

Graphic Design Curriculum and Printing Technology: The Partnership and the Impact In The Industrial Printing Market

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Abstract:

Graphic design education at the Jordanian Universities teach students mainly design theories, concepts and digital graphic, without considering the printing technology and training in their teaching. As a result, this led to a decline in opportunities for graduates in the labor market. On the other hand, the printing and graphic design industry are going through a period of transformation, because of the emergence of digital technology, and downsizing the employees' number in printing companies. When the job market change, educational institution respond. Therefore, the researcher emphasizes to include printing technology education in the graphic design curriculum, in association with discipline based courses. This paper explores the partnership between graphic design and printing technology, and the importance of teaching printing technology to graphic design students. Furthermore, this paper suggest teaching offset lithographic printing and digital printing to graphic design students, because these methods contribute to the development of graphic designers, and they will offer new capabilities and job opportunity to them. As well, the researcher suggests off campus training course for graphic students to put what they learned about printing into practice.

Keyword: graphic design, students, offset lithography, digital printing technology, training, printing education, partnership, impact.

Introduction

Graphic design is a vital component of the communications we all receive each and every day. Newark says, "...It's the most universal of all the arts. It is all around us, explaining, and decorating, identifying, imposing meaning on the world". (Newark, 2007, p. 6) The history of graphic design is intertwined with many movements in artistic, social and political change, but nothing has affected how designers create their work more than advances in printing technology, since all designs must be produced and printed.

As a graphic design educator for many years, and with a combined experience in graduate and undergraduate teaching, I have witnessed the design world change, including educational institutions in response to new technologies. The western universities such as United States and Canada and others included printing technology in their graphic design curriculums. However, graphic design education curriculums at Jordanian Universities, concentrate mainly on theories and discipline based courses that teach students designing skills such as studying forms, building concepts, and manipulating scale, rhythm, and color. On the other hand, printing processes such as lithographic printing technology has virtually being ignored in the graphic design curriculums, maybe the reason for the omission is financial or technical, or they are not aware of its potential. As a result, the opportunities of graphic design graduates in getting proper jobs in distinguished companies are little, and if they were lucky and get hired, they faces the possibility of being discharge from their jobs even if they have good artistic ability and many years of experience, because understanding and practicing print production is the most essential skill employer seek in designers.

Additionally, it was noticed lately that printing companies are downsizing their employees' numbers, because of economic reasons and introducing improved technology that allows to do much more work in far less time (Waite, 2006). Therefore, companies have increased their emphasis on employers with high level of experience and skills in both designing and printing technology; designers who have the knowledge to do the whole cycle process from design to correct errors, to assembly and to print final production; designers who can keep up with the advances in the printing technology, and the value of training course at the fourth year before graduation.

The extensive retraining of the workforce and the reexamination of the basic skills required for graphic design students employments, accompanied by the growth of lithographic offset printing and digital printing, whence copy preparation, image setting, plate making, press work and finishing, all have brought forth the need for high level of graphic design education associated with printing technology. Thus, it's more important than ever for graphic design curriculum to include contents that reflect both the offset lithography and the digital printing technology education.

The present research will investigate the relationship between graphic design and printing technology. It will also discuss the importance of printing technology for graphic design students. Furthermore, I will address what to teach graphic design students about printing technology.

This research is valuable because learning the lithographic and digital printing technology in the graphic design curriculum education, will play a major role in providing high-quality education and professional development to the printing industry in Jordan's printing markets. There will be greater numbers of qualified professionals to accomplish many technical tasks relating to the broad spectrum of the graphic design and printing industry. Moreover, graphic design students will expand their opportunities of getting better job in the world of graphic design and printing business.

The partnership between graphic design and printing

Graphic design industry and printing technology are inseparable and they were always linked together. In fact, lithographic printing in early poster design marked the birth of graphic design (Newark, 2007). As a profession, graphic design has only existed since the middle of the twentieth century. It owes its creation to the industrial revolution, and fundamental transformation on western economics. At that time, graphics played an important role in the progress of industrial developments, and in marketing factory output (Weill, 2004).

Worthington (1998) asserted that during the industrial revolution, the lithographic printing process was invented in Germany in 1797 by Alois Senefelder which was then perfected by Englemann. At the end of the nineteenth century, lithography allowed artists to print large formats of posters and to use color, and gave them the freedom to draw their own lettering, which had previously been limited to a ready-made type design. **Hird and Finley (2010)**, and Mack (2007) stated that the ability to combine word and image in such an attractive and economical format finally made the lithographic poster a powerful innovation. This control over print was the beginning of graphic design. Later, posters became a primary method of advertising and publicizing events, boosted by the lithographic process.

The lithographic process revolutionized the creative conventions of graphic design and found new ways to communicate. Designers as Henri de Toulouse-Lautrec and Privat Livemont were at the front of early poster design that elevated the status of the poster to fine arts by using the lithographic process. Livemont took full advantage of the lithographic methods to impose his creative control over the use of color. He produced a variety of hues, shades and gradient color in his designs. Other hand, Toulouse-Lautrec employed the use of firm outlines with flat panels of color and contour, and he utilized hand-drawn lettering which was integrated into the text. Posters played a large communication role in world war two. By this time, most posters were printed using the mass production technique of photo offset. (Meggs, 1992).

In 2008, Kahng conducted a study that discusses the notion of a shared technology roadmap between lithography printing and design from several perspectives. He examined how printing and design affected each other. He concluded that through technology, lithography printing and design can truly bridged together by determining layout practices and design roles (Kahng, 2008). Kaye an editor and publisher in the *Graphic Design USA Magazine* asserts that graphic designers and other creative professionals view print as central to their personal and professional lives. He said that more than 90% of graphic designers will work on print and that nearly 75% of their projects involve a print component (Kaye, 2011).

The importance of teaching printing technology to graphic design students

Graphic designers create solutions to design problems. A part of every solution includes communicating how to get the job done technically, and how to get the poster printed or how to create the mechanicals for the package design. The designer must learn to clearly express and transmit ideas and instructions as well as to receive and evaluate feedback.

Education and training provides an important pathway into the printing and graphic arts industry. Students entering the field of graphic design must be provided an education that teaches them not only discipline-specific content, but also teach them how to approach printing technology methods, starting with offset lithographic processes and digital printing. According to Ervin, Olusegun and Daniel (1996) universities should provide quality learning and assessments resources to graphic students, to support their consistent implementation. In addition, prospective employers need a stamp of approval such as accreditation or certification for the quality of the program and instruction, to be confident that the student has a core set of skills required for the business.

With the advance of new technologies, graphic designers can purchase a powerful computer workstation, high resolution scanner, and a suite of image creation, editing and layout software, which will allow them to do much more work in far less time. But, even with using the computer and the right software, it may not result in a printed job that meets the customer's needs, because a graphic designer working in isolation from printing processes cannot possibly know all the interactions and permutations between ink, paper, process and press (Waite, 2006).

According to the American graphic design community, the value of print is not an abstract concept but a fundamental mainstay of their lives (Kaye, 2011). Kaye argues that for most designers, printing promises an authentic human connection. The real, tangible, sensual attributes of print, enable it to touch people emotionally and convey trust. Furthermore, he listed four reasons that explain why graphic designers view printing as central to their personal and professional lives. First, designers are drawn to the real world physicality of print, its ability to be held and touched. Second, printmedia remains relevant to designers because it's practical, easy, effective, convenient and understandable. Third, designers will learn to establish a productive coexistence between print and new media. Finally, designers are taking advantage of print's evolution into a smarter, faster, more efficient, more convenient medium (Kaye, 2011).

When printing technology education is introduced to graphic design students, they will develop exceptional technical understanding of printing industrial technology, and they will intensify the learning of printing quality, design, compositional and media handling skills (Ervin, et al., 1996). Learning and practicing a new method and experimenting with the new materials and technology will expand student creativity, imagination and aesthetic freedom. Weill (2004) explained that when Toulouse-Lautrec used lithography in the poster 'Moulin Rouge, La Goulue', it gives the image the sense of the aesthetic freedom, but at the same time he has control over the media showing that lithography could be manipulated by the designer.

Additionally, through utilizing printing technology such as lithographic offset printing, students will learn the methodology of problem-solving. Morin (2013) clarified that offset printing may include some common printing errors, such as uneven color, picking and muddy or uneven screens. Students will learn how to locate and define the problem, how to research and gather information, then find solutions and finally implement one or more solutions. Also, students will gain certain level of predictability which is sometimes difficult to accomplish.

Most of all, it's important for graphic design students to be involved with printing methods and techniques for career purposes. Pepper Communications Ltd (2013) stated that they worked closely with marketers and graphic designers through the United Kingdom for three decades, and they recognized the importance of converting design to effective print, and how it fits into the overall marketing communication mix. One of the most skills employers seek in designers is an understanding of print production. Erawan Interactive Co., Ltd (EICL), a well-known lithographic offset printing company in Thailand which provides printing service, mentioned that they are employing highly skilled designers, with years of experience in page layout, image manipulation, and illustration packages, but they seek to make their designers experts in the use of printing press (Erawan Interactive Co., Ltd, 2013). The American Institute of Graphic Arts (AIGA) founded in 1914 stated that when designers master printing techniques, they will be able to convert their design into high quality print, which is important because the printed material is often the first impression people get of the designer work, so it's essentially to get it right. Also, good print gives the customers confidence in what they do (American Institute of Graphic Arts, 2013). Additionally, the well trained designer can provide the client with sophisticated solutions that match and satisfy client's needs.

The Environment Scan (Escsn) provided Innovation and Business Skills Australia (IBSA) with a report that examined the key challenges facing the printing and graphic design industry, and considered their impact on workforce development. It concluded that the printing and graphic design industry are going through a significant period of transformation, because of the emergence of digital technology, and reducing the number of employers in prepress and printing departments. As a result, much of prepress and printing duties have been pushed to the graphic designers (Innovation and Business Skills Australia, 2010). Therefore, it's more important than ever for graphic design student to be prepared by having the best education and training about printing technology, in order to do the prepress and printing services, which include designing, correcting errors, assembly, and printing final production. Moreover, to respond to employers needs, by allowing qualifications and professional skills to keep pace with industry and technological change.

What to teach graphic design students about printing technology

Any successful program is graduating students who are hired in the industry, and go on to successful careers. Design education is a preparation for practice, and therefore, students should be involved with a program that combine education and work experience. This will be achieved by graphic design curriculums that include contents of printing technology education, represented by offset and digital printing.

Most current design programs for undergraduate curriculum emphasizes certain subjects and concepts as aesthetics and visual organization, visualization techniques (techniques and processes used to produce images, sketches, models and finished work), tools and technology, blending ideas and production techniques, history and criticism, design theory and graphic design subjects (Typography, design systems, symbol and identity system, book design, poster design, and computer graphics) (American Institute of Graphic Arts, 2013). Not every category is taught, because the time is too short. I believe that teaching printing technology will be a valuable addition to the graphic design program.

Printing technology includes different methods such as Offset lithography, flexography, gravure, xerography, inkjet and screen printing. Educator's main concern is about lithographic methods to be included in the graphic design curriculum, because it's the first fundamentally printing technique, its dominant and most printing industries utilizes offset lithographic printing to produce prints in mass. Moreover, lithography allows the designer almost complete freedom in terms of image development production (Environmental Protection Agency, 1995).

To introduce the graphic design students to the printing world, a basic introduction about lithographic printing will be appropriate to start with. Hird and Finley (2010) suggested to include basic information and concepts as, how and why the lithographic process? How these processes work? What is the importance of various aspects of printing in our world, how to apply lithographic theory to practical situation, the proper set of material used in the process (paper, ink, fountain solutions, plates, blankets and rollers), and the different types of presses used; beside important technical information about the process. This will enable students to gain basic knowledge of the lithographic process.

Offset lithography printing is another form of lithographic printing technology that is common and widely used for mass production. It is a process of transfer an inked impression from a plate to a rubber-covered cylinder to a paper or other medium for the final printed product. There are two types of offset printing: sheet fed that is most suitable for shorter runs, and web fed that uses rolls of paper, and it is suitable for larger print jobs. The web offset lithography is a high speed and high printing process. This technology requires transforming the skill sets, the equipment and the processes to support the evolving printing industry. In these methods, electronic applications are used, which includes computer-to-plate operations,

computer-controlled inking and printing, digital image generation and electronic prepress (Bruning, 2007).

The design students should be instructed about the principles and technical operations of offset lithography in both types, the properties of offset materials, the interrelationships among inks, papers, plates, blankets and fountain solutions, and understanding the concept of color space (a combination of types of color and how those colors interact to create other colors) (Environmental Protection Agency, 1995). Additionally, Xerox Corporation (2011) mentioned that in offset lithography, students need to learn technical ability to use machinery and advanced computer programs, in order to run the press and all of its subsystems such as ink/water, paper feeding, drying systems, plate alignment and color balance. Also, safety is an important issue for student to know, because of environmental concern and because printing industry is involved with hazardous chemicals that might affect health.

According to Hird and Finley (2010) lithography printing involves two types of operations that students need to be aware of and learn. First, related to the pre-press operations which include design layouts and assemble text, and graphics into page formats for printing, using computerized typesetting and image assembly. The second one related to printing press operations, which include preparing, operating, and maintain the printing presses. The quality of the print product depends not only on the press but also on the proper set of materials used in the process. Mistakes made in pre-press can cost thousands of dollars to the business. Therefore, it's crucial for students to make sure that everything is correct, and to prepare completed files as accurately as possible, in order to effectively pass through the print workflow. Waite suggested teaching graphic design students specifications and guidelines that help to reduce pre-press problems. He said "Teachers of graphic design should procure, read, understand, and teach the relevant specifications that correspond to the industry segment in which their students are likely to be employed" (Waite 2006, p. 26).

Waite appointed four types of specifications. First, Specifications for Web Offset Publications (SWOP); it's good for everyone involved with magazine advertising printed by web offset or by gravure. Second, Flexographic Image Reproduction Specifications (FIRS); it's good for students involved with packaging, wrappers, labels, and designing folding cartons. Finally, Specifications for Newsprint Advertising Production (SNAP) and General Requirements for Applications in Commercial Offset Lithography (GRACOL); these works for newspaper and production, advertising agencies and publishers (Waite, 2006).

Other problem that might face the graphic designer is printing related problems. Erawan Interactive Co., Ltd has conducted surveys over the years to better understand the requirements of the customers. They concluded that printer satisfaction was low because of lack of variable quality printing with common print errors, and inflexibility in file formats and proofing options (Erawan Interactive Co., Ltd, 2013). Therefore, its vital for students to know how to recognize, analyze and solve offset printing problems, such as uneven color, chosts (images formed in areas where they should not appear), hickies (non inked circles created by lint on the plate or blankets), picking (non-inked areas look like snow) and smashed blankets. Chou and Krauss (1997) asserts that by exploring the interactions that cause many common press problems, students will gain an understanding of the variables involved, as well as the means for controlling them, which will improve quality and productivity.

On the other hand, digital printing is becoming a new standard in printing industry. It appeared as a result of the advent of software design tools and high speed digital printing. Digital printing has characteristics that are not available with other printing processes. It offers fast turnaround time with each job easy to update products and layouts, and the ability to print and deliver the job to the customer. Xerox Corporation (2011) affirms that in the digital printing world, the skills required are significantly different than the offset printing

skills. A digital output device has no ink and water, no printing plates and no drying system. Digital laser printing devices use electro photography, via a laser to charge an image onto a drum and then apply toner to the charged image with a final step of fusing the toner to the paper. Additionally, the Innovation and Business Skills Australia (2010) mentioned that digital printing has a feature that is not available in the offset printing, it's known as variable data printing; it's the ability to do any adjustments to the image without impacting output device productivity, through operating software on the device.

Graphic design students need to learn about the characteristics of digital printing, what differentiate this method of printing than the others, and when to use it. To operate a digital production printing device, graphic design students should know typical skills as knowledge of the operating software, knowledge of the application capabilities of the device (imposition, color adjustment), how to perform color calibration, digital file preparation, knowledge of Digital Front-End (DFE), digital pre-flighting, font management and problem resolution (Xerox Corporation, 2011). Waite (2006) stated that it's important for graphic design students to learn how to use a page layout program (desktop publishing program) such as Adobe, Publisher and Quark. Print design also requires an understanding of concepts like color separations, grid layout, and master pages.

The need for training

The successful printing companies demand from their employees to be creative, well educated and trained. Thus, a training course that concludes for years of formal education will be valuable for graphic design students who are interested in entering the printing industry. In order to maximize the benefits of this course, it should be implemented off campus in one of the print-media companies, because they are fully and properly equipped with the most advanced graphic arts printing technology. Also, students will put what they learned about printing into practice, and they will learn new graphic communication processes, software and equipment.

Walker (2011) stated that a training course present a good opportunity to expand the knowledge base of all graphic students, and it will strengthen those skills that each students needs to improve. Furthermore, Walker argues that students who receive the necessary training will be better to perform their job when they enter the printing market. Training creates an overall knowledgeable staff, more aware of proper procedures for basic tasks and safety practices. A staff who can take over for one another as needed, work on team or work independently without help or supervision from others.

Moreover, training will improve student performance, efficiency, and productivity. According to Forst (2013) training will also build the student's confidence because they have a stronger understanding of the industry, and this confidence will push them to perform even better and think of new ideas that help them to excel. The U.S Bureau of Labor Statistics (2009) asserts that after training and gaining experience, those students will get more responsible positions when they hired such as skilled craft jobs or even supervisors.

The most common training methods being currently used in the printing industry are workshops and seminars. The trainees receive hands-on training because of the small class sizes and personal attention they are given (Walker, 2011). Frost (2013) added that workshops are developed to go beyond classroom and theory training, they are designed to use demonstrations and hand-on experience to increase student's skills set, such as the latest printing software, prepress, pressroom, and bindery equipments training. The printing related workshop and seminars include both knowledge concepts and operational procedures demonstrated in industry, color management, special press problems, process controls, and safety issues.

Interactive modules also used for training purposes. After introducing each topic, the trainee will take a quiz to see how much information he/she retained. At the end of the module, each trainee will receive a certificate of completion that present the trainee's name, date of completion and the quiz score (Forst, 2013). At last, training in the printing industry is an ongoing process, due to increased competition in the print industry, and advances in technology. Thus, students who enter the printing market need to keep an eye on technological breakthroughs throughout their careers.

Conclusion

Graphic design and printing technology are inseparable, and they are highly connected to each other. Printing and graphic art industry are going through a significant period of transformation, such as the emergence of digital technology and reducing the number of printing employers in printing companies, which certainly have affected the workforce development. Therefore, educational institutions should respond to the industry workforce development needs, and they should develop advanced curriculums and training courses to built workforce skill and productivity.

The graphic design students must be provided a special education courses and field training that teaches them not only discipline-specific contents, but also teach them how to approach printing processes and providing the students with firsthand training practices, because of the increasing emphasis of companies on high level of printing skills, and for employment purposes. Offset lithography printing and digital printing technology are highly recommended to be included in the graphic design curriculum, because they are dominant and widely utilized in most printing industries, for their ability to produce prints in mass production. Students need to learn and understand the special skills set that are associated with each method.

Printing technology education will offer new capabilities and job opportunity to the graphic designer, and it will supply the workforce with adequate job skill and experiences. In addition, learning and practicing a new method and experimenting with new materials and technology will expand the graphic design student's printing creativity and skills, and to be able to become qualified to engage in the labor market.

A training period for graphic design students that conclude what they have learned about printing is valuable especially for those who intend to enter the printing industry. It was found that a training course will expand the knowledge of all graphic students, improve students' performance, efficiency and productivity, and it will give them a better opportunity to get more responsible positions when they hired.

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