From Photocopying to Object-Copying in the Classroom: 3D Printing and the Need for Educational Fair Use in Patent Law

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INTRODUCTION

Globalization impacts the American workforce by creating jobs in the technical sector while stunting the growth of jobs in other sectors.1 In response to these workforce changes, education is shifting from a traditional model, which focuses on the humanities, to a model focusing on STEM education, which emphasizes science, technology, engineering, and mathematics.2 In 1976, Congress


The United States has developed as a global leader, in large part, through the genius and hard work of its scientists, engineers, and innovators. In a world that’s becoming increasingly complex, where success is driven not only by what you know, but by what you can do with what you know, it’s more important than ever for our youth to
passed the Copyright Act, which included a fair use exception for educational purposes.\textsuperscript{3} The educational exception focused on the technology of the time—the photocopier—to offer protections to teachers photocopying poems, stories, and other written works for their students.\textsuperscript{4} With the focus of education changing to STEM subjects, the protections offered to teachers must also be extended to methods of STEM instruction, including additive manufacturing—commonly referred to as 3D printing. Although there are currently open platforms available where educators can access open-computer-aided design (CAD) files for unpatented objects, the “digitization of things” will likely drive these platforms to become restricted—forcing teachers, particularly those in higher education, to resort to printing patented objects as demonstratives for educational purposes.\textsuperscript{5} Educators concerned about patent infringement claims may stop using 3D printers in their classroom. Thus, the Legislature must consider methods to protect educators—as they did in 1974 for educators using photocopiers—who want to 3D print patented objects in STEM education.\textsuperscript{6}

From children’s toys to firearms, to human tissue and aircrafts, 3D printing is almost limitless in its production possibilities.\textsuperscript{7} Although

\begin{itemize}
  \item be equipped with the knowledge and skills to solve tough problems, gather and evaluate evidence, and make sense of information. These are the types of skills that students learn by studying science, technology, engineering, and math—subjects collectively known as STEM.
\end{itemize}

\textit{Id.}


\textsuperscript{7} ANDREAS GEBHARDT & JAN-STEFFEN HÖTTER, ADDITIVE MANUFACTURING: 3D PRINTING FOR PROTOTYPING AND MANUFACTURING 3 (2016); Lawrence E. Murr, Frontiers of 3D Printing/Additive
manufacturers are slow to adopt large-scale additive manufacturing, forecaster predict that additive manufacturing will revolutionize the manufacturing industry as the technology becomes cheaper and more accessible. Fueled by 3D printing’s widespread coverage in the popular press, there is broad public awareness of advancements in additive manufacturing technology, further stimulating interest and innovation. For instance, in 2013, the additive manufacturing global market was valued at $2.3 billion. This figure is expected to jump to $8.6 billion by 2020. In addition to industrial manufacturing, additive manufacturing’s next hypothesized frontier is the consumer’s home.

Rapid changes in additive manufacturing will lead to the digitization of things. As Professors Deven Desai and Gerard N. Magliocca explain:

[W]hen the costs drop and a wide range of businesses and people can use the power of digitization—business and legal realities shift dramatically. Disruption is not only a

8. GEBHARDT & HÖTTER, supra note 7. “3D Printing is also the brand name of a family of powder binder processes . . . .” Id.; Dara G. Schniederjans, Adoption of 3D-Printing Technologies in Manufacturing: A Survey Analysis, 183 IN’L J. PRODUCTION ECON. 287, 287 (2017); Ching-Chiang Yeh & Yi-Fan Chen, Critical Factors for Adoption of 3D Printing, 132 TECH. FORECASTING & SOC. CHANGE 209, 209 (2018); John Pletz, 3-D Printing Is Coming to the Factory—Really, CRAIN’S CHI. BUS. (Aug. 23, 2018, 6:14 AM), http://www.chicagobusiness.com/innovators/3-d-printing-coming-factory-really [https://perma.cc/JZ8Y-U9FA]. Lou Rassey, CEO of Fast Radius, explained: “Previously, parts weren’t good enough, production was too slow and the cost was too high . . . . We’ve crossed that threshold.” Id.


12. See generally Desai & Magliocca, supra note 5.
business or private matter; the underlying legal system is disrupted as well. 3D (or additive) printing brings the promise and challenge of digitization to tangible goods. Many copyright and trademark-based industries have faced digitization, but patent-based industries have not. Advances in 3D printing technology are launching an Industrial Counter-Revolution, and the laws governing the way things are made will need to make peace with the reality of digitized objects and on-demand fabrication.\footnote{Id. at 1692. Professors Desai and Magliocca further predict that: Patent law relies, in part, on the premise that the cost to infringe is relatively high, but 3D printing challenges that assumption. The Industrial Revolution and the parallel growth of intellectual property laws supporting that economy were driven by economies of scale. Plenty of capital was necessary to support research, production, and distribution, and therefore any serious infringement also required a substantial investment. That nineteenth-century model is crumbling. Copyright was the canary in the coalmine. Once music, film, and books were digitized, those industries were transformed. Production costs fell. Distribution became fast, cheap, and on-demand. Many new players entered the market. Patent is starting down that same road. In short, digitization has reached the rest of the economy—the economy of things.}

Thus, additive manufacturing could be the catalyst that ignites a mass shift in patent law, including carving out a fair use defense in patent law similar to the defense in copyright law.\footnote{Id. at 1716. See generally Lorelei Ritchie De Larena, What Copyright Teaches Patent Law About “Fair Use” and Why Universities Are Ignoring the Lesson, 84 OR. L. REV. 779, 802 (2005).}

of the Maker Movement’s open-source sharing, 3D printing is a collaborative technology people can use to build off of one another’s innovations.\footnote{17} 3D printing’s open-sharing culture is bound to change once additive manufacturing becomes more prominent.

This Note is broken into three parts. Part I includes background information about additive manufacturing, the Maker Movement and its importance in the promotion of STEM education, and the history of copyright and patent law. Part II analyzes the development of fair use in copyright law, potential reasons that patent law has no statutory fair use defense, and one exception in patent law that is essentially fair use—the Hatch-Waxman Act, a codified version of the experimental use exception for the pharmaceutical industry.\footnote{18} Finally, Part III offers three distinct solutions aimed at protecting educators who use 3D printing in their curriculum.

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\footnote{17} Dougherty, \textit{supra}, note 16, at 12.

I. Background

First, this background section gives a historical perspective on the development of the fair use exception in copyright law. Then, it delves into the way that additive manufacturing works. Finally, it discusses the Maker Movement generally and focuses on its effect in schools.

A. Historical Origin of Copyright and Patent Law

“Copyright and patent law are sister bodies of jurisprudence,” which the founding fathers “placed hand-in-hand” together in the Intellectual Property Clause of the Constitution. The origins of copyright and patent law were further intertwined in 1790 when Congress enacted their first respective acts together. In 1841, Justice Story explained in *Folsom v. Marsh* that copyright and patent law had similar legal considerations by noting, “Patents and copyrights approach, nearer than any other class of cases belonging to forensic discussions, to what may be called the metaphysics of the law, where the distinctions are, or at least may be, very [subtle] and refined, and, sometimes, almost evanescent.” Because of their close


21. *Folsom v. Marsh*, 9 F. Cas. 342, 344 (C.C.D. Mass. 1841). Justice Story continued by stating: In many cases, indeed, what constitutes an infringement of a patented invention, is sufficiently clear and obvious, and stands upon broad and general agreements and differences; but, in other cases, the lines approach very near to each other, and, sometimes, become almost evanescent, or melt into each other. So, in cases of copyright, it is often exceedingly obvious, that the whole substance of one work has been copied from another, with slight omissions and formal differences only, which can be treated in no other way than as studied evasions; whereas, in other cases, the identity of the two works in substance, and the question of piracy, often depend upon a nice balance of the comparative use made in one of the materials of the other; the nature, extent, and value of the materials thus used; the objects of each work; and the degree to which each writer may be fairly presumed to have resorted to the same common sources of information, or to have exercised the same common diligence in the selection and arrangement of the materials.

*Id.*
relationship, several patent law doctrines, including misuse, contributory infringement, licensee estoppel, and first sale have been adopted by copyright law.\(^{22}\)

Historically, there were certain common law doctrines in patent law that were similar to copyright’s fair use doctrine, including the common law research exemption, the experimental use defense, the experimental use exemption, and the experimental purpose doctrine.\(^{23}\) However, there is no statutory fair use doctrine for patent law, and moreover, courts have not recently given judicial recognition to the common law fair use doctrines in patent law.\(^ {24}\)

**B. Additive Manufacturing**

Since additive manufacturing first emerged in the 1980s, the technology experienced rapid innovation.\(^ {25}\) Now, there are approximately 300 different 3D printers available on the market, ranging from $300 hobbyist printers to HP’s recently announced Metal Jet printer, which has the capability to print at industrial volumes and at automotive-grade quality.\(^ {26}\) Additive manufacturing systems turn CAD files into three-dimensional objects by adding feedstock material, such as plastic, metal, or mineral materials, layer by layer until the desired shape is formed.\(^ {27}\) Two main application levels comprise 3D printing: (1) rapid prototyping, making prototypes and models, and (2) rapid manufacturing, making final parts and products.\(^ {28}\)

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Although the use of additive manufacturing offers certain advantages, including “simplification of product innovation, price premiums achieved through customization,” and easily reconfigured components, the majority of manufacturers have been slow adopters of 3D printing technology. Additive manufacturing comprises less than 2% of the manufacturing market. Slow-adoption of additive manufacturing is due in part to the high price of 3D printing when compared to the lower cost of traditional manufacturing. However, industry commentators argue that the “threshold” has been crossed and that factories will soon begin adopting additive manufacturing on a grander scale. This expected growth in adoption rates is largely due to a new generation of high-end machines from HP and Carbon.

C. Maker Movement Bringing 3D Printing into Education

The Maker Movement’s community, which focuses on a person’s ability to create things—or be a “maker”—is comprised of individuals from all backgrounds, such as “tech enthusiasts, engineers, educators, amateurs[,] and students of all ages.” Makers create all sorts of functional devices, including technological gadgets, home goods, and custom-engraved jewelry. The origins of the

29. See Murr, supra note 7, at 994; Schniederjans, supra note 8, at 294; Yeh & Chen, supra note 8.
30. Yeh & Chen, supra note 8. Although a survey by Allied Market Research found that, in 2013, the global additive manufacturing market was valued at $2.3 billion and was expected to grow to $8.6 billion by 2020. Id.
31. Id. Several factors could be the cause of the slow adoption rate of additive manufacturing, including antiquated technical infrastructures, external forces, and supply chain issues. Id. at 210–11. Other, more specific factors include: the financial costs of upfront capital expenditures to purchase the technology required to implement mass-additive manufacturing, the lack of skilled laborers specialized in additive manufacturing, and concerns over future certification and regulations for additive manufacturing. Jesse Coors-Blankenship, Challenges Associated with Additive Manufacturing, FORBES (Mar. 28, 2018, 8:00 AM), https://www.forbes.com/sites/forbestechcouncil/2018/03/28/challenges-associated-with-additive-manufacturing/#5ae4f4f6db0 [https://perma.cc/A2EU-5XFF].
32. Pletz, supra note 8.
33. Blain, supra note 26; Pletz, supra note 8.
35. Papavlasopoulou, Giannakos & Jaccheri, supra note 34, at 57; Bajarín, supra note 16; Brit
Maker Movement stem from Dale Dougherty’s launching of *Make* magazine in 2005.  

Make magazine’s opening column, written by Dougherty, explained, “More than mere consumers of technology, we are makers, adapting technology to our needs and integrating it into our lives. Some of us are born makers and others, like me, become makers almost without realizing it.” Chris Anderson has further noted the following about the Maker Movement:

> The real revolution here is not in the creation of the technology, but the democratization of the technology. It’s when you basically give it to a huge expanded group of people who come up with new applications, and you harness the ideas and the creativity and the energy of everybody. That’s what really makes a revolution.

... What we’re seeing here with the third industrial revolution is the combination of the two [technology and...]

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manufacturing]. It’s the computer meets manufacturing, and it’s at everybody’s desktop.38

Because of the rising interest in developing STEM education in schools, many schools and collegiate institutions nationwide and worldwide have adopted aspects of the Maker Movement into their curriculum.39 Moreover, makerspaces are now built in libraries and museums.40 In 2016, there were 556 makerspaces in Europe, 483 in North America, and 354 in the rest of the world.41 The most frequently used “maker” tool in library and university makerspaces is the 3D printer.42

II. Analysis

Numerous legal scholars have proposed the development of a fair use exception in patent law; however, this Note focuses on the narrower need for an educational fair use exception.43 Because the laws of copyrights and patents have been intertwined since their


39. Papavlasopoulou, Giannakos & Jaccheri, supra note 34; McCracken, supra note 37; Maker Faire: A Bit of History, MAKE: MAKER FAIRE, https://makerfaire.com/makerfairehistory/ [https://perma.cc/WL4J-BQ6Q] (last visited Nov. 4, 2018). Approximately 200,000 people attended the two flagship Maker Faires in the Bay Area and New York annually, and in 2017 there were over 190 independently produced “Mini Maker Faires” and over thirty larger Featured Maker Faires in cities around the world including Tokyo, Rome, Paris, Shenzhen, Milwaukee, and Detroit. Papavlasopoulou, Giannakos & Jaccheri, supra note 34, at 58; Fernández, supra note 34; Maker Faire: A Bit of History, supra.

40. Morin, supra note 35.

41. Nicole Lou & Katie Peek, By the Numbers: The Rise of the Makerspace, POPULAR SCL (Feb. 23, 2016), https://www.popsci.com/rise-makerspace-by-numbers [https://perma.cc/6HSQ-SUG7]. There were 14 times more Makerspaces in 2016 than there were in 2006. Id. In 2016, the following states had the most makerspaces: California with 56, New York with 31, Florida with 24, Texas with 20, and Michigan with 17. Id. However, in 2016, the states with the most makerspaces per person were North Dakota, Wyoming, New Mexico, Montana, and New Hampshire. Id.

42. Papavlasopoulou, Giannakos & Jaccheri, supra note 34, at 58.

43. See generally Desai & Magliocca, supra note 5; Miller, supra note 20, at 57; O’Rourke, supra note 22; Katherine J. Strandburg, Patent Fair Use 2.0, 1 U.C. IRVINE L. REV. 265 (2011).
inception, this analysis first parses through the reasoning for the divergence between the two areas of law when it comes to the existence of a fair use doctrine. Next, the analysis explores the codification of the educational fair use exception in copyright law and then focuses on the fair use rules of photocopying by educators to illuminate the need for fair use for educators using 3D printing. Finally, the analysis discusses the Hatch-Waxman Act.

A. Development of Fair Use in Copyright

The fair use doctrine was an integral part of copyright common law before its codification. In 1976, Congress enacted the first Copyright Act to include a codified fair use defense. Section 107 of the Act was merely “intended to restate the [pre-1976] judicial doctrine of fair use, not to change, narrow, or enlarge it in anyway.” Common law fair use existed in part because of the constitutional policy for promoting the progress of science and the arts.

Section 107 of the 1976 Copyright Act states that “the fair use of a copyrighted work, including such use by reproduction in copies . . . for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research, is not an infringement of copyright.” Section 107 does

45. 4 NIMMER & NIMMER, supra note 4.
46. Id.
48. Harper & Row, Publishers, Inc. v. Nation Enters., 471 U.S. 539, 549 (1985) (quoting HORACE G. BELL, THE LAW OF COPYRIGHT AND LITERARY PROPERTY 260 (1944)). The Bell treatise explains: [T]he author’s consent to a reasonable use of his copyrighted works ha[d] always been implied by the courts as a necessary incident of the constitutional policy of promoting the progress of science and the useful arts, since a prohibition of such use would inhibit subsequent writers from attempting to improve upon prior works and thus . . . frustrate the very ends sought to be attained.

49. 17 U.S.C. § 107 (2018). Some examples of valid fair use include:
[Q]uotation of excerpts in a review or criticism for purposes of illustration or comment; quotation of short passages in a scholarly or technical work, for illustration or clarification of the author’s observations; use in a parody of some of the content of the work parodied; summary of an address or article, with brief quotations, in a news report; reproduction by a library of a portion of a work to replace part of a damaged copy; reproduction by a teacher or student of a small part of a work to illustrate a lesson; reproduction of a work in legislative or judicial proceedings or reports;
not define “fair use” or provide a rule that automatically decides whether a particular use is “fair.” Instead, the statute provides four factors courts must consider when determining whether or not the fair use defense applies in a copyright infringement case:

(1) the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes; (2) the nature of the copyrighted work; (3) the amount and sustainability of the portion used in relation to the copyrighted work as a whole; and (4) the effect of the use upon the potential market for or value of the copyrighted work.

Neither the statute nor higher court decisions provide further guidance about which factors should be weighted more heavily in fair use considerations or how many of the factors must be met to create a fair use defense. Thus, whether or not there is a fair use defense depends on a case-by-case determination on a “consideration of all the evidence.”

Because Congress provided little guidance as to how the four factors enumerated in the statute should be applied, legal discussion and confusion continues to surround fair use in copyright law. Therefore, though the fair use exception provides protection for educators making photocopies for their students, the practical limitation of that protection is unclear, leading to lawsuits against educators by publishers.

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incidental and fortuitous reproduction, in a newsreel or broadcast, of a work located in the scene of an event being reported.

H.R. REP. NO. 94-1476, at 65 (quoting 64 REG. OF COPYRIGHTS ANN. REP. 24 (1961)).

50. 4 NIMMER & NIMMER, supra note 4, § 13.05(A).
52. Id.; 4 NIMMER & NIMMER, supra note 4, § 13.05(A).
53. 4 NIMMER & NIMMER, supra note 4, § 13.05(A).
54. Id. As noted in the Nimmer treatise on copyright law: “[A] vast body of scholarship also addresses this arena—indeed, more law review articles are published about fair use than cases actually adjudicating the subject!” Id. § 13.05.
55. See generally Cambridge Univ. Press v. Patton, 769 F.3d 1232, 1267 (11th Cir. 2014).
B. Difference in Nature Between Copyrights and Patents

Although patents and copyrights have been so historically intertwined to be referred to as “sister bodies of jurisprudence,” with copyright law frequently borrowing doctrines from patent law, no broad statutory fair use exception—a staple of copyright law—has been carved out in patent law.\(^56\) Professor Maureen A. O’Rourke noted that one potential reason that patent law does not provide fair use protections is due to the nature of protections that copyrights and patents offer and the differences in the processes to obtain those protections.\(^57\) Title 17 and Title 35 of the United States Code describe those processes and protections for copyrights and patents, respectively.\(^58\)

1. Title 17: Copyrights

The subject matter of copyrights subsists in “original works of authorship fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device.”\(^59\) A work of authorship has copyright protection from “the moment it is created and fixed in a tangible form” such “that it is perceptible either directly or with the aid of a machine or device.”\(^60\)

Registration of a copyright is voluntary and does not change the copyright protections that are vested at the creation of the work of

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\(^{56}\) Miller, supra note 20, at 57; O’Rourke, supra note 22; Ritchie De Larena, supra note 14, at 790.

\(^{57}\) O’Rourke, supra note 22. Professor O’Rourke, in proposing that there be a fair use patent exception, also proposed that the following factors be considered in showing that there has been a fair use: “(i) the nature of the advance represented by the infringement; (ii) the purpose of the infringing use; (iii) the nature and strength of the market failure that prevents a license from being concluded; (iv) the impact of the use on the patentee’s incentives and overall social welfare; and (v) the nature of the patented work.” Id. at 1205.


\(^{59}\) 17 U.S.C. § 102(a) (2018). “Works of authorship include the following categories: (1) literary works; (2) musical works, including any accompanying words; (3) dramatic works, including any accompanying music; (4) pantomimes and choreographic works; (5) pictorial, graphic, and sculptural works; (6) motion pictures and other audiovisual works; (7) sound recordings; and (8) architectural works.” Id.

authorship.\textsuperscript{61} The term of protection for a copyrighted work depends on whether or not the work has been published, the work’s date of first publication, and whether or not the work has an author or is an “anonymous work, a pseudonymous work, or a work made for hire . . . .”\textsuperscript{62} Generally, works of authorship created after January 1, 1978, have copyright protections that last for the lifetime of the author plus seventy years.\textsuperscript{63}

2. \textit{Title 35: Patents}

Under Title 35, a person may obtain a patent when they “invent[] or discover[] any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof . . . .” subject to the conditions and requirements of the statute.\textsuperscript{64} To get an invention patented, an applicant must show that their invention: (1) is subject matter eligible, (2) is disclosed in an enabling disclosure, and (3) meets the statutory standards of utility, novelty, and non-obviousness.\textsuperscript{65} The initial threshold for patent eligibility is a higher standard than the threshold for copyright eligibility.\textsuperscript{66} Moreover, the United States Patent and Trademark

\begin{itemize}
  \item \textsuperscript{61} Id. Barring statutory exceptions, such as fair use, the owner of a copyright under Title 17 has the exclusive rights to do and to authorize any of the following:
    \begin{itemize}
      \item (1) to reproduce the copyrighted work in copies or phonorecords;
      \item (2) to prepare derivative works based upon the copyrighted work;
      \item (3) to distribute copies or phonorecords of the copyrighted work to the public by sale or other transfer of ownership, or by rental, lease, or lending;
      \item (4) in the case of literary, musical, dramatic, and choreographic works, pantomimes, and motion pictures and other audiovisual works, to perform the copyrighted work publicly;
      \item (5) in the case of literary, musical, dramatic, and choreographic works, pantomimes, and pictorial, graphic, or sculptural works, including the individual images of a motion picture or other audiovisual work, to display the copyrighted work publicly; and
      \item (6) in the case of sound recordings, to perform the copyrighted work publicly by means of a digital audio transmission.
    \end{itemize}
  
  \item \textsuperscript{62} 17 U.S.C. § 106.
  \item \textsuperscript{63} 17 U.S.C. § 302(c).
  \item \textsuperscript{64} Id. §§ 302–305; \textit{How Long Does Copyright Protection Last?}, COPYRIGHT.GOV, https://www.copyright.gov/help/faq/faq-duration.html [https://perma.cc/T9C7-TDBK] (last visited Nov. 4, 2018).
  \item \textsuperscript{65} 35 U.S.C. § 101 (2018).
  \item \textsuperscript{66} Id. §§ 101–104 (2018).
\end{itemize}
Office (PTO) is notorious for its backlog of pending patent applications, with wait times of approximately two years.\(^6^7\)

When an inventor submits their application, a PTO examiner evaluates the application for compliance with the statutory standards and negotiates with the inventor over the correct wording of the patent’s claims.\(^6^8\) The patent’s claims “form the metes and bounds of the inventor’s property right . . . .”\(^6^9\) Once the patent is granted—a process that is often expensive and takes a few years—the inventor’s property rights:

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\text{[S]}\text{hall be for a term beginning on the date on which the patent issues and ending 20 years from the date on which the application for the patent was filed in the United States or, if the application contains a specific reference to an earlier filed application or applications under section 120, 121, 365(c), or 386(c) from the date on which the earliest such application was filed.}\(^7^0\)
\]

### 3. Comparing the Processes

Thus, the process for obtaining a patent is more expensive and takes longer than the process for obtaining a copyright.\(^7^1\) Moreover, patent terms last for a shorter period than copyright terms. Because patents are harder to establish than copyrights, it is possible that the Legislature has been hesitant to carve out a fair use exception in


\[^{68}\text{O’Rourke, supra note 22, at 1186.}\]

\[^{69}\text{Id. Patent infringement occurs when, “Except as otherwise provided in this title, whoever without authority makes, uses, offers to sell, or sells any patented invention, within the United States, or imports into the United States any patented invention during the term of the patent therefor, infringes the patent.” 35 U.S.C § 271(a) (2018).}\]

\[^{70}\text{35 U.S.C. § 154 (2018).}\]

\[^{71}\text{O’Rourke, supra note 22, at 1186.}\]
patent law, offering greater protections to the investments made by inventors seeking patents. As Professor O’Rourke further explains:

The two systems also each employ scope-limiting doctrines to guard against overprotection. A brief review of these devices reveals not only that copyright law is more tolerant of a certain amount of infringement than patent, but also that this tolerance is not simply a logical by-product of copyright’s relatively low investment in evaluating whether a work merits protection. Rather, it performs socially useful functions that patent law, even with its substantial upfront investment in making the protection decision, should find it desirable to incorporate.

However, in 1998, the digitization of media forced the Legislature to reexamine copyright law with the passage of the Digital Millennium Copyright Act. Soon, the digitization of things, as described by Professors Deven Desai and Gerard N. Magliocca, will similarly require the Legislature to reexamine patent law.

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72. Id.
73. Id. at 1187.
74. Desai & Magliocca, supra note 5. As Professors Desai and Magliocca noted:
Digitization has already disrupted copyright-based industries and laws. As cost barriers fell, individuals engaged with copyrighted work as never before. Business-to-business and business-to-consumer models of industrial copyright faltered and, in some cases, failed. Industries were forced to reorganize, and the foundations of copyright were reexamined.

Id. 1998’s Digital Millennium Copyright Act sought to rectify this circumvention as well as respond to novel copyright issues that copyright holders were facing with the growth of digital media, as the distribution of digital content over the Internet was making traditional copyright law obsolete. Digital Millennium Copyright Act, AM. LIBR. ASS’N, http://www.ala.org/advocacy/copyright/dmca [https://perma.cc/PLU7-MCYE] (last visited Nov. 4, 2018). The DMCA even criminalizes the circumvention of digital rights management systems for fair use processes, such as backing up purchased files or moving to a different platform, as the court found in Universal City Studios, Inc. v. Reimerdes, “[i]f Congress had meant the fair use defense to apply to such actions, it would have said so.” 82 F. Supp. 2d 211, 219 (S.D.N.Y. 2000); Kyle Wiens, Weird Rules Governing What We Download, HARV. BUS. REV. (Nov. 3, 2015), https://hbr.org/2015/11/the-weird-rules-governing-what-we-download [https://perma.cc/T257-2P7N].
75. Desai & Magliocca, supra note 5. Professors Desai and Magliocca concluded:
3D printing is the next step in general-purpose computing. Michelangelo said that he made statues by removing the parts of the stone that hid the sculpture, but 3D printing promises to transform manufacturing by applying the opposite idea. Activities that
C. Education Fair Use Exception in Copyright

1. Generally

“Nonprofit educational purposes” is the only fair use purpose expressly included in the first factor listed in the copyright statute.\textsuperscript{76} By including educational fair use in the statute, the Legislature reveals the importance with which they regard nonprofit educational purposes.\textsuperscript{77} The Committee expressed a “need for greater certainty and protection for teachers” and that “[i]n an effort to meet this need, the Committee has not only adopted further amendments to section 107, but has also amended section 504(c) to provide innocent teachers and other non-profit users of copyrighted material with broad insulation against unwarranted liability for infringement.”\textsuperscript{78} The policy behind the codification of the fair use educational purpose was to allow teachers to use copyrighted selections from literature without facing infringement claims from publishers.\textsuperscript{79}

2. Photocopying in Education

Before passing the 1976 Copyright Act, the Legislature “employed the help and advice of a committee of educators and publishers to insure that the legislation was evenhanded and workable.”\textsuperscript{80} In doing so, the Legislature “devoted considerable attention to working out the proper scope of the fair use defense as applied to copying for educational and classroom purposes.”\textsuperscript{81} The House Report that were once the province of only a few are now in the hands of many. The patent system has been able to require disclosure of how a process works, because the cost to infringe was high. Now, cost structures that once required an inventor to find a deep-pocketed outside backer are gone. The design, manufacture, and distribution of goods is easier, faster, and less expensive than ever before. These tasks can be done at home, in a start-up, or at a large business. Patent law and industries that rely on patents will have to adapt to this new environment or face potential obsolescence.

\textit{Id.} at 1719.
\textsuperscript{77} Id. See generally 4 NIMMER & NIMMER, supra note 4.
\textsuperscript{78} 17 U.S.C. § 107 (explaining the historical notes behind the statute).
\textsuperscript{79} Id.
\textsuperscript{80} Maddox, supra note 6.
\textsuperscript{81} Cambridge Univ. Press v. Patton, 769 F.3d 1232, 1267 (11th Cir. 2014).
accompanied the Copyright Act endorsed classroom guidelines (created by representatives of the Ad Hoc Committee of Educational Institutions and Organizations on Copyright Law Revision, the Authors League of America, Inc., and the Association of American Publishers, Inc.) as “a reasonable interpretation of the minimum standards of fair use.”

The classroom guidelines, although offering some assistance to teachers using photocopiers for their classrooms, are flawed. For instance, as noted by the Eleventh Circuit in the 2014 case *Cambridge University Press v. Patton*, although the Legislature endorsed the classroom guidelines, they hold no force of law. Moreover, the classroom guidelines do not differentiate between fair use needs at different educational levels. Indeed, neither the American Association of University Professors nor the Association of American Law Schools would endorse the classroom guidelines because they were too restrictive for the university and graduate level.

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82. H.R. REP. NO. 94-1476, at 72 (1976). The endorsed guidelines are divided into two different types of photocopying—(1) single copying for teachers and (2) multiple copies for classroom use. The guidelines for single copying for teachers provide that:

A single copy may be made of any of the following by or for a teacher at his or her individual request for his or her scholarly research or use in teaching or preparation to teach a class: A. A chapter from a book; B. An article from a periodical or newspaper; C. A short story, short essay or short poem, whether or not from a collective work; D. A chart, graph, diagram, drawing, cartoon[,] or picture from a book, periodical, or newspaper[

Id. at 68. The guidelines for multiple copies for classroom use provide that:

Multiple copies (not to exceed in any event more than one copy per pupil in a course) may be made by or for the teacher giving the course for classroom use or discussion; provided that: A. The copying meets the tests of brevity and spontaneity as defined below; and, B. Meets the cumulative effect test as defined below; and, C. Each copy includes a notice of copyright.

Id. The guidelines then go on to define brevity, spontaneity, and cumulative effect. Id. at 68–69. Finally, the guidelines offered limitations to educational fair use that are prohibited. Id. at 69.

83. *Cambridge Univ. Press*, 769 F.3d at 1273. The *Cambridge Univ. Press* opinion explained:

We note that the Classroom Guidelines, although part of the legislative history of the Copyright Act, do not carry force of law. In any case, to treat the Classroom Guidelines as indicative of what is allowable would be to create the type of “hard evidentiary presumption” that the Supreme Court has cautioned against, because fair use must operate as a “sensitive balancing of interests.”

Id. (quoting Campbell v. Acuff-Rose Music, Inc. 510 U.S. 569, 584 (1994)).

84. H.R. REP. NO. 94-1476, at 72. The guidelines were not supported, however, by representatives of the American Association of University Professors and the Association of American Law Schools who
D. Narrow Statutory Exception in Patent Law

In 1984, the Legislature passed the Hatch-Waxman Act, a codified version of the experimental use exception for the pharmaceutical industry that provides that it is not “an act of [patent] infringement to . . . use . . . a patented invention . . . solely for uses reasonably related to the development and submission of information under a Federal law which regulates the . . . use . . . of drugs . . . .”\textsuperscript{85} The Hatch-Waxman Act is not technically a codification of a fair use exception in patent law.\textsuperscript{86} However, it functions much in the same way as fair use in copyright law by providing a “safe harbor” to scientists who would technically be infringing upon patents in their research.\textsuperscript{87} However, the Hatch-Waxman Act differs from copyright fair use by providing more concrete guidelines and restrictions.\textsuperscript{88}

\begin{quote}
felt that the guidelines were “too restrictive with respect to classroom situations at the university and graduate level.”\textit{Id.}
\end{quote}

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It shall not be an act of infringement to make, use, offer to sell, or sell within the United States or import into the United States a patented invention (other than a new animal drug or veterinary biological product (as those terms are used in the Federal Food, Drug, and Cosmetic Act and the Act of March 4, 1913) which is primarily manufactured using recombinant DNA, recombinant RNA, hybridoma technology, or other processes involving site specific genetic manipulation techniques) solely for uses reasonably related to the development and submission of information under a Federal law which regulates the manufacture, use, or sale of drugs or veterinary biological products.
\end{quote}

\begin{quote}
86. Rowe, \textit{supra} note 85.
87. \textit{Id.}
88. \textit{Id.} As Professor Elizabeth A. Rowe explained:
\end{quote}

\begin{quote}
The Act provides a safe harbor, permitting drug manufacturers to perform experiments needed to obtain FDA approval of their drugs, even if those experiments are conducted during the patent life of a patented drug being tested—an otherwise infringing use. In addition, the Act lengthens the patent term for drugs requiring FDA approval before entering the market. It also exempts certain activities that would otherwise amount to infringement.
\end{quote}

\begin{quote}
\textit{Id.}
\end{quote}
III. Proposal

The establishment of a statutory fair use defense in patent law need not be as broad as it is in copyright law. Unlike copyrighted songs or films, it is unlikely a patented invention or discovery (such as a medical prosthetic) would become the subject of parody. Furthermore, the policies for extensive copyright protection, which are offered for purposes such as criticism, comment, news reporting, scholarship, or research, are not all necessary to protect the policy interests of STEM education and 3D printing.

Accordingly, the establishment of a broad fair use exception in patent law is unnecessary to protect the interests of educators utilizing additive manufacturing in their classrooms. Therefore, this proposal focuses on an educational fair use exception. This Note provides three distinct proposals, with the first proposal considering an educational patent fair use exception to be modeled after the current copyright fair use exception, the second proposal considering an adapted copyright fair use model that codifies limitations, and the final proposal suggesting that the Legislature use the method it used in adopting the Hatch-Waxman Act.

89. 17 U.S.C. § 107 (2018). Fair use in copyright law may be used as a defense “for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research . . . .” Id.

90. 4 NIMMER & NIMMER, supra note 4; see Brownmark Films, LLC v. Comedy Partners, 800 F. Supp. 2d 991, 1000 (E.D. Wis. 2011) (finding a fair use parody when a South Park episode had a nine-year-old character dressed as a teddy bear singing the song “What What (In the Butt)”), aff’d, 682 F.3d 687 (7th Cir. 2012).

91. However, legal scholars have made arguments for other fair use exceptions in patent law. Desai & Magliocca, supra note 5 (proposing that at-home 3D printer users should have some protections for patent infringement liability); Miller, supra note 20, at 57 (proposing a technology-specific fair use doctrine in patent law); O’Rourke, supra note 22 (arguing for the introduction of a broad fair use exception in patent law); Strandburg, supra note 43, at 266 n.7 (expanding upon and concurring with Professor Maureen A. O’Rourke’s argument for broad fair use in patent law); Deepa Varadarajan, Trade Secret Fair Use, 83 FORDHAM L. REV. 1401, 1401 (2014) (arguing that courts should adopt a multi-factor trade secret fair use analysis). See generally Liza S. Vertinsky, Patents, Partnerships, and the Pre-Competitive Collaboration Myth in Pharmaceutical Innovation, 48 U.C. DAVIS L. REV. 1509, 1509 (2015) (arguing that a targeted statutory patent fair use in the pharmaceutical industry could drive collaborative innovation that could accelerate cures for Alzheimer’s disease).
A. Option A: Model After the Copyright Fair Use Exception

Congress could model an educational patent fair use exception for 3D printing on the already existing educational copyright fair use exception for photocopying. The language of the four factors in the Copyright Act fair use statute could be amended for patent law resulting in: (1) the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes; (2) the nature of the patented work; (3) the amount and sustainability of the portion used in relation to the patented work as a whole; and (4) the effect of the use upon the potential market for or value of the patented work.

Much like the Legislature did in 1974, the Legislature could confer with a committee of educators and patent-holders to draft guidelines, and then the Legislature could endorse those classroom guidelines. Further, the Legislature must ensure that consideration is given to different levels of education. 3D printing in an elementary school science class is not the same as 3D printing in a university-level engineering course. Thus, to promote STEM education in all learning institutions, there should be different guidelines created for each level of education.

However, an option modeled almost exactly after copyright fair use would likely lead to the same issues of ambiguity in educational patent fair use as there are in copyright fair use. If the guidelines are endorsed but not integrated into the statute, they will hold no force of law, as is the case in copyright fair use.

96. 4 NIMMER & NIMMER, supra note 4.
97. Cambridge Univ. Press v. Patton, 769 F.3d 1232, 1273 (11th Cir. 2014); 4 NIMMER & NIMMER, supra note 4.
clear limitations on 3D printing in education, this option would lead to litigation between educators and patent-holders. Because of fear of potential liability, educators would likely not feel secure in allowing the 3D printing of patented objects in their classrooms, and less advancement in STEM education would occur.

B. Option B: New Factors

Congress could modify the copyright fair use factors in a way that is more applicable to patent fair use, such as the factors proffered by Professor O’Rourke: “(i) the nature of the advance represented by the infringement; (ii) the purpose of the infringing use; (iii) the nature and strength of the market failure that prevents a license from being concluded; (iv) the impact of the use on the patentee’s incentives and overall social welfare; and (v) the nature of the patented work.”

Professor O’Rourke argued that these factors should be applied to a general fair use in patent law; however, these factors could also be applied to the more narrow fair use exception for educational uses of 3D printing.

Then, the Legislature could provide concrete limitations on the fair use of 3D printing of patented objects. To do this, the Legislature should again consult with educators and patent-holders to develop different limitations for primary, secondary, and higher education institutions. The Legislature should codify those limitations, instead of merely endorsing them as guidelines, so that the codified limitations would have the force of law.

The limitations must be clear enough to allow educators to know what is and what is not allowed because any type of 3D printing in classrooms should not be allowed for any purpose. For instance, students should not be permitted to 3D print a patented object for their own personal use. Moreover, much like there is a limit of one photocopy per student in copyright fair use, there should be a limit on

98. O’Rourke, supra note 22, at 1205.
99. Id.
100. Cambridge Univ. Press, 769 F.3d at 1273.
the amount of patented objects a classroom may print.\textsuperscript{101} What happens with the patented objects after they are used as demonstratives for educational purposes? Should the students be allowed to make changes in the design of patented objects and then 3D print the object with those changes? To make these determinations, the Legislature must learn more about how 3D printing is being used in STEM education at all levels.\textsuperscript{102}

This option has its own issues. The first issue is that 3D-printing technology is constantly developing, with the technical limits of what can and what cannot be printed becoming narrower with each discovery.\textsuperscript{103} Thus, the codified limitations would need to be broad enough to encompass things that cannot currently be printed but are likely to become available soon, such as large-scale metal machines. Otherwise, the limitations would have to be amended as frequently as additive manufacturing technology is updated—an impossible expectation of the Legislature.

\textbf{C. Option C: Follow Methodology of Hatch-Waxman Act}

The third option could be to create a statute that is not officially titled a fair use exception but essentially functions in the same way by acting as a safe-harbor, similar to the Hatch-Waxman Act.\textsuperscript{104} This option would likely quell the slippery-slope fears of introducing a

Because there is already a narrow safe-harbor exception in patent law that is similar to copyright law’s fair use exception, the precedent could allow for the establishment of another narrow exception—one focusing on permissible 3D printing of patented objects in education. The Hatch-Waxman Act precedent, in conjunction with the narrow need to protect educators using 3D printing, would make Option C the most viable option of those proposed in this Note.

Like the other two options, in order for any safe harbor in patent law for 3D printing to be successful, the Legislature must first make a thoughtful inquiry into the needs of STEM educators. Then, the Legislature could add a clause to 35 U.S.C. § 271 with the same starting language as the experimental use exception for the pharmaceutical industry codified in 35 U.S.C. § 271(e)(1): “It shall not be an act of infringement to . . . .” Finally, the clause should explain the actions that are not infringement.

Rather than utilizing or adapting the four fair use factors, as suggested in Option A and Option B, the safe-harbor clause could, like the Hatch-Waxman Act, be tailored to the needs of fair use in educational uses of additive manufacturing. As discussed in Option B, the clause should provide clear limitations so that teachers can feel secure in using 3D printing in their classrooms. Similarly in Option B, those limitations should also be based on guidance from a committee of educators, from all education levels, and patent-holders.

Fundamentally, Option B and Option C would require the same considerations and have similar shortcomings. The main difference between the two options is essentially the use of the factors suggested by Professor O’Rourke versus the use of the phrase “fair use.”

107. See discussion supra Section III.B.
108. See discussion supra Section III.B.
109. See discussion supra Section III.B.
110. O’Rourke, supra note 22.
However, both options provide educators with a way to continue incorporating 3D printing into their curriculum.

CONCLUSION

As additive manufacturing becomes more integral in the commercial sector, the open-sourcing and sharing of 3D-printed files is likely to disappear, with patenting of 3D-printed goods becoming the norm.\footnote{111} Globalization is changing the job market, and educators must be able to inspire their students to pursue STEM careers for the United States to have a viable place in future industry.\footnote{112} In 1976, the Legislature wanted to protect \textit{traditional} education models; however, the technology used in education is no longer limited to the photocopier.\footnote{113}

As the methodology in education continues to change to include the use of new technology, such as the 3D printer, teachers could become liable for patent infringement. Educators concerned about patent infringement would likely stop allowing the use of 3D printers in their learning institutions, thus eliminating a useful tool in STEM education. Because of the policy considerations behind the focus on STEM education, the Legislature should offer patent fair use protection to educators who use 3D printers in their instruction, as the Legislature did in 1976 when it granted fair use protection to educators who used photocopies to teach their students.\footnote{114}

First, Congress must evaluate the needs of STEM and learn more about the use of 3D printing in classrooms in primary schools,
secondary schools, and post-secondary institutions. This first step must be taken no matter which process Congress decides to take in protecting educators. Then, Congress must decide how to best protect those teachers from future patent infringement issues, whether it be by creating a fair use in patent law for educational purposes or by creating a safe-harbor statute for educators. Finally, Congress should integrate the information about the needs of STEM educators into whichever method it chooses.

At this time, there is still sufficient open-source file sharing available to educators, so Congress may take its time in deciding how to proceed. However, if Congress does nothing to protect the use of 3D printers in education as the importance of additive manufacturing grows and as open-source sharing disappears, the progress of STEM education could be stunted because of patent infringement issues. Therefore, as jobs continue to grow in science, technology, engineering, and math fields, Congress must protect teachers encouraging their students’ excitement about STEM learning through 3D printing.


116 Elrod, supra note 102; Dogru, supra note 102; McConnell, supra note 102.