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Designing for Digital: Skill Sets Needed to Design for Variable Data

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Thesis submitted in partial fulfillment
of the requirements for the degree of
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College of Imaging Arts and Sciences
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Abstract

Variable data printing (VDP) is a key technology in the production of unique and personalized products. Derived from digital printing, the three key components in a successful VDP workflow are the creative aspect, the database management, and the print production. A designer needs to be familiar with all three in order to obtain the skills needed to design for VDP. However, VDP's trend for growth is not as rapid as the industry had projected.

This research examined how a variable data workflow was set up in a print production environment. The production workflow and the skills needed to properly design documents for VDP were the focal points of the research. Two designers, two advertising agencies, and five print companies participated in this research study. Additionally, graphic design and graphic communication undergraduate programs were examined across many institutions to see which of them offer instruction in VDP.

From this research, it was seen that one likely reason for the delay in growth for VDP was that creative professionals working in print production do not have the adequate training or skill level needed to fully embrace offering variable data solutions. This concept was reinforced by the lack of instruction on the subject at the college level, particularly in the discipline of Graphic Design. Other delays are caused by the multiple workflows used in creating variable documents. Finally, a common limitation to VDP was the lack of data needed to create a successful variable data piece.

Based on these findings, the researcher created an outline for a VDP class. The outline focuses on teaching skill sets needed to design for VDP, as determined through this research. It is the goal of this project to make leads in finding solutions to close the gap between design and production in designing for VDP.

Chapter I

Introduction

A Statement of the Research Problem

Designing for variable data printing (VDP) requires much more than knowing how to create visually pleasing pieces. Clients want to work with printers who have the expertise to meet the requirements of their projects. Few digital printers have someone who has experience working with four-color VDP with fully variable text and graphics (Tolliver-Nigro, 2000). To fully generate designed work for variable data, the areas of design, data management, and printing limitations must be understood. Having employees with knowledge and skills in all these areas is a great, value-added service for any company working with variable data.

Design

Graphic designers working with variable data should be acquainted with databases and other various applications involved in the workflow to create and to better deliver designs to their clients (Lena, 2007b). It is valuable to consider that designer's workflow will vary, depending on the relationship created with the printer. They may work in-house as part of the everyday personnel of a company or the client, or the print provider may outsource them. In either case, direct marketing uses variable data to target markets for specific products and services. Therefore, designers responsible for the creation of marketing pieces should

know the strengths and limitations of the services that they can provide to their client.

Data Management

Variable data creation can be very challenging when dealing with multiple systems. For example, file formats (such as AFP, P, PDF, PPML, VPS, VIPP, and VDX) all differ from each other, but they all control the way a job's information gets from data to a tangible printed piece. Depending on the type of application used to design the job, the workflow, and the output device, different file formats must be used in order for the process to run smoothly (Printweek, 2006). Having knowledge of these differences is vital in designing for variable data.

Printer Limitations

Understanding that some products just cannot be created by certain machines is an important aspect of designing for any process. Printing limitations cause designers to have to reconsider certain aspects of product creation daily.

According to PIA/GATF (2006), important points to consider when designing for VDP include:

1. Images and their formats are different than they are for conventional print.
2. Substrates must be compliant with digital presses.

3. Large areas of solid color or screened tints can exhibit variation in toner coverage.
4. Bleeds must be considered within a digital printer's image area.
5. Variable data text boxes must be large enough to accommodate lengthy entries and cannot be based off a random model.
6. Too much variable data can cause Raster Image Processing errors.
7. Pagination and imposition for documents are greatly reliant on software systems or coding.
8. Understanding of United States Postal Service regulations is essential (Lena, 2007a).

Currently, the industry trend of transforming to digital workflows for personalization has often lacked the professional skills to do so flawlessly (Frey & Christensen, 2008). Further analysis of why this is occurring and what should be done to correct it was examined.

Reason for Interest

The movement to a relationship-based marketing method has lead to an expansion of the direct marketing world. This, in turn, has pushed the VDP industry to make advances in digital printing. As new solutions in digital printing have increased over the past few years, so has the need for new positions and

skill sets. Graphic designers have easily adapted to the idea of digital publishing and variable outputs. Unfortunately, a number of those designers do not have the production or programming knowledge to flawlessly execute this idea and process.

This may be directly related to the VDP methodology in which designers are taught or trained. Even when designers are trained to work with VDP systems, there seems to be some disconnect between the designers and the actual VDP process. The reason for this is that often when designers are trained to work with VDP software, they are only learning the technical aspect of that software, without understanding the theory behind what they are doing. This, in turn, results in designers who understand how to work with only the VDP software system with which they are familiar. In reality, matching the software/workflow that a designer is familiar with to a new or different print provider is difficult. Since one of the largest limitations with VDP is the multiple numbers of software/workflows that are used to create a variable data piece, designers' current knowledge of VDP is failing to be helpful.

Having been one of the few who studied both graphic design and graphic communications in my undergraduate career, I have always been interested in bridging the apparent gap that exists between the two disciplines. I recognize that the job of a graphic designer goes well beyond that of merely creating works. They must be able to manage their files (including databases and asset systems) to develop creative solutions, to be familiar with multiple software and production

limitations, and to execute their ideas. After completing Cross Media Workflow II, a graduate course, I found that my interest in variable data grew. Introductions to programming and variable content in this course have me eager to know more about the creation of variable data pieces. In my research, I sought to find a solution for a more flawless VDP workflow by identifying the skill sets needed to design for VDP.

Chapter II

Review of the Literature

Introduction

Today's environment supports a wide array of communication channels, including print, radio, television, Web, and wireless communication. However, with so many channels contending for the consumer's attention, creative professionals are faced with the challenge of creating campaigns that target specific consumers through personalization. Variable data printing (VDP; also known as *database driven print*, *personalized printing*, or *one-to-one marketing*) has rapidly developed in the past ten years to accommodate for this growing trend of personalization.

However, this trend's growth has led to a need for certain new skill sets. Creative professionals who have expanded their offerings to include VDP solutions also have to differentiate themselves by offering value-added services that produce results in delivering messages. The flexibility of VDP yields a broad set of applications, from the basic data merge for business correspondence to highly complex customized pieces, causing the diversity of skill levels to increase. This, in turn, means that personnel for these service companies must understand the multitude of tasks necessary to carry out a VDP workflow. Currently, there is a draught of employees who can link together all the intricacies of creative, IT, and print production skills (Frey & Christensen, 2006). This said, it is not surprising that VDP has not transformed the industry more

rapidly. Resistance to changing technology and workflows has left creative professionals struggling to find easy and affordable ways to implement variable data processing.

The following literature review acknowledges this truth about VDP, while identifying the skills that a graphic designer who is producing jobs for a variable data service provider should know; these skills can bridge the gap among the areas of creative skills, IT, and print production. This review focuses on techniques and skills that designers should be aware of, workflow variables, and a discussion of why VDP has struggled to meet maturity.

Bridging the Gap among Design, IT, and Print

“Variable data projects have three elements: the creative, the database, and the print production. If any one of these falls short, the whole job fails” (Tolliver-Nigro, 2000.) This quote by Tim Graves could not be truer. With advancements in VDP come advancements in skills that must be adapted. Personnel working as part of a VDP workflow must have at least an appreciation/understanding of how all three areas influence each other. Today, there are many different types of VDP solutions available. Some require scripting or programming. Some have a complete point-and-click interface, while others have a point-and-click interface that can be used for most tasks, but also require a little bit of scripting or programming to do other tasks. This variation in skills needed to tackle certain VDP programs have led designers to need to know more than just how to make things aesthetically pleasing. The designer must

understand the variable data and be able to plan the rules and the logic that specify which variable elements are used and where they will be placed.

Although the faults of why VDP is struggling in its advancement have been identified by the gaps in skills needed across professions, little has been done to date to accommodate for it. There are two reasons for this. The first reason is that only a handful of printers can expand to full variable data services economically. The second reason is that the skills needed to run a VDP workflow are still divided among many traits (Farquharson, 2008). This idea is also supported by Hedi Tolliver-Nigro who states that “though variable data printing is effective, it is almost never easy” (Tolliver-Nigro, 2000). Economically, the relationship between profitability and ease-of-use software is simple to understand but hard to implement. Print providers begin to offer VDP to gain competitive advantage, but they forget to train their staff on how to sell and market it (Fraquharson, 2008). Even those companies that claim to be strong in VDP are, in reality, not using anywhere near the capabilities available (Frey & Barzely, 2008).

Additionally, few printers have the capability or experience to handle four-color VDP with full variable text and graphics (Tolliver-Nigro, 2000.) Many print providers are capable of simple mail merge and basic applications of VDP, but more complex projects (requiring multiple images, dozens or even hundreds of different pieces of data, and complex rules for combining text and images) are something that only a select, few print providers can currently tackle. Other

issues resulting in this gap are focused around workflow and undefined skill sets.

As stated by Frey and Barzely,

[the] key issue is the mix of workflow, tools and skills employed by digital print establishments. Without understanding digital content and database technology, decision about workflow, tools, and skill sets become difficult and the probability of obtaining optimal results is less likely (Frey & Barzely, 2008).

The basic reason for this difficulty is that most creative professionals lack the skill sets needed to run an effective VDP workflow. Print providers need to hire someone with programming skills if their VDP software relies heavily on programming or scripting; even if the VDP software allows most tasks to be done by pointing and clicking, and all that is needed is a person with basic computer skills and a knowledge of common document formats, an additional skilled worker is still needed (Citation Software INC, 2008). So either way, the software, output devices and trained personnel needed to invest in VDP are costly.

Problems with the Development of VDP Skill Sets

According to Frey and Christensen, "Skill sets refer to the employees' ability to solve concrete tasks regarding implementation and operation of technology." When hiring specifically for VDP, companies today are looking for employees who have these new skill sets that did not exist previously (Frey & Christensen, 2006).

However, finding employees who have these sought-after skills is difficult. Some reasons for this seem to be linked to education and training methods. A

study by Neidemyers about aligning class curricula with technical industries highlights the difficulty that VDP is currently experiencing. Similarly, as technology continues to change and business sectors grow with global outlooks, institutions must update their program curricula in order to prepare graduates. The Neidemyers study showed that, with fashion and interior designers, the education system was not keeping up as the fashion industry evolved (Neidemyers, 2008). This lag is likely to also be the cause of the apparent gap in VDP. Secondly, a larger problem is that of training and transitioning within a company (Cleveland, 2006). Most often, companies use in-house training when needed. However, the level of education that they require and training topics that they offer does not lend themselves to a full deployment of the technology. With VDP, skill sets stem from technical tasks like database programming, software skills, and workflow integration. Often training for these tasks is focused on merely operating the software.

This was confirmed by the results of a survey sent out by Frey and Christensen, showing that the most common training for VDP was on variable data applications, which means that training focus was on operation, and not setup or workflow. However, soft skills (such as understanding the customers' wants and objectives with a variable data product) are also skills on which employees must be trained. Because training is usually operational, these soft skill sets are not covered in such training program but are necessary.

Other problems with training are that manufacturers use training to market their own products, such as software systems. Whereas this is an effective way to learn about a VDP system, printers will have a hard time developing strategic competitive advantages if their employees do not have the skill sets to move beyond the choices offered by the manufacturers (Frey & Christensen, 2006).

A problem in training is that there is a large demand for training but little money to spend on it. Training is often the first part of the budget that is cut (E-learning, 2006).

The challenge for the industry is that it will continue to deploy new technology, which creates new battles for managing information as well as employee skill sets. Adequate training or education is essential for a company to hire the most qualified employees. This is likely to be a growing need as print companies can expect major competition for human capital both now and in the future.

VDP Workflow

As stated by Frank Romano back in 2002, “[the] current problem with defining an efficient workflow for VDP is that none of the VDP systems are compatible with, or even similar to, each other.” This problem still exists to a degree, due to the variation in file formats and device output compatibility. However, advancements in both of those areas have been made and are slowly improving VDP workflow. Nevertheless, the basic workflow for the VDP process

involves a computer application taking content from a database and integrating it into a document according to rules that specify which elements are used and where they are placed. A client requests a database extraction from the database administrator. Then, the designer creates a page layout and works closely with the client to choose the variable content. Once the layout is created with a visible placeholder for variable content, a proof is run for approval of the job before it is sent to production (Clark & Romano, 2000). Figure 1 illustrates each of the sections of a basic VDP workflow:

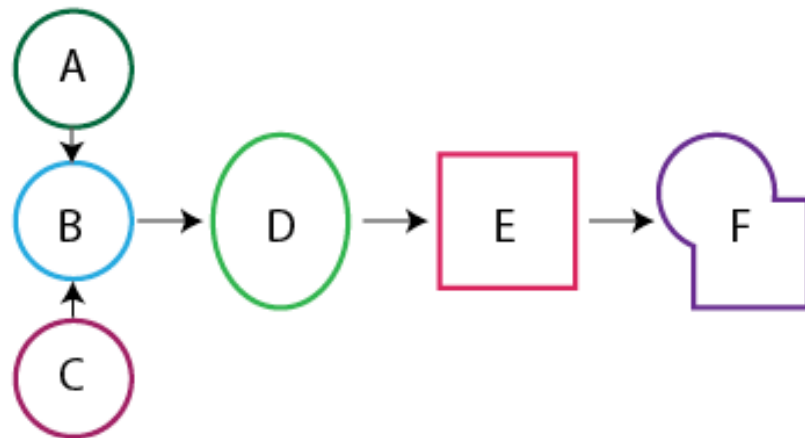


Figure 1: An Example of VDP Workflow (Sorce & Pletka, 2006)

A. Database: For most variable data printing, a simple table or spreadsheet contains the copy, graphics, and photographs that will be assorted in the printed document. Such databases can be created in an application such as Microsoft Excel.

B. Rules: Specify what variable content to use and where to place them.

They can be written in a programming language.

C. Content: Both static and variable content can be created with a variety of software: text, with word processing software, photographs, with graphic software, etc.

D. Layout: Created with common desktop publishing or word processing software. It must be designed to accommodate variable text and images.

E. VDP application: Software *merges* content and prepares the document for printing

F. Output devices: Printing devices convert the digital files into tangible prints.

Programming

One of the largest projected issues for many companies that are trying to implement VDP is IT (Lena, 2007, PIA/GATF). Because of the skill level needed to understand and operate the technical side of VDP programming, many companies today let the customer handle all responsibility for assembling data and content. However, this means that the printer has to assume that the data is

clean and organized when they receive it, and often, this is not the case, which puts a great risk on both the customer and the printer (Frey & Barzely, 2008).

Designers have little exposure to programming and do not understand the differences among programming, scripting, and markup languages. However, with a basic understanding, these languages can influence and benefit design.

A scripting language is used with an interpreter that reads a source code file and compiles it on the fly. This means that scripting languages are used for very specific purposes like generating an action when a symbol is recognized by the interpreter in the source file. Familiar examples are languages like JavaScript and VB script, which are used commonly to convert symbols into acceptable symbols for mailing conditions (Greer, 2007).

A programming language, on the other hand, has to link to the source code from a compiled language into an executable form. Meaning, every time a change is made to the source code, the language needs to re-compile before any changes are reflected in the executable program. Common examples of programming languages are C, Pascal, C++, SQL, Perl, and Postscript. Postscript, being highly recognizable in the printing industry as a graphic format, is also known as a page-description language, a type of font, and an internal RIP language. All of these are correct because fundamentally PostScript is a programming language. PostScript is set up to control the action of output devices by instruction written within its code. It is, however, a device-independent

language that utilizes a series of operators, dictionaries, arrays, stacks, paths, and coordinates to control the final processing of images, vectors, text, and layouts (Greer, 2007). Postscript and other programming languages are beneficial to design in that they allow for text manipulation, where the language can convert, combine, read, write, save, and perform decision through text strings. They are also helpful in creating conditionals such as IF-this-THEN-that actions and caching (Greer, 2007, Postscript).

Finally, markup languages such as HTML and XML function through a set of annotations in a body of text that describes how that text is to be structured, laid out, or formatted. These types of languages can have a direct correlation with design due to their functionality. The XML, for example, can be used to create book/magazine/newsletter layouts that can exist more or less independently of a page-layout application software. This, in turn, allows formatting of variable data pieces to be indexed, compiled, and tracked (Clark & Romano, 2000).

Database Management

A database, according to the Merriam Webster Dictionary, is a large collection of data organized especially for rapid search and retrieval by an electronic file (www.merriam-webster.com). For VDP, these databases store copy, graphics, and images in an electronic format. Databases are usually organized in two ways: by records or by fields for each record. Each record has a

predetermined number of fields. Typically, databases store the variable elements into various fields. A variable data application then draws these elements from the database, according to predefined rules, to create pages and documents that contain different images, text, and even layouts (EFI).

Building the list in databases is the initial step in designing for VDP. Only the required information from the databases should be selected. Text information should be sent to an ASCII file. ASCII files are used on most computer terminals and printers. The use of ASCII allows for data files generated by one type of program (i.e., a database management system) to be used in another type of program (i.e., a spreadsheet). ASCII tab-delimited files, which are text files with tabs between each column in the text, are another way to import and to place data that is arranged in rows and columns, such as tables. Image files specific to each record should be included in a separate field for each data record according to the format that is accepted by the VDP software system being used.

For even basic variable data jobs, databases must be *clean*, meaning no spelling errors, no duplicates, and no extra spaces. Names and addresses should be accurate, and there should be consistent use of capital letters, state and street abbreviations, and title conventions. Old, duplicate, and invalid data should be removed to avoid postage and print costs (Sorce & Pletka, 2006). For more complex jobs, database preparation includes extracting the relevant information, or *data mining*; deciding on the rules for combining text, images, and graphics; and adding in the separated information by record. Print providers must

identify the necessary information and who will extract it, and then, specify how the information should be delivered. This process takes a significant amount of time. Depending on the size for the database, there are many layers of *red tape* that must be sorted through every time an element is changed. For these reasons, the database is often the downfall of many VDP projects. Often, clients realize too late that the database is not clean (Tolliver-Nigro, 2000).

Many computer programs are designed to handle databases. Familiar desktop programs include Filemaker Pro and Microsoft's Excel. The vast majority of VDP requires nothing more than a simple spreadsheet. Print providers can work with a database by extracting only the information needed and putting it into a spreadsheet. In a spreadsheet, each row corresponds to a record, and each column identifies a field. It is critical that the fields match the field names used in the variable data production program (Clark & Romano, 2000). Other database systems (including My SQL, Microsoft's SQL Server, Oracle from Oracle Corporation, and DB2 from IBM) provide a more in-depth solution for heavy or larger databases (Frey & Barzely, 2008).

"Knowledge about databases is a skill that can be the foundation for greater revenues" (EFI). Knowing how to work with a database should be like working with any other tool. Creative professionals regularly retouch photographs and adjust graphics and layouts, but those who can further assist their clients on achieving the best print quality are the ones who can also help clients with their database by removing redundant or obsolete information and by extracting

relevant information. Personnel with this knowledge and skill can help printers provide a wider range of services, which allows them to appear better prepared than their competition, giving them a stronger position to win more business (EFI).

Artistic/Graphic Design Skills

Shifting from an IT outlook to a more creative one, this section briefly discusses the best ways to handle text and images in a design layout situation. Preparing these elements for VDP requires skill sets in addition to those required for conventional design. Creating placeholders properly in page layouts and connecting links from databases or program languages through tags are critical skills needed by VDP, in addition to the typical skill sets needed for conventional page layout and design.

Before print professionals can learn the ins and outs of properly designing for variable data, they must understand the origins of how their work will be reproduced. Variable data printing is a digital printing process, and if the idiosyncrasies of designing for digital reproductions are not understood, then the advanced concepts of variable data are learned in vain. With this in mind, designers must understand the basics of digital printing (see Appendix A).

Variable Data File Formats

Until approximately 2002, every VDP program was linked to a specific digital printing output system. This made it hard for designers to produce VDP jobs because they had to know exactly which printer would print the job before even starting the job, and this information is often not known (Anonymous. 2002, America printer).

However, in 1998, the Digital Print Council of PIA did acknowledge that something needed to be done about the lack of a standard for VDP. Having no standard was hurting the growth of the print industry. At that time, there were over 30,000 high-end digital printers, but only about 5% of them offered VDP solutions (Romano, 2001, VDP). With over 20+ different types of variable data programs, each linked to a particular RIP, and therefore output device, designers suffered because they had to know what print company would produce their jobs, before even creating them. With the lack of standardization, even simple mailings became huge projects. The entire industry was held back because of the lack of a standardized approach in getting a variable data print job from a designer to a print company offering VDP solutions (Romano, 2001, VDP).

The industry demanded the kind of efficiency and convenience that they had recently received from Postscripts' PDF. PIA, PODi, and other graphic organizations finally took this problem to the International Standards Organization (ISO), where they all began to look for a solution. The result was the Personalized Print Mark-up Language (PPML) (Romano, 2001, VDP). PPML

was a step in the right direction, but limitations, especially on speed, still existed. It was almost a year later when the creators of PPML realized that what they lacked was a data format for defining the variable elements. What they did realize, however, was that this format already existed. Adobe's PDF format specifically represents individual objects, which is what PPML was lacking. Combined with the methods of PDF, PPML became PPML/VDX, which created an open standard for variable data exchange. This standard VDP format, PPML/VDX, enables a document to combine both database information and variable content through a 'Save-As command in most new software products (Romano, 2001, VDP).

Still, new developments are moving the industry toward adoption of the PDF format throughout VDP production workflows. ISO is already in the process of formalizing a format called PDF/VT (V for Variable and T for transaction) as a digital master standard for the exchange of personalized jobs (Adobe, 2008). This standard is slowly being adopted by new software packages.

Although standards are forming, other formats are still in use. This is particularly evident with print service providers, such as Xerox and Kodak, who are promoting their own formats that work only with their products. This said, the formats AFP, P, PDF, PPML, VPS, and VDX will each be further examined as they are the most predominant in the industry today. Each of these formats work differently, depending on the type of work, the application used to design the job, the workflow, and the output device on which it is processed (see Table 1).

Table 1: File Formats Used in VDP

Name	Abbreviation	Developer	Features
Advanced Function Presentation	AFP	IBM	<ul style="list-style-type: none"> Handles print data from mainframe computers Controls formatting, data management and storage, and content output. Cross platforms compatible Commonly used for transactional printed pieces, such as bills and bank statements (Printweek, 2006)
PostScript	P	Adobe, (John Warnock)	<ul style="list-style-type: none"> Originator of page description formats Basis of PDF Versatile Often used for alternative programming processes (Printweek, 2006)
Portable Document Format	PDF	Adobe	<ul style="list-style-type: none"> Worldwide industry standard file format Preferred format for many print jobs, whether personalized or not The third version of a PostScript file format Takes the PostScript information and the document, which normally had to be digested at once, and distills it, creating a new format that saves each page of a document individually while compressing text and images Operates like a database of objects that has direct control over all of the pieces it contains inside reducing RIP time, a process known as caching (Romano, 2001, PostScript). Cross platform compatible Operates independently from all application software, fonts, or hardware used to create it. Used in other formats, such as PPML and VDS, to carry graphic elements (Cardin, 2001)
Personalized Page Mark-up Language	PPML	PODi	<ul style="list-style-type: none"> Open, standard variable data exchange format defined by the American National Standards Institute (ANSI) accredited Committee for Graphic Arts Technology Standards (CGATS) Allows any design or personalization software to communicate with any RIP or printer to create and/or proof variable data jobs (Romano, 2001, Variable Data Printing) Based on PDF and XML as open standards Enables documents combining both database information and variable content to be created through a Save As command in some software products

Variable Data Exchange	VDX	PODi	<ul style="list-style-type: none"> • Subset of PPML • Created to enable faster printing of variable data jobs • Built to work with PDF and PPML to create an open standard for variable data exchange; this means that VDX allows documents that combine both database information and variable content to be created through a Save As command in new software product to create variable data jobs (Romano, 2001)
Variable Data Intelligent Postscript Printware	VIPP	Xerox	<ul style="list-style-type: none"> • Open language format • Allows for the output of high-quality postscript documents • System consists of a set of macros that reside on a PostScript interpreter, eliminating many of the time-consuming steps associated with other variable data information workflows; therefore, reducing the time that it takes to compose, process, and print documents • Only compatible with Xerox's DocuPrint and DocuTech Machines (Xerox, 1999-2008)
Variable Print Specification	VPS	Scitex	<ul style="list-style-type: none"> • Originally invented by Scitex, this format was acquired by Kodak in 2004 • Has the ability to specify which elements of a VDP job will be repeated from page to page • Allows VDP jobs to print at or near rated speed on digital presses • Based off of a PostScript style, which causes its processing to discard data once the page has been printed (Printsoft, 2006)

Variable Data Software Solutions for Creative Professionals

As listed in *Data Driven Print*, there are six categories of variable data software: versioning, mail merge, personalized printing, transactional software, extension software for the creative professionals, and stand alone applications (Sorce & Pletka, 2006). The first few are so simple that they are often not even considered to be a part of VDP. Mail merge software, such as Microsoft Word, takes data from a list, and then merges names and addresses, in many cases with templates. Mail merge has been around for a long time, and it is very much a form of personalized variable data, but just on a very basic level. Extension software works in combination with layout programs. Several software work with QuarkXPress, InDesign, or both programs. Finally, there are standalone applications. These are variable data front ends that are not tied to any particular application. From the basic to the complex, there are many options today in variable data software, all in which bring unique opportunities.

Quark Xtensions

In the past, variable layouts have been created with a proprietary layout system. Now, extension software for QuarkXPress (called Quark Xtensions) has been created to allow designers and other creative professionals to have the design freedom needed in creating variable data print jobs. Designers use Quark to create the layout of the template for a job; this software, since it is an add-on

to Quark, simply provides the additional personalization utilities to turn QuarkXPress documents into customizable personalization templates.

InDesign Plug-in Software

The constant battle between Adobe and Quark seems to never end; however, the front-runner at this time is Adobe. Eight years ago, that was not true. PageMaker began losing functionality over Quark, and it seemed to pull ahead in the Desktop Publishing Industry. That was until Adobe released InDesign, and within a year, Adobe was back on top (Burke, 2008). With this reality, the trend for plug-ins for VDP has followed. Today, there is more InDesign plug-ins than Quark Xtensions, which only means that careful consideration should be made, if a print provider who utilizes Quark wants to integrate into the world of VDP. However, Quark and Adobe continue to battle, so another reversal may occur in the future. InDesign plug-ins operate similarly to Xtensions. Designers also use the layout program to create the template of a job, and then the plug-in provides the additional personalization utilities to turn the document into a customizable piece. See Appendix B for further comparison of 13 creative solutions

Chapter III

Research Objectives

The objectives for this research were:

1. To develop a clear understanding of how a variable data workflow is implemented in a print production environment.
2. To determine why the industry seems to be unclear on how to fill the pre-media positions that handle variable data.
3. To discover what skill sets (a) are requested from the industry to design for variable data and (b) can be taught to help bridge the gap between designing a document and producing a printed variable data piece.

For this investigative research, the following methods were taken to achieve the defined research objectives:

1. In-depth secondary research study to provide an understanding about the variable data industry today and its workflows, as they relate to designing for VDP.
2. Interviews conducted with designers and graphic communication companies to better understand what skills are pursued by the

industry. These interviews provided a basis for what skill sets should be taught in order to prepare designers for a pre-media position involving variable data.

3. Interaction with several art and design schools, as well as those that offer a printing discipline, was made to see if and how the current educational system is preparing designers for VDP skill sets.

Chapter IV

Methodology

The purpose of this research was to find some bottlenecks and limitations in VDP design and in the industry as well as in education so as to make improvements and suggestions on how the design for VDP. Therefore, nine interviews were conducted. In addition to interviews, a study was conducted between several educational institutions. This type of research can only be measured qualitatively. Qualitative research methods are based on the analysis of circumstance and do not depend upon the measurements of variables. Nevertheless, when these methods are applied, they contribute to the findings and insights of the research, which cannot be derived from conventional and quantitative research methods. The following qualitative research was conducted through observation, interviews, and secondary research.

The researcher conducted a two-part investigation. First, an educational analysis between 10 art schools and 30 print schools was conducted to see who was teaching how-to designing for VDP. Secondly, these concepts were further investigated through nine interviews among designers/professors, advertising agencies, and print professionals. These interviews also served in developing a clearer understanding of how a variable data workflow is implemented in a print production environment. Several questions during the nine interviews were tailored to address the issues of skill sets needed to design for variable data. The

two-part investigation assisted in an attempt to bridge the gap between designing a document and producing a printed variable data piece.

Procedure

Educational Analysis

An investigation between 10 art schools and 30 print schools was made to find out whether or not their programs in either print, graphic communication, graphic design, or the like are offering any courses, seminars, or alternative education in VDP. The art schools used for this investigation were targeted and compiled through Internet research for the most well known art institutions in the United States. A list of 26 institutions that offered degrees in the print field was acquired from the School of Print Media at RIT. From here, each institute, whether for art or print, was further researched through their college websites to find the correct contact to question. Once the contact was established, email correspondence was sent out to ask if the program in question offered any type of education in VDP.

Interviews

In addition to the education analysis, the researcher personally interviewed nine participants from corporations currently working with some aspect of VDP (see Tables 2-4 for titles and job descriptions). These participants were found through local contacts at Rochester Institute of Technology and a company based in Rochester. Once the contacts were established, the participants were asked to have a 30-45 minute, face-to-face interview, which

was established through phone and/or email communication. With the exception of two participants whose locations did not permit a face-to-face meeting and, therefore, were conducted by phone, the interviews took place at the participant's facilities. Asking each participant the same questions from the questionnaire, as best applicable to each participant, standardized the procedure. All interviews were audio recorded to collect data and to retain the participant's exact phrasing. For confidentiality reasons, the names of the participants are not published in the research. The participants are identified by number as designers, advertising agencies, or printers.

Sample

Two designers/professors, two advertising agencies, and five print companies participated in the research study. They were all asked similar questions from a questionnaire (see Appendix C) when applicable to their profession. The questions were tailored to that of the interviewee's job description roles and responsibilities (see Tables 2-4).

Table 2: Designers/ Professors Job Descriptions

Title	Job description
Creative Director/ Freelance Designer	<ul style="list-style-type: none"> • Responsible for the creative output of her creative team and creative processes • Oversees the ideation, presentation, and execution of client branding and marketing campaigns • Creates logos, brochures, websites, etc. Is proficient in Adobe Illustrator, Photoshop, and InDesign, as well as other creative programs
Associate Professor	<ul style="list-style-type: none"> • Responsible for teaching basic, intermediate, and advanced design/media/motion graphics courses • Fulfills departmental duties including participation in department advisement and curriculum development

Table 3: Advertising Agencies Professional Job Descriptions

Title	Job description
Sr. Production Manager	<ul style="list-style-type: none"> • Directs all aspects of the agency's organizational policies, objectives, and initiatives • Is responsible for short- and long-term projects within the creative aspect of the company • Demonstrates expertise in a variety of procedures Holds role for research on variable process.
Executive VP/Chief Creative Officer	<ul style="list-style-type: none"> • Responsible for organizing the objectives and workflow of the agency • Oversees research and development and assists in developing client relationships

Table 4: Print Company Profession Job Descriptions

Title	Job description
Senior Director of Sales	<ul style="list-style-type: none"> • Plans and directs all aspects of sales • Develops the sales plan to grow revenue • Responsible for ensuring maximum sale volume and customer satisfaction • Builds client relations
Prepress Operator	<ul style="list-style-type: none"> • Operates prepress software to assemble images into pages and to retouch and make color corrections to page elements to be used in production • Enters digitized data, such as artist's layout, color separations, text, page dimensions, and layout instructions, into prepress system
I.T. Director	<ul style="list-style-type: none"> • Plans and implements additions, deletions, and major modifications to the supporting infrastructure of his company • Oversees the implementation of network security • Assists in innovation of new projects
Director	<ul style="list-style-type: none"> • Is responsible for direction of print production and hands-on expertise related to offset and digital. • Works with print production team and creative executives to develop, execute, and distribute layouts for final jobs
Print Project Manager	<ul style="list-style-type: none"> • Oversees print projects by planning and monitoring processes • Is responsible for completion of the project on time and budget • Performs a variety of tasks including coordinating all resources, setting deadlines, and communicating the progress of the project
Vice President of Cross Media and Marketing	<ul style="list-style-type: none"> • Develops and implements strategic marketing plans for the company • Stays current on the changes being made in the marketing and printing industry to best serve the objectives of the organization • Manages marketing and print professionals

Study Limitation

Limitations in the research study includes a small sample size of only nine interviewed participants, variability of what is considered to be VDP and the limitation of geographic area, since all of the companies interviewed were from the Northeastern region. Further limitations include the results being qualitative; thus, it has no statistical inference.

Chapter V

Data Analysis

To identify some of the skill sets needed to design for VDP, the researcher first had to determine where potential bottlenecks in VDP are occurring. This was done in two parts. First by assessing if educational institutions with design or printing disciplines amply teach students the skills needed to design for VDP. Secondly, by studying the industries' current practices of VDP in design, advertising, and printing companies.

Part One of this analysis highlights the findings of a survey of several art and print institutions. The results were categorized into several segments to establish the level of the participants teaching of VDP. Part Two of this analysis highlights similarities between participants who were first interviewed individually as designers, advertising agencies, and print companies, then collectively. Only part of each interview was included in this analysis.

Education Analysis

As the industry trends towards reducing its prepress departments, it is becoming increasingly important for designers to submit correct digital files (Waite, 2006.) Many studies in the past, such as the one done by Jerry Waite, have examined the differences between what is being taught in design education versus what is taught in print. His studies show that guidelines and methods of process control are hardly ever taught in design programs. Even when access to

references and instrumentation was available, little emphasis was put on what happens to a piece past the aspect of ingenious creation. Knowing this to be generally true for design programs, it was assumed that this same lack of education or knowledge of printing, is contributing to the gap between designers and printers in VDP. Therefore, further research was done to confirm that these assumptions were correct.

Differences in Art schools vs. Print schools

An art school is an educational institution, usually private, whose primary focus is on the visual arts, especially graphic design, illustration, painting, photography, and sculpture. They are usually distinguished from larger institutions which may also offer degrees in the visual arts but often only as one part of a broad-based range of programs such as Liberal Arts. Print schools are programs or schools inside larger institutions (public or private) that offer a degree associated with graphic communication and production. In the sample tested, 90% of print schools also had a design program/degree offered at their institution.

Art Schools

Ten art schools were identified to see if VDP was being taught in any aspect of the disciplines they offer. Table 5 shows the result of this study. With a 70% response rate, it was found that 100% of the art schools that were reached and questioned offer no training in VDP or database-assisted design of any kind.

Additionally, many of the schools were unaware not only of how to teach VDP but what variable data in design was in general.

Table 5: Art Schools with VDP Survey Results

Art school	Feedback
AS1	No courses on VDP or designing with databases
AS2	No courses on VDP or designing with databases
AS3	No courses on VDP or designing with databases
AS4	No courses on VDP or designing with databases
AS5	No response
AS6	No response
AS7	No courses on VDP or designing with databases
AS8	No courses on VDP or designing with databases
AS9	No response
AS10	No courses on VDP or designing with databases

Print Schools

Twenty-six print schools were also identified and questioned to see if VDP was being taught at their institutions. Table 6 shows the result of this study. Of the 25 targeted schools, 15 schools responded. Within those 15, five of the schools offer no type of VDP course or training at this time, nine do offer some type of course or training, and two are developing some type of course or training within the next year. Table 7 further breaks down the eight schools that are teaching VDP. It shows what was currently being taught and the software/hardware being used at this time. Figure 2 shows a visual breakdown of the educational analysis of the responsive sample.

Table 6: Print Schools with VDP Survey Results

Print schools	Feedback
PS1	No response
PS2	Offers some form of VDP class or training
PS3	No courses in VDP or designing with databases
PS4	No courses in VDP or designing with databases
PS5	Offers some form of VDP class or training
PS6	No response
PS7	No response
PS8	Class is currently being developed
PS9	Offers some form of VDP class or training
PS10	No response
PS11	No courses in VDP or designing with databases
PS12	No response
PS13	Offers some form of VDP class or training
PS14	No response
PS15	No response
PS16	Offers some form of VDP class or training
PS17	Class is currently being developed
PS18	No courses in VDP or designing with databases
PS19	Offers some form of VDP class or training
PS20	No response
PS21	No response
PS22	Offers some form of VDP class or training
PS23	Offers some form of VDP class or training
PS24	No response
PS25	Offers some form of VDP class or training
PS26	No courses in VDP or designing with databases

Table 7: Print Schools with VDP Program Descriptions

Print schools	Program
Arizona State University East	<ul style="list-style-type: none"> • Offer a concentration in graphic information technology that provides students with a seamless graphic user interface from traditional printing and publishing applications to digital printing, multimedia, VDP, database management, and Internet/Intranet Web development. • VDP hardware/software provides students with an applications-level working knowledge of the different facets of the graphic information industry.
California Polytechnic State University	<ul style="list-style-type: none"> • VDP is taught across a few classes. In the past no specific class was taught on VDP alone, rather classes in digital printing and database management covered the area of VDP. • Now, however, one class has been formed to teach subjects such as VDP software applications, design for VDP and business models for VDP. • They also provide workshops for VDP through their Graphic Communication Institute, which give resources to people outside of school in the industry.
Clemson University	<ul style="list-style-type: none"> • Offer a few classes that teach variable data printing, not one course alone. • Also offer an independent study course that deals with VDP, Storefronts, PURLs, Mailing, and Cross Media. The course references Penny Bennett's book from Cal Poly as well as Strategic Database Marketing by Arthur M. Hughes. Additional literature from Xerox, HP, Kodak, and Canon on how to market VDP is also used for reference. • Students have to do everything from design to mail sort. An emphasis is put on the importance of database management, cleansing the data, creating relational databases, and working with Java Script.

Ferris State University	<ul style="list-style-type: none"> • Offer a three-credit hour course called Digital and Variable Data Printing Systems. The course covers all aspects of VDP including some cross media. Penney Bennett's GATF text on VDP is used for the course. • The students must complete a course from the Information Systems Management Department in Database Design as a prerequisite so they have prior database experience coming into the course.
Illinois State University	<ul style="list-style-type: none"> • Offer two VDP/Database courses where students are introduced to databases (both flat and relational). They prepare a flat database in Excel and design and print a VDP greeting card with a minimum of 20 records, two images, and two business rules. • An advanced class has students work in teams on a cross-media marketing project where they develop an input form with PHP and pass the files to a simple database. The data is then used in a student-designed VDP advertising mailer.
Rochester Institute of Technology	<ul style="list-style-type: none"> • Offer a set of classes that put an emphasis on VDP and cross media workflows. • Students work with databases to create variable content through XML code. Data is used to create a series of products from postcards to multi-page brochures.
Southeast Missouri State University	<ul style="list-style-type: none"> • Offer a course in variable data that interconnects with data bases. • An advanced VDP course in variable graphics, interactivity, and server and client side web interfacing is also offered.
University of Wisconsin Stout	<ul style="list-style-type: none"> • Offer a course called Cross Media Marketing System that covers VDP, as well as multichannel personalized graphics, web to print, and email. XMPie Adobe plug-ins for the design work and XMPie uPlan and uProduce for the production. • The only scripting taught is the built-in QLingo scripting in XMPie.

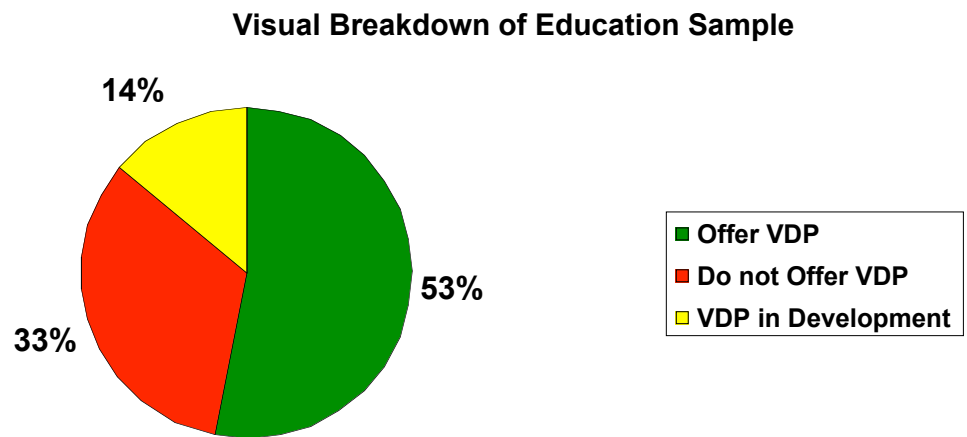


Figure 2: Visual Breakdown of Educational Analysis's Responsive Sample

Interview Analysis

D1: Associate Professor/ (Creative Director/Freelance Designer)

D2: Associate Professor/ Creative Director

AA1: Sr. Production Manager of Advertising Agency

AA2: Executive VP/ Chief Creative Officer of Advertising Agency

P1: Senior Director of Sales & a Prepress Operator at a Print Company

P2: I.T. Director at a Print Company

P3: Director of Implant Print Shop

P4: Print Project Manager at a Print Company

P5: Vice President of Cross Media and Marketing at a Print Company

Designers/Educators

Demographics

Table 8 shows the demographics for both designer/educators interviewed. D1 and D2 refer to Designer 1 and Designer 2, respectively. D1 and D2 are similar in the areas of income. They are also similar in that they both have been utilizing VDP for less than ten years and only use it in a small amount of projects produced for direct mail. D1 works with clients in the entertainment, wrestling, food, and gaming industry. D1's only experience in working with VDP was with direct mail. However, even the percent of direct mail D1 does was very small. D2 creates motion graphics, interactive services, and print to create brand identity. Again, the area in which VDP was utilized for D2 was in direct mail, which was a

small part of D2's operation. The fact that the director, herself, was the only one who knows how to control or work with the production of VDP jobs contributes to this.

Table 8: Demographic Comparison of D1 and D2

Demographic	D1	D2
Established	1998	2005
Total Employees	1	9
VDP Employees	1	1
Revenue	> \$5 million	> \$5 million
Started working w/ VDP	2002	2005
VDP Pieces monthly	Unknown	0.33

Tools and Workflow

Both designers follow a similar workflow, which was dictated by the client, when creating a variable product. They both utilize Quark and InDesign as page layout software. However, InDesign was their preferred software, whereas Quark files are converted to InDesign. When the design was developed for a VDP project, templates are used. D1 only creates design that was static. Variable content was not used or set up until after the printer or mail house receives her templates. D2 tries to create variable pieces with more creative type templates so that they can easily tie into a campaign or web presence. However, her templates are also static until the final file is given to the printer where variable data is applied. No variable software systems such as XMPie or Designmerge are used by either designer, and in both cases, all VDP projects are outsourced to a printer or mail house where all of the data merging and variable content is

handled. Table 9 further compares these similarities in workflow between designers.

Table 9: Comparison of Tools and Workflow between D1 and D2

Workflow	D1	D2
Layout Software	Quark/InDesign	Quark/InDesign
VDP Software	None	None
Templates/Image and Data Manipulation	Templates	Templates
Workflow	Client Dependent	Client Dependent
Outsource To	Printers/Mail houses	Printers/Mail houses

Data Management

Table 10 shows a comparison of data management information between D1 and D2. D1 never acquires any type of data list or spreadsheet to plug in variable content. The designer was fully dependent on the client to provide an outside party with the data to perform these services. The data was often times not even seen by the designer. D2 does obtain the data, but the printer or mail house in which the file is printed handles all of the data merging and variable content. No data storage or cleansing was done by either designer.

Table 10: Data Management Comparison between D1 and D2

Data management	D1	D2
Data Source	Client Controlled	Client Dependent/Third Party
Data Storage	None	None
Data Implementation	Printer Dependent	Printer Dependent/Third Party
Data Cleansing	None	None

Skill Sets for Hire

The designers also showed similarities in what was valued as far as skills to design for VDP. Both designers share the perspective that hiring new designers for VDP should be a process based on their creativity, design development, and critical thinking before looking at their technical skills.

Whereas, D2 did feel that design and printing go hand in hand just as design and development (IT) go hand and hand; she still felt it was critical for a designer to first and foremost have the skills needed for design creation before learning the software and technical side to VDP. D2 understands the connection needed between design and production and feels that designers should be familiar with the production side so that they know what they are asking people to produce and can appreciate the efforts being made to create the product they design.

Educational Diagnostic

Table 11 shows the designer's diagnosis and solution for why VDP was not effective across disciplines in educational institutions. D1's additional profession as a teacher has her very interested in the disconnect between the design and printing programs at her school. However, her solution to create personalized courses limits the amount of time spent on fundamental classes. D2 feels similar in that there was only so much a teacher can fit into a lecture, a quarter, or a year and that teaching additional or new classes means that good fundamental classes will be replaced. D2's school has made some effort in teaching students cross-disciplinary concepts through new majors and tracks.

However, she values the principles that are taught in the traditional graphic design program and was unsure of how to adequately incorporate all the concepts from multiple programs into four years of college.

Table 11: Educational Diagnosis and Solution Comparison between D1 and D2

Diagnosis/ solution	D1	D2
Diagnosis	Expectations are too high/not enough time in a four-year program	Not enough time in a four-year program
Solution	Personalized courses	Cross disciplinary studies

Advertising Agencies

Demographics

Table 12 shows a demographic comparison of the two advertising agencies interviewed. AA1 and AA2 refer to Advertising Agency 1 and Advertising Agency 2, respectively. The agencies are similar in revenue and number of employees. Both agencies also work with a VDP team and have approximately the same number of employees on that team. AA1 produces commercial, collateral, and direct mail campaigns as well as packaging options and POP displays for clients in the telecommunications, banking, and gaming industry. From this mix of products, the agency averages 8-10 VDP projects monthly. AA2 has clients from a number of industries including many non-profit organizations and has been working with VDP for 25 years.

Table 12: Demographic Comparison of AA1 and AA2

Demographic	AA 1	AA 2
Established	1988	1971
Total Employees	73	75
VDP Employees	8	7
Revenue	\$20+ million	\$20+ million
Started Working w/VDP	1981	1984
VDP Pieces Monthly	8-10	Unknown

Tools and Workflow

Both advertising agencies work with VDP using a team model. AA1 has a team of eight that works to design, set up, and produce the variable jobs. This team also plays a part in sales as the production team heavily influences what type of variable product can be produced. AA2's team was composed of two to three designers who are familiar with how to use XMPie and two to three production people who use XMPie for prepping files. They also have a full-time database person who actually does the scripting and will work back and forth with the designers and production people to make sure that everything was assembled correctly. The designers at both companies are trained to work with ulmage, a component of XMPie, to create variable imaging. However, they both are utilizing their partnerships with printers to merge the data into the production. AA1's team was fully dependent on their printers to provide this service; whereas, AA2's team was more technical savvy and can implement their own data when needed. Whereas, AA1 is fully dependent on XMPie's software and their partnerships, AA2's team cannot only create variable pieces for production, but they are also involved in overseeing elements like databases for database

cleansing. Both agencies are using the XMPie system; however, neither one of them are using the system to its full potential. AA1 stated that it was not that they did not know how to use the system but rather that they did not have the variable information needed to make all its features necessary. AA2 was facing a similar problem that has limited them from using XMPie's server options for sharing websites or email. Additionally, it was found that other than some light HTML, both agencies generally did not see a need for someone to be equipped with the skill of being able to code.

The largest distinguishable factor between the two agencies was that AA2's workflow involved creative ways to build more data for their clients. AA1 talked about the limitation of not having enough data to work with but did not incorporate any type of solution into their workflow to overcome this obstacle. AA2 tries to drive people to microsites, or websites, to get more information to target their market. Table 13 further shows the tools and workflow used by both advertising agencies.

Table 13: Comparison of Tools and Workflow between AA1 and AA2

Tools/workflow	AA 1	AA 2
Templates/Image and Data Manipulation	Both	Both
VDP Software	XMPie	XMPie
Workflow	Centered Around Team	Client Dependent
Outsource to	Printers and Mail Houses	Printers and Mail Houses

Data Management

Table 14 shows a comparison of data management information between AA1 and AA2. AA1 receives data directly from their client. It was usually in the form of a Microsoft Excel spreadsheet, which was the agencies preferred file because they find it the most user-friendly when it comes to simple database management. AA2 gets their data in various ways. In some cases, their clients supply it. Other times, the agency uses a third-party company, which supplies them with a list from a large database. AA2's preferred file format is PDF because they are the easiest for printers to work with as far as workflow.

Neither one of the agencies provide any type of data storage. The data was stored outside within a secure means or was completely managed by the client who controls who receives information. AA1 is completely dependent on their partnerships with printers to implement the variable content into their designs. AA2 does implement their own data, which was their preferred workflow. However, they do occasionally have their printers provide this service.

Table 14: Data Management Comparison between AA1 and AA2

Data management	AA 1	AA 2
Data Source	Client Dependent	Client Dependent/Third Party
Data Storage	None	None
Data Implementation	Printer Dependent	Internally/Occasionally Outsourced
Data Cleansing	None	Internally
Preferred Data File Format	Excel	PDF

Limitations

Table 15 shows a list of self-proclaimed limitations for VDP in both the industry and their particular agencies. Both agencies are in agreement that their clients have to collect more in-depth data than just a name and address to have a successful VDP product. They also agree that the data they currently receive was commonly inefficient.

Table 15: Comparison of Self Proclaimed Limitation between AA1 and AA2

Advertising agency	Limitations
AA1	<ul style="list-style-type: none">• Designers have minimum interaction with client• “Lack of information is the biggest thing holding VDP back”• XMPie is not being utilized to its full potential• “Hey, John” marketing is not effective• The client has to collect more in-depth data than a name and address• Client data is inefficient, invalid, or non existent• Until recently with software developments, variable data was difficult because a lot of programming was needed on the printer’s end• VDP software is still too complicated
AA2	<ul style="list-style-type: none">• Client data is inefficient, invalid, or non existent• XMPie is not being utilized to its full potential• The client has to collect more in-depth data than a name and address

Skill Sets for Hire

AA1 has mixed opinions on hiring someone for VDP. They expressed that in the pass they usually hire someone with a more design-oriented background because they have to be able to design. Not enough work comes in on a daily bases to hire someone who only deals with the variable side of design. When

AA2 seeks new designers, they also do not look for someone who specializes in VDP exclusively. They look for someone who understands the concepts of design and the fundamentals behind direct marketing.

Print Companies

Demographics

Table 16 shows the comparison of demographics among five print companies. Across all five companies, there was no relationship between number of employees, revenue, or years working with VDP. P1 through P5 represent Printer 1 through Printer 5, respectively. P1 works with Fortune 500 companies including many from the pharmaceutical, educational, and gaming industry. The company has been working with VDP since 2004, a year after they purchased a Xerox iGen3. They currently print 15 variable jobs a month, with 35% of those 15 jobs being large jobs. P3 has a small staff of 21 employees, two of whom work with the production of variable data products. This service has only been available at the plant for a year now and was handled through XMPie's Personal Affects System. P4 has 78 employees; all of them work in conventional-type positions. No team or specified employee handles variable jobs. Variable data production was done through versioning, and no VDP software was used. The company has been working with versioning for 30 years. However, the manager talked about how there has been increased emphasis put on it in the last 5-6 years. P5 implements cross-media solutions through the use of XMPie and a cross-media team. They have a variety of offset and digital equipment

including an iGen3 and Indigo technology. P5 has been in operation for 61 years but has only been offering VDP services for just over five years. This shift was fueled by the acquisition of their digital presses, which opened up a new revenue stream for the company.

Table 16: Demographic Comparison of Five Print Companies

Demographic	P1	P2	P3	P4	P5
Established	1960	1926	Not Asked	1951	1948
Total Employees	40	94	21	78	54
VDP Employees	5-6	7	2	0	7
Revenue (\$million)	10	10-15	> 5	20+	5-10
Started Working w/VDP	2004	Unknown	2007	1985	2004
VDP Pieces Monthly	35	Not Asked	0.25	Not Asked	Not Asked

Tools and Workflow

Table 17 shows a comparison of tools and workflows used by five print companies. Sixty percent of the printers in this sample use XMPie as their VDP software. Sixty percent of the sample only make the most of VDP through a template workflow and are not utilizing their software for image manipulation. The 40% who are doing image manipulation also use XMPie's ulmage software. No relationship was seen between software and those printers who use a template workflow.

P1's workflow for VDP starts with sales. When selling conventional print, sales are based on equipment; however, when selling for VDP, the salesperson often approaches the role as a consultant rather than a typical salesperson. The

files for variable pieces come from an advertising agency or from internal design departments of larger clients. If a client does not have a design department in which they can provide files, they have to go through an advertising agency before their files can be printed at this company. Once the design aspect was finished, if there are further needs for data cleansing or management, the company utilizes its parent company that can provide the client with options for merging and handling data.

P2's workflow starts after a design was submitted. They see design knowledge as valuable but do not have an in-house design department. After the design was final, the company does all the data implementation to make the design variable. This service was offered with no expectation that the designer has previous knowledge in designing for a variable data piece.

In terms of workflow, P3 always has the design for VDP products prepared outside. Two of the plants' internal designers have been through XMPie's training program provided by Xerox. After the design was submitted, the plant provides all data implementation and mailing services.

P4's workflow also starts with sales. Sales people work to help the client target the right audience by demographics, gender, race, etc. They also play a role in helping to assist the client in the type of offering that will be made available through the various printed pieces. The designers of the pieces may or may not be trained in VDP, but this issue was left to the concern of the client not

the print company. Direct implementation of the data was done through each version of the variable pieces. No VDP software was used during this process.

P5 has a cross-media department that handles all the design, programming, web development, etc. around cross-media efforts. The company has an in-house design and creative services department. All the designers in this department have the knowledge needed to design for VDP because the company provided an internal training process. The designer's main focus was to design. Where training was provided on how-to design for digital printing and VDP, the designers do not actually ever work with any data or the XMPie software. After design was completed, full data implementation and image manipulation was done in production.

Table 17: Comparison of Tools and Workflows Used by Five Print Companies

Tools/ workflow	P1	P2	P3	P4	P5
Template/ Image and Data Manipulation	Both	Template	Template	Template	Both
VDP Software	XMPie	Print Fusion	XMPie	None	XMPie
Workflow	Dependent on advertising agency or parent company	Fully functional data implementation in house	Fully functional data implementation in house	Works solely with versioning	Fully functional data implementation in house

Data Management

Table 18 shows a comparison of data management information among five print companies. All companies in this sample receive their data either directly from their client or by a third party. Three out of five from the sample have no means for or do not offer data storage services. P5 was the only company from the sample that offers full data cleansing services. As far as file formats, four out of five from the sample preferred Excel as one of their data file formats. Again, P5 was the only company that prefers a strictly VDP file format. Therefore, this format was used in P5's cleansing process and may be directly connected to why a VPS file format was preferred.

P1's technology center takes care of hosting and manipulating all data. Xerox has also provided training for their employees on the iGen3. The types of files received from either the client or the client's advertising agencies vary from native InDesign or Quark files attached to a Microsoft Excel sheet to PDFs and XMPie files. P1's preferred file format was an Excel sheet or .dbf file.

P2's data was run through IT. They handle the data and all its formats. This skill was something that the director feels a creative would not be able to do at this time. Data was implemented with Print Fusion VDP software. JavaScript and Perl can be used with Filemaker Pro and/or Excel and then imported into InDesign to create a simple, lower-cost workflow for creating variable products;

the director felt that there were too many barriers to overcome to make that work with his company.

P3 receives all kinds of file formats; however, they prefer to receive native files from the creative suites because they are easy to work with and allow for quick, last-minute changes. From here, PDFs are created and sent for output. The variable part of the pieces printed at the plant come as Excel or comma-delimited files. These lists are often acquired from BCC's databases. As far as data management, everything was handled on the client's end.

P4's files for the projects come directly from the client or an advertising agency that the client has hired. When the files arrive, they are in a number of file formats although data was preferred to be received through an Excel spreadsheet. After a file is printed, all the information about that file and its versions are stored on location at the company. P4 keeps client archives as well as reports from the clients about how successful a print for their products were in a versioned campaign.

P5's final file formats for outputting variable files are either VPS or PDF, with 75% being output by the companies preferred format, VPS. The data for variable pieces was acquired in a variety of ways. Once acquired, it was stored in a data center building that handles all sever database and IT issues as well as data warehousing, mining services, and modeling for their clients. Some clients

ask for assistance and lists are provided, some clients supply the data themselves, and some clients want the company to handle their data exclusively.

Table 18: Data Management Comparison among Five Print Companies

Data management	P1	P2	P3	P4	P5
Data Source	Client/ Advertising Agency/ Third Party	Client/ Third Party	Client/ Third Party	Client/ Third Party	Client/ Advertising Agency / Third Party
Data Storage	Parent	None	None	None	Internal
Data Implementation	Client/ Advertising Agency/ Parent	Internal	Internal	Client/ Advertising Agency	Internal/ Client/ Advertising Agency
Data Cleansing	Parent/ Partner	Third Party	None	None	Internal
Preferred Data File Format	Excel or PDF	Excel	Excel or comma delimited	Excel	VPS or PDF

Limitations

Table 19 shows a list of self-proclaimed limitations by all five print companies interviewed for VDP in the industry. There were similar answers among companies about how clients have to collect more in-depth data than just a name and address to have a successful VDP product. There were also similar responses about how XMPie was not being utilized to its full potential.

Table 19: Self Proclaimed Limitations of Five Print Companies

Printer	Self proclaimed limitations
P1	<ul style="list-style-type: none">• Design has minimum interaction with client• XMPie was not being utilized to its full potential• Client data was inefficient, invalid, or non existent• “Largest problem with VDP was that customers are not happy with the final product, not because of the way it turned out, but because the variable data did not target their consumers the way they wanted it to.”
P2	<ul style="list-style-type: none">• XMPie was not being utilized to its full potential• The client has to collect more in-depth data than a name and address• VDP software was too complicated, requiring a large learning curve• Client data was inefficient, invalid, or non existent
P3	<ul style="list-style-type: none">• Software was still underdeveloped• There are three distinct areas in VDP: design, IT, and production. To have one person who can do all three things was rare• There needs to be some sensitivity to graphic design in VDP• Workflow was tricky and software needs to be more user-friendly before it would be used in a standard workflow.
P4	<ul style="list-style-type: none">• IT and coding knowledge was not there and limiting
P5	<ul style="list-style-type: none">• Client data was inefficient, invalid, or non existent

Skill Sets for Hire

P1 had no comments on designers for VDP directly but felt that at this time, IT skill sets are not necessary for VDP production with the advances that are being made in VDP software.

P2 feels like the ideal employee will have multiple skill sets. The employee who can bridge the gap between design and asset management, asset management and IT, and IT and design will be most beneficial in the future.

P3 feels that as time goes by, people who have expertise in digital printing will naturally prevail in VDP. Most of the ideas behind variable data are rooted in digital printing therefore; P3 would look for digital printing skills first, variable software knowledge second, and design experience last when hiring a designer for VDP.

P4 does not have a design department but feels that the industry would not need designers to have an additional skill set for VDP. As long as they have awareness for how the changing fields function, they can be successful with VDP. Those in print and production should have an additional employee to implement variable data so that designers can focus on designing. Therefore, P4 feels that designers should be hired based on their knowledge of design software and theory.

P5 feels that there should be multiple employees who handle specific aspects of a variable data workflow. They do not hire designers with the mindset

of designing for variable print only. Instead, they look for designers who understand multiple kinds of media.

Collective Comparisons

Table 20 shows the collective demographics for the entire sample. Table 21 shows data management information for the entire sample. All of those interviewed receive their data from their clients directly. P5 was the only provider of data storage. Forty-four percent of the sample does internal data implementation, and 22% offer full-service data cleansing. Excel was the number one overall preferred data file format for the sample interviewed.

Table 20: Collective Demographics

Demographic	D1	D2	AA1	AA2	P1	P2	P3	P4	P5
Established	1998	2005	1988	1971	1960	1926	Not Asked	1951	1948
Total Employees	1	9	73	75	40	94	21	78	54
VDP Employees	1	1	8	7	5-6	7	2	0	7
Revenue (\$million)	> \$5	> \$5	\$20+	\$20+	\$10	\$10-15	> \$5	20+	5-10
Started working w/ VDP	2002	2005	1981	1984	2004	Not Asked	2007	1985	2004
VDP Pieces Monthly	Not Asked	0.33	8-10	Not Asked	35	Not Asked	0.25	Not Asked	Not Asked

Table 21: Collective Data Management

Data management	D1	D2	AA1	AA2	P1	P2	P3	P4	P5
Data Source	Client Controlled	Client Dependent/ Third Party	Client Dependent	Client Dependent/ Third Party	Client / Agency / Third Party	Client / Third Party	Client / Third party	Client / Third Party	Client / Agency / Third Party
Data Storage	None	None	None	None	Parent	None	None	None	Internal
Data Implementation	Printer Dependent	Printer Dependent/ Third Party	Printer Dependent	Internally/ Occasionally Outsourced	Client/ Agency/ Parent	Internal	Internal	Client/ Agency	Internal / Client / Agency
Data Cleansing	None	None	None	Internally	Parent / Partner	Third party	None	None	Internal
Preferred Data File Format	N/A	N/A	Excel	PDF	Excel or PDF	Excel	Excel or comma delimited	Excel	VPS or PDF

Table 22 shows the collective values of skill sets desired by those in the industry. Seventy-seven percent of the sample value designer skills over technical skills. Fifty-five percent of the sample does not even have the ability to hire a designer for VDP because they do not hire for VDP exclusively.

Table 22: Comparison of Desired Skill Sets for a VDP Designer

Designer/ agency/ printer	Skill Sets Desired
D1	Values design knowledge over technical skill
D2	Values design knowledge over technical skill / Do not hire exclusively for VDP
AA1	Values design knowledge over technical skill
AA2	Values design knowledge over technical skill / Do not hire exclusively for VDP
P1	Values design knowledge over technical skill / Do not hire exclusively for VDP
P2	Was looking for an employee with cross-disciplinary skills
P3	Was looking for an employee with cross-disciplinary skills in multiple types of media
P4	Values design knowledge over technical skill / Do not hire exclusively for VDP
P5	Values design knowledge over technical skill / Do not hire exclusively for VDP

Table 23 shows the comparative breakdown of predictions for VDP in the next year for the industry and solutions to the educational need in teaching designers the skill sets needed to design for VDP. There are mixed opinions on growth versus no growth over the next year. However, all those who responded with an educational solution suggest that skill sets be learned across multiple disciplines.

Table 23: Predictions for the Industry in the Next Year and Solutions for Education

Designer/ agency/ printer	Industry Predictions	Educational Solutions
D1	No noticeable change will occur,	Institutions should offer personalized courses in which classes are taught across disciplines
D2	No noticeable change will occur,	Institutions should offer personalized courses in which classes are taught across disciplines
AA1	Not provided	Not provided
AA2	No noticeable change will occur,	Believes that the schools that are teaching how to bridge the gap between many disciplines rather than niche skill are the most successful in preparing someone to work with VDP.
P1	Thinks that printers have a large desire to push VDP but the supporting resources are not there yet and, therefore, it was not seen as a big priority. Until a different model was found, things will probably stay the same or grow slowly as people naturally get better at what they do.	Not provided
P2	Growth of the industry was dependent on the needs that are demanded. Instead of automatically seeking new innovation for variable printing, it was typical for companies to identify a need that must be filled and then meet that need.	Believes that the schools that are teaching how to bridge the gap between many disciplines rather than niche skill are the most successful in preparing someone to work with VDP.
P3	Growth was predicted to be a slight increase.	Not Provided

P4	VDP and 1-to-1 marketing was the way that all advertising and printing will head. There will be a point when companies will have to change over to include further services and consolidate the market, but for now, as long as partners in the industry work well together, things will continue to grow in that way first.	Disciplines should focus on multiple media and teach workflow so that all parts of a project can be understood and appreciated. Students with skills across the board are more desirable in the work field.
P5	"We personally have seen a growth in cross-media applications, somewhere around 40%, and I think we will continue to see that grow."	Not provided

Chapter VI

Summary and Conclusions

After in-depth primary research and a review of the literature, the following conclusions were discovered:

1. VDP workflow is complex and contributes greatly to its lack of growth.
2. A large gap exists between VDP knowledge and implementation.
3. A lack of instruction exists in VDP at the collegiate level.
4. Many skill sets are needed to design for VDP.

VDP Workflow

After reviewing the literature, it was apparent to this researcher that VDP was a very complex process requiring sophisticated tools and skill levels. The number of tools and the level of education needed to operate those tools contribute to the complexity and inconsistency of a VDP workflow. Additionally, it can be expensive and time consuming to successfully establish a VDP workflow due to the cost of the investments, human capital, and training.

Aside from the cost and time invested to establish a VDP workflow, proper implementation must also occur for it to be successful. This includes understanding how to use variable data effectively, how to manage the data, how to properly implement the data, and finally, how to determine good data from inadequate data. From the interviews conducted in this study, the companies that know their customers well and have horizontal databases that continue to

develop valuable data are the most successful with VDP workflows. Their success was also contributed to the fact that they offer services in data cleansing, management, and implementation.

From this study, it was also seen that the problem of system compatibility as defined by Romano back in 2002, still exists. As seen from the companies interviewed in this research, variation in file formations and device output processing contribute to the complications of creating an effective workflow.

Figure 3 demonstrates the complexity of VDP workflow that still exists today. More research to specifically and to further identify the bottlenecks in VPD workflows is suggested.

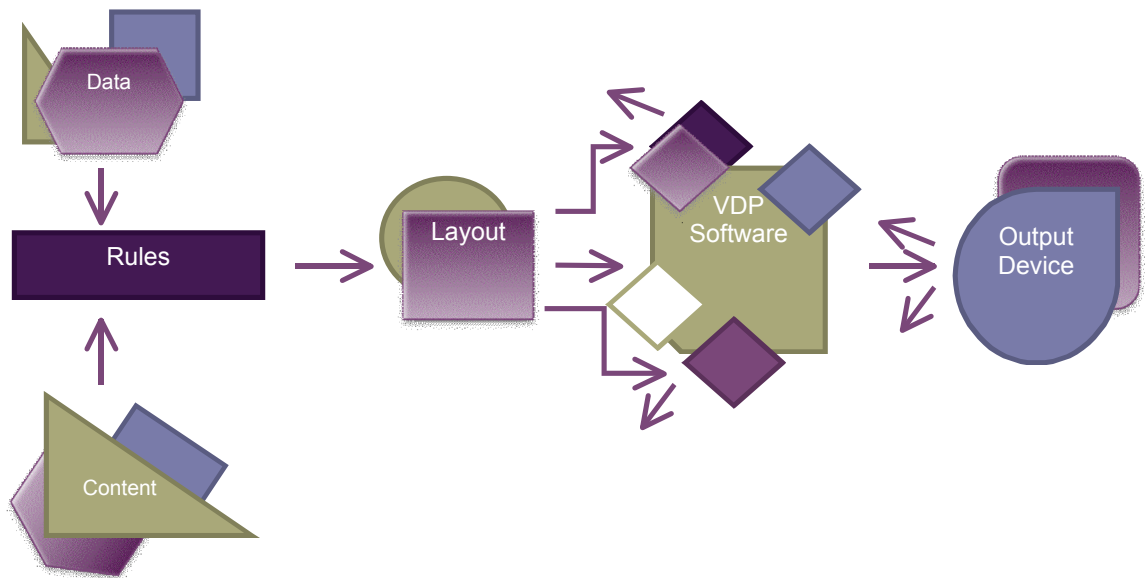


Figure 3: Example of a Complex VDP Workflow.

Bridging the Gap

The literature also demonstrates that there was still a considerable gap between declarative and actual knowledge in implementing VDP. Although an awareness of the necessity to have the skills in the creative, IT, and production areas has been made, a bridge among them has not. This gap is inevitable, due to a number of tools that handle data and VDP solutions, all which have some overlapping functionality, yet also some challenging quirks. Their quirks cause inconsistencies in workflow, and though progress has been made with standard file formats, a generalized workflow standard has not yet been established.

It seems that the only way to bridge this gap among the departments of VDP is by matching skill sets. Designers should work closely with printers to gain that experience. They must also familiarize themselves with some sort of programming structure and database management. For print providers to become more successful in implementing VDP services, they must understand the digital printing process, as well as the management of databases, and know how to develop expertise in designing documents for variable data. In short, successful VDP service providers need to integrate print expertise with database knowledge, graphic design skills, and print knowledge. As the print industry advances with VDP, it will have to learn and to apply the skills needed for design, programming, and print methods. Front-end operations will have to adapt to new approaches of VDP printing, and new skills will have to be adopted by designers and print personnel.

Lack of Educational Instruction

Previous studies have found that there are large differences between what is being taught in design versus what is taught in printing. This background research was the foundation for analyzing design schools and print schools on their education and knowledge of VDP. In this research, the same results were found. Large differences exist in what is being taught in design programs versus print programs. It was seen that art schools whose focus was solely on design programs have little to no knowledge of VDP, with no formal education on the subject at all. Print schools have a greater knowledge of VDP concepts, yet surprisingly determined from this research, only about a third of the schools targeted had any formal teaching of VDP concepts. This lack of education seems to be one source which contributes to the gap between designers and printers in VDP.

The schools that did offer education in VDP were among those highly known for their printing programs. Further research was done to examine these schools that offer VDP courses and their curriculum. From this research, the researcher would like to offer the following course outline (Table 24) as a reference for teaching designers the skill sets needed to effectively design for VDP. This outline was created to target students who are involved in graphic design programs as well as print programs. It is suggested that the course be taught at a minimum of 10 weeks, following the suggested lessons on data, file creation, software, design implementation, and production of VDP.

Table 24: Recommended Teaching Outline

Week	Lesson	Detailed explanation
1	What is Variable Data Printing?	<ul style="list-style-type: none"> • Create a common starting point for all students by discussing case studies from suppliers and printers. • Familiarize students with the common language and perspectives basics of VDP in orientation.
	All About the Data	<ul style="list-style-type: none"> • Discuss all the things needed to be known about data before designing for VDP: rules, UPSP standards, time, application, CASS certification, etc.
2	Database Generation	<ul style="list-style-type: none"> • Describe how to create a database from scratch with a plan for future growth. • Describe horizontal database building
	Database Maintenance	<ul style="list-style-type: none"> • Explore reformatting and merging existing database information. • Identify how to prepare VDP for low-cost/high-end VDP options.
3	Database Cleansing	<ul style="list-style-type: none"> • Discuss cleansing databases and prepping the fields for VDP
	Database Lab	<ul style="list-style-type: none"> • Explain to students how to complete several assignments: <ul style="list-style-type: none"> ○ one where they create a database from scratch ○ one where they are asked to reformat and clean an existing database ○ one where several databases including their original is to be merged and prepped for horizontal building
4	Creating VDP with Markup Languages	<ul style="list-style-type: none"> • Describe alternative methods on implementing variable content into a printed piece without the use of VDP software will be discussed. • Give an overview of XML and how markup languages and programming languages alike can be used in VDP.
	XML Lab	<ul style="list-style-type: none"> • Assign students to create a variable brochure using XML and InDesign instead of a VDP software.
5	VDP Software	<ul style="list-style-type: none"> • Discuss the various software options available for VDP and the issues that should be considered in deciding which software is best for ones needs.

	VDP Software Lab	<ul style="list-style-type: none"> • Demonstrate and provide students with exposure to two or three software programs that handle VDP (most likely XMPie and DesignMerge). • Assign students to create a variable product in each program and compare the differences in workflow and ease of use.
6	Midterm	<ul style="list-style-type: none"> • Test for retention
	VDP File Formats	<ul style="list-style-type: none"> • Discuss the many file formats being used in VDP currently, the push to find a standard, and the limitations caused by manufactures.
7	The Basics of PDF Files	<ul style="list-style-type: none"> • Discuss and demonstrate preflighting and certifying PDFs for use in printing commercial work or web page images.
	VDP File Generation	<ul style="list-style-type: none"> • Show how to create PostScript files and establish correct distiller settings for the proper use of PDF files used in print, on the web, or for proofing.
8	Implementation of Data into Design	<ul style="list-style-type: none"> • Discuss the best ways to handle text and images in a design layout. • Describe how to create placeholders properly, connect links from databases, and use of tags.
	Design Lab	<ul style="list-style-type: none"> • Assign students to design their own variable project and implement a database properly into their design using placeholders and tags.
9	VDP Start to Finish	<ul style="list-style-type: none"> • Assign students a project where they will have to create a VDP project from start to finish, including: database creation, sorting, cleaning, implementation into design, and output to a device.
	Start to Finish Lab	<ul style="list-style-type: none"> • Provide students with lab time to work on their start-to-finish project.
10	Final Presentation	<ul style="list-style-type: none"> • Facilitate students' brief presentations on their start-to-finish projects, including why they chose what workflow used to create the piece and any limitations they may have had.
	Final Exam	<ul style="list-style-type: none"> • Test for retention

Skill Sets

Finally, it was apparent from this research, that designers with VDP skills are appreciated but not currently sought after when hiring for design. Whereas, human capital was predicted to be the distinguishing competitive factor between VDP solution providers in the near future, there was little execution of transitioning to a staff where designers do more than design. From the research conducted, all companies felt that designers who have experience with VDP were valuable, yet they preferred to focus mainly on designing. This mixed impression of what was needed to improve designing for VDP contributes to the slow development of VDP in the industry. The reason behind the hesitation of seeking employees with new skill sets is still unknown. However, the interest in having a designer who was more than a creative mastermind was still prevalent. Eventually, designers will need to be familiar with the skills of a marketer, programmer, database analyst, and printer. The following list of skill sets for designers of VDP has been identified through this research.

- Information, knowledge, and experience in VDP
- Networking and system integration skills
- Business and marketing awareness
- Image, color management, and asset management skills
- Text manipulation and process skills
- Knowledge of programming skills
- Database administration

- Proper preparation and data-mining skills
- General design skills
- Proper layout for addressing VDP pieces
- Proper coding being placed along mailing address
- USPS rules and mailing penalties
- Cross-media development skills

In summary, it was seen from this research that one possible reason for the delay in growth for VDP, was that designers do not have adequate training or skills needed for VDP. This was reinforced by the lack of instruction on the subject at the college level, particularly in the discipline of graphic design. Many limitations exist with VDP, but a prominent one was the lack of efficient data needed to create a successful variable data piece. Other limitations stemmed from difficulties in workflow in the areas of design, data management, and printer/file limitations. For designers to adequately design for VDP, a new skills set, as well as a basic understanding of the previous limitations, was necessary.

Chapter VII

Suggestions for Further Research

This research has opened the door for further study in the field. After conducting nine interviews and an educational analysis of several art and print schools, it was determined that there was an apparent lack of instruction for VDP in schooling as well as support in the workforce where companies are not looking for employees who focus on cross-disciplinary skills, but rather hiring those with specialized skills in a defined area. Further research on why there is a lack of instruction and support should be investigated.

Suggested areas of research are:

- 1) A survey could be conducted to extend this preliminary research to a larger sample size.
- 2) A case study in which a student would monitor how effectively he or she learns multiple workflows for creating a VDP piece from start to finish. Multiple workflows that work with different design and VDP software could be examined, as well as the benefits of learning a programming language like Perl.
- 3) The objectives outlined in this study's VDP course outline versus the objectives taught by institutions offering VDP could be compared.

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Appendix A: Artistic/Graphic Skills needed for VDP (A Theoretical Chapter)

Design Basics of Digital Printing

The two main categories of digital printers are: those that use toner and those that use ink. Whereas inkjet printing is making many advances in quality and speed, toner reproductions still tower above inkjet reproductions in the variable data industry at this time. Digital presses use a process, called electrophotography, where a digitally controlled laser or series of light-emitting diodes (LEDs) create an electric charge attraction that forms an image. This charged image attracts toner, and the toner is then transferred directly or indirectly to a substrate with a slightly stronger charge. This process works well with creating variable images because, unlike conventional printing, where a plate is imaged to print the same image multiple times, a digital press cylinder can be imaged and erased in a single rotation (Williams, 2008).

Toners can be dry powders or liquids, but in either case, they encompass the same type of properties when used in the digital electrostatic process. Currently, HP is the only manufacturer whose printers use liquid toner, which has given them an advantage in mixing new color toners for spot reproduction. Otherwise, digital imaging is somewhat limited by four-color process printing. This is important for designers to understand because process printing will limit the gamut of colors that can be reproduced; therefore, these colors outside the gamut should not be included in a design.

It is also important for designers to understand digital image creation. As with conventional printing, images and text are reproduced using spots, dots, and pixels. A spot is the smallest mark that a digital output device can put on a substrate; it is created by a binary code of either one or zero. This code influences the spots per inch (SPI) of an image, which normally ranges from 72 SPI to over 4000+ SPI on modern film imagesetters. These spots make up what is called a *dot*. When several spots appear in a close area of a bitmap grid, a dot is formed and can be used in halftone processing to create an image or a word. In digital printing, resolution issues can arise, due to the limited range of SPIs that can be imaged (normally between 400-800 SPI). However, software-screening enhancements have allowed the industry to achieve the apparent line screens that are used in conventional offset printing (Lena, 2007a). These systems have the ability to vary the bit depth of images to simulate high resolutions.

Other characteristics of digital printing include how the raster image processing (RIP) of a machine processes information. Designers should be aware of the initial file building process for submitting files to RIPs. The challenge in VDP for designers is that not every RIP processes files the same way. Those who understand this process and its variables will be able to avoid reworks (Tolliver-Nigro, 2006).

It is also important that designers be familiar with the digital presses that will be producing their final products. Because there is currently no industry

standard (such as SWOT, SNAP, or GRACol) for digital printing, factors (such as determining maximum and minimum dot size, color conversion, and file formats) can often be device-dependent and should be known beforehand (Clark & Romano, 2000).

Problematic Preparation

There are several other characteristics of digital printing that designers must consider before even beginning to create pieces for output. Digital presses are notoriously bad at creating vignettes. Due to the way that the photoreceptor receives its charge, limitations in creating halftones, and reduced resolutions, banding can often occur when blends, vignettes, and gradients are incorporated into designs. A bad vignette is easily seen in publications and draws negative attention to pieces containing them. Adobe Photoshop's noise filter can reduce banding but does not completely solve this problem (Clark & Romano, 2000).

As with conventional printing, bleeds, overprints, and imposition must be accounted for in digital printing. Bleeds should be about 1/8 of an inch in all directions to allow for proper trimming. This area must be considered because many digital printers have paper size limitations and, without a proper bleed, a white void will appear around the edge of each imaged paper sheet. This is because digital presses do not allow toner to be applied to the very edge of the sheet. In general, overprints should be darker than the background. Text should be black only for the best visibility. Rich blacks can be used if a busy background

is affecting the transparency of the text. Rich black is also recommended for large areas of black coverage. This way, support screens in the building colors present a strong black instead of a weak grayish color that sometimes appears with black toner alone (Clark & Romano, 2000). Imposition for digital printing, and especially variable content, can be largely dependent on the printer to which it is being output. This, again, is why it is important for designers to know their machine. Imposition for multi-page variable data jobs can be imposed at the RIP, or with standalone imposition software before the RIP, by creating PDF or PostScript files. New file formats have been designed to reduce RIP strain by having static information and imposing variable content as needed. This has greatly reduced preprocessing time.

Electrophotography is a very strenuous process on substrates, mainly paper, even in a humidity-controlled environment. A large amount of heat is involved when applying toner to paper. A normal process job is charged four times before even reaching the fuser, where a large amount of heat is applied to bond the toner to the paper. These conditions can often create what is known as *toner curl* (Lena, 2007a). Toner curl has a direct relationship with image area or toner coverage. Stronger paper stocks and those with minimum water content should be chosen for pieces that will require heavy toner coverage. Toner itself is made from a polymer; this plastic is fused to the paper by essentially melting onto the substrate. This, in effect, can cause problems for finishing. If a product is designed to be folded, creased, or perforated, then it should avoid having toner in

the areas where this would occur in order to eliminate toner cracking. Once toner is fused, it becomes brittle if its substrate changes form. Avoiding solids or images in these areas is essential for designers to know. The plastic properties of toner also effect glossiness in digital printing. Digital papers have been developed to accommodate this effect somewhat. However, in general, toner gives a glossy appearance, even when printed on dull or matte stock. The opposite effect is seen on glossy papers (Lena, 2007b). It is a good idea for designers to have a test run or proof of their piece printed on the final substrate (prior to finishing) to see how the digital process and paper will affect a job.

In VDP, hybrid-printing methods are becoming increasingly more available. To reduce production costs, a combination of ink and toner printing is done, where all the color and static information is printed on a conventional offset press, and the variable information is added later. When this type of method is used, it is important that hybrid papers and digital-safe inks are used, so as to prevent smearing, wear off, and machine damage.

Designing for a Targeted Audience

Personalization began in the early 1940s with the personalized letter. Twenty years later, typewriters and magnetic tape printers began word processing. From there, the inkjet system was developed and used to announce sweepstakes winnings to consumers of *Readers' Digest*. In the 1970s, personalized text was incorporated into the body of text in documents and could

wrap freely. The 1990s brought in digital color printing, and the result, as of 2002, has been the development of a \$35 billion market for direct-mail marketing (Romano, 2002). Marketing through direct mail is a big business. Due to the one-on-one nature that the industry has taken on, targeting specific individuals or businesses has become essential in making sales.

With this concept in mind, it is important to know how to design for a certain targeted audience. This is done in variable data design with customization and personalization. Romano defines personalization as a printed unit targeted to a particular group of people, where only the name and address vary. He defines customization as printed units that are targeted to individuals where additional information (i.e., in addition to the name and address) will vary. Both techniques could be used to create the ultimate in one-to-one marketing.

One of the most common methods of reaching prospective buyers is through personalized direct mail. Personalization has been around for a very long time but is usually associated with costly customization, such as in tailored suits and custom built automobiles. However, it has still been popular because it works (EFI).

These mail pieces are often sculpted to incorporate some type of customization, whether in the design of the piece itself, or in the images and message that it portrays.

Design plays an essential role in how effectively you communicate the intended message. Good design is reader and message oriented, rather than aesthetic. The design should enhance the reader's willingness and ability to

understand the message and then drive them to act on it. “Designers are communicators, not beautifiers” (Romano, 2002). The beauty happens only after the basis of the message functions. If designers start out trying to create good-looking pages first, they may miss the message entirely.

Variable data pieces are usually designed for attention. They want to get prospective readers to notice that poster, postcard, or cover of a book. Designing for attention involves the use of striking colors and images to engage wow reactions. Good design also makes complicated information easy to understand by breaking down the message; utilizing simple headings and subheads can do this. Replacing text with visuals, tables, charts, and information graphics also keeps the design simple and clear. Clarity can also be achieved by using a clearly defined hierarchy, with white space and graphic accents to organize the message. Main elements (such as headlines, subheads, dominant illustrations or photos, text, and logos) should be placed appropriately. Pages filled with text should be avoided, for they present a gray, boring appearance, which discourages readership. Finally, design should reflect a personality, meaning material should project a distinct image that appeals to the targeted market for which it was designed.

The bottom line of VDP in direct marketing is to increase business opportunities so that they translate into new services that command higher profits. This is achieved by using personalization to design for a targeted

audience by appealing to the interest of individuals, rather than by using mass marketing (EFI).

Handling Text

When designing for variable data, it is important to understand fonts. Certain typefaces do not always work with the output devices used for production (Clark & Romano, 2000). For example, a client may supply material with the font Century Old Style, which can be slightly different than the version of Century that the printer uses for production. Other conversions from Type 1 to TrueType formats may also be necessary. For instance, Adobe allows users to convert Postscript Type 1 fonts into TrueType font, or to embed fonts into EPS or PDF files for reproduction as long as the resulting file with the embedded font is not modified further and the font is used only for displaying or printing the document (Romano, 2002).

In the past ten years, the problem of matching font formats with output devices has been greatly reduced, due to the PDF and OpenType format. However, there are still some important differences between TrueType, PostScript Type 1, and OpenType. All of these formats are all multi-platform outline fonts. This means that they utilize glyphs by a way of points, which define their lines and curves. Having this type of format allows the fonts to be scaled to almost any arbitrary size, making them resolution-independent (Phinney, 2002). In printing, outline fonts are converted or rasterized for production, meaning that the dots/pixels/line screen of an output device represents their outlines. This can

sometimes cause the thin curves or serifs of fonts to disappear. However, a means (called *hinting*), which is encoded into all three types of fonts, helps to prevent this from occurring (Phinney, 2002).

Text Reflow

Aside from text fonts missing and format conversations, text reflow in VDP can result from using different versions of the same font from the same type foundry. If text reflow is occurring, the font may have been created with a TrueType version of a PostScript Type 1 font. This is a re-occurring problem that stems from jobs that originate on Windows computers and are processed on a Macintosh (Clark & Romano, 2000). Reflow is critical to VDP pieces, particularly mailers. If text boxes are not made large enough or if fonts change, documents can fail to wrap text properly, causing the rest of the piece and those pieces behind it to be off. This mistake, if not caught before the final press run, can be costly.

Specific to variable print is the case of variable text that overflows a text box, causes ugly word breaks, or is missing completely. Designers need to be prepared for worst-case eventualities: an 18-character surname, a field accidentally left blank, a new product that has a much longer description than its predecessor, and so on (Clark & Romano, 2000).

Designers should also prepare for odd word breaks. Especially with larger font sizes, words for headlines and such may hyphenate or break to create unpleasant or awkward spacing. To avoid this, the length of the largest variable text in the series of pieces should be determined, and the text box on the master

page should be made to accommodate it appropriately. All variable data jobs should be proofed carefully to avoid text mistakes.

Handling Images

“VDP image preparation is complex because of the number of image types that may be encountered and because of the types of corrections, adjustments, and enhancements that may be required to make an image suitable for print” (Frey & Barzely 2008). Digital file formats all serve different purposes and were made for different end uses. Therefore, choosing the appropriate one for a certain job will influence the output and the RIP processing that takes place. In VDP, there are some key file formats for images that perform better than others. Uncompressed TIFF or EPS files work best with most RIPs, whereas BMP, JPEG, GIF, and PNG files tend to require more processing and can congest the RIP.

As a general rule, designers must also keep in mind that image resizing and rotation should be done in a photo application like Photoshop and not in layout applications (Tolliver-Nigro, 2006). Images that are enlarged will suffer from pixelization, and images that are significantly reduced can soften in appearance. Images that are reduced in page layout software also cause RIP backups. This is because when a 300-dpi image is reduced significantly (perhaps to 20%), the software will send the entire original image with instructions to scale it down to the RIP, causing considerable slowdown in processing time (Clark &

Romano, 2000). Also, keep in mind that more resolution is not always better. A 1200-dpi images that will be output on a 300-dpi digital press is an unnecessary waste of resolution (Tolliver-Nigro, 2006).

Other RIP problems may result from color space issues within images. Color images should be separated in CMYK format, unless the RIP supports internal separation of composite RGB images. Black-and-white images should be saved in the grayscale mode. EPS files containing imported raster images (such as TIFF files) should be converted to CMYK format if the RIP does not support internal separation. Illustrations that contain *nested* EPS files, screen angles, rules, and halftone dot shapes can create unusual output and may cause the RIP to abort the job, as can images saved in an incompatible format. Designers should carefully examine source files for objects that have custom line screens or halftones applied to them. Linked images that are placed into illustration files can be included in exported EPS files by using layout application options for image handling. This may result in larger EPS files but ensures that the quality of the image is retained. In general, converting all RGB and spot color elements to CMYK format will eliminate problems in processing the final file (Clark & Romano, 2000).

General File Assembly

Programming, mark-up languages, and software have created multiple pathways to import data that actually assemble files for final output. However, in

a general sense, no matter the method, certain things must take place. A template for the design must be created. Here, designers have as much freedom as they desire, as long as they accommodate placeholders properly for images, as well as textboxes that are large enough for free-flowing text. Once the template is finished, using either a software program, mark-up language, or an ASCII tab delimited file, variable data is imported to the template. A sample page must be previewed, so that proper tags can link the data to the template. These tags can also help to describe an item so that it can be found again by browsing or searching. Tags can be informal and named after anything. However, tags in code or from spreadsheets or databases must completely match the tags created in a layout in order to function properly (Maivald, 2008). Once all tags have been connected, the file can be saved in a certain VPD file format. This format may or may not be reliant on a certain type of RIP, which should be known beforehand. From here, the assembly of the file is complete and is now ready for output.

Appendix B: Analysis of Creative Software Solutions for VDP

[Sources: (Bitstream Inc, 2008), (Digital River, 2008), (DirectSmile, 2007), (EMC Document Sciences, 2008), (Finite Matters Ltd, 1998), (Greer, 2007, XMPie), (Kodak, 2008), (Kodak, 2008, DARWIN), (Meadows Publishing Solutions, 2008), Power Exchange LLC, 2006), (Vision's Edge, 2003)]

Company	Product Names	Brief Description	Platforms	Application Compatibility	Key VDP Applications	Output Formats
Kodak (PODS)	Darwin VI Darwin Pro Darwin Designer	The Darwin products have an easy-to-learn, drag-and-drop interface that supports all the enhanced text-handling features of QuarkXPress. It functions on a rule-based logic, which enables the creation of complex jobs with large databases without scripting. Darwin Pro's new functionality and graphical interface allows for the inclusion of PURLs and web campaigns.	Macintosh Windows	QuarkXPress InDesign	<ul style="list-style-type: none"> ▪ Mail merge ▪ Customize publications ▪ One-to-one marketing ▪ Direct mailers ▪ Statements ▪ Personalized information kits ▪ Web-to print campaigns ▪ PURLs 	VSP VIPP PPML PPML/VDX PDF
AGFA	Personalizer X	Personalizer X is a user-friendly software Xtension that has no design limitations. It features and supports object caching, barcode generation and advanced step and repeat features. Data can be imported from ASCII files or more advanced options can be chosen. In either case, the program operates as part of an Intellistream workflow.	Macintosh	QuarkXPress	<ul style="list-style-type: none"> ▪ Direct mail ▪ Mail merge ▪ Data merge ▪ Variable letters, brochures and postcards 	PostScript PPML PPML/VDX
Vision Edge	Focus Gold	Industrial strength software with an industrial strength learning curve, Focus Gold has highly developed data manipulation tools that allows for almost an	Macintosh	QuarkXPress	<ul style="list-style-type: none"> ▪ Direct mail ▪ Transactional Documents ▪ Personalized 	PostScript PDF PPML

		unlimited number of variable items, whether images, image locations, text, text box locations and /or barcodes, to be added per document, all without the use of scripting or coding. The software also includes a valuable error-checking feature that ensures that there are no mistakes when the job merges data from the database to the template.			<ul style="list-style-type: none"> Marketing Cross-media campaigns 	
Design Merge	DesignMerge Pro	The DesignMerge Pro bundle is a suite of software that provides sophisticated variable data print and publishing features. Using a menu-driven interface and rules-based logic, the software allows designers to define variable elements anywhere on the page without coding. The software can merge text or images from practically any data source and has many features, including a barcode module and data-driven graphic component.	Macintosh Windows	QuarkXPress InDesign	<ul style="list-style-type: none"> Direct mail Postcards Newsletters Transactional documents Personalized marketing collateral 	PostScript PDF PPML VPS VIPP
DirectSmile	DirectSmile Designer DirectSmile Studio DirectSmile Creator Pro Direct smile SE Direct smile Generator DirectSmile Production	DirectSmile is a German manufactured software that combines leading-edge image personalization and production solutions with InDesign. Entry-level production products like Direct Smile studio are tailored words, lower output size, and mail merges; however, products like DirectSmile Generator can handle high-volume, complex jobs with ease. Server-based products expand the product to produce cross-media campaigns and PURLs.	Windows	InDesign	<ul style="list-style-type: none"> Direct mail Marketing collateral Coupons Calendars Cross media campaigns PURLs Web to print systems Online shops 	PPML PDF JLYT
EMC Document Sciences	Xpression 3 xPresso	EMC Document Sciences products allows for creation and production of personalized communication in both real time and high-volume batch. From finical statements to highly personalized correspondence,	Macintosh Windows	InDesign	<ul style="list-style-type: none"> Personalized customer communications On demand 	PDF ColorPrint PostScript AFP

		Xpression's customization software utilizes a menu-driven workflow that culminates at a SPRS server for output.			<ul style="list-style-type: none"> fulfillment ▪ Direct Mail ▪ Catalogs ▪ Transactional statements 	
Finite Matters	Patternstream 3	PatternStream 3 is a revolutionary automated database-publishing program for designers who need to use InDesign software for batch document creation. PatternStream provides a more efficient way to acquire information from databases, XML files, and other sources for data-driven projects such as catalogs, directories, reports, reference books, and other pattern-based information for print and electronic distribution. It connects directly to multiple databases and XML/HTML files; imports a variety of files, including images, word processing, and spreadsheets; and publishes directly to InDesign Server.	Windows	InDesign	<ul style="list-style-type: none"> ▪ Customized catalogs and directories ▪ Yearbooks ▪ Direct Mail ▪ Transactional printing ▪ Personalized portfolios and marketing material 	PostScript PDF PPML
Object Lune	PrintShop Mail	PrintShop Mail is a professional software tool that optimizes the process of merging variable database information with a design. It integrates database information into the layout of a document. There is no network congestion, allowing the PostScript printer to print at or near rated speed.	Macintosh Windows	InDesign	<ul style="list-style-type: none"> ▪ One to one campaign ▪ Direct mail ▪ Marketing collateral ▪ Catalogue wrappers ▪ On demand fulfillment 	PostScript PDF PPML
Bitstream Inc.	PageFlex	PageFlex software has multiple modules for total cross-media marketing. The desktop application or plug in will assist InDesign in creating custom cards, brochures, signage, books, and more while the server option covers all PURLs and HTML needs.	Windows	InDesign Or Standalone	<ul style="list-style-type: none"> ▪ Direct mail ▪ Datasheets ▪ Localize marketing materials ▪ Luggage tags ▪ Advertisings 	PostScript PDF PPML PPML/VDX

XMPie	PersonalEffect <ul style="list-style-type: none"> • uDirect • ulmage • uCreate • uChart • uStore 	XMPie PersonalEffect is a product that can contain many different modules, each with a different function. These modules manage data, manage design templates, or put them both together. XMPie has created software that is customizable to the print providers' needs but also allows printers to become full-service marketing and variable-data providers with a single software.	Macintosh Windows	InDesign	<ul style="list-style-type: none"> ▪ Cross media campaigns ▪ Direct mail ▪ Print to web campaigns ▪ Email and mobile device production 	PostScript PDF PPML PPML/VDX
EFI	Fiery Freeform	This server-based approach works though a PostScript print driver, which allows the use of just about any application to create both a static background and a variable information overlay. The Fiery RIP tracks the job in a cache process, which reduces RIP, and therefore, production time, to turn out high-volume jobs.	Macintosh Windows	Standalone	<ul style="list-style-type: none"> ▪ Suited for any VDP print production 	PPML PDF PostScript
Kodak NexPress	NexStation	Kodak NexStation front end drives the NexPress, monitors all press functions, and supports a demand for high quality and volume variable data jobs. The front end caters to a wide range of production needs from direct mail to fully variable data and image pieces.	Macintosh Windows	Standalone	<ul style="list-style-type: none"> ▪ Direct mail ▪ Customized marketing materials ▪ Personalize collateral 	PostScript PDF PPML/VDX VSP
HP Indigo	SmartStream	HP SmartStream Designer provides variable data printing and imposition tools designed specifically to optimize output from the HP Indigo digital press. Its increasing creativity and functionality give it the power to generate seamless jobs with personalized images, barcodes, charts, and more.	Macintosh Windows	Standalone	<ul style="list-style-type: none"> ▪ Marketing collateral ▪ Direct mail ▪ Personalized postcards ▪ Photo specialty 	PostScript PDF PPML PPML/VDX JLYT

Appendix C: Interview Questionnaire

Demographics

1. What is your job title?
2. How long has your company been in operation?
3. What bracket describes your company's revenues in the last year? (Less than \$5 million / \$5 to \$10 mill / \$11 to \$20 million / More than \$20 million)
4. How many employees are in you company currently?
5. What is your main type of printing operation if not digital?
6. What do you produce? (Print / Internet / Pops / Packaging)
7. How long has your company been working with VDP?
8. How many employees control or work with the production on VDP jobs?
9. How many designers do you have setting up the pre press side of your VDP operations?
10. On average, how many VDP jobs do you run monthly?
11. Of the digital printing jobs you have had in the last year, how many are VPD jobs?
12. What percentage of your VDP jobs are large jobs?
13. Please describe your current VDP setup and production workflow.
14. What is your competitive advantage? Does VDP contribute to this?
15. How do you sell VDP versus conventional print?
16. Is your company resistant to changing technology?
17. How do you target your audience?

Design

1. Quark or InDesign?
2. Design in-house /outsource / freelance... Who do you use?
3. How do you locate these designers?
4. Is there any type of approval needed / test done/ questions asked before a designer is hired for a VDP job?
5. Do multiple designers work together on the same project?
6. What is the most common type of VDP job you produce?
7. How direct is the connection between the designer and the client? That is,. is there a medium like a CSR?
8. What limitation do you feel your designers have with VDP now?

IT

1. What is your current IT supports for VDP?
2. How often is XML, Perl, or other coding needed or used in VDP jobs?
3. Access, SQL or Oracle?

Database

1. What program do you use to store your data?
2. Do you use a desktop application / plug in / network?
3. How are your databases organized?
4. Do you offer data mining services?

5. Who is responsible if the data is incorrect?
6. Are you aware that 17% of data is corrupted each year?
7. Where does the data come from? Customer? Vendor list? Live feed?
Marketing?
8. How do you build lists?
9. Do you build your own “relationship data lists”?

Mailing

1. What kind of mailing software do you use?
2. Do you have any limitations on jobs due to standards in mailing?
3. Are your mail pieces CASS certified?
4. Do your designers understand USPS regulations before you hire them? Is this vital to know beforehand?

Equipment/ Software

1. In what year approximately did you get your first digital press?
2. What type of output equipment do you use for processing your VDP jobs?
3. What file formats work with your output system? (PDF, PPML, VDX, VIPP)
4. Is there a preferred file format?
5. Have you experienced any RIP problems due to file formatting in VDP jobs?

6. What type of software programming do you use for processing you VDP jobs?
7. What type of interface does your software system utilize? (Drag and drop / coding / scripting / combination)
8. How does your system handle problems like text reflow?
9. Are you using your VDP system to its full capacity?

Hiring

1. How do you seek new employees?
2. What are you expectations when hiring for a new designer in a VDP position?
3. What are important skills you look for before hiring someone in VDP?
4. What level of education do you expect from an employee hired to setup VDP jobs?
5. When hiring new employees for VDP, which is more important to you, knowing the theory behind VDP or knowing how to operate and use your particular VDP system?
6. What is the job title given the person hired to design for VDP?
7. Are you willing to invest time / money to train new employees?
8. Are you prone to hire someone new with advanced skill sets over training old employees?

9. In the past five years, have you hired an employee for VDP who needed additional training immediately after being hired?

Expectations

1. What is your view on the growth of VDP in the industry?
2. Do you see the demand for VDP increasing in the next year for your company?
3. What would you like to change about your current VDP workflow?