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Automatic Success: Teaching Advanced Process Automation to Undergraduate Graphic Communications Students

by Christopher Smyth, MBA • Ryerson University, Canada

Introduction to Workflow

Workflow is a term we use to describe a series of steps. The definition of a workflow is "a reliable repeatable sequence of operations, enabled by a systematic organization of resources and information into defined roles and processes that can be mapped and documented" (PIRA, n.d.).

At a basic level, printing companies have seven core processes they undertake in their daily operations for clients: ordering, designing, production, image/content transfer, printing, finishing, and delivery. Workflow is the activities of building connections between these steps, and the organizational groups historically responsible for them.

Automation & Integration

Process *automation* is the practice of analyzing a discrete step and its 'sub processes' in a manufacturing methodology, and building a framework to achieve these with the minimal amount of operator intervention required to complete the step while meeting functional requirements.

Process *integration* is connecting the various steps in such a way that the job data and required project files route through the system independently, with the minimum of human touches required to repeatedly meet predetermined quality levels.

For printing and communications-based companies, workflow automation and integration is discussed at length because, "to be profitable with print it is important that files are touched as little as possible" (Ellis 2013). The more manual intervention the project receives, the more the job costs to produce, and the less revenue is kept as profit.

Workflow Background Perspective

The current complex digital routing challenges faced by modern communications companies could reasonably be considered to have started with the desktop publishing revolution in the mid 1980s. Later, with the emergence of Computer-to-Plate (CTP) in 1990s, the Raster Image Processor became the center of production for printing companies. Vendors created systems based on the 'ROOM' philosophy (Rip Once Output Many), where page files were rasterized but imposition, screening and final output could be completed separately when and where required—an important step for process flexibility.

Today's digital era, starting in the late 1990s, has evolved dramatically to its present state. The second half of that decade saw the emergence of online file review as well as assembly and web-to-print—the start of what we consider workflow today (Zwang, 2013).

By the mid 2000's, "Time-to-Market" had become a mantra of for catalogers, periodical publishers, and retail flyer production. Market pressures drove this, as more consumers moved their media habits online. Digital workflows are allowing production schedules to be compressed.

Emerging Standards

In her popular work *Strategic Management of Technological Innovation,* Melissa Schilling identifies patterns for new technologies in marketplaces, and how standardization for technologies ultimately emerges. She also explains that supporting enablers are often the key to the success of technological innovations (Schilling, 2005).

One key enabler for graphics-based workflows is the development of specifications and standards essential for manufacturing. These make it possible to match predictable inputs with consistent, repeatable outputs. They are important because "the use of industry standards not only alleviates risks, but also reduces time to market (PRIMIR, 2011).

Standards and specifications developed by groups such as the ISO (International Standards Organization) TC130 Committee, CIP4 (The International Cooperation for the Integration of Processes in Prepress, Press and Postpress) and the ICC (International Color Consortium) and languages such as XML (extendable mark up language), formats including JDF (Job Description Format) and JMF (Job Messaging Format), PDF/X (Portable Document Format for eXchange), and XMP (Extensible Metadata Platform), as well as process dependent color specifications (FOGRA, GRACol, SWOP, SNAP) are each important to understand. They are the mechanisms that allow us to automate and integrate. Native transparency renderer software (such as Adobe's 'Print Engine' and Global Graphics' 'Jaws') is another key enabler for successful workflow.

Workflow for Today's Markets

A process orientated, automated, and integrated workflow allows for quick turnaround times. It also reduces internal costs, which supports the lower prices the current market is driving. As the industry consultancy Smithers Pira correctly points out, "print is now competing with alternative digital channels in the marketing mix and many of them have low production costs and almost zero distribution costs" (PIRA, (n.d.). A properly set up and managed automated workflow can also be leveraged to support new "value adds," as well as additional media channels (PRIMIR, 2011).

Recognizing the changing market landscape, especially since the financial crisis of 2008, printers continue to focus attention on rebuilding and/or expanding their workflows for efficiencies, as well as to be more aligned with their customers' expectations, including better access and transparency. Printers have to become strategic partners with their clients and part of this process is to "eliminate barriers and make the process of printing more efficient" (PIRA, (n.d.).

The 2010 NAPL (now Epicomm) Capital Investment Study was based on a comprehensive industry survey where almost ⅔rds of respondents acknowledged they were looking to get faster by "streamlining workflow, processes, reducing touches, and reducing steps." Over half of respondents were focusing on "reducing spoilage, rework, waste," and "focus(ing) on cost control/doing more with less." The same study emphasized that companies also need to hire workers with new skill sets to meet these new demands of the printing industry (NAPL, 2010).

The 12th edition of the Epicomm State of the Industry Report (2014) indicated that company revenues from digital printing and value added services increased to over 40% in 2014. Both digital printing and value added services, such as Data Asset Management and variable output, benefit from a structured, automated workflow. This survey also explored company "must do's" in the next two to three years. The number one response, from over 80% respondents, was to "be as Lean as possible, do more with less, streamline workflow, (and) reduce steps, and touches" (Paparozzi, 2014).

MIS and Web-to-Print

In the mid-2000's, Management Information Systems (MIS) had become popular with the printing industry. Initially these solutions offered support for accurate job estimating, along with related invoicing features (British Printing Industries Federation, 2007). Today, they have expanded their capabilities to include capturing production and performance information from various functions and stages of graphic communications manufacturing processes.

While MIS and Web-to-Print are sometimes offered as integrated parts of a comprehensive workflow software solution, it is helpful to clarify the different functions that the systems perform from a workflow perspective. Jennifer Matt, an industry consultant, clearly distinguishes between Management Information Systems (MIS) (those which are used for managing business processes through accurate information), and Web-to-Print (those that are used for client facing order entry) (Matt, 2010).

Modern workflow systems generally have the ability to receive job order details from a Web-to-Print system, and then exchange data with an MIS system. Ideally this exchange is built on standards, such as JDF and JMF. The systems should support a bi-directional exchange, being able to issue direct commands, as well as reporting on results.

These systems are important to an overall effective workflow. This is in part because of the efficiencies that are realized from a company having a single 'System of Record' for a production order. Capturing all of the information and data related to a job in one system reduces data entry and potential errors. Also, a properly utilized MIS provides solid production performance data for improved analytics.

The MIS can capture data from sales, finance, front line client services, as well as production departments. Examples of Key Performance Indicators (KPIs) from these groups include estimates per month and their conversion rates, value of work in progress (WIP), percentage of jobs delivered on schedule, and also equipment effectiveness (Vision in Print, 2006). An effective MIS is used to share accurate production related information, such as planned vs. actual production costs with regard to machine time and material usage (Kodak, 2012). This, in turn, is used to help monitor daily operations, as well as develop more effective operational strategies. As well, historical data can be consulted to help establish performance benchmarks, useful for accurate costing, as well as a comparator for measuring the results of automation initiatives.

ROI: Hard and Soft Returns on Investments

Outlay: hardware/software integration and support

For workflow expenditures, the Return on Investment (ROI) is generally calculated from how much costs savings are realized as a result of the capital outlay. The capital outlay can include direct costs such as hardware and software, and indirect costs related to facility upgrades (electrical, networking, server racks, security). It is often reported in terms of months (or years) required to pay off the initial investment. These can be calculated through labor resource savings, derived from the cumulative total hours automating repetitive tasks saves.

In some cases, this return is realized directly through reduced overhead. However, often these labour savings are used to increase volume through a facility and reduce turnaround times, as well as to allow personnel to invest their valuable time on jobs which do not lend themselves to full automation, or on improving other aspects of the overall workflow.

ROI can also be calculated using materials savings: through ink savings, reduced spoilage and 'make-goods' due to avoidable errors, and shorter makeready times in output and finishing.

Tertiary benefits: manufacturing knowledge and customer relationship management

In addition to the quantifiable hard ROI, it is worth considering the less tangible, or "soft," workflow ROI benefits as well. To better understand resource utilization, workflow automation can be used to accurately record and report on job costs. This can be used to subjectively evaluate the true amounts certain client jobs are costing. It can help identify opportunities.

In many cases, workflow automation provides real benefits for the customers of the companies providing the automation. For example, many automated workflows include web-to-print functions that allow customers to upload, preflight, preview, and approve their jobs, from anywhere and at anytime. These portals can also to be 'branded' to the customer, creating a sense of ownership to the system and its process, building client relationships. Further, many systems have online quoting systems that are tied to MIS that are in turn tied into production workflows. This means that quotes can get out faster and more accurately. These quotes can be automatically converted into job tickets for production. Automation can also be leveraged for ecommerce, or to generate invoicing of completed jobs.

It is worth noting, however, that an automated workflow does have additional costs other than direct and indirect capital ones, including but not limited to staff training and support, customer education for client facing pieces, and implementation / integration costs (EFI, 2004).

Culture of Innovation

Present day print companies generally view automation and integration as key parts of an overall digital infrastructure. This is important as it creates a platform which printers can leverage for building a culture of innovation in their companies: "It's about encouraging employees to find ways to do their jobs even a little better and to reject the 'we've always done it that way' mentality" (Paparozzi, 2014). As one presenter in an enfocus 2015 Virtual Safari webinar iterated, companies need to look for 'consistent inconsistencies' in their processes (Sawatzk, 2015). These may have developed through attrition, things done out of immediate need that become defacto standard operating procedures (SOPs). Regardless of the reason, they need to be identified and corrected.

Skills and Training

There are many justifiable reasons as to why workflow automation is a crucial part of a graphic communications education. For example, in 2008 The Skills and Technology Roadmap for the Canadian Printing and Graphic Communications Sector identified trends in technology expected to have the greatest impact on the development of the printing and graphic communications industries, and the professional skills associated with them (CPISC, 2008). These included:

- Enhanced systems integration
- Greater demand for database management services
- Widespread use of customer interface software
- Significant developments in press technologies
- Increased automation and integration of post-press tasks
- Radical new advances in science and technology
- Environmental awareness

The first five bullets above are relate to, or are tied to, workflow and automation.

In 2011 Xerox published the whitepaper, 'Evolving Print Industry', advocating companies to hire for the future, not the past" (Xerox, 2011). The key skills they identify include operating systems and application knowledge, but

also Digital Front End systems (DFEs, also known as RIPs) and workflow software. While their focus is on operators, they highlight that "while hardware and software continue to advance, there is a shortage of skilled individuals who possess a working knowledge of the new tools of the trade" (Xerox, 2011). The 2014 RIT Cross-Media Innovation Center Summit also emphasized that future graphic communications professionals need to understand the integration of all types of media (CIMC, 2014).

Automation and integration can require skill sets in information technology, business processes, software knowledge, database literacy, as well as logical programming. For the graphic communications industry, it is ideal when these skills are built on a solid foundation of printing processes and cross media knowledge to provide context and comprehension of the steps involved. It has been noted that workflows start out as generic systems that need to be customized or tailored to the unique requirements of individual print companies, and perhaps more importantly, their customers. This requires a greater understanding than being able to recite the script of efficiencies, error reduction and increased capacity.

Workflow Automation in a Curricular Framework

In an effort to meet the present and future need for workflow automation, the School of Graphic Communications Management (GCM), at Ryerson University in Canada, has developed a highly successful approach to teaching advanced workflow automation to the students of its four-year undergraduate degree program. This graphic communication-centric approach uses a combination of theory-based concepts and hands-on, project-based learning to teach how to process jobs manually, and then progress through advanced degrees of workflow automation. The process automation curricula in GCM encourages students to explore through action, and see how individual processes can be linked together to automate between systems and steps, for total integration.

When it comes to the task of teaching automation, constructivism theory within a student-centered learning strategy is used. As envisioned by the father of constructivist theory, Jean Piaget, constructivism encourages learning through a two-stage process of assimilation and accommodation. As discussed by Harlow et al.,

> "Initially, the [learner] tries to assimilate this new information into existing schema or thought structures. If the exploration of the object or idea does not match current schema, the [learner] experiences cognitive disequilibrium and is motivated to mentally accommodate the new experience. Through the process of accommodation, a new schema is constructed into which the information can be assimilated and equilibrium can be temporarily re-established. Disequilibrium reoccurs, however, each time the [learner] encounters new experiences that cannot be assimilated. This is how construction of knowledge takes place" (Harlow, Cummings, & Aberasturi, 2006).

In order to maximize the impact of student-centered learning and constructivism, GCM engages in a variety in instructional strategies, recognized by Carnegie Mellon University's Eberly Center, to deliver its workflow automation curriculum. The strategies include, but are not limited to, traditional lectures, discussions, case studies, writing, labs, group and individual projects (Carnegie Mellon, n.d.). Table 1 lists the instructional strategies used by the School of Graphic Communications Management and their functions.

The concepts and strategies of workflow automation are best taught through the application of a variety of these instructional strategies. This enables students to understand the theory, but also allows them to build on that knowledge through hands-on exploration. Further, report writing, case studies, and projects develop essential management and problem solving skills. This approach also ensures a variety of learning styles are accommodated.

The foundation for learning workflow automation at GCM is set in the first semester that a learner enters the program. Students begin by learning the theory and practice of workflows, the functions of each stage of the workflow, and the consequences of both correct and incorrect job processing at each stage. In the labs, the students process jobs manually from initial design, to final output.

By second year, students progress to semi-automated workflows. The concept of hot folders and simple scripts are introduced. Students learn to create basic workflows that include automated preflight and processing. Students are also introduced to estimating, imposition, and job planning. All these skills are applied in one large project where students design, build, proof and print a multiple signature book, within the specifications of available equipment.

By third year, learners are introduced to ICC-managed color, profiling, static and variable data digital printing,

Table 1: Instructional strategies used by the School of Graphic Communications Management and their functions (Carnegie Mellon, n.d.)

Instructional Strategies Used to Teach Automation in the School of Graphic Communications Curriculum	
Instructional Strategy	**Function**
Lectures	Explore and discuss theoretical concepts Openly explain, discuss and debate challenging material Venue for guest speakers from industry Garner interest and build excitement for new topics
Discussions	Build student confidence Explore, defend and/or consider alternative views Enhance abilities in succinct articulation of ideas Encourage evidence-based evaluation of concepts
Case Studies	Identify, assess and work towards solving a problem Provide real-world examples in which to apply theory
Writing	Enhance task specific writing skills (technical, proposal, etc.) Articulation of original ideas and concepts Encourage the use of research to validate ideas and conclusions Maintain a high degree of written competency
Labs	Engage in hands-on exploration and practice Enhance procedural skills Engage in applied problem solving Foster independence Introduce industry standard equipment and processes
Group projects	Foster collaborative work skills necessary for work life Strengthen time management and planning skills Analyze large projects by dissecting them into smaller parts Enforce oral and written communication skills Stimulate the sharing of knowledge through collaboration Enforce the concept of accountability to peers Manage conflict resolution
Individual projects	Foster self motivation Explore areas of interest at a detailed level Encourage self-directed problem solving Enhance primary and secondary research skills Strengthen independent work habits

simple database management and data scrubbing, and cross-media campaigns. Workflows are further enhanced with the introduction of simple MIS functionality and automated job planning tools.

In their fourth year students build their proficiency with complex workflow automation and process integration. Students learn how to configure custom portals for job submission, and explore how triggers and actions can be used to route files submitted to various predetermined functions. Using rules based automation, students create complex multipath workflows that follow "if-then-else" logic to advance files and send notifications along their trajectory. Using industry standard protocols like JDF and XML, students learn how job planning and estimating data can be used to automatically set the workflow parameters for a job. Finally, students learn how third party solutions, such as enfocus Switch, can be used to foster automation between systems (process integration).

Using a heuristic-based approach, students are given challenging tasks, encouraged to "break" the systems and workflows to make mistakes and learn from them, and to problem solve unexpected results. This constructivist-learning model enables students to develop an understanding of automation through their own journey of assimilation and accommodation.

As Len Goins, Director of Operations for TC Media, notes, "graduates of the Ryerson GCM program fundamentally comprehend the importance of standardization in automated workflows while demonstrating creative problem-solving excellence when dealing with the inevitable exceptions" (personal communication, May 1, 2015).

Len continues that the student's direct experience with "many widely used prepress systems and utility applications enable GCM grads to 'hit the ground running' when entering the workplace, often immediately contributing to process improvements with fresh perspectives and analytical approaches" (personal communication, May 1, 2015).

Of course not all companies will operate the same configurations of hardware and software. Stephanie Eagle, Production Coordinator at Southern Graphic Systems in Etobicoke, explains that while she has not directly used the software she learned while a student at GCM, the curriculum "was essential to helping [her] understand workflows and automation – it made it easier for [her] to start out in a company and bring a new perspective" (personal communication, April 30, 2015).

Practical Challenges Teaching Automation and Integration

Some of the important challenges that arise in teaching workflow automation and integration include the sometimes disparate level in learner backgrounds, interests and knowledge in digital systems, how information is captured and exchanged, as well as the unique challenges that arise with using some of the enterprise solutions.

With regard to knowledge and interest, an effort is made to increase curiosity toward the mechanics of how digital workflows work — basic networks and topology, pieces (switch, router, hub, cabling) are described and examples presented. This helps explain how data is stored and managed, and helps students understand the concepts of the "Cloud," and software virtualization, and their impact on how we use software today.

Databases can play an important role in integrating workflows — if we're using an automated workflow we most likely have 'users' updating at least one database. Ensuring that students understand database fundamentals should help make them more productive. Further, their understanding could lead to insights that may help with integration

For introducing databases, using the spreadsheet as a metaphor is helpful; rows as records (object, entity), columns as fields (single value for each record, attribute), and sheets as tables (database table) can help people relate to the concept and better understand the importance of databases. Further, students are introduced to the principle that databases are only as good as the information in them, and consequently learners are exposed to the important task of database "scrubbing."

For the initial discussions of automation, and conditional logic leading to programming, examples from outside the classroom, such as the popular IFTTT (if this then that) site provide a practical real world tool that students can interact with immediately.

However, as end users of vendor's enterprise level software, educational institutions are sometimes in a tough spot. While traditional desktop software and websites are increasingly designed with user's needs in mind, unique challenges arise with enterprise software. These systems can be complex, appear to be difficult to learn and use, and risk being dissatisfying. This may be the result of a separation between the actual end users and those buying the systems (Finstad, C. et al., 2009).

Sample 'trigger' and 'action' from IFTTT (n.d.)

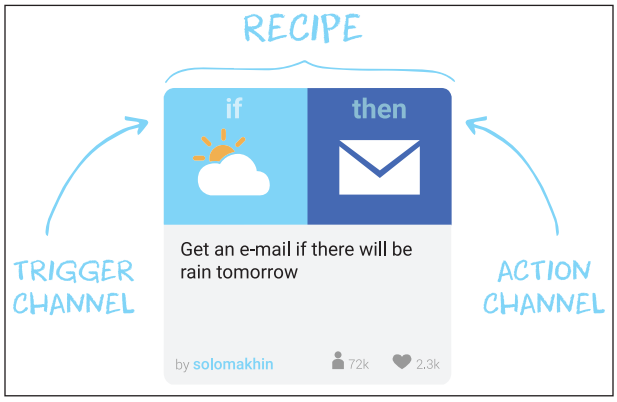

Figure 1

Another challenge with compressive systems is their use in lab environments. For example, with Kodak Prinergy's Rules Based Automation, and other complex enterprise systems, a system administer must set up users and passwords, with access to specific areas of a complex workflow tool. The levels of permissions are not necessarily designed with a single instance of a workflow system (controlled by a database) having the equivalent of hundreds of users with the same high level of user permissions concurrently accessing the system. It is frustratingly easy to have an immediate (and possibly detrimental) impact on every other user.

In addition, most automation systems are designed to load balance in scenarios different from educational labs. For example, it often happens that 30–60 students are applying an automation process simultaneously during an interactive lab demonstration. This means that each student uploads files at the same time, generates job tickets at the same time, RIPs the files at the same time, and so on. Consequently educational environments often need solutions from vendors that are robust, and sometimes modified, as well as having advanced database support.

Conclusions: It's Working

One of the best ways an educational institution can measure success is to evaluate the success of its graduates. It is also important to receive feedback from the companies that are in positions to hire graduates.

The student's hard work and exposure to automation helps once they are in industry. Matt Serwin, Graphic Arts Sales Specialist at Spicers Canada Limited, and Sessional Instructor at Ryerson University, explains the importance

of what he learned about the foundation of automation at Ryerson, "when I left, GCM provided me the ability to at the very least ask the right questions… to be able to present myself as an 'intelligent' individual, with fundamental understanding of the pieces and the ultimate end goal" (Serwin, M., personal communication May 1, 2015).

Stephanie Eagle, Production Coordinator at Southern Graphic Systems, Etobicoke, explains "with the knowledge I gained from [GCM], I've been able to look critically at the workflows within my company and come up with ways to make them more efficient… I'm always using what I learned about workflows and automation to try and find the most efficient way to complete the job" (Eagle, S., personal communication, April 30, 2015).

Daniel Quattrociocchi, Software Developer at G Adventures, reflects on his GCM courses, "Often it is after the work is complete that a clear path on how you might automate appears. You need to fully understand what you are doing before you can explain it to a machine" he continues, "at the core of great automation is a deep understanding of workflow and processes." (Quattrociocchi, D., personal communication May 1, 2015).

Graduates from the Graphic Communications Management program can help contribute to their organizations quickly. As Aleks Niestroj, Chief Digital Officer, Blue Hive (WPP) Toronto explains, "a foundational understanding of process and workflow helps our teams keep the day to day moving along and still have time, experience, and flexibility to deal with immediate requests and course-changes on the fly. My experience with GCM grads is that they have this important foundation" (Niestroj, A., personal communication April 28, 2015).

Don Albin, Vice President, Client Planning and Development, St Joseph Communications reinforces Mr. Niestroj's view when he says that, "over the last few years the lines between digital and print marketing have disappeared… The ability to market to different audiences (web, print, mobile and motion graphics) at the same time using the same assets is now the norm. Students graduating from Ryerson should be top of mind to the employers of tomorrow in this fast paced and changing market place" (Albin, D., personal communication April 28, 2015).

GCM has made significant inroads in teaching students the understanding and knowledge of the necessary workflow steps, so that they are better equipped to participate in, evaluate, and assess existing and developing workflows to create, refine, and manage enhanced automation workflows.

The Future of Workflow Automation at GCM

In November 2014, Ryerson University's Senate approved a major curriculum revision for the School of Graphic Communications Management. The revised curriculum offers many benefits over its predecessor, including an increase in hands-on, lab-based instruction, electivity within the core curriculum, and the flexibility to offer students concentrations in specific areas of the industry.

Within the context of this paper, it is worth noting that the revised curriculum strengthens the School's ability to teach students automation in that there are more courses targeted to automation in communications, including a new course dedicated to workflow automation. This is a lab only course designed to support students as they build, test, and troubleshoot advanced automation processes that they design and implement. Through core elective courses, students have the ability to further expand their automation knowledge through advanced database, cross-media, web-to-print, and asset management courses.

The new curriculum also increases students' exposure with workflow automation earlier in their studies. In their first year, they begin manually running jobs through various workflows to gain a core understanding of the various stages of workflow. From there, students gain more knowledge and slowly develop their skills through exposure to automation in seven different courses before arriving at taking a course specifically in workflow automation. Further, the new curriculum offers students the chance to further hone their workflow automation skills through a series of core elective courses that focus on various aspects of workflow and process automation. In the future, students might even be able to graduate from the program with a concentration in workflow automation.

Other items to consider for future improvements in the education of workflow automation and integration could include building student engagement and support through expanded networking and educational opportunities with industry groups such as Xplor (.xplor.org), or perhaps student chapters of the Printing Industries of America's Automation Solutions Network (printing.org/automation), and by encouraging students to explore

further certifications, such as Idealliance's Integrated Media Workflow Training (idealliance.org).

Lastly, perhaps an opportunity exists for a comprehensive survey of industry staffing needs and requirements, which could help frame future curriculum adjustments. Further, a companion survey targeting recent graduates in an effort to identify areas of success and opportunities might help improve curricular areas.

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Members of the Graphic Communications Education Association, or students of GCEA members, may publish in the *Visual Communications Journal*.

Audience

Write articles for educators, students, graduates, industry representatives, and others interested in graphic arts, graphic communications, graphic design, commercial art, communications technology, visual communications, printing, photography, desktop publishing, or media arts. Present implications for the audience in the article.

Types of Articles

The *Visual Communications Journal* accepts four levels of articles for publication:

1. Edited articles are accepted or rejected by the editor. The editor makes changes to the article as necessary to improve readability and/or grammar. These articles are not submitted to a panel of jurors. The decision of the editor is final.
2. Juried articles are submitted to the editor and are distributed to jurors for acceptance/rejection. Juried articles are typically reviews of the literature, state-of-the-art technical articles, and other nonempirical papers. Jurors make comments to the author, and the author makes required changes. The decision of the jurors is final.
3. Refereed articles are submitted to the editor and are distributed to jurors for acceptance/rejection. Refereed articles are original empirical research. Jurors make comments to the author and the author makes required changes. The decision of the jurors is final.
4. Student articles are submitted by GCEA members and are accepted/rejected by the editor. These articles are not submitted to a panel of jurors. The editor's decision is final. Please be aware that poorly written student papers will be rejected or returned for editing.

Submittal of Manuscripts

All manuscripts must be received by the editor no later than December 15th to be considered for the spring *Journal* or by June 15th to be considered for the fall *Journal*. Include digital copies of all text and figures. Prepare text and artwork according to the instructions given in these guidelines. Be sure to include your name, mailing address, e-mail address, and daytime phone number with your materials. E-mail all materials to the editor (address shown below).

Acceptance and Publication

If your article is accepted for publication, you will be notified by e-mail. The *Visual Communications Journal* is published and distributed twice a year, in the spring and in the fall. Printed copies are mailed to GCEA members. A PDF version of the *Journal* is published online at www.GCEAonline.org.

Notice

Articles submitted to the *Journal* cannot be submitted to other publications while under review. Articles published in other copyrighted publications may not be submitted to the *Journal*, and articles published by the *Journal* may not be published in other publications without written permission of the *Journal.*

Submit All Articles and Correspondence to:
Dan Wilson, dan.wilson@illinoisstate.edu
or check www.GCEAonline.org for contact information for the GCEA First Vice-President.

See following page for style guidelines

Manuscript Form and Style

- Prepare manuscripts according to the APA style, including the reference list.
- List your name and address on the first page only. Article text should begin on the second page.
- Provide a short biography for yourself that can be used if the article is accepted for publication.
- All articles must be submitted in electronic form on a CD-ROM or as an email attachment.
- Submit a Microsoft Word document, maximum of 10 pages (excluding figures, tables, illustrations, and photos). Do not submit documents created in page-layout programs.
- Word documents must have been proofread and be correct.
- Call out the approximate location of all tables and figures in the text. Use the default style "Normal" on these callouts. The call-outs will be removed by the designer.
- Use the default Word styles only. Our designer has set up the page layout program styles to correspond to those style names.
  - Heading 1
  - Heading 2
  - Heading 3
  - Normal

Graphics

- Be sure that submitted tables and other artwork are absolutely necessary for the article.
- Write a caption for each graphic, include captions in a list at the end of your Word document.
- Electronic artwork is preferred and should be in PDF or TIFF format.
- Send all artwork files and hard copies of these files with your submission.

Tables

- Set up tables in separate documents, one document for each table.
- Do not attempt to make it "pretty." Use the default Word style "Normal" for all table text. Do not use any other formatting.
- Do not use hard returns inside the table ("enter" or "return").
- Get the correct information into the correct cell and leave the formatting to the designer.
- Tables will be formatted by the designer to fit in one column (3.1667" wide) or across two columns (6.5" wide).

Artwork

- Scan photographs at 300 ppi resolution.
- Scan line drawings at 800 ppi resolution.
- Screen captures should be as large as possible.
- Graphics should be sized to fit in either one column or across two columns.
  - One column is 3.1667" wide, two columns are 6.5" wide.
  - Graphics may be larger than these dimensions, but must not be smaller.