approximately 50 percent of the students indicated that they had a satisfactory understanding of copyright law.[10] Nevertheless, the written responses they offered revealed their misunderstanding with regard to some aspects of copyright law, such as the ownership of copyrightable works.[11] While the respondents had the capacity to describe copyright as a legal instrument that forbids others from using copyrighted products without the creators' permission, they failed to demonstrate that they had sufficient knowledge of the exceptions and limitations available under copyright law. Additionally, the 2014 study found that some of the students encountered challenges in distinguishing the terms 'plagiarism' and 'copyright infringement'; some students incorrectly defined plagiarism as scanning or photocopying literary works and distributing genuine works.[12] As stated in the same study, students' lack of copyright awareness may result from educational institutions employing minimal enforcement of copyright policies.[13]

Digital Content and Sharing

Copyright confusion has continued among graduate students in the complex and constantly evolving digital environment of higher education. With the help of the internet, the physical boundaries between a work and its audience have disappeared, and works can be downloaded without much effort or cost, which results in frequent copyright violations.[14] Ahmadi and Sonkar argue that doctoral students could have a greater tendency to engage in copyright-infringing behaviors because they are more likely to be highly exposed to copyrighted works and information technologies.[15] To further ascertain students' level of copyright awareness on the internet, Aynur Kolburan Geçer, and Arzu Devecı Topal distributed online questionnaires among 188 academics and students at the postgraduate level, including 17 doctoral students and 82 postgraduates at different universities across Turkey.[16] Approximately 63.8 percent of participants used licensed photos and animations from the internet without the owner's permission.[17] Roughly 78.7 percent admitted to using software downloaded from the internet without paying for it, and 66 percent confessed that they obtained computer programs and serial

numbers from their friends or the internet.[18] Geçer and Topal concluded that copyright infringement results from using copyrighted digital works without fear of penalty and that the postgraduate students were mostly unaware of the copyright-related resources available to them on campus.[19]

Copyright Knowledge in Library and Information Sciences

Scholars across various disciplines, including those in library and information sciences (LIS), are working diligently to tackle the growing epidemic of copyright infringement. Many LIS scholars have been conducting studies into the copyright knowledge of students within library schools in the United States, proposing the incorporation of more copyright courses into LIS curricula. In a survey of 94 students from three LIS programs, 66 percent self-reported being acquainted with national copyright law.[20] These students' familiarity with issues related to open access works and licensing for digital information were 46percent and 35 percent, respectively.[21] The variety of responses implied that LIS students do not have a high level of familiarity with certain copyright topics based on their subjective judgment.[22] Furthermore, their answers regarding the copyright training they received demonstrated that LIS graduate programs have insufficient copyright-related instructions to fulfill the demand of the field, especially in academic library hiring.[23] In a similar vein, some researchers found that of 51 ALA-accredited graduate courses, only 11 courses were found to be specific to copyright, all of which were elective and not mandatory for students.[24] Therefore, the aforementioned findings highlight the importance of enhancing the coverage and centrality of copyright-related courses within LIS curricula. Such knowledge proves vital for newly graduated librarians as they enter their prospective workplaces.[25]

Copyright Education

There is an increasing consensus among scholars from non-LIS fields that broader copyright training needs to be developed and adopted throughout all graduate programs, a move that stands to benefit their students. For example, some researchers designed a copyright-related training program for STEM graduate students and demonstrated its effectiveness in enhancing understanding of copyright and patent laws.[26] As shown in the pre- and post-test evaluations, the program had an essential positive impact on the participants' level of understanding of these two areas. This finding was corroborated recently by another group of researchers who worked closely with publishing librarians and copyright and IP librarians to develop an outreach program of scholarly communication and copyright services.[27] This program was created in response to the needs of faculty and graduate students to respect author rights, Creative Commons licenses, and other nuances of copyright.[28] The importance of educating students about copyright throughout the entirety of a graduate program was also emphasized in a 2020 study at Texas A&M University, wherein their program was evaluated.[29] The program emphasized a multi-stage approach, containing online training, workshops, and one-on-one consultations designed specifically for graduate students.[30] The program objective was to instruct graduate students on an appropriate level of copyright knowledge for surviving high-pressure publication and dissertation efforts.[31] These findings were bolstered by

Andrea Schuler's article in which the author explained the close relationship between electronic dissertations, copyright teaching, and what graduate students should know about copyright law.[32]

In addition to the role of copyright education in scholarly publishing, understanding copyright laws and practices is paramount for graduate students developing information literacy skills. The Association of College and Research Library Information Literacy Framework for Higher Education states the value of understanding copyright law under the concept "Information Has Value." Copyright is specifically mentioned in the knowledge practice of this framework, which encourages learners to be able to "articulate the purpose and distinguishing characteristics of copyright, fair use, open access, and the public domain." [33] Bolarinwa Adeyemi utilized a descriptive survey approach in 2018 to assess the students' information literacy skills at the Federal University of Agriculture, Abeokuta, Nigeria.[34] This study distributed questionnaires to 135 students from nine colleges, including 116 graduate students and 19 doctoral students.[35] Of these, 98.2 percent expressed that they need training to prevent copyright violations from occurring in research.[36]

University Intellectual Property

It is relevant to note that university intellectual property (IP) policies significantly impact ownership of copyright on campus.[37] For instance, although university professors' syllabi and course materials would be considered a work made for hire under general copyright law principles, many universities grant copyright of "Traditional Academic Copyrightable Works"[38] in academic and research production back to professors under campus statutes and rules.[39] Data and lab outputs as well as patents, however, are still generally owned by the university as they use a significant amount of university resources.[40] Students, too, often own their own IP, such as their academic papers and dissertations.[41] However, when students are paid under a grant or are working for the university as a graduate assistant or in a laboratory, they may not own the copyright to their work.[42]

While studies examining the ethical use of copyright knowledge among graduate students across various disciplines have been conducted all over the world, there is still a lack of robust literature exploring awareness of students' copyright and ownership over the material they create, especially among graduate students with STEM majors or pursuing professional science degrees. To address this need, this work studies how these graduate students interact with copyright through various scenarios, aiming to inform future research and the development of integrated copyright-related training in STEM.

Research Questions

This study is a continuation of a previous research article which addressed significant gaps in the literature regarding undergraduate students' knowledge of copyright concepts. For this study, the researchers chose to recruit graduate students from a variety of STEM fields. The following research questions informed the research design:

- What do graduate students in STEM know about basic copyright requirements and rights?
- How did graduate students in STEM learn what they know about copyright?
- Have graduate STEM students received any formal educational instruction about copyright?

Methodology

The research method chosen for this study is a qualitative interview approach used to identify themes revealed in the data while allowing students to freely explain their understanding of the issues presented in two case study examples.[43] This study is modeled, with few variations, after a 2022 study by two of the authors with undergraduate subjects.[44]

Graduate students enrolled at the University of Illinois Urbana-Champaign majoring in a STEM field (as defined by the Department of Homeland Security) were invited to participate in a 20-minute interview session. Homeland Security classifies a STEM discipline as any field that is included in the Department of Education's Classification of Instructional Program taxonomy as biological and physical sciences, mathematics, or related fields.[45] This research employed purposive sampling from STEM fields, as students studying in STEM fields tend to have hands-on practice with a variety of copyrighted materials during their time as undergraduate and graduate students, ranging from scholarly literature and journal articles, to images, to software code. Similarly, students may have experience creating copyrightable materials such as lab notebooks, coding software, and photographs of biological specimens.

Students were recruited through physical and digital flyers placed in science libraries on campus, and through calls for participation via the library's social media platforms. The authors also posted the invitation to participate in various listservs, including those for the colleges of agriculture, medicine, molecular and cellular biology, and veterinary medicine. At the start of the interview process, consent was obtained, and students were asked to confirm they were over 18 years of age. By participating in this research study, participants agreed to an audio recording of the session for transcription purposes. Recordings and transcriptions were kept in an institutional cloud folder only accessible to the researchers, and the audio was destroyed once the transcriptions were complete. Students were informed that personal identifiers would not be published or presented, and de-identified information may be used for future research without additional informed consent. Each participant received a $25 Amazon gift card for their participation. A total of 30 students participated in the interviews, each lasting 20-30 minutes. 15 female graduate and 15 male graduate STEM students were interviewed. The interview participants spanned every year of graduate school training. The students' area of graduate studies included disciplines in the agricultural, biological, economic, engineering, and medical sciences (see Table 1).

Table 1.

List of Students' Status and Area of Study*

Interview	Area of Study	Degree Sought	Year
1	Applied Economics	Doctorate	Graduate student
2	Veterinary Medicine	DVM**	Graduate student
3	Veterinary Medicine	DVM	Graduate student
4	Veterinary Medicine	DVM	Graduate student
5	Agricultural Economics	Masters	Graduate student
6	Medicine	MD	Graduate student
7	Crop Sciences	Doctorate	Ph.D. student
8	Veterinary Medicine	DVM	Graduate student
9	Food Science	Doctorate	Ph.D. student
10	Computational Biology	Masters	Graduate student
11	Food Science	Masters	Graduate student
12	Animal Sciences	Doctorate	Ph.D. student
13	Agricultural Engineering	Doctorate	Ph.D. student
14	Veterinary Medicine	DVM	Graduate student
15	Agricultural Engineering	Doctorate	Ph.D. student
16	Medicine	MD	Graduate student
17	Medicine	MD	Graduate student
18	Applied Economics	Unknown	Graduate student
19	Ecology, Evolution and Conservation	Doctorate	Ph.D. student
20	Veterinary Medicine	DVM	Graduate student
21	Entomology	Doctorate	Ph.D. student
22	Veterinary Medicine	DVM	Graduate student
23	Nutritional Sciences and Cancer Research	Doctorate	Ph.D. student
24	Entomology	Masters	Graduate student
25	Food Science	Masters	Graduate student
26	Statistics	Masters	Graduate student
27	Nutritional Sciences	Doctorate	Ph.D. student
28	Ecology and Epidemiology of Infectious Diseases	Doctorate	Ph.D. student
29	Plant Biology	Doctorate	Ph.D. student
30	Plant Biology	Doctorate	Ph.D. student*

Note that a PhD candidate generally denotes a student who has completed all coursework, has passed qualifying examinations, and is working on their dissertation.

**Doctor of Veterinary Medicine

Two interviewers were present for each interview except for one due to a scheduling conflict. Participants were given two case studies discussing the creation and ownership of a photograph used for a class project. (For full text of the case studies and questions, see Appendix A.) Once the participant finished considering the first case study, the interviewers asked three structured questions. Then the participants were given time to consider the second case study. This scenario included six prepared questions. Upon conclusion of the interview process, participants were provided with a handout that included explanations of the copyright implications for each case study (see Appendix B).

The audio recordings were sent to an external company for transcription and once the interviews were transcribed, the researchers analyzed the data, using open code methods and Atlas.ti to code the interview transcripts and analytical coding to identify related themes.[46] After the coding process of the qualitative data was complete, connections and anomalies were explored among the team of three researchers.

Results and Discussion

Ownership versus Copyright

Much like the previous study involving undergraduates, this study revealed that graduate STEM students have a basic understanding of ownership rules but are confused about the implications for how that ownership translates into the legal concept of copyright.[47] The first case study presented a photo that had been taken by the student; the second used a photo found on a website. The students understood that they would "own" the photo from case study no. 1 (CS1), and that the professional photographer would "own" the photo in case study no. 2 (CS2). Some comments that reflected the students' understanding of the term "ownership" were, "So I think you would own it since you took the photo", and "According to my opinion, it's me in this case. Since I clicked the photo, it's my ownership of the photo. Though it's a natural thing, the photography, the art of collecting that photo is done by me. I believe it's the photographer who owns the photo."

However, students were uncertain about how one obtains copyright over a work. Most of the students' confusion around copyright stemmed from the belief that a person must take some formal action to own a copyright. One student said, "I don't know if I would as a photographer have to take some actions to make it copyrighted." Another student commented, "I would think you would own the copyright. But I'm pretty sure in order to copyright something, I could be wrong, I'm pretty sure in order to copyright something, you have to pay money to get it copyrighted…" Sixteen students responded that they had no idea how they could acquire copyright for their works. and eight students said that they might need to fill out some forms or file a claim in a legal department to get copyright approval for their work. There is, in fact, no requirement to either put a copyright notice on a work or register (or renew) a work with the United States Copyright Office to own copyright on a minimally creative work, although registering a work with the Copyright Office allows an author to sue for copyright infringement.[48]

Only three students understood that copyright is automatic. For example, one of the students stated, "I have [copyright] automatically because I took the photo." This

finding is not surprising in the view of the researchers, however, because in prior studies many people shared this misconception about copyright and believe, incorrectly, that formalities such as copyright registration are required prior to copyright formation.

Conflation of Copyright and Plagiarism

Like undergraduates from previous studies, graduate STEM students tend to confuse the concept of academic plagiarism with the legal concept of copyright. While plagiarism concerns the proper attribution of a source for academic purposes, copyright law (generally) concerns legal permission to copy a work, especially in its entirety, unless a copyright exception or limitation, such as the education exception, applies.

In this study, many students noted that using the image from the internet, in example CS2, was not copyright infringement simply because it was properly cited and acknowledged in the class poster. For example, one student opined, "I do believe that this is okay because you're giving credit where credit is due within your citations. Even scientific papers that you read, as long as you cite the source that you've received this photograph from, it's okay to use." This confusion may be in part related to the extensive training most students receive exclusively in the realm of plagiarism. Another student conjectured, "I would think that it's legal because I feel like in school, they always tell us we have to cite where we got material from. So I would think that that's the legal use of the photograph."

Only one student correctly distinguished the difference between the terms plagiarism and copyright, stating, "I think plagiarism is not a legal term. The person who plagiarize[d], he himself is punished. He's not violating somebody else's rights by like selling or distributing them. But, if you sell whatever you got from somebody else, that's a violation of somebody else['s] copyright." While citations can be a helpful factor in a fair use analysis, they are not as important in a legal analysis of copyright infringement. Use of citation can, however, be the deciding factor in cases involving issues of plagiarism.[49]

Understanding Profit Implications

CS2 gave students the opportunity to grapple with educational, non-profit uses of copyright-protected works. The students were asked whether they were allowed to use the photograph taken from the website for their own assignment. Many students' responses indicated a basic understanding that educational, non-profit uses are generally permissible under copyright law. In fact, under the face-to-face teaching exception to copyright in Section 110(1) of the Copyright Act, displaying a work in a poster in a classroom setting would not constitute copyright infringement.[50] Other uses, such as sharing the poster in a learning management system might constitute fair use as well.[51]

Many students expressed the opinion that using the photograph in class with a proper citation to the author would be permissible under copyright law. However, this focus on the citation again points to the confusion between plagiarism and copyright because under the face-to-face teaching exception, citation is not necessarily required. Upon further examination, only ten respondents understood there was some kind of key difference under copyright law between educational and commercial use. For instance, one student said, "I think for academic purposes or just for personal use, like noncom-

mercial, it should be fine. If he resells them, or distribute them, it is not". Similarly, many students understood that using the work outside of the classroom context would change the copyright implications. For instance, a formal publication or a conference presentation, in their view, might require permission from the author. One student noted: "So if, and most people, if you're publishing something in a paper or in a poster, you're going to be kind of campaigning their image around. So you want to make sure that they're okay with that because that is their property". Most students did indicate that making a profit should be a problem, at least ethically, but they were not clear on the legality of these issues.

A couple of students expressed the notion that if a photo is online, it is virtually copyright-free. One stated, "Because it's on the photograph's website, I would think... To me, it's free except if the person physically states on the website that this is not to be downloaded or something. If there's no restriction to the picture of going to download, I think it's fine."

On the other end of the spectrum, eight students indicated that no matter their purpose for the image, they should contact the creator to get permission to use their work legally. For example, one student said, "I don't think it should. I think people think that it [the intended purpose] changes things. Like 'Oh, I'm using it in class. It doesn't matter. No one's going to go and like report me or something.' I think there shouldn't be a difference between using it in class and for a professional setting. You should always cite where you're getting something from if it's not yours." Students were fascinated by the ethical question this scenario raised and, while they clearly had varying opinions on legality, the majority felt that for-profit use ought to require some kind of additional permissions.

Student Knowledge of Copyright-related Topics

In answering questions from CS1 and CS2, some students demonstrated an understanding of copyright-related terminology, including Creative Commons (CC) licensing, public domain, fair use, and open access. For instance, six participants displayed basic knowledge about CC licensing and one of the students discussed both CC licenses and the public domain. In CS2, when we asked whether it was legal to use a photograph from the internet, one participant partially corrected and pointed out, "I know there are Creative Commons licenses and public domain licenses. If it were a public domain, it would be legal. If it were Creative Commons, I think that I would have to cite that it was used under Creative Commons." Another student fleshed out the idea of Creative Commons in their response:

> If I am the owner of an idea, a publication, a photograph, and I upload it on the Creative Commons, or I mark it as Creative Commons, it means that I'm giving my idea, my photograph out to the public to be used even for commercial purposes. Only that clause is that the user needs to cite me and reference me as I wish….

This does indicate some knowledge of CC licensing; however, the non-commercial designation depends on the license used. It is evident from this response that this graduate student understood that CC licenses could be attached with different attributions to restrict commercial uses in some instances. Other students' answers also indicated an

understanding of the multiple kinds of CC licenses, such as, "I'm asking for attribution, if somebody else uses it, then you can let us know or reference or cite me, . . . I think there's five, but I'm only describing three. One where if it's a corporation, you don't want it to be used for industry purposes."

Moreover, when asked about their experience with publishing articles, one student put forth that they had conversations in terms of open access while at another academic institution. A student revealed that they were interested in the CC license because of their passion for photography, and they gained some relevant knowledge by browsing online reviews: "I had seen discussions on Reddit. Photographers ask other photographers about their work being used without their permission, so I followed that chain… the Creative Commons in VO (sic) box and then seeming like following that because it links to the license." Interviewees demonstrated an overall interest in open access in these discussions, and a willingness to learn more about the topics.

Student Retention of Copyright-related Information

When the authors asked students about where they might have received copyright training, most of these students specified that they didn't receive any specific instruction, but roughly 21 students stated that they gained the knowledge through other activities, such as social media, TV shows, news, and hobbies. One student shared their experience of learning through the news story about the case of copyright violations of Kylie Jenner's Valentine's Day lipstick collections:

> So they were talking about how that company was interested in potentially pursuing a lawsuit due to copyright to Kylie cosmetics because of the issues with basically it looks like they copied their exact prototype of their lip gloss, which is either just a big coincidence or they saw it and they were like, that's a great idea, maybe we can get away with it, unfortunately.

Additionally, some students' hobbies built a bridge between themselves and potential copyright-related knowledge in their everyday lives. A student explained that they noticed copyright signs and statements at the end of movies while watching them in their leisure time. Another noticed similar licensing language on YouTube:

> My first interaction with copyrights was at YouTube. As you go into the description, every YouTube video or an audio or whatever post has a "Licensed by, copyright owned by." That's where you come into contact with these kind of legal terms for the first time. And then you look it up on the web, "What does this mean?" "What does this license mean?" "What does license for music and videos mean?" "What does license for only videos mean?" That was my first interaction with these kind of things.

Student fandoms also provided copyright education due to the intensity with which they followed news of people they admired. A student who was a big fan of Taylor Swift's music stated:

> Yeah, maybe not incredible source, but just being a fan of music, I feel like that becomes an issue with a lot of artists. I like Taylor Swift's music and I know that she's had a big issue and I wasn't aware of this because I am not at all involved in the music industry,

> but she signed a contract with the recording company and so those songs and all that work that she did is now owned by a record company. And it's up to them whether or not they released that back to her and from my understanding they chose not to.

Some students mentioned that when they were engaged in a publication process or a research project, they would have considered some copyright implications. Although it is beyond the issue of copyright, few students also indicated that they had some knowledge of IP rights, such as trademarks and patents, through a past job or coursework. The authors noted that these informal sources of information seemingly better prepare them to address issues involving copyright laws in an academic or professional setting.

Student Awareness of Copyright Importance

As part of the STEM disciplines, student groups often have multiple opportunities to create copyrightable materials, such as keeping laboratory notebooks, writing their dissertations and research papers, creating instructional materials, and so forth. In this study, all but one student indicated they were working on or had completed a thesis, dissertation, or published research articles. Unfortunately, most students were unaware of the importance of protecting their author rights to their original works, especially published works.

When assessing ownership of works yet to be published, such as dissertations or research papers, students often mistakenly believed that the university would own the copyright or share copyright ownership of the work. Conjectures about ownership included: "I would think the laboratory team as well as the school because we're under the school." Even more surprising, many students expected that the university would retain the copyright to their dissertation once they deposited it into the institutional repository. Four students explicitly disstated that the university owned the copyright to their dissertations. In fact, student authors own the copyright for their dissertations, and the deposit of their dissertation to the repository merely grants a university a limited and non-exclusive license to reproduce their work.

Additionally, some students mistakenly believed that their advisor or principal investigator was also a copyright owner of their dissertation. One student held such a view because their advisor provided guidance during the dissertation writing process. Another student agreed that their advisor would be an author and a copyright holder on their dissertation since the dissertation was derived from a project led by their advisor.

Sixteen of the interviewed graduate students correctly understood that once a work was published, the copyright may be transferred to the publisher. For instance, one student noted, "The journal owns the copyright, because I publish with them and they own the paper. They have it on their website and everything." However, when asked whether they had read their author agreement before signing the publishing agreement, many students admitted they had not or could not recall doing so.

Some students had some understanding of what an author's agreement might entail but were not overly concerned with loss of ownership as they prioritized publication. Other students acknowledged that they willfully signed away any rights to the journal for their article as they were desperate to publish it. There was only one student who had read the authors' agreement before signing it and was able to summarize the agreement's

contents. They stated, "I think they make you do that. They say everything that you're saying is original. It's not somewhere else. And you swear that you're not sending the same thing to somewhere else at this particular point of time..." Understanding copyright ownership is the first step toward learning how to best negotiate author's rights. As such, it is unsurprising that students who are confused about copyright ownership do not feel empowered to negotiate their journal publishing agreements.

Students were also confused about the ownership of work created in a teaching or instructional capacity as a teaching assistant (TA). Nearly half—13 of the respondents—had created materials in the role of TA, such as slide decks, syllabi, or handouts, and there was no clear consensus about whether those materials belonged to them. Often, they believed that these materials belonged to the university, although they offered various explanations. Three of them explained that the university contracted them to fulfill certain duties, including course materials' creation. Others elucidated that students paid tuition to the university for courses in which they were a TA and therefore thought the university owned the copyright of the course material. While the ownership of these types of work varies by university or institution, oftentimes these materials are considered traditional academic copyrightable works, and creators retain copyright. In other instances, they are considered work for hire and the university owns the copyright. Understanding these distinctions is important for any student who may create works in the course of teaching.[52]

The responses to the different scenarios mentioned here indicate that the students lacked awareness of the importance of protecting the copyright over the works they create. Without being mindful of protecting the copyright of their works, students may lose the right to reproduce their own work in the future.

Student Retention of Copyright Training

When the authors asked students whether they had ever acquired formal copyright-related training, their responses varied. Some stated that they did not have any formal copyright training, while others had received various levels of training in copyright or other IP law within different contexts. Some students received IP training as undergraduates. For instance, a student responded, "I took one course in undergrad, in my undergrad institution. It was Intellectual Property Rights. That covered trademarks, patents, Creative Commons and all other patent-related laws." Another student enrolled in a course of business law stated: "I did take business law . . . when I was [an] undergrad . . . Just copyrights, patents, that kind of stuff." There were a few students who specifically received patent education. One of them took a patent course while in college, and another student was able to apply those skills in their workplace.

Interestingly, the student who took a course in business law a decade ago was able to retain the information incredibly well. Their answers about copyright throughout the interview were largely correct, and they demonstrated a solid understanding of basic copyright law rules as it relates to student work. For instance, when asked about CS2 in which an individual took a photograph from the internet for a class project, the study participant answered: "In that case, I think the use was permissible under the copyright law. My understanding is that if you gained some kind of profit from using someone

else's copyrighted photo, then you have to get permission from the owner first. That's my understanding." This student demonstrated an understanding of educational copyright exceptions (for face-to-face teaching) as well as fair use and noted that there might be a difference if you are using the photograph for profit. While the student was unfamiliar with the term fair use when asked directly, the basic principles behind educational versus commercial uses of works were clear to the student. This student also knew that no copyright formalities needed to be followed for a person to own a copyrighted work (from CS1). The only time the student became a bit confused was when discussing copyright implications for student-written dissertations; they incorrectly believed that the university would have some ownership of the work in addition to the student author.

Some students received formal copyright training by other means aside from coursework. For instance, graduate students who worked as teaching assistants could receive copyright training by attending an optional workshop prior to their teaching assistantship. One student articulated their participation in a workshop that involved new TAs, and the student noted:

> I'm a TA, so when you're becoming a TA, there is this workshop they conduct and that's when they tell you when you are making your material, you might go and look at material from some other universities. You might want to take down some photographs. If it says creative comments (sic), you're free to go and do that. Again, in that scenario, you're still using it within the class. But it's just mentioned that if it's creative comments (sic) you are good to go.

The student mentioned that they had taken the training the past spring semester (the trainings are provided just after the winter break) and was interviewed the next fall. Although about ten months had passed between the training and the interview, the student's answers to the CS1 and CS2 questions were accurate, and the student added additional information to their answers about licensing. This proven retention of copyright training is promising for librarians who are only able to provide "one-shot" copyright lessons. Even with only the provision of a single 50-minute session, this student was able to retain the information very well. While it is promising that students will retain their IP-related training; unfortunately, nearly half of them received no training whatsoever.

Student Interest in Copyright Education

While asking about students' interests in having copyright-related instruction in graduate school, all but one of the students interviewed expressed a desire for education in these concepts and the one remaining student said "maybe." Some students were keen to understand basic concepts including the definition of ownership and the exclusive rights granted to copyright holders. One of these students wanted instruction "For both understanding how we own our own copyright, or how we have rights over what we create and using other people's materials."

Other students explained the ways in which the usefulness of copyright-related knowledge could manifest in different aspects of their academic lives. For instance, they emphasized the vital role that copyright-related knowledge would play in dealing with the ownership of their dissertations by stating, "Yeah, I think that would be helpful... Maybe I would own my dissertation …" Another student shared that the inclusion of

copyright-related knowledge would be beneficial for writing a scientific manuscript or leveraging someone's photos or data. Furthermore, one student agreed because they had recently experienced difficulties using copyrighted photos online while creating and delivering public presentations. They indicated that they ran into trouble locating a non-copyrighted heart image to decorate their PowerPoint slides and ended up drawing it themselves.

A couple of students specifically thought copyright education would be useful as a result of this interview. They mentioned that the interview questions enabled them to be aware of copyright-related issues they had never considered. One student noted:

> I think before our interview, I even did not consider about that … because that is kind of like I lack the sense to kind of protect my own copyright. And so, if we can learn that and then maybe for your questions, like the papers or the [inaudible] that copyright if belongs to me and then maybe I can protect my future right for the work that did here. So I have the questions in my mind now. I think if I can get some resources to learn it, this will be very nice.

The overwhelmingly positive response to this study demonstrated that students highly valued copyright education being included in their graduate programs. They were eager to acquire copyright-related knowledge, primarily related to ownership of the works they create, and the lawful use of copyrighted works created by others. Overall, it was clear that incorporating copyright-related knowledge into students' graduate studies can bring convenience to their everyday lives. Students placed high value on prior copyright training opportunities and courses and retained the information well.

Limitations

The authors acknowledge that the survey sample is not representative of all STEM areas equally Additionally, the authors only interviewed students from the University of Illinois Urbana-Champaign, which introduces bias related to the unique characteristics of this institution. Findings may not be applicable to students in other institutions with different contexts.

Conclusion

Despite most of the participating graduate students indicating they have not received official copyright education; they indicated a willingness to learn and desired that this information should be included in their graduate education. As information professionals, we can capitalize on this interest by tying our instruction to the interests and livelihood of the students themselves. Comprehensive copyright-related curricula or workshops should be embedded in graduate programs, particularly for STEM students who struggle with publishing agreements and the potential consequences of not understanding those agreements. Such training would not only serve students throughout their graduate studies but also carry them into their professional careers.

As in the previous study conducted by the authors related to undergraduate students, this study revealed that graduate students have confusion about copyright law. This is

particularly evident when discussing the specifics of obtaining copyright, specific limitations and exceptions to copyright law, and ownership of content created as a student. More education during the graduate school program or in undergraduate work will empower these pre-professionals to protect their work and the work of others, both in educational environments and when they progress to their careers.

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Appendix A

Case Studies for Interviews

Case Study No. 1 (CS1)

You are taking a class about nature and the environment. One of your assignments for class is to take a photograph in a natural environment, write a short paragraph about the photograph, and submit it for a grade in the class. You go to a local park over the weekend and take a photograph of a butterfly landing on a local flower. You write a paragraph about why you chose that particular scene for the assignment, noting that the flower is a local variety and, as such, highlights the local environment.

Give some thought to the ownership of the photograph—who owns it? Please outline your thought process about the ownership of the photograph.

The following three questions were used to begin the conversation with additional questions as needed:

1. What do you mean by ownership?
2. Who owns the copyright of the photo?
3. What do you need to do to have a copyright of the photo?

Case Study No. 2 (CS2)

You are taking the same class about nature and the environment. Later in the semester, the professor asks you to create a poster to show to the class about a particular subject in the natural world. You choose to create a poster about polar bears. Because you do not have any photographs of polar bears that you have taken yourself, you look on a professional photographer's website and download a copy of a photograph taken by

a professional photographer. You incorporate the photograph into your poster. In the credits section of the poster, you include a citation to the photographer's name, the title of the photograph, and the location of the website where you obtained the photo.

Give some thought to the legal use of the photograph. Was your use of the photograph permissible under copyright law? Please outline your thought process about the legal use of the photograph.

The following six questions were used to begin the conversation with additional questions as needed:

1. Who owns the photo in this scenario?
2. Who owns the copyright of the photo?
3. Can you compare and contrast the two case studies?
4. Have you ever been in a formal classroom where the instructor discussed copyright? If so, which class?
5. Where else have you learned about copyright?
6. Do you think it would be useful to learn about copyright in your graduate level courses?

Appendix B

Handout for Conclusion of Interview

Thank you for participating in the interview today. Here are some explanations of the copyright implications of the Case Studies.

Case Study 1: A photograph taken by a student for a class project.

There are no formal requirements to own a copyright other than the requirement that the work be minimally creative and fixed or written down or recorded. Thus, when the student took the picture of the butterfly, the student created a copyrightable work and the student owned the copyright for the work.

When the student submitted the photograph to the instructor along with the written assignment, the student allowed the instructor to "own" the physical copy of the work, but the student retained ownership over the intellectual property or the creativity/copyright of the work.

Case Study 2: A photograph taken by a professional photographer from the internet to be used in a class project.

Although it is a common myth that everything placed on the internet waives copyright, that is incorrect. The copyright in the photograph taken by a professional photographer is owned by the person who took the photo (or the photographer). However, there are numerous exceptions to copyright for educational purposes including the face-to-face teaching exception, whereby the student could display the work of another in the classroom without violating copyright. Here, the student wishes to make a copy

of the work and incorporate it into a poster. If the face-to-face teaching exception does not apply, this use may be a fair use. Fair use is a limitation on the rights of the copyright owner where the user of the work does not need permission to use the work. Fair use must be considered on a case-by-case basis (i.e. not every educational use is a fair use) and it does involve a risk assessment (the copyright owner could still sue you and you would need to assert a defense of fair use).

If you would like more information about copyright in general and fair use, please review the Copyright Reference Guide, located at: https://guides.library.illinois.edu/copyrightreferenceguide

Notes

1. Yuening Zhang, "How Chemistry Graduate Students and Researchers Are Finding and Using Chemical Information: Findings from Interviews in a Chinese University," *Issues in Science and Technology Librarianship* 2017, 86 (2017), https://doi.org/10.5062/F4PR7T0G.
2. Ibid, 3.
3. Ibid, 2.
4. Ashiya Ahmadi and Sharad Kumar Sonkar, "Awareness regarding plagiarism and fair use of copyrighted work: a survey amongst doctoral students of Babasaheb Bhimrao Ambedkar University, Lucknow," *Journal of Information Management* 2, no. 2 (2015): 114-127.
5. Ibid, 126.
6. John Villasenor, "Intellectual Property Awareness At Universities: Why Ignorance Is Not Bliss," *Forbes*, November 27, 2012, https://www.forbes.com/sites/johnvillasenor/2012/11/27/intellectual-property-awareness-at-universities-why-ignorance-is-not-bliss/.
7. Ibid.
8. Nancy Sims, "Graduate Student Authors' Experiences with Creative Commons Licenses," *Against the Grain* 33, no. 5 (2021): 10–12, https://issuu.com/against-the-grain/docs/atg_v33-5/10.
9. Jonathan Tetteh Korletey, "Copyright awareness at KNUST" (Master thesis, Kwame Nkrumah University of Science and Technology, 2014), https://ir.knust.edu.gh/items/98ce1eb8-9c6d-40ce-a6e5-56d15c35ad42/full.
10. Ibid, 83.
11. Ibid, 83-84.
12. Ibid, 70-71.
13. Ibid, 88.
14. Irina Atanasova, "Copyright Infringement in Digital Environment," *Economics & Law* 1, no. 1 (2019): 13–22, https://el.swu.bg/wp-content/uploads/2019/07/COPYRIGHT-INFRINGEMENT-IN-DIGITAL-ENVIRONMENT.pdf.
15. Ahmadi and Sonkar, "Awareness regarding plagiarism and fair use of copyrighted work," 114-15.
16. Aynur Kolburan Geçer, and Arzu Devecı Topal, "Academic and Postgraduate Student Awareness of Digital Product Copyright Issues," *Information Development* 37, no. 1 (2021): 90–104, https://doi.org/10.1177/0266666919895550.
17. Ibid, 94.
18. Ibid, 94.
19. Ibid, 102.
20. Laura Saunders, and Allison N. Estell, "Copyright Literacy of Library and Information Science Students in the United States," *Journal of Education for Library and Information Science* 60, no. 4 (2019): 329–353, https://doi.org/10.3138/jelis.2018-0059.

21. Ibid, 337.
22. Ibid, 338.
23. Ibid, 344.
24. LeEtta Schmidt, and Michael English, "Copyright Instruction in LIS Programs: Report of a Survey of Standards in the U.S.A.," *Journal of Academic Librarianship* 41, no. 6 (2015): 736–743, https://doi.org/10.1016/j.acalib.2015.08.004.
25. Saunders and Estell, "Copyright literacy of library and information science students in the United States," 345.
26. Christa Walck, Jacqueline E. Huntoon, James R. Baker, Jean S. DeClerck, and Nora Allred, "Web 2.0 Ethics Education: Patents and Copyright for STEM Students," (paper presentation, 119th ASEE Annual Conference and Exposition, San Antonio, Texas, June 2012), https://doi.org/10.18260/1-2--22225.
27. LeEtta Schmidt, and Jason Boczar, "Designing a Flexible Outreach Program for Scholarly Communication and Copyright Services: A Modular Roadshow for the University of South Florida," *College and Research Libraries News* 82, no. 5 (2021): 233–236, https://doi.org/10.5860/crln.82.5.233.
28. Ibid, 234.
29. Kathy Christie Anders, and Emilie Algenio, "Copyright Education for Graduate Students: A Multi-Stage Approach," *Journal of Librarianship and Scholarly Communication* 8, no. 1 (2020): 1-17, https://doi.org/10.7710/2162-3309.2359.
30. Anders and Algenio, "Copyright education for graduate students: A multi-stage approach," 6-10.
31. Anders and Algenio, "Copyright education for graduate students: A multi-stage approach," 12.
32. Andrea L. Schuler, "Thesis and Dissertation Copyright Instruction for Grad Students: What They Should Know and Why They Should Care," in *Copyright Conversations: Rights Literacy in a Digital World*, ed. by Sara Benson, (Association of College and Research Libraries, 2019), 189-209.
33. Association of College & Research Libraries (ACRL), "Framework for Information Literacy for Higher Education," February 2 2015, https://www.ala.org/acrl/sites/ala.org.acrl/files/content/issues/infolit/framework1.pdf.
34. Bolarinwa M. Adeyemi, "Information Literacy Search Skills among Post-Graduate Students at the Federal University of Agriculture, Abeokuta, Nigeria," *Information Technologist* 15, no. 1 (2018): 36–51, https://www.ajol.info/index.php/ict/article/view/173736.
35. Ibid, 42.
36. Ibid, 45.
37. Sara R. Benson, "I own it, don't I?" The Rules of Academic Copyright Ownership and You," *College & Undergraduate Libraries*, 25, no. 4 (2018): 317-327, https://doi.org/10.1080/10691316.2018.1533201.
38. "The General Rules Concerning University Organization and Procedure," The Board of Trustees of the University of Illinois, updated May 18, 2023, https://www.bot.uillinois.edu/governance/general_rules#sec34.
39. Benson, 'I own it, don't I?" 322.
40. "Ownership | UIUC Office of Technology Management," Office of Technology Management, updated September 15, 2023, https://otm.illinois.edu/disclose-protect/ownership.
41. Ibid.
42. Ibid.
43. Sharan B. Merriam and Elizabeth J. Tisdell, *Qualitative Research: A Guide to Design and Implementation*, 4th ed. (John Wiley & Sons, 2015).
44. Sara Rachel Benson, Kelli Trei, and Merinda Kaye Hensley, "A Qualitative Study of Undergraduate STEM Majors' Copyright Knowledge and Educational Experiences," *College & Research Libraries*; 82, no. 6 (2021): 845-862, https://doi.org/10.5860/crl.82.6.845.

45. Department of Homeland Security, "DHS STEM Designated Degree Program List," July 23, 2023, https://www.ice.gov/doclib/sevis/pdf/stemList2022.pdf.
46. "Rev," *Rev*, accessed February 7, 2024, www.rev.com; Merriam & Tisdell, "Qualitative Research: A Guide to Design and Implementation."
47. Benson, Trei and Hensley, "A Qualitative Study of Undergraduate STEM Majors' Copyright Knowledge and Educational Experiences."
48. United States Copyright Office, "Circular 1: Copyright Basics." https://www.copyright.gov/circs/circ01.pdf.
49. Marcus v. Rowley, 695 F.2d 1171, 1176 n.8 (9th Cir. 1983) (noting that attribution is one factor that is considered by courts when determining whether fair use was justified).
50. Sara R. Benson, *Compact Copyright: Quick Answers to Common Questions*, (ALA Editions, 2021): 53-58 .
51. Ibid, 71-86.
52. Benson, 'I own it, don't I?", 322.