Judging the Need for and Value of DDA in an Academic Research Library Setting

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Abstract

This article reports findings from a multiphase analysis of demand-driven acquisitions (DDA) within the academic research library setting. Evaluating local collections within the context of Trueswell’s (1969) often-cited 80/20 Rule, phase one of this study illustrates the deficiencies of a just-in-case approach to building library collections. Following from this, phase two evaluates the viability of DDA as the just-in-time collection-building solution librarians have sought as an answer to low-use titles that plague most academic library collections. Supported by 16 months of data, this study scrutinizes the comparative value of DDA against traditionally acquired titles along two key dimensions—the subject-matter profile of purchases and their overall usage levels. Further, the concept of a utility as value paradigm, as well as a purchase-use equilibrium for library collections, provide a theoretical framework in which the relative value of DDA is assessed. From a content, or subject-matter, perspective, this study finds negligible deviation in those purchasing patterns associated with DDA when compared with traditionally-acquired materials. At the same time, DDA titles experience much higher levels of use and are, therefore, associated with markedly lower cost-per-use figures and greater overall value.
Introduction

Libraries are continually in a position where they must justify the purchasing decisions they make, the services they provide, and in some cases their very existence. What’s more, the historical trends within the areas of monograph acquisition and overall collection utilization have represented an elephant in the room for academic libraries. Specifically, on a national level, hundreds of millions of dollars have been expended to procure high quality content that rarely, if ever, is actually used. In turn, this idea of utilizing a *just-in-time*, rather than a *just-in-case*, approach to library acquisitions has taken center stage within librarianship. Side-stepping the potentially contentious issue of what drives collection use, if not content quality, the need to produce immediate results in the face of administrative oversight has led librarians to demand-driven acquisitions\(^1\) (DDA) as a possible solution to low-use collections.

Over the past two years, the University of Alabama (UA) Libraries has worked with GOBI Library Solutions from EBSCO (GOBI) and EBSCO Information Services (EBSCO) to design and implement a robust DDA program to drive the purchase of e-books. As one might expect, a great deal of planning went into the design and implementation of this program. Indeed, an entire article could be dedicated to these activities alone. However, this is not the central topic of interest here. While some details regarding planning and implementation are shared as context for interpreting the findings of this research, this study is more directly aimed at understanding DDA program outcomes. This research provides an in-depth study of the first 16 months of purchasing and use data associated with the DDA program at UA Libraries.

In the pages that follow, an overview is provided for the literature surrounding DDA in the academic library setting. This includes a discussion of the dilemma presented by unused content.

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\(^1\) Also frequently referred to as “patron-driven acquisitions” (PDA).
Judging the Need

library collections, as well as the collection development approaches atop which this issue rests. The breadth of systemic dysfunction in traditional collection development approaches is described and provides a jumping off point for a discussion of the fundamental ways in which DDA programs differ. Details regarding the functional elements of a DDA program are outlined, as well as findings from previous studies of DDA program implementation in the academic library setting. Finally, methods and findings are discussed for a research study aimed at answering important questions about the function and value of DDA within the context of the UA Libraries system and beyond.

Literature Review

The idea of building library collections around the needs of users is nothing new (Breitbach and Lambert, 2011; Gilbertson et al., 2014; Lugg, 2011). “Selecting the most appropriate content for a community is a challenge librarians have faced since the dawn of libraries” (Breitbach and Lambert, 2011, p. 17). However, in recent years, with fiscal constraint as impetus, the paradigm driving how collections are built is evolving (Gilbertson et al., 2014; Lugg, 2011; Snider, 2016). Under this new paradigm—which is essentially economic in nature—the quality of a collection is most readily defined by how frequently it is used. Secondarily, the value of any approach to building such a collection is viewed in light of the need for staffing efficiencies and ever-increasing constraints on physical spaces within libraries (Downey et al., 2014; Fisher et al., 2012).

The Problem of Unused Collections

For as long as there have been libraries, librarians have sought to build collections of information resources (e.g., clay tablets, scrolls, books, etc.) around the desires and needs of the library user. However, the unfortunate truth that a majority of high quality print collections
within academic libraries are never used has only come to light in the last few decades.

According to many, the work of Trueswell (1969), led to this remarkable realization. In his short, three-page article, he applied a simple business principle to library collections—the 80/20 rule. In a nutshell, Trueswell (1969) was able to illustrate how 80% of print circulation within an academic library could be attributed to roughly 20% of that library’s collection (Fulton, 2014; Gilbertson et al., 2014; Goedeken and Lawson, 2015; Perdue and Van Fleet, 1999).

In years since, scholars have expanded on the work of Trueswell, providing for additional statistical rigor and understanding of his work and, more generally, the 80/20 rule itself (e.g., Burrell, 1980, 1982, 1984 and 1985; Burrell & Cain, 1982; Chen et al., 1993; Eghee, 1986; Turner, 1980). Most prominently, Burrell (1985) urged against misconstruing the work of Trueswell and others, whose research “were based purely on empirical studies” (p. 24). Instead, Burrell (1985) endorses a research approach that incorporates “a theoretical model of library operations” (p. 25). Moreover, he is able to show how several factors, including the way in which “circulation” is defined, influence the probability distribution that describes circulation of any particular library’s collection (Burrell, 1985). Thus, what has been called the “80/20 rule” may actually manifest, depending on the aforementioned factors, as an 80/30, 80/40, or some other distribution.

The accuracy of this accepted rule of thumb (i.e., the 80/20 rule) aside, several circulation studies within the academic library setting have produced findings similar to that of Trueswell—findings that illustrate how a substantial proportion of academic library collections do not

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2 E.g., (a) the size of the collection, (b) average circulation levels for items within that collection, as well as (c) the span of time encompassed by the circulation data under study.

3 A probability distribution is a mathematical function that describes the chance of any particular occurrence within a defined sample space. For example, a probability distribution that describes the outcome of a coin toss (e.g., heads or tails) is framed within a sample space defined by the number of possible outcomes for a single coin, and the number of times the coin will be tossed.
circulate\textsuperscript{4} (Gilbertson et al., 2014; Goedeken and Lawson, 2015; Rose-Wiles and Irwin, 2016). The *University of Pittsburgh Study* of 1979 found that less than 40\% of books purchased in 1969 had circulated even once during the following six-year period (Bulick et al., 1979). This led Bulick et al. (1979) to assert, “…if a minimum of two uses is set as the criterion…54.22\% of the collection would have not been ordered” (p. 42). Additional circulation studies throughout the ensuing decades have affirmed the findings of Trueswell (1969) (Fulton, 2014; Goedeken and Lawson, 2015; Rose-Wiles and Irwin, 2016). One of the more recent studies, a 2010 report out of Cornell University, noted that 55\% of those books purchased since 1990 had not circulated once (Fulton, 2014; Goedeken and Lawson, 2015). Four years later, an analysis of print circulation across member libraries of the Ohio Library and Information Network (OhioLINK) showed that, collectively, 80\% of print circulation was generated by just six percent (6\%) of holdings (Fulton, 2014; Gammon & O’Neill, 2010).

The collection development shortcomings revealed through circulation studies, in conjunction with increasing fiscal stricture and scrutiny, have led to the emergence of a new paradigm for building academic library collections (Gilbertson et al., 2014; Goedeken and Lawson, 2015; Lugg, 2011; Snider, 2016). Whereas libraries have traditionally concerned themselves with acquiring materials of the highest intellectual quality *just-in-case* they will effectively meet some future need, the idea of instead using DDA to build *just-in-time* collections has been gaining support (Gilbertson et al., 2014; Lugg, 2011; Perdue and Van Fleet, 1999).

\textsuperscript{4} It is worth note that while some studies have addressed the in-house use of library collections (i.e., browsing), a majority do not address this particular form of material use. What’s more, this type of material use is not addressed within the current study, due to: (a) a lack of browsing data for the periods under study, and (b) intellectual uncertainty as to validity and reliability associated with these type of data when used as proxy for collection use or value.
Meeting User Need

Many scholars have, perhaps incorrectly, relegated DDA solely to the realm of electronic materials. However, even before the term itself was coined, the concept was already in practice within academic libraries. For many years, libraries have catered to the immediate needs of their users through the fulfillment of inter-library loan requests, as well as outright purchases made on recommendation (Gilbertson et al., 2014; Lugg, 2011). In fact, inter-library loan requests, as proxy for user need, have been particularly effective in helping to steer the procurement of print collections that serve the demonstrable need of a library’s user base (Lugg, 2011; Perdue and Van Fleet, 1999; Tyler et al., 2014; Walters, 2012). There is little doubt that, in general, such practices qualify as a form of DDA. However, with the proliferation of information technology witnessed over the past two decades, a more direct form of DDA, which is integrated into the information seeking process itself, has emerged with significant potential for building high-quality, in-demand e-book collections.

The concept of DDA, as it is most readily understood today, emerged in 1990 as an approach to building high-demand e-book collections. As noted by Polanka and Deliquié (2010), the first DDA product for e-books was created through a collaboration between NetLibrary and the Colorado Alliance of Research Libraries. “The Alliance proposed to NetLibrary an option to buy only the books that patrons read. This was based on knowledge that many print books went unused. Since e-books were a new medium, the Alliance wanted to guarantee a sound investment by purchasing only titles that people used” (pp.119-120). Since that time, a host of academic libraries have waded into the waters of DDA with varying, but mostly positive, results.

The Mechanics of DDA
To better understand the results of e-book DDA programs at various academic libraries, it is imperative that one first understand the way in which such programs work. The typical DDA program begins with a selection profile like those used to steer approval plans (Egan et al., 2016; Fulton, 2014; Gilbertson et al., 2014; 2016; Longley, 2016; Rogers et al., 2017). In creating the profile, one can limit titles by subject, publisher, cost, or other vendor-enabled limits (Buck and Hills, 2017; Longley, 2016; Rogers et al., 2017). Rogers et al. (2017) specifically note the value of more granular filtering options that are available on some e-book platforms, which can help ensure more appropriate content acquired in a more controlled fashion (Rogers et al., 2017).

Once the DDA profile is established, an initial batch of machine-readable cataloging (MARC) records for DDA e-book titles that meet profile parameters are loaded into the local OPAC or discovery layer (Egan et al., 2016; Gilbertson et al., 2014). After the initial load additional records can be added on an ongoing basis, based on the selection profile. Records might also be added on an irregular schedule, based on some other criteria, such as expanding titles in a subject area where some need is present (Rogers et al., 2017). Occasionally, titles are removed due to lack of use (Buck and Hills, 2017), association with unsustainable purchasing patterns (Longley, 2016), or some other intervening factor (Goedeken and Lawson, 2015). The auto-weed feature provides an automated means of withdrawing records that have not seen use, which can help keep the total number of DDA records at manageable levels as new titles are continually added (Buck and Hills, 2017).

Once in place, MARC records for DDA titles allow library users to discover and access the full-text of those e-book titles—often before they have been purchased (Gilbertson et al., 2014). Indeed, it is the user’s interaction with that content that will trigger a purchase (Egan et al., 2016; Longley, 2016). Since records are only brought to the attention of a user through their
own information discovery process (i.e., at the point of need), users will only interact with those titles for which there is some demonstrable need (Buck and Hills, 2017; Fulton, 2014; Longley, 2016; Rogers et al., 2017; Snider, 2016).

Triggers are an important part of any DDA program, as their activation parameters are meant to recognize need through use—triggering a purchase when appropriate. There are two common purchasing models, which use similar triggers that can vary across vendors (Snider, 2016; Zhang et al., 2015). One such model is the single-trigger model (Snider, 2016). Here, a single trigger event leads to an outright purchase of the title being used (Goedeken and Lawson, 2015; Snider, 2016). Triggers typically conform to what has been called the 10-10-1-1-1 paradigm (Goedeken and Lawson, 2015; Polanka and Deliquié, 2010; Zhang et al., 2015). Here a title is purchased upon completion of any of the following trigger events: 10 minutes viewing a title, 10 pages of that title viewed, and either one download, print, or copy (Longley, 2016; Rogers et al., 2017). A second available purchasing model involves what are called short-term loans (STLs). Here purchases occur after one or more STL trigger events, which typically conform to the 10-10-1-1-1 parameters (Zhang et al., 2015), but can vary across publishers (Buck and Hills, 2017). In addition, each STL, aside from the final one that triggers an outright purchase, is associated with a cost that currently falls into the range of 20-25%\(^5\) of the list price of the title (Egan et al., 2015; Longley, 2016).

**Fine-Tuning DDA**

For many years, lack of librarian mediation has stood as a central criticism of the DDA approach to building collections (Fulton, 2014). As Walters (2012) points out: “The available evidence supports the idea that librarians have an important and necessary role as mediators” (p.

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\(^5\) A widespread increase in STLs prices occurred in 2014. Before that time, STL price averaged about 10%. (Buck and Hills, 2017).
200). However, it should also be noted that there are DDA products that allow for significant librarian oversight (Fulton, 2014; Rogers et al., 2017). Just as profiles can be customized, so too can purchasing models and triggers (Buck and Hills, 2017; Rogers et al., 2017; Sinder, 2016). For example, one might alter the number of STLs that must occur before a purchase, or pre-set the type of access license purchased (Buck and Hills, 2017). Such program customization has been especially useful in more recent years, as STL costs have risen and publishers are increasingly moving to embargo or eliminate STL options for their titles (Buck and Hills, 2017). Importantly, DDA customization allows librarians to more effectively steer DDA as a longer-term collection development tool (Fulton, 2014; Rogers et al., 2017).

**DDA Outcomes**

While the first DDA programs were implemented in libraries over 20 years ago, the technology has just recently begun to receive widespread acceptance as a viable collection development solution (Goedeken & Lawson, 2015; Sinder, 2016). As previously mentioned, a great deal of the interest shown toward DDA is driven by the idea of building just-in-time, rather than just-in-case, collections (Gilbertson et al., 2014; Lugg, 2011; Perdue and Van Fleet, 1999). And while research in this area remains relatively sparse, the findings of a handful of studies show wide agreement in the fact that DDA programs are helping to build collections that are highly relevant for local users, as evidenced by their demonstrated utility.

As DDA purchases are triggered by use, the collections that result are implicitly associated with higher levels of initial use than traditionally acquired collections. However, even more important is the fact that these collections also see higher levels of continued use after purchase (Downey et al., 2014; Gilbertson et al., 2014; Longley, 2016). Additionally, the subject-matter profile of these collections often aligns closely with the research profiles of the
parent institution (Bennett, 2016; Downey et al., 2014). As Longley (2016) notes, these benefits help to show DDA as a cost-effective solution for putting library users in contact with high quality content at the point of need.

**Background**

The University of Alabama has experienced substantial growth in student enrollment in recent years—growing from 19,633 in 2001 to 37,665 in 2016. Ranked 46th among public universities by U.S. News and World Report in 2017, this four-year, doctoral-granting university offers more than 80 undergraduate programs in 12 colleges, and over 150 advanced degrees across a wide range of disciplines. To support the research and educational mission of the university, UA Libraries provides access to a robust collection of tangible and electronic resources. Holdings of UA Libraries include over 4 million volumes and access to approximately 200,000 serial titles. UA Libraries also provides access to over 550 major electronic resources via Springshare’s A-Z Database Management Tool.

As a first step in promoting greater efficiency in acquiring library materials, a workflow analysis was carried out to assess library acquisition processes and collection priorities. A significant area of concern discovered early on was the inefficiency of existing practices related to approval plans. UA Libraries had an established approval plan through YBP (now GOBI Library Solutions from EBSCO), which had experienced fluctuations in recent years. This included a decrease in the number of books received. Further, associated expenditures had dipped to $75,000 while over $1.1M was expended through librarian-mediated firm-orders.

The diminished approval plan profile reduced the number of title notifications and required librarians and acquisitions staff to firm-order more content. This is less than ideal for a library spending upwards of $1 million on books. However, the prevailing opinion among
librarian selectors was that the approval plan profile did not accurately reflect the needs of a large research library. Therefore, a complete review of that plan profile would be essential to addressing inefficiencies. Consequently, that review process would also provide a more stable platform for a leap into DDA.

Implementation of Demand-Driven Acquisitions

The library reviewed the approval plan profile in the fall of 2015 to coincide with the beginning of fiscal year (FY) 2016. The review was planned with three specific goals in mind. First, expand the approval plan to improve efficiency—increasing the number of print and e-books acquired automatically rather than relying on firm-order selections. Second, increase the pool of notifications for titles aligned with local curriculum, though not considered a close enough match to trigger a purchase. Finally, and perhaps most critical, was the need to expand the profile in order to drive demand driven acquisitions.

With GOBI and a new approval plan profile driving selection and acquisition, the amount of money expended on approval plan purchases increased from around $75,000 in FY15 to over $280,000 in FY16. Firm-ordering was greatly reduced based on these changes. In turn, the reduction in time spent on the selection allowed for new efficiencies elsewhere. Additional staff time was now available to focus on implementation of shelf-ready processing and the introduction of DDA. Following these comprehensive changes, the efforts of librarian liaisons shifted from title selection to outreach and support for academic programs. This change meant liaisons would now occasionally review the profile to ensure it represented the needs of the institution while spending much less time on selection and firm-order of materials.

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6 The University of Alabama adheres to an October 1st through September 30th fiscal year.
Demand driven acquisitions began in March 2016 and the program has since seen steady growth. The robust approval plan profile managed by *GOBI Library Solutions from EBSCO* drives selection of titles that match the educational and research needs of academic programs at UA. The e-book title list generated from the profile, checked against DDA availability on the EBSCO platform, generates the DDA pool. EBSCO then makes those titles available to the university community via MARC records that are loaded into the UA Libraries website discovery layer.

**Data and Methodology**

The discourse surrounding DDA revolves around a few specific concepts and questions that this study is geared toward addressing. Perhaps the most important concept driving the widespread adoption of DDA is the apparent lack of utility associated with librarian-mediated print title selections. As pointed out within this article’s literature review, a host of circulation studies conducted over the last 50 years have helped to establish this concern within the library community. Librarians spend a great deal of time making such selections, and there is little doubt that such selections are of high quality. Yet, a large portion of these titles are never used. Coupled with the fiscal constraints faced by most libraries, low-use titles become a problem that librarians cannot afford to overlook. Here a preliminary research question presents itself: *Does the 80/20 rule apply to the UA Libraries collection?*

With the ability to support a seamless, convenient, and traceable try-before-you-buy purchasing model, DDA programs would seem a viable solution for those concerned with wasted dollars spent on unused collections. Of course, when considering any automated collection development solution, several additional questions are raised. In the case of DDA,

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7 Consider that libraries can provide their users with access to content that has not yet been purchased. The vendor (and library) can monitor usage of that content, triggering outright purchase when usage levels warrant such action.
librarians want to know: *In what ways, if any, will a DDA program alter the subject-matter profile of a library collection? How do usage levels of DDA selections differ from librarian-mediated selections? What overall value is realized through a DDA program?* These are the research questions that help drive this study.

To set about answering these wide-ranging questions, the researchers utilize a multi-phase analytical approach. In the first phase, historical circulation data for the UA Libraries collection is subjected to a simple descriptive statistical analysis framed within the context of Trueswell’s 80/20 Rule\(^8\). For this portion of the analysis, which is effectively exploratory in nature, no hypotheses are offered.

In the second analytical phase of this study, attention turns to more recent purchasing and usage data for librarian-mediated and DDA purchases. Here the unit of analysis shifts from the collection to the sub-collection level, as defined by the Library of Congress Classification (LCC). These data provide a foundation for answering questions related to the subject-matter profile and relative usage levels for these collections. Importantly, this phase is also exploratory in nature. Therefore, here too, no hypotheses are offered. Instead, the objective is to merely offer a descriptive analysis of how purchase and usage rates for DDA and librarian-mediated purchases compare and contrast across the LCC range.

As phase three of this study deals with *value*, it is important to define this somewhat subjective concept. Unfortunately, discussions of value relative to DDA have potential for

\[^8\] The reader should note: Within the context of this study, the 80/20 rule is used merely as commonly cited point of reference and readily accessible framework in which circulation study findings might be understood. While there exist valid criticisms regarding the methodological approach used by Trueswell (1969), the authors would contend that such criticisms are inconsequential within the context of this study. That is to say, the exact deployment of the 80/20 rule in relation to understanding circulation is secondary to the well-established fact that a significant proportion of large research library collections rarely, if ever, circulate. Further, the authors do not intend to equate the frequency of a particular title’s circulation with that title’s intellectual value, but rather as a possible indicator of inopportune expenditure of collection funding that comes at the expense of purchases that might prove more appropriate and beneficial to local users.
digression into deeper philosophical waters, due to what some consider the controversial paradigmatic foundation on which DDA rests. To be clear, this paradigm equates an individual title’s value to its demonstrated (i.e., empirically verifiable), rather than conceptual, utility. This contradicts the traditional collection develop paradigm, which defines value as a concept completely divorced from demonstrated utility and, instead, more in line with the quality, timeliness, and source authority of the title’s informational content. To be clear, this alternative paradigm does not necessarily eschew those qualities driving more traditional acquisition approaches; they are simply not positioned as the central focus.

Clearly, there is sufficient room for debate on the matter of how one defines the value of library collections. However, such a debate will not be had here. Instead, the reader should understand that this study is framed within a utility as value paradigm—a paradigm that equates value with demonstrated utility. With that said, there remains a matter of operationalizing value within the context of this study. Here, value is most directly defined by the relationship between title cost and use. Cost is the amount paid for a title, while use is defined by the number of full-text views of said title. In addition to analyzing these two variables separately, a cost-per-use (CPU) metric derived from the total cost of a title divided by its use, acts as a meaningful compound value metric.

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9 There are a wide variety of organizational costs that one might roll into a cost analysis. For example, analyzing personnel costs in relation to library acquisitions would be appropriate within the context of an organizational cost/benefit analysis. However, there are several reasons why such costs are not analyzed by this study. First, this study does not take the form of an organizational cost/benefit analysis, but rather solely an analysis of collections costs in relation to use. Second, DDA was not meant to replace, but rather supplement, traditional acquisitions within the local context. Therefore, quantifying the portion of personnel costs attributed specifically to DDA vs. print materials would call for a much more complex methodological approach. Third, organizational measures, such as personnel costs, tend to be highly specific to the immediate, local context—often necessitating the inclusion of additional data in the form of various control variables (e.g., controlling for the local cost of doing business, which varies from one community to the next). In order to keep the current study practical, as well as generalizable to a broader set of libraries, the researchers have chosen the less complex route described herein.
Regarding the third phase of this study, which takes advantage of inferential statistical methods, the following null and alternative hypotheses are offered:

$H_0$: DDA and librarian-mediated purchases are used at the same rate, and are associated with statistically indistinguishable cost-per-use figures.

$H_1$: DDA purchases are associated with higher levels of use than librarian-mediated purchases.

$H_2$: DDA purchases are associated with lower cost-per-use figures than librarian-mediated purchases.

**Analytical Approach**

As seen in similar studies, descriptive statistical methods provide for a substantial portion of the analytical approach used here. The first two analytical phases of this study, regarding the 80/20 Rule and the subject-matter profile of DDA selections, will exclusively utilize descriptive statistical methods. Similar methods will also provide preliminary answers during phase three, regarding the overall value of the DDA program. However, these descriptive methods are also supplemented by inferential methods that provide for additional rigor in the evaluation of value. These methods will be described in greater detail in the pages that follow.

**Data Procurement & Cleanup**

**Phase One.**

A variety of data supplement this study. For the first phase, item-level circulation data are harvested from the Voyager integrated library system (ILS) for the years 1990 through 2017\(^{10}\). The database query created for this purpose keyed off the unique item record identification number (item ID) of each library volume cataloged within the system to pull all historical data falling within this time period represent all available data within the local Voyager ILS at the outset of this study.
charges associated with those volumes, which are held within a separate database table. Item IDs associated with both un-suppressed and suppressed holdings records (MFHDs) were included in these data. This ensured that all historical circulation for the target period was included.

At this point it is worth noting that the definition of circulation that is used will affect which data are harvested for this portion of the study. For this study, *circulation* is defined as the total number of initial charges, and renewals, associated with any given volume (as defined by a unique item ID). These circulation data have also been limited to the book item type, which is locally defined within the Voyager system. As the reader is likely aware, books are defined as monographic, as opposed to serial, publications.

*Phase Two.*

The evaluation of any DDA program is heavily dependent upon vendor-supplied data. For this study, the authors worked closely with personnel at EBSCO to procure title-level purchasing, descriptive, and usage data for firm-order and DDA e-book purchases occurring over the first 16 months of DDA program activity.

With the vendor-supplied data in hand, focus turns toward harvesting the in-house data required for this phase of analysis. Here data are pulled from two sources: the GOBI system and the Voyager ILS. First, details for all librarian-mediated purchases for tangible print materials enacted in the 16 months prior to DDA implementation, are harvested from the GOBI acquisitions system. Then circulation data for that same period are harvested from the Voyager ILS. The database query used here provides a data set that includes Item IDs, ISBNs, LCC call
numbers, and charge dates for all circulation transactions. Pairing of these data with the aforementioned GOBI data is facilitated via an ISBN matching protocol\(^{11}\).

To facilitate manageable and meaningful comparisons for procurement and usage across the LCCs, raw counts of title purchases and content views are converted to percentage rates of total procurement and usage. This approach nullifies any data offset caused by variable scales of measure between purchasing and use. What’s more, this approach facilitates a more meaningful comparative analysis.

**Phase Three.**

To support the use of inferential methods in phase three of this study, the researchers use the IBM SPSS software package for statistical analysis (SPSS) to derive a random 50% (approx.) sample\(^{12}\). This is done to satisfy the implicit assumption of an independent, random sample that forms the foundation of all inferential methods. Additional assumptions that must be met require data that conform to a normal distribution and feature homogeneity of variance. However, a Shapiro-Wilk test for normality (*Table 1*) reveals that these data are not normally distributed. Additionally, Levene’s test (*Table 2*) reveals that a homogeneity of variance is not present. Therefore, with

\[\text{Table 1} \quad \text{Shapiro-Wilk Test of Normality}\]

<table>
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<th>Variable</th>
<th>Statistic</th>
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<td>Days in Use</td>
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<td>4249</td>
<td>0</td>
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<td>Cost</td>
<td>0.87</td>
<td>4249</td>
<td>0</td>
</tr>
<tr>
<td>Full Text Views</td>
<td>0.52</td>
<td>4249</td>
<td>0</td>
</tr>
<tr>
<td>Cost-Per-Use</td>
<td>0.822</td>
<td>4249</td>
<td>0</td>
</tr>
</tbody>
</table>

\[\text{Table 2} \quad \text{Test of Homogeneity of Variances}\]

<table>
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<th>Levene Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
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<tbody>
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<td>Days in Use</td>
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<td>4246</td>
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<tr>
<td>Cost</td>
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<td>2</td>
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</tr>
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<td>2</td>
<td>4246</td>
<td>0</td>
</tr>
</tbody>
</table>

\(^{11}\) During the course of this research, it was found that many bibliographic records within the ILS featured no ISBN. While this problem did not affect any of the titles purchased during the period under study, it was prevalent among titles purchased in the 10 or more years prior to the period under study.

\(^{12}\) \(n = 3,700\)
regard to descriptive analyses of these data, median and interquartile range will be used instead of mean and standard deviation. For inferential testing, the non-parametric Kruskal-Wallis test will be used instead of a standard analysis of variance (ANOVA).

**Analysis and Findings**

During the first 16 months of DDA implementation, bibliographic records for 31,530 untriggered DDA titles were loaded into the EBSCO Discovery Service EDS layer accessible through the UA Libraries website. While the mean monthly load was over 2,100, this number is deceptive due to a few outlier months. As seen in Table 3, over 88% of DDA records loaded are associated with just three months of activity (i.e., April, October, and December of 2016). These three loads correspond to an initial retrospective title load and two additional adjustments to non-subject profile parameters aimed at expanding the size and scope of the DDA pool.

After 16 months of activity logged by the earliest loaded DDA titles, 8,266 (26%)\(^{13}\) have experienced use. For DDA titles, as with most e-book titles, vendor-provided usage data is broken down into abstract and...
full-text views. However, for the purposes of this study, only full-text views are of interest. Therefore, within this study use for e-books (DDA and firm-order) is defined as the number of full-text views, while a combination of initial check-outs and renewals defines this variable in relation to tangible print books. This decision is most notably driven by a desire to reach the closest possible comparative ground for both tangible print and electronic book titles.

Table 4 shows basic usage stats across all DDA and firm-order categories. Interestingly, untriggered DDA titles (i.e., titles that have not yet been purchased) account for over 20% of all DDA title usage and 17% of usage across all four analytical categories listed in Table 4. This is quite striking, considering this content use is provided at zero cost. Of course, as one would expect, 100% of purchased DDA titles within this data set are associated with use. Further, these titles account for 80% of all DDA full-text views, and 66% of all content use across all acquisition/format categories.

Firm-order e-book and tangible print purchases continued as the DDA titles were loaded and purchases triggered. This study analyzes a sample of 1,326 firm-order e-book purchases. Importantly, 95% (1,260) of these titles experienced use during the period under study and accounted for nearly 13% of all use activity (i.e., full-text views). A total of 5,154 firm-order print titles, purchased in the 16 months prior to DDA implementation, are analyzed here. During the period under study, 625 of these titles (12%) produced 1,150 circulations. This accounts for four percent (4%) of all use activity under study.

14 This was done to ensure no DDA effect, in regards to the usage levels of tangible print collections.
The 80/20 Rule

Before discussing Trueswell’s 80/20 Rule in relation to print collections, it seems worth noting that this study’s analysis illustrates this concept’s applicability within the realm of e-books. As alluded to in the previous section and outlined in Table 4, the 2,087 titles purchased via DDA represent 25% of all DDA titles associated with use. Further, these titles account for 80% of all DDA title use.

Viewing print circulation through the prism of Trueswell’s 80/20 Rule, 80% of all circulation since 1990 is supplied by 41% of the circulating collection (see Table 5). Here the authors are defining circulating collection as the collection of monographic titles that have circulated at least once since 1990. Importantly, the decision to analyze only titles that have circulated is in line with the approach used by both Trueswell (1969) and Burrell (1985). Unfortunately, it seems to be the case that some of the more recent circulation studies outlined within the literature missed this important point or, at the very least, did not believe it worth mentioning. However, as Burrell (1969) points out, the inclusion of zero-use titles within such an analysis can produce radically different findings.

Table 5

<table>
<thead>
<tr>
<th>Historical Circulation of Monographs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Monographs in Collection</strong></td>
</tr>
<tr>
<td>Volumes</td>
</tr>
<tr>
<td>1,045,886</td>
</tr>
<tr>
<td><strong>Monographs Circulated (since 1990)</strong></td>
</tr>
<tr>
<td><strong>80% of Monographic Circulation (since 1990)</strong></td>
</tr>
<tr>
<td><strong>Monographs Circulated (16-Month)</strong></td>
</tr>
<tr>
<td><strong>80% of Monographic Circulation (16-Month)</strong></td>
</tr>
</tbody>
</table>

15 A total of 8,266 DDA titles experienced at least one full-text view.
16 Untriggered and purchased DDA titles have a combined use of 24,407 full-text views. Purchased titles account for 19,445 full-text views, or approximately 79.7% of all full-text DDA views.
17 When zero-use titles are included within this study’s analysis, findings show that 80% of circulation since 1990 is provided by 21% of the entire UA Libraries collection.
If 51% of all book titles have circulated at least once, then 49% of the monograph collection has not circulated\textsuperscript{18} since 1990. As shown in Table 4, with the scope of inquiry narrowed to a sample of purchases that occurred in the 16 months prior to DDA deployment, 625 (12%) of 5,154 titles purchased by UA Libraries circulated at least once. As noted in the previous section, this activity generated a total of 1,150 charges, which represent slightly less than one percent (1%) of the 119,998 circulation transactions recorded during the same 16-month period. Similarly, the 625 new titles that circulated account for slightly more than one percent (1%) of the 43,920 monographic titles that circulated during that time. Within the context of the 80/20 rule, 80% of the monographic circulation during that 16 months was provided by: (a) 52% of the titles that circulated during that period, (b) five percent (5%) of the historical circulating collection, and (c) approximately three percent (3%) of the entire print monograph collection.

These findings are not shocking in that they correspond closely with the findings of previous circulation studies. Nevertheless, the value of carrying out such an analysis is in discerning the unique local-level variations in this seemingly global trend. Such an analysis informs a holistic understanding of one’s local collection, which supports deeper conversations about return on investment.

\textit{Subject-Matter Profile}

Moving on to the second phase of this study’s analysis, Fig. 1 shows the LCC subject-matter profile for all library holdings, along with firm-order print/e-book and DDA purchases. For the purposes of this graphic, firm-order print and e-book purchases are consolidated under the single heading of \textit{firm-order}. While such consolidation will not always be appropriate, in this

\textsuperscript{18} As Burrell (1985) notes, reporting the number of zero-use titles is highly unreliable. So while it can be said here that 49% of the collection did not circulate over the past 20 years, it is difficult to say with any certainty how many of those items failed to circulate in the period before 1990.
case, where subject-matter profiles are the topic of interest, such consolidation is acceptable. Indeed, this approach helps to nullify purchasing variations tied to format (i.e., e-book versus print), which are not germane at this time.

As one can see, there is substantial agreement across the LCC profile for DDA and both historical and current librarian-mediated purchases, with differences averaging less than three percent (3%). What’s more, as shown in Table 6, the average LCC profile difference when comparing DDA purchases to all print monograph holdings is half the amount seen when comparing DDA with more recent librarian-mediated purchases made in the 16 months prior to DDA deployment. This is due to the unique acquisitions program foci one might expect to see over such a short span of time, as more immediate academic program needs present themselves. Of course, where the firm-order category represents more current and immediate program goals, all holdings represent long-term collection development trends within the collection. Overall, the relatively similar purchasing levels seen across the LCC range suggest that the subject-matter
Judging the Need

profile of DDA selections align relatively well with current and historical librarian-mediated purchases. Of course, in cases of above-average difference between categories, one can glean additional insight.

<table>
<thead>
<tr>
<th>LC Class</th>
<th>All Holdings</th>
<th>Firm-Order</th>
<th>DDA</th>
<th>All Holdings vs. Firm-Order</th>
<th>All Holdings vs. DDA</th>
<th>Firm-Order vs. DDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.40%</td>
<td>0.10%</td>
<td>0.30%</td>
<td>0.30%</td>
<td>0.10%</td>
<td>-0.20%</td>
</tr>
<tr>
<td>B</td>
<td>6.90%</td>
<td>7.40%</td>
<td>10.70%</td>
<td>-0.50%</td>
<td>-3.80%</td>
<td>-3.30%</td>
</tr>
<tr>
<td>C</td>
<td>0.70%</td>
<td>1.30%</td>
<td>0.70%</td>
<td>-0.60%</td>
<td>0.00%</td>
<td>0.60%</td>
</tr>
<tr>
<td>D</td>
<td>6.90%</td>
<td>6.60%</td>
<td>8.90%</td>
<td>0.30%</td>
<td>-1.90%</td>
<td>-2.20%</td>
</tr>
<tr>
<td>E</td>
<td>3.50%</td>
<td>3.00%</td>
<td>4.30%</td>
<td>0.40%</td>
<td>-0.90%</td>
<td>-1.30%</td>
</tr>
<tr>
<td>F</td>
<td>2.60%</td>
<td>1.60%</td>
<td>2.70%</td>
<td>1.00%</td>
<td>-0.20%</td>
<td>-1.20%</td>
</tr>
<tr>
<td>G</td>
<td>2.50%</td>
<td>3.10%</td>
<td>5.00%</td>
<td>-0.50%</td>
<td>-2.40%</td>
<td>-1.90%</td>
</tr>
<tr>
<td>H</td>
<td>18.20%</td>
<td>12.40%</td>
<td>17.70%</td>
<td>5.80%</td>
<td>0.50%</td>
<td>-5.30%</td>
</tr>
<tr>
<td>J</td>
<td>3.30%</td>
<td>12.40%</td>
<td>3.20%</td>
<td>-9.10%</td>
<td>0.10%</td>
<td>9.20%</td>
</tr>
<tr>
<td>K</td>
<td>1.70%</td>
<td>1.30%</td>
<td>0.90%</td>
<td>0.40%</td>
<td>0.80%</td>
<td>0.40%</td>
</tr>
<tr>
<td>L</td>
<td>5.10%</td>
<td>3.10%</td>
<td>7.50%</td>
<td>2.00%</td>
<td>-2.40%</td>
<td>-4.40%</td>
</tr>
<tr>
<td>M</td>
<td>1.90%</td>
<td>5.30%</td>
<td>3.40%</td>
<td>-3.40%</td>
<td>-1.50%</td>
<td>1.90%</td>
</tr>
<tr>
<td>N</td>
<td>3.60%</td>
<td>3.50%</td>
<td>2.80%</td>
<td>0.10%</td>
<td>0.80%</td>
<td>0.70%</td>
</tr>
<tr>
<td>P</td>
<td>22.60%</td>
<td>28.90%</td>
<td>17.30%</td>
<td>-6.40%</td>
<td>5.20%</td>
<td>11.60%</td>
</tr>
<tr>
<td>Q</td>
<td>7.10%</td>
<td>2.80%</td>
<td>5.90%</td>
<td>4.30%</td>
<td>1.20%</td>
<td>-3.00%</td>
</tr>
<tr>
<td>R</td>
<td>2.90%</td>
<td>2.30%</td>
<td>2.90%</td>
<td>0.60%</td>
<td>-0.10%</td>
<td>-0.70%</td>
</tr>
<tr>
<td>S</td>
<td>0.40%</td>
<td>0.70%</td>
<td>0.10%</td>
<td>-0.30%</td>
<td>0.30%</td>
<td>0.60%</td>
</tr>
<tr>
<td>T</td>
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<td>0.60%</td>
<td>4.00%</td>
<td>5.40%</td>
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<td>-3.30%</td>
</tr>
<tr>
<td>U</td>
<td>0.90%</td>
<td>1.20%</td>
<td>0.80%</td>
<td>-0.40%</td>
<td>0.10%</td>
<td>0.50%</td>
</tr>
<tr>
<td>V</td>
<td>0.20%</td>
<td>0.10%</td>
<td>0.10%</td>
<td>0.10%</td>
<td>0.10%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Z</td>
<td>2.70%</td>
<td>2.30%</td>
<td>0.90%</td>
<td>0.40%</td>
<td>1.70%</td>
<td>1.30%</td>
</tr>
</tbody>
</table>

*Averages of the absolute value of percentage differences

<table>
<thead>
<tr>
<th>Percentage Differences</th>
<th>All Holdings vs. Firm-Order</th>
<th>All Holdings vs. DDA</th>
<th>Firm-Order vs. DDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.40%</td>
<td>0.10%</td>
<td>-0.20%</td>
</tr>
<tr>
<td>B</td>
<td>6.90%</td>
<td>7.40%</td>
<td>-3.80%</td>
</tr>
<tr>
<td>C</td>
<td>0.70%</td>
<td>1.30%</td>
<td>0.00%</td>
</tr>
<tr>
<td>D</td>
<td>6.90%</td>
<td>6.60%</td>
<td>-2.20%</td>
</tr>
<tr>
<td>E</td>
<td>3.50%</td>
<td>3.00%</td>
<td>-1.30%</td>
</tr>
<tr>
<td>F</td>
<td>2.60%</td>
<td>1.60%</td>
<td>-1.20%</td>
</tr>
<tr>
<td>G</td>
<td>2.50%</td>
<td>3.10%</td>
<td>-1.90%</td>
</tr>
<tr>
<td>H</td>
<td>18.20%</td>
<td>12.40%</td>
<td>-5.30%</td>
</tr>
<tr>
<td>J</td>
<td>3.30%</td>
<td>12.40%</td>
<td>9.20%</td>
</tr>
<tr>
<td>K</td>
<td>1.70%</td>
<td>1.30%</td>
<td>0.40%</td>
</tr>
<tr>
<td>L</td>
<td>5.10%</td>
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<td>-4.40%</td>
</tr>
<tr>
<td>M</td>
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<td>5.30%</td>
<td>1.90%</td>
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<tr>
<td>N</td>
<td>3.60%</td>
<td>3.50%</td>
<td>0.70%</td>
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<tr>
<td>P</td>
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<tr>
<td>Q</td>
<td>7.10%</td>
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<tr>
<td>R</td>
<td>2.90%</td>
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</tr>
<tr>
<td>S</td>
<td>0.40%</td>
<td>0.70%</td>
<td>0.60%</td>
</tr>
<tr>
<td>T</td>
<td>6.00%</td>
<td>0.60%</td>
<td>-3.30%</td>
</tr>
<tr>
<td>U</td>
<td>0.90%</td>
<td>1.20%</td>
<td>0.50%</td>
</tr>
<tr>
<td>V</td>
<td>0.20%</td>
<td>0.10%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Z</td>
<td>2.70%</td>
<td>2.30%</td>
<td>1.30%</td>
</tr>
</tbody>
</table>

*Averages of the absolute value of percentage differences

A majority of titles across all three categories shown in Fig. 1 come out of the P (Language & Literature) and H (Social Sciences) LCCs. A substantial percentage of titles are also associated with the B (Philosophy, Psychology, & Religion) and D (World History) classifications. Firm-order titles within the J (Political Science) classification significantly outpace those levels seen within the established collection profile, as well as with DDA purchases. This pattern conforms, albeit to a less pronounced degree, to the discrepancy seen
within the $P$ (Language & Literature) classification. Within the $T$ (Technology) classification, the base collection profile, as well as DDA selections, far exceed the level of firm-order activity.

As previously noted, a majority of the established collection, as well as those titles purchased through both DDA and traditional acquisition approaches, come from the $P$ (Language & Literature) and $H$ (Social Science) classifications. So, it makes sense to look at these portions of the collection more closely, which can be done by targeting the underlying LCC sub-classifications. Fig. 2 shows the top four sub-classifications, in terms of percentage of titles, acquired for all three analytical categories. Once again, while some minor differences can be noted, there remains substantial agreement between the established collection and those titles purchased through DDA and traditional, librarian-mediated selection. Therefore, on a descriptive
level, the subject-matter of DDA selections correspond closely to both historical and current librarian-mediated selections.

\textit{DDA Title Usage}

While the subject-matter of any particular resource remains relatively unaffected by format, usage activity is a completely different matter. Electronic and print materials differ in foundational ways that affect both their potential and effective utility (i.e., use). To better illustrate this point, consider the print title for a moment. If it is checked out by one user, it is not typically available to any other user. What’s more, check-out periods, on average, span multiple weeks or months. On the other hand, e-books, depending on their license, can often be available for use by multiple simultaneous users. Where a license limits use to a single user, shorter “check-out” periods mean the potential utility of these titles is still much greater than seen with tangible print titles.

While some will contend that such foundational differences across formats prevent a true apples-to-apples comparison, the authors of this study disagree. Indeed, we contend that such comparisons help to fully flesh out the important ways in which these formats differ—thus, illustrating the higher value potential for electronic materials. Moreover, if carried out in a careful and deliberate manner, with findings properly contextualized, there is no good reason to avoid comparing titles across tangible and electronic formats.

\textit{Purchase-Use Equilibrium}

In their article, Downey et al. (2014) rightfully note: “The best indicator of user requirements of a library collection is their actual use of the collection” (p. 146). Further, to quantify the performance of their collections, Downey et al. utilize a differential measure of the purchase and use rates for titles across the LCC range. While they do not describe any theoretical
underpinnings driving their approach, this methodology seems built upon the implicit premise that collection development efforts are considered most effective when purchase and use rates align. For example, if selections in the P classification represent 36% of all purchases, then, ideally, 36% of all use should come from those titles. While Downey et al. gave no name to the conceptual balance of purchasing and use rates, we have decided to refer to this concept as the *purchase-use equilibrium (PUE)*. Further, the measure of difference between purchasing and use is referred to as the *purchase-use differential (PUD)*.

Without additional study it is difficult to say whether or not the PUE is methodologically valid or useful in the context of collections assessment. Nevertheless, with this study classified as exploratory in many respects, and in the absence of any better comparative measure of title utility by LCC, the authors thought the idea worth building upon. Further, we believe the PUD of a collection of titles may help identify when, and by how much, purchasing outpaces use, or vice versa, for titles falling within a particular LCC. Here it is important to note that during this analysis the researchers found that, due to their fundamentally dissimilar use rates, mixing formats within a single analytical category produced misleading skew in PUD measures. Therefore, we recommend not mixing print and electronic formats in the same PUD matrix—though format-based comparisons across PUD matrices remain valid.

*Table 7* shows the results of a PUE Analysis across three analytical categories (i.e., DDA, firm-order e-book, and firm-order print). While the use variable within the work of Downey et al. is operationalized as the number of user sessions, this study utilizes full-text views. Once again, the basic idea is that purchasing and use rates for a collection of titles should, roughly, align. Moreover, where purchasing outpaces use, titles are characterized as *underutilized* and, therefore, one might consider slowing purchases for that classification. When use outpaces
purchasing, it would seem to indicate that a healthy market exists for the associated content and, therefore, one should consider increasing purchases within that LCC.

As shown in Table 7, the PUD for DDA selections is two-thirds less, on average, than the PUD for librarian-mediated selections. With the average PUD of one percent (1%) for librarian-mediated selections set as our threshold, there are just two instances where the PUD for DDA selections raise concerns. On the other hand, PUDs for firm-order print and e-book titles surpass the established threshold in several cases. As one might expect, the average use-per-title (UPT) for DDA titles is many times greater than is seen with firm-order print and e-book selections.
Value of DDA Collections – Descriptive Analysis

As previously noted, within the context of this study, value is defined by the use-cost of any particular title or collection of titles. However, it is important to recognize that the amount of use a particular title experiences is heavily dependent upon the amount of time that title has been available for use. Therefore, any meaningful comparison of titles purchased via DDA, versus traditional librarian-mediated selection, should control for this variable (i.e., days-in-use). With this in mind, it may not be enough to sample purchasing and use data for an equivalent period of time across all acquisitions categories and title formats19.

All three acquisitions categories feature relatively steady purchasing patterns over the 16-month periods sampled, as indicated by the fact that the average number of days these resources were available to library users is roughly equivalent. With this fact established, an apples-to-apples descriptive analysis of these data is possible. An aggregate (i.e., program-level) measure of cost-per-use (CPU) for each acquisition category is calculated to help better understand cost differentials. As shown in Table 8, the aggregate CPU for firm-order e-books is three times as high as seen with DDA purchases. In addition, the CPU is 21-times greater for firm-order print titles than DDA purchases.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Title Count</th>
<th>Average Days-in-Use</th>
<th>Full-Text Views</th>
<th>Total Cost</th>
<th>Aggregate CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDA</td>
<td>2,087</td>
<td>241</td>
<td>19,445</td>
<td>$216,410</td>
<td>$11</td>
</tr>
<tr>
<td>Firm Order E-Book</td>
<td>1,326</td>
<td>241</td>
<td>3,891</td>
<td>$151,512</td>
<td>$39</td>
</tr>
<tr>
<td>Firm Order Print</td>
<td>5,154</td>
<td>242</td>
<td>1,150</td>
<td>$255,830</td>
<td>$222</td>
</tr>
</tbody>
</table>

19 If purchasing patterns differ too much, the average number of days-in-use for titles within each sample will not coincide. Where this occurs, a valid apples-to-apples comparison of cost-per-use is not possible.
Although aggregate-level measures of CPU have been frequently used within the previous literature, a closer examination of this practice raises some doubts regarding the utility of this approach. For example, while this metric is perfectly acceptable for macro-level (i.e., program-level) assessment, it is not appropriate for micro-level (i.e., title-level) assessment. As Clark and Avery (1976) note, “In its most general form the aggregation problem can be defined as the information loss which occurs in the substitution of aggregate, or macro-level, data for individual, or micro-level, data” (p.428). In this case, the information lost is related to title-level variations in cost and use, which are essentially nullified.

For a title level analysis of value, it is important to utilize a title-level CPU measure. However, when one attempts to derive such a metric for non-DDA titles, zero-use titles pose a significant obstacle. Specifically, one cannot calculate CPU for a zero-use title, as this would require one to divide by zero, which is not possible. Nevertheless, to not include such titles in an analysis of value is unthinkable—as those titles are associated with sunken costs equivalent to, at minimum, their original purchase price.

To overcome the problem of zero-use titles, this study utilizes a title-level measure of cost-per-next-use (CPNU). Simply put, this metric is geared toward eliminating the zero-use title scenario by calculating the cost of a title at its next use, which for zero-use titles would be equal to a single use. Subsequently, when calculating this metric for titles that have previously experienced use, we also add one instance of use. While perhaps unconventional in light of established assessment protocols, this approach is methodologically valid and provides for an elegant solution to the problem of zero-use titles in a CPU scenario.

If these data conformed to a normal distribution, mean and standard deviation might prove useful descriptive measures, while an ANOVA would be an appropriate inferential method
for determining the statistical significance of our descriptive findings. However, the data being analyzed here are not normally distributed. Therefore, our analyses must utilize measures better-suited to non-parametric data. For descriptive analysis, this means using the median and interquartile range, while a Kruskal-Wallis test is the inferential test of choice.

Compared with the program-level findings shared in Table 8, Table 9 shows median title-level CPNU for firm-order print purchases at a lower cost of $32. This is not only in line with, but falls below, the $45 CPNU associated with firm-order e-book titles. DDA titles have a CPNU of $11, indicating a return-on-value (ROI) three-times as great as seen with firm-order print and e-book purchases.

Table 9

<table>
<thead>
<tr>
<th>Activity</th>
<th>Days in Use Median</th>
<th>Days in Use IQR</th>
<th>Total Cost Median</th>
<th>Total Cost IQR</th>
<th>Full-Text Views Median</th>
<th>Full-Text Views IQR</th>
<th>Title-Level CPNU Median</th>
<th>Title-Level CPNU IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDA</td>
<td>254</td>
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<td>$92</td>
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<td>7</td>
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<td>Firm Order E-Book</td>
<td>226</td>
<td>279</td>
<td>$125</td>
<td>$80</td>
<td>1</td>
<td>1</td>
<td>$45</td>
<td>$50</td>
</tr>
<tr>
<td>Firm Order Print</td>
<td>216</td>
<td>178</td>
<td>$36</td>
<td>$45</td>
<td>0</td>
<td>0</td>
<td>$34</td>
<td>$39</td>
</tr>
</tbody>
</table>

*Value of DDA Collections – Inferential Analysis*

To support a more rigorous analysis of comparative value, data associated with four variables of interest are subjected to the Kruskal-Wallis test for non-parametric data. These variables are: days-in-use, total cost, full-text views, and CPNU. As shown in Table 9, the number of days-in-use for titles across all three analytical categories does not differ at a statistically significant level. However, statistically significant variations are present across analytical categories for the three remaining variables.
To interpret these results, we return to those descriptive findings shared in Table 9. While the median days-in-use for titles does differ slightly, results of a Kruskal-Wallis test (shown in Table 10) confirm that these variations are not statistically significant. Therefore, the researchers feel confident in asserting the title-level comparability of their three analytical samples. Additionally, a more detailed understanding of those variations that do exist is provided by Fig. 3. As one can see, dispersion for the days-in-use variable is greater in the cases of both DDA and firm-order e-book purchases, when compared with firm-order print purchases. Further, the medians fall close together and there are no significant outliers.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Test Statistic</th>
<th>df</th>
<th>Asymptotic Sig. (2-sided test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days in Use</td>
<td>4,249</td>
<td>0.692</td>
<td>2</td>
<td>0.955</td>
</tr>
<tr>
<td>Total Cost</td>
<td>4,249</td>
<td>1,273.64</td>
<td>2</td>
<td>0.000*</td>
</tr>
<tr>
<td>Full-Text Views</td>
<td>4,249</td>
<td>3,920.80</td>
<td>2</td>
<td>0.000*</td>
</tr>
<tr>
<td>CPNU</td>
<td>4,249</td>
<td>1,214.97</td>
<td>2</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

* Significant at confidence interval of 0.99
found within any of the categories. Both the DDA and firm-order print data feature a slight negative skew, while the data associated with firm-order e-books shows a positive skew.

Regarding total cost, firm-order print materials are the cheapest materials to acquire—three to four times less than either DDA or firm-order e-books. Considering the added premium publishers place on the e-book format, this finding was to be expected. As shown in Fig. 4, there are a disproportionate number of outliers associated with the firm-order print category. This is explainable by two factors. First, the average cost of print materials is less than e-books. At the same time, local acquisition policy has not established a firm price ceiling for these purchases. On the other hand, a price ceiling is built into our DDA model, as is also much more of a consideration during the selection of firm-order e-book titles for purchase.
For full-text views, titles acquired via DDA show the highest levels of activity. The median number of full-text views for these materials is seven-times greater than the levels seen with librarian-mediated print and e-book selections. The significant number of outliers and narrow dispersion seen across all three acquisition categories shown in Fig. 5 would seem the result of Trueswell’s 80/20 Rule in action. Interestingly, we can see that even collections purchased via DDA are not immune to the rule.

The final variable of interest is the title-level measure of CPNU. As shown in Table 9, as well as Fig. 6, the median CPNU for DDA purchases is considerably lower than seen with the other two acquisition categories. Interestingly, the astronomical average CPU of $336 for firm-order print purchases now drops to more reasonable median CPNU figure of $32. Indeed, this is a slightly lower median CPNU than seen with firm-order e-book purchases. What’s more, these patterns are consistent with a scenario where firm-order e-books are used at relatively the same rate as firm-order print titles, while showing slightly higher costs at the point of purchase.
Discussion and Conclusion

This research set out to answer research questions related to DDA deployment in an academic research library setting. Simply put, the authors wanted to know if local print collection usage patterns substantiate the need for a just-in-time collection development solution, and, importantly, does DDA provide such a solution? To answer in the affirmative, the subject-matter profile of DDA selections would need to be comparable to what is seen with traditionally-acquired materials. The overall subject-matter profile should align with the needs of the environment, as defined by the enrollment and research profile of the parent institution. Further, materials acquired via DDA would need to show higher average levels of use than traditionally-acquired materials. Overall, to be a viable solution for building a just-in-time collection, DDA would also need to show a greater ROI, as defined by a measure of cost-per-use.
Viewing the tangible print collections of UA Libraries through the prism of Trueswell’s 80/20 Rule, the first phase of analysis for this research found that 80% of circulation is supplied by 51% of the circulating monographic collection (21% of the entire monographic collection). In addition, 49% of the circulating monographic collection (79% of the entire monographic collection) has not circulated in the years since 1990. While these findings fall in line with findings from previous research\(^{20}\) (depending on the methodological approach used), and are therefore excusable in some senses, the ubiquity of this inefficient state of affairs cannot lessen the sting of such realizations. What’s more, these findings clearly indicate a local need for an acquisitions solution with the purported benefits of DDA. Of course, with any such solution, proof is in the results.

Taking a closer look at the ways in which DDA purchases differ from more traditional, librarian-mediated purchases, phase two of this study found the overall subject-matter spread of DDA purchases to be comparable to traditional purchases. In fact, DDA purchases are more evenly dispersed across the LCC range than traditional purchases. Within the context of the PUE, the respective use data for these LCCs reveal that DDA is serving previously underserved areas of content interest, while simultaneously mitigating excessive expenditures within other classifications.

To answer questions related to the value of DDA collections, title-level cost and use were examined. Importantly, the days-in-use variable was identified as a key factor in ensuring comparable data across analytical samples of interest. The problem of zero-use titles within the context of deriving an accurate cost-per-use (CPU) metric was also discussed. Here, the novel

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\(^{20}\) I.e., a substantial proportion of local monographic holdings have not circulated over the past 28 years.
solution of a cost-per-next-use (CPNU) metric was offered as remedy for assessing title-level
cost-per-use when zero-use titles would typically hamper such efforts.

Simple descriptive analyses in phase three indicated the samples under study were
comparable, as defined by the days-in-use variable. In terms of cost, firm-order print titles are the
cheapest to acquire, with firm-order e-books and DDA associated with costs at least three times
as high. Titles acquired via DDA showed substantially higher levels of use than both firm-order
e-book and print purchases. Where the median number of full-text views for firm-order print
titles is zero and firm-order e-book titles is one, DDA titles show seven full-text views. With
regard to overall title-level value, DDA titles were associated with a substantially lower median
CPNU of $11—as compared with $32 and $45 for firm-order print and e-book, respectively.

During the final phase of study, descriptive analytical findings are confirmed by more
rigorous inferential testing via the non-parametric Kruskal-Wallis test. Specifically, it was found
that the title-level days-in-use variable for these data are statistically indistinguishable across the
three samples. Further, differences found in the cost, use, and CPNU metrics across all three
analytical categories of interest differ in a statistically significant manner. Simply put, DDA titles
show significantly higher levels of value than traditionally-acquired titles, as defined by a lower
title-level CPNU.

Within the context of the utility as value paradigm, the findings of this research confirm
the value that a DDA program can deliver. Overall DDA titles provide for a greater ROI than
traditionally-acquired materials, as confirmed by a title-level cost-per-use analyses. Simply put,
these titles, though initially more expensive, are associated with much higher levels of
demonstrable utility than those titles acquired by way of a traditional librarian-mediated
approach. Indeed, the rate of use is so much higher that when title value is calculated as a measure of cost-per-use, higher initial costs are mitigated. Nevertheless, the authors do not believe these findings should lead any library to completely abandon their traditional acquisition programs. Indeed, if a library were to end librarian-mediated and approval plan purchasing, they would also abandon approximately 60% of the high-quality research content available for purchase. Indeed, while e-books have become more prevalent, they still represent a subset of all monographic content—for which titles available for DDA are a subset. Therefore, at the current time, DDA programs are likely best utilized as a supplemental collection development approach that provides high quality content at the point-of-need, while also helping to mitigate the lower average ROI associated with more traditionally-acquired materials.

**Study Limitations and Future Research**

The authors have done their best to ensure the accuracy of all data and the validity of all methods used in this research, yet limitations persist. In particular, there exists a host of functional elements related to local DDA implementation that can hamper the generalizability of this study’s findings. For example, the profile feeding a DDA pool can be established in a variety of ways that will affect the subject-matter profile, overall utility and, therefore, usage levels of DDA purchases. What’s more, this research involves content from just one of several vendors that offer DDA. Across these vendors profile-building options will vary, as will a host of other DDA program elements such as: content availability, licensing options, options for short-term-loans, and purchase triggers. Future research should focus on defining the variability in DDA that exists across vendors, as well as quantifying its associated effects on local assessment findings.
While the findings of this research help to paint DDA in a positive light, it is important to bear in mind that this study is exploratory in many regards. While this research utilizes several established approaches for assessing DDA collections, some of the methodologies used are less established and, therefore, of questionable value more broadly. Further, only through their replication in subsequent research will the value of these approaches be fully realized. In particular, the value of subject-matter analyses tied to what this research refers to as the purchase-use equilibrium (PUE) remains unclear. In the absence of some better analytical approach, the PUE can serve as a methodological stop-gap. Nevertheless, future research should attempt to affirm or refute the value of this approach by way of a deep-dive analysis of this method using a variety of collections data, ideally from a variety of diverse sources.
Works Cited

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