Consumer Behavior Analysis Approach to Teacher Choice of Reading Interventions

Rochelle N. Picardo
Louisiana State University and Agricultural and Mechanical College

Follow this and additional works at: https://repository.lsu.edu/gradschool_dissertations

Part of the Applied Behavior Analysis Commons, and the School Psychology Commons

Recommended Citation
https://repository.lsu.edu/gradschool_dissertations/6502

This Dissertation is brought to you for free and open access by the Graduate School at LSU Scholarly Repository. It has been accepted for inclusion in LSU Doctoral Dissertations by an authorized graduate school editor of LSU Scholarly Repository. For more information, please contact gradetd@lsu.edu.
CONSUMER BEHAVIOR ANALYSIS APPROACH TO TEACHER CHOICE OF READING INTERVENTIONS

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy

in

The Department of Psychology

by

Rochelle Picardo, MA
B.A., University of British Columbia, 2014
M.A., University of British Columbia, 2019
August 2024
# Table of Contents

List of Acronyms .................................................................................................................. iv

Abstract ................................................................................................................................. v

Chapter 1. Review of the Literature...................................................................................... 1
  Approaches to Reading Instruction ...................................................................................... 2
  The Role of Education Policy ............................................................................................. 5
  Response to Intervention and Reading Intervention ......................................................... 6
  Evidence-Based Practices in Education .............................................................................. 8
  Consumer Behavior Analytic Approach to Evidence-Based Practices ......................... 14
  The Operant Demand Framework .................................................................................... 18
  Research Questions .......................................................................................................... 22

Chapter 2. Methods ................................................................................................................ 23
  Participants and Study Power ............................................................................................ 23
  Inclusion and Exclusion Criteria ...................................................................................... 23
  Materials and Measures ..................................................................................................... 24
  Analytical Strategy ............................................................................................................ 29

Chapter 3. Results .................................................................................................................. 35
  Participants ........................................................................................................................ 35
  RQ1: Alone-Price Demand for EBPs ................................................................................ 36
  RQ2: Cross-Price Demand for Interventions .................................................................. 39

Chapter 4. Discussion ............................................................................................................. 44
  RQ1: Characterizing Demand for Evidence-based Practices ........................................ 44
  RQ2: Teacher Substitutability of Reading Interventions ................................................ 47
  Study Limitations and Future Directions ......................................................................... 49

Appendix A. Summary of Literacy EBPs .......................................................................... 51

Appendix B. Study Materials ............................................................................................... 52

Appendix C. Source Code ...................................................................................................... 58
References .......................................................................................................................... 62
Vita ..................................................................................................................................... 71
List of Acronyms

RTI: Response to Intervention

EBP: Evidence-based Practice

LVP: Low Value Practice

IES: Institute of Education Sciences

WWC: What Works Clearinghouse

RCT: Randomized Control Trial

ABA: Applied Behavior Analysis

BPM: Behavioral Perspective Model

UR: Utilitarian Reinforcement

IR: Informational Reinforcement

HPT: Hypothetical Purchase Task

HICT: Hypothetical Intervention Choice Task

ZBE: Zero Bounded Exponential model

GEE: Generalized Estimating Equation
Abstract

The use of Evidence-based Practices (EBPs) in schools is heavily emphasized in educational research and policy; however, many teachers do not use EBPs for reading instruction and intervention. Previous research on the limited use of EBPs in classrooms has primarily focused on teacher characteristics, such as their attitudes or beliefs toward these practices. As an alternative to this view, this study applied a behavioral economic approach to understanding teacher choice (i.e., EBPs over other alternatives, such as interventions with a base of limited empirical support; low-value practices [LVPs]). Hypothetical Intervention Choice Tasks were developed and used to evaluate how both utilitarian reinforcement (UR; evidence of effectiveness) and informational reinforcement (IR; support from the verbal/social community) contingencies influence small-group reading intervention choices (Tier 2). Study participants were teachers who have provided Tier 2 supplemental reading intervention for school-age students. Study participants were recruited using a Qualtrics® panel. Results indicated that teachers demonstrated substitutability of EBPs for reading intervention with alternatives regardless of whether those alternatives had evidence of efficacy. Results of this study contribute to the limited body of literature on the ecological factors that influence teacher choices regarding the consumption of EBPs for reading.
Chapter 1. Review of the Literature

The term literacy encompasses a collection of skills that are crucial not only for success in academics but for success in life. The United States (US) Department of Education has emphasized the functional nature of literacy in its definition: “Literacy is the ability to use printed and written information to function in society, to achieve one’s goals, and to develop one’s knowledge and potential” (White & Dillow, 2005, p. 4). Low literacy is associated with a range of adverse health outcomes, such as poorer health (DeWalt et al., 2004), higher healthcare costs (Weiss & Palmer, 2004), and higher rates of mental illness (Sentell & Shumway, 2003). It is also associated with lower overall academic achievement. For example, in a cross-national study, Park and Kyei (2011) analyzed literacy skills data from 19 countries that participated in an adult literacy survey. In all countries, higher literacy was associated with higher educational attainment. However, countries varied in terms of the discrepancy between literacy and level of educational attainment, with the US demonstrating the largest gap between literacy and level of educational attainment. In other words, in the US, educated individuals have higher literacy skills than less educated individuals, and this gap is more pronounced than observed in other countries. The authors suggested that this gap is driven by higher levels of between-school inequality. Such results highlight the importance of equal and adequate literacy instruction for all K-12 students.

Literacy is also crucial for the functioning of societies as a whole. Economic research suggests that when the adult literacy rates of a country increase, economic growth follows (see Johnston, 2004). This makes good sense, given the relationship between individual literacy skills and earnings. In a National Institute for Literacy report investigating changes in adult literacy as they relate to changes in adult employment/earnings, Reder (2010) outlined five key findings: 1) among high school dropouts, literacy proficiency was associated with earnings; 2) literacy
proficiency affects both initial earnings and the potential for growth of subsequent earnings; 3) individuals’ literacy growth rate affects earnings, both in terms of initial earnings and potential for growth; 4) the relationship between literacy and earnings is unidirectional, with literacy resulting in earnings but not the reverse; and 5) the relationship between literacy and earnings depends on labor market conditions, with literacy being particularly important for earnings and employment during an economic downturn.

Despite the importance of literacy for the functioning of both individuals and societies, in the US, many adults demonstrate inadequate literacy proficiency. The Program for International Assessment of Adult Competencies ([https://nces.ed.gov/surveys/piaac/](https://nces.ed.gov/surveys/piaac/)) was a large-scale, international study of working-age adults. In the US, data for this study was collected in 2011-12 and 2013-14. Several different literacy tasks (e.g., comparing and contrasting information, paraphrasing, and making low-level inferences) were administered, in English, to respondents. Results indicated that 1 in 5 adults in the US had difficulty completing literacy tasks, which translates into an estimation of approximately 43 million US adults with low literacy. This figure supports Park and Kyei’s (2011) suggestion that between-school inequality in the US has resulted in inadequate literacy instruction for all Americans.

**Approaches to Reading Instruction**

The term “literacy” does not refer to a single, discrete skill; rather, it encompasses a collection of skills. At the core of this collection of skills is the ability to use written information for everyday tasks related to functioning, and almost all literacy tasks require the ability to read and understand words (OECD, 2013). Because of the critical nature of reading for literacy, it is essential to consider reading instruction when discussing literacy.
The Great Debate: Whole Language vs. Phonics

Two approaches are most represented in reading instruction: 1) whole language approaches; and 2) phonics-based approaches. Whole language approaches emphasize teaching children to attend to words as a whole and can include instructional strategies such as drill and practice (Schmidgall & Joseph, 2007) and attending to the context in which words occur (Nicholson et al., 1991). These approaches are considered “top-down”, as learners are taught to attend to the general stimuli first (i.e., words) before attending to more specific stimuli (i.e., letters; Liu, 2010). In contrast, phonics approaches are considered “bottom-up”, whereby learners first learn how to understand letters and their sound properties before learning how to join these letters into words and read words in and out of text (Liu, 2010). Whole-language approaches rely on the presumption that children will memorize whole words and that this memorization will result in a vocabulary built on sight words (de Graaff et al., 2009). In other words, children will acquire reading skills by first recognizing words based on their visual features.

Proponents of phonics approaches posit that children acquire reading skills by first learning to decode—“sound out”—words. The phonics approach can be further divided into systematic and unsystematic approaches. Systematic phonics is distinct from unsystematic phonics in that it involves teaching planned sets of phonics elements in a planned and sequential order (Ehri et al., 2001a). These sets can include, but are not limited to, consonants, long and short vowel sounds, and vowel and consonant digraphs (Ehri et al., 2001a). Unsystematic approaches involve teaching these sets but without a clearly defined sequence. In the 1990s, a “Great Debate” emerged regarding which approach to reading instruction was more effective. The reluctance to adopt phonics-based approaches was widespread, despite clear scientific
evidence indicating that these approaches were more effective than whole language approaches (Baumann et al., 1998; Foorman, 1995).

**Addressing the Great Debate**

To address the Great Debate, in 2000, the National Reading Panel (NRP) reviewed literacy research from 1970 to 2000. The goal of the panel was to investigate whether systematic phonics approaches to reading instruction were more effective than nonsystematic phonics approaches or non-phonics approaches (e.g., whole-word). The panel found compelling evidence in favor of systematic, explicit phonics instruction (Ehri et al., 2001a). However, ten years after this report was published, shifts towards the use of the systematic phonics approach were minimal with regard to inclusion in teacher preparation and training related to reading (Brady, 2011a).

In a chapter related to the efficacy of phonics instruction for reading outcomes, Brady (2011a) highlighted two major difficulties in the implementation of systematic phonics programs: 1) inadequate information about what high-quality phonics instruction entailed; and 2) resistance to using systematic/explicit methods of phonics instruction, which involve progression through prespecified, sequential sets of phonics elements. This resistance to systematic/explicit methods of phonics instruction persists to date. For example, Bowers (2020) reviewed 12 meta-analyses and disputed the consensus in favor of phonics. He encouraged further exploration of “alternative” approaches to reading instruction, including whole-language and “balanced” approaches (e.g., approaches that involve both phonics and whole word instruction).

Research continues to support systematic phonics as the most effective approach to reading instruction. For example, de Graaff et al. (2009) compared systematic and nonsystematic approaches to phonics instruction with 93 Dutch Kindergarteners, from eleven different
classrooms, at three different schools. Each classroom was randomly assigned to systematic phonics training, unsystematic phonics training, or no treatment. Performance on letter-sound correspondence, phonemic awareness, overall reading, and overall spelling measures was collected both pre and post-training. In terms of letter-sound correspondence, both systematic and nonsystematic groups outperformed the control group post-intervention, providing support for phonics over non-phonics approaches. However, for all other outcome measures (i.e., phonemic awareness, overall reading and spelling), the systematic phonics groups outperformed the other groups, consistent with the overall findings synthesized by Ehri et al. (2001a). Bower’s (2020) paper was subsequently rebutted (see Buckingham, 2020). In his rebuttal, Buckingham (2020) argues that even conservative analyses of the current literature reveal that the strongest available evidence supports systematic phonics as the most effective approach to reading instruction. Buckingham (2020) further asserts that it is irresponsible to encourage teachers to consider alternatives to research-supported approaches to reading instruction. Bower’s (2020) paper and the subsequent heated rebuttal by Buckingham (2020) highlights the reality of the debate on reading instruction—adoption of systematic phonics instruction remains limited among educators and researchers, despite compelling evidence.

The Role of Education Policy

A complete, nuanced discussion of the development and applications of the Response to Intervention (RTI) model is beyond the scope of this work; however, a working understanding of reading intervention in the US is necessary to contextualize the situation in which interventions occur. Briefly, in US schools, intervention occurs on three different tiers following the RTI model of service delivery (Mesmer & Mesmer, 2008). Language regarding RTI was first introduced in the Individuals with Disabilities Act (IDEA) due to the broad use of a highly
criticized model of learning disability identification (Fletcher & Vaughn, 2009). This model, the discrepancy model, involves identifying learning disabilities based on a discrepancy between cognitive scores and academic achievement scores. It has been criticized for making early identification difficult, missing students with below-average cognitive scores, and relying on intelligence tests that are resource-intensive to administer and interpret (Restori et al., 2009).

In contrast to the discrepancy approach, RTI is a process that focuses on evaluating a student’s academic performance in response to an intervention. Measurement and intervention occur on three tiers. At Tier 1 are universal services. That is, all students receive the universal services programmed at Tier 1. Tier 2 services are those that are provided to students who require more targeted support than what is provided at Tier 1 (e.g., additional feedback, larger instructional dose). Students receiving Tier 2 services are typically identified with Tier 1 screening procedures (e.g., brief assessments of target skills; Jenkins et al., 2007). Tier 3 services are those that are provided to the students who have not responded to Tier 1 or 2 services. Students receiving services at this tier may require individualized support or a detailed assessment of their specific academic difficulties. Students who do not respond to the intensive support provided at Tier 3 may be considered eligible for special education services (Mesmer & Mesmer, 2008).

**Response to Intervention and Reading Intervention**

In 2008, the US Department of Education’s Institute of Education Sciences (IES) published a practice guide to implementing RTI for reading in primary grades (Gersten et al., 2008). This guide, an exhaustive summary of research on reading intervention, includes descriptions of, and recommendations for, each tier of the RTI model. Tier 1 encompasses general reading instruction—the core reading curriculum (Baker et al., 2010). Services at Tier 1
are offered on a universal-level, across classes. Despite the importance of Tier 1 instruction for the reading skill development of all students, the least is known about effective practices at this tier (Gersten et al., 2008). Indeed, Tier 2 and 3 interventions have more often been the focus of research (Jones et al., 2012).

Tier 2 is considered a supplement to Tier 1, with Tier 2 intervention provided as extra support for students demonstrating difficulties following Tier 1 instruction (Gersten et al., 2008). At Tier 2, services are delivered at the small-group level. In the literature on Tier 2 reading intervention, there is consensus that 30 minutes of small-group instruction 3-5 times per week, with progress monitoring at least once per month, is effective for promoting reading skill development in struggling readers (Baker et al., 2010; Gersten et al., 2008). In elementary grades, there may be a large degree of overlap between the reading interventions offered at Tiers 1 and 2. When students are “learning to read”, both tiers focus on core reading skills (i.e., phonological awareness, phonics, fluency, vocabulary, and comprehension). Therefore, in earlier grades, Tier 2 interventions can be considered preventive (Wanzek et al., 2016). In later grades, however, when students are “reading to learn”, core reading skills are de-emphasized at Tier 1. Thus, Tier 2 reading intervention may share fewer common features and goals with Tier 1 in these circumstances (Vaughn et al., 2010).

Tier 3 reading intervention is provided to students who do not demonstrate a positive response following a reasonable period of Tier 2 intervention (e.g., 10 weeks; Vaughn et al., 2012). Unlike the supplementary nature of Tier 2, Tier 3 intervention may replace Tier 1 core reading instruction (Baker et al., 2010). In other words, students who receive Tier 3 reading support may receive little or no reading instruction from the core curriculum. At this tier, intervention is intensive and individualized, and one-on-one service delivery is recommended.
(Gersten et al., 2008). Regular collection and analysis of progress monitoring data (once per week) are vital for the identification of intervention approaches that promote skill development at the individual level (Gersten et al., 2008).

**Evidence-Based Practices in Education**

Scientifically-based practice is at the heart of both general and special education. This principle is enshrined in legislation. National laws such as the IDEA and policies such as the No Child Left Behind Act specify that teachers must use scientifically supported practices (Odom et al., 2005). Regarding RTI, at each tier, scientifically-based practices must be used and documented (Mesmer & Mesmer, 2008).

Growing emphasis on the importance of practices that are supported by evidence has raised several issues in the field of education. One such issue is that there is a need for clear terminology and definitions. In speaking about various practices supported as effective, educators may use a variety of terms, such as “practices supported by scientifically based research”, “best practices”, “research-based practices”, and “evidence-based practices” (Cook & Cook, 2013). Cook and Cook (2013) argued that the term “evidence-based practices” connotes a higher standard of evidence than other terms. For example, the term “research-based practices” can be used to describe practices that range in terms of scientific support, from robust and rigorous, to weak and flawed (Cook & Cook, 2013). Similarly, Mesmer and Mesmer (2008) argued that without a precise definition, the need for practices to be “scientifically based” will result in the misuse of this label as a marketing ploy. In the proposed study, the term “evidence-based practices” (EBPs) will be used to reflect the rigorous standards required for a practice to earn this label.
Various definitions of EBPs are available in the literature. According to Kratochwill and Shernoff (2004, p. 35), an intervention “…should carry the evidence-based designation when information about its contextual application in actual practice is specified and when it has demonstrated efficacy under the conditions of implementation and evaluation in practice.” This definition emphasizes the importance of intervention research that is conducted under conditions that are similar to the context of implementation. Hoagwood and Johnson (2003, p. 5) emphasized the importance of high-quality evidence when they stated “Evidence-based practice or EBP is a shorthand term denoting the quality, robustness, or validity of scientific evidence.” Cook and Cook (2013, p. 73) broadly define EBPs as “practices that are supported by multiple, high-quality studies that utilize research designs from which causality can be inferred and that demonstrate meaningful effects on student outcomes.” This definition underscores the importance of both meaningful effectiveness and support from multiple, high-quality research studies.

**Standards for Evidence-Based Practice**

To assist educators in navigating educational research, the IES established the What Works Clearinghouse. What Works Clearinghouse (WWC) is an organization that reviews programs, policies, and practices using specified standards determined by a panel of experts in the field. The WWC creates several different products to communicate “what works” in education: intervention reports, single study reviews, quick reviews, and practice guides are all available for free to the public on the WWC website (https://ies.ed.gov/ncee/wwc/FWW/).

Scientific studies on programs, policies, and practices that are reviewed by the WWC are rated as meeting or not meeting standards, and studies meeting standards are summarized. Randomized control trials (RCTs) are regarded as the “gold standard” for research addressing the
effectiveness of a program, policy, or practice. Studies reviewed are graded with respect to study strength and rigor. To meet standards “without reservations”, studies must have randomly assigned groups, low rates of attrition in the sample, and limited confounding factors or other concerns with outcomes. Studies that have randomly assigned groups and few confounding factors or concerns with outcomes, but high sample attrition meet standards “with reservations,” so long as the groups were similar pre-intervention. Studies with groups that are not randomly assigned or are randomly assigned with high attrition and dissimilarities pre-intervention do not meet WWC standards. Studies with randomly assigned, similar groups that have a high attrition rate as well as confounding factors also do not meet WWC standards (IES, US Department of Education, n.d.).

It is worth noting that there is debate regarding whether the emphasis on RCTs is limiting. Odom et al. (2005) argued the importance of not allowing one methodology to dominate special education research. The authors acknowledged that RCTs are important because of the experimental control of this methodology (p. 140), but argued that different methodologies are important for answering different questions. With regard to EBPs, they argued that research quality indicators be specified for each research methodology identified in special education research: a) experimental group; b) correlational; c) single subject; and d) qualitative. When determining the quality of research, there first must be clarity about “…(a) the match between research questions and methodology, (b), the features of each methodology that represent high quality, and (c) the use of research findings for each methodology as scientific evidence for effective practices in special education” (Odom et al., 2005, p. 146).
**Low-value Practices**

In the proposed study, the term “low-value practices” (LVPs) is used to describe practices with limited established support for efficacy. This term has been used by the medical research community to describe practices that are not aligned with current or best evidence. In the medical research community, LVPs refer to practices that do not benefit, only marginally benefit, or have the potential to result in harm to patients (Niven et al., 2015). On a continuum of evidence, EBPs are at one end, the end exemplifying rigorous support, and LVPs are at the other. Although there is rarely physical risk involved in the use of LVPs for reading instruction, parallels can be drawn between using LVPs in medicine and education.

In medicine, employing clinical practices that are later disused due to limited evidence of effectiveness creates inefficiencies in the medical system; resources that could have been devoted to effective practices are instead devoted to those that are ineffective, at best, and harmful, at worst (Niven et al., 2015). “Hand over mouth” procedures in pediatric dentistry are an example of a practice that was once widely used but has since been de-adopted due to the potential to cause psychological harm in children (e.g., Eaton et al., 2005). These procedures involved dentists physically restraining their patients as a means of behavior management (Acs et al., 1990).

Due to the inefficiencies inherent in adopting and subsequently disusing LVPs in medicine, incidences of this reversal process should be minimized to protect the quality of healthcare service delivery (Niven et al., 2015). Similarly, the broad use of LVPs in education would compromise the quality of educational service delivery in much the same way. That is, a major consequence of using LVPs to teach reading is the diversion of resources (i.e., time and
money) away from EBPs. The long-term, large-scale implications of the widespread use of LVPs for reading instruction might be the compounding of the existing literacy crisis.

**Barriers to Evidence-Based Practice**

There are several barriers to the widespread use of EBPs in classrooms despite the longstanding emphasis on their importance. Moreover, there is a dearth of literature about how educators use, acquire, and interpret research evidence. For the research community to improve the odds that their research on EBPs will be used by educators to directly inform practice, it is vital to understand how (or even if) research evidence influences the decision-making of educators (Nelson et al., 2009).

Some barriers exist at the systems level. Noell and Gansle (2009) outlined several barriers to systems-level change in schools and argued that the education system is slow to change. Widespread change—such as that which would be required for EBPs to dominate—would require a massive change in the systems that establish and maintain educator behavior. In other words, for widespread change to occur, there must be contingencies in place to both prompt initial change as well as support that change over time. Modifying teacher training programs at the national level might be one strategy to support the widespread promotion of EBPs in education practice at the systems level. In an evaluative report, Scheeler et al. (2016a) highlighted that preservice teachers do not have the necessary training to implement EBPs in their classrooms. Moreover, even if widespread reform of teacher training programs was conducted to address this inadequacy, there would still be many teachers from previous generations of training programs in the field requiring additional training.

Several other barriers to implementing EBPs in the classroom occur at the individual level. First, the integration of EBPs into various forms of classroom instruction may not be
feasible in busy classrooms and for resource- and time-limited teachers. Teachers may have the training and desire to implement EBPs in the classroom, but incorporating these EBPs may not be possible because of competing demands (e.g., completing classwide standardized testing required by the school district; Kratochwill & Shernoff, 2004). Second, despite EBPs being more cost-effective in the long run, many are time-intensive and expensive to implement in the short run (Kratochwill & Shernoff, 2004). This may be especially true for EBPs in literacy; as aforementioned, the most supported literacy interventions involve systematic phonics instruction, which can require specialized training and purchasing intervention materials. Third, the criteria for organizations (such as WWC) to establish an evidence base for any given practice varies between organizations. There is a lack of clarity over what constitutes an EBP. Further, there are numerous research groups all claiming to review the literature on interventions, yet many of these groups use different criteria for coding studies. Such a variety of efforts surrounding what constitutes an EBP creates challenges for consumers, who may not know which sources present quality information (Kratochwill & Shernoff, 2004).

These latter two barriers at the individual level concern the behavior of consumers of EBPs: educators. Research on EBP-related behaviors of educators, however, has centered on reviewing educator attitudes toward such practices. For example, educator attitudes towards EBPs have been cited as a barrier to the consumption of EBPs in schools (e.g., Cook & Cook, 2013). Boardmen et al. (2005) investigated special education teachers’ attitudes toward research-based practices using focus group interviews. Their findings suggested that many educators do not regard research as an important criterion for the selection of interventions, and instead place weight on the feasibility, appropriateness, implementation ease, and the potential for individualization of interventions. Nelson et al. (2009) also used focus groups and individual
interviews of 65 self-identified leaders in education policy and practice. Their findings suggested that, among this sample, the underlying belief that research is not trustworthy was prevalent. This sample reported awareness that even for studies meeting “gold standard” criteria, methods could have been manipulated to report false success or failure rates.

**Consumer Behavior Analytic Approach to Evidence-Based Practices**

Educators can be conceptualized as consumers of interventions. The choice to implement one intervention over another involves allocating resources (e.g., time and money) to that chosen intervention, much the same as choosing between Folgers™ and Starbucks™ coffee at the grocery store. Although educators’ perceptions of EBPs may factor into their choices to implement alternative, less empirically supported interventions, such explanations of educator behavior favor cognitive constructs such as attitudes (Foxall et al., 2011). However, relationships between attitudes and consumer behaviors are often weak, making it difficult to predict consumption choices by simply measuring attitudes (Foxall et al., 2011).

**Behavioral Perspective Model**

The consumer behavior analytic approach extends applied behavior analysis (ABA) to consumer behavior. This approach emphasizes situational and environmental variables, rather than cognitive variables, to characterize the behavior of consumers. At the heart of consumer behavior analysis is the behavioral perspective model (BPM), an adaptation of the three-term contingency. In ABA, the three-term contingency is central to explaining operant behavior. The three-term contingency explains that all behaviors are either reinforced or punished in the presence of stimuli or in contexts that function as discriminative stimuli (Skinner, 1963). In other words, behaviors have antecedents (stimuli and situations) and consequences (reinforcement or punishment) that evoke behaviors and influence their probability of occurring again,
respectively. Behaviors that are reinforced have a higher probability of occurring again, whereas behaviors that are punished have a lower probability of occurring again. There are many different sources of reinforcement and punishment, and these vary across individuals and contexts. In other words, what may be reinforcing for one individual may be punishing for another. Moreover, what functions as reinforcement in one context may not function as reinforcement in another. According to Foxall (2016), consumer behavior can be understood as the allocation of resources among these alternative, competing reinforcing outcomes.

**Tenets of the Behavioral Perspective Model**

In the BPM, consumer behavior occurs at the intersection of an individual’s learning history and their current setting. This intersection is called the consumer situation. More precisely, the consumer situation is the “social and physical environment in which the consumer is exposed to stimuli signaling a choice situation” (Foxall et al., 2007, p. 5). How an individual interprets these stimuli is dependent on their learning history, or the summation of their previous experiences with environmental events or stimuli, behaviors, and consequences.

The BPM posits that the consumption of goods and services is influenced by three types of consequences (Foxall, 2016; Foxall et al., 2011). Since EBPs can be thought of as a good or service available for consumption by educators, the BPM can be applied to the consumption of EBPs. The first type of consequence is called utilitarian reinforcement (UR). UR refers to the direct, practical benefits of consuming a particular good or service. Foxall et al. (2011) explained the concept of UR using the example of purchasing a car. The UR of buying a car relates to the practical, functional consequences of car ownership, such as access to places that are inaccessible by public transportation and the ability to easily transport large objects. The UR of
consuming an EBP can be conceptualized as the expected improvements in a target skill resulting from the consumption of that EBP.

The second type of consequence is called informational reinforcement (IR). IR refers to the indirect, symbolic, and social consequences of purchasing a good or service; such consequences are social in nature. Keeping with Foxall’s car analogy, the IR of buying a new car might be an elevation in social status or favored attention from others. This type of reinforcement may be especially potent for purchases of premium cars, such as Mercedes™ and BMW™. For teachers, the IR of EBP consumption might be attention and approval from other teachers, parents of students, or supervisors/administrators.

The last type of consequence is called aversive consequences. Aversive consequences are the costs of purchasing a good or service, such as surrendering money and time. Any given purchase of a good or service confers differing amounts of each type of reinforcement. For example, the UR of buying a Toyota™ might be equivalent, or nearly equivalent, to the UR of buying a Mercedes™. Depending on an individual’s social context, buying a Mercedes™ might confer more IR than a Toyota™. However, the aversive consequences of buying a Mercedes™ may be much higher, due to having to relinquish a much larger sum of money to make that purchase. Again, the potency of each type of reinforcer relies on an individual’s learning history and current context. The BPM posits that consumers will attempt to maximize some combination of these contingencies (Foxall, 2016).

Noell and Gansle (2009) suggested that systems-level change is difficult because it requires reforming the contingencies that establish and support educator behavior. In other words, without changing the contingencies that support/maintain educator behaviors, widespread change cannot occur. This assertion is consistent with the tenets of the BPM. Thus, it follows
that the BPM may be a useful framework with which to investigate educator behavior related to the choice to consume EBPs. The goal of such an investigation would be to reveal the sources of reinforcement that most influence educator behavior (i.e., intervention choice). This information could be used to inform the programming of contingencies that support the consumption of EBPs for reading instruction.

**Applying Behavioral Economics to Literacy Intervention Consumption**

Regarding the UR of interventions, previous research has conceptualized the UR of any given intervention as the direct, expected change in behavior resulting from the consumption of a specific intervention (Gilroy & Picardo, 2022). Thus, the UR of reading interventions can be represented by the likelihood of positive changes in reading performance resulting from consuming those interventions. EBPs for reading can be considered to have higher UR than alternative interventions: the rigorous standards for evidence that are required to earn the EBP label suggest that EBPs carry a higher probability of producing the desired outcome than alternative, unsupported options (i.e., LVPs).

The IR of reading interventions—EBPs and LVPs alike—are the indirect, social contingencies associated with educational programming. That is, the IR of any intervention refers to the reinforcing or punishing contingencies that are independent of intervention effectiveness (i.e., UR). Sources of IR may include, but are not limited to, social approval from other teachers, administrators, and parents for a given practice (e.g., EBP, LVP). For various reasons that are likely influenced by an educator’s current context, some interventions will confer higher IR than others (i.e., varying educational contexts). See Figure 1 for a summary of where EBPs and LVPs with differing social consequences fall on continua of UR and IR.
The aversive consequences of consuming reading interventions are the costs associated with those interventions. Interventions vary in terms of both the time and money required to implement those interventions. Although EBPs are often more cost-effective overall, the initial costs of training and planning for EBPs may drive choice toward LVPs or other alternative intervention choices (Raghavan et al., 2008).

![Figure 1. UR and IR of Reading Interventions](image)

**The Operant Demand Framework**

Operant behavior is known to be influenced by the number of responses required per reinforcer, and the magnitude of the reinforcer (Madden et al., 2000). The Operant Demand framework has been widely used to evaluate how various contextual factors associated with reinforcers affect choice behavior (Bickel et al., 2016; Bickel & Vuchinich, 2000; Gilroy, 2021;
Hursh et al., 2013). In this framework, the ratio of response requirement to reinforcer magnitude is called unit price. In other words, unit price is the amount of resources (e.g., money, time, effort) that must be expended to produce/consume one unit of the respective commodity (Roane et al., 2007; Hursh, 1980). Unit price is represented with the equation $P = \frac{R}{A}$, where $P$ is the unit price of the reinforcer, $R$ is the response requirement, and $A$ is the magnitude of the reinforcer. For example, given a choice between a 5lb bag of rice costing $2 (P = \frac{2}{5} = $0.40/lb) and a 10lb bag of rice costing $3 (P = \frac{3}{10} = $0.3/lb), the latter option has a more affordable unit price despite a greater overall price.

Economic theories are useful in making predictions about how unit price influences choice behavior and/or maintains consumption of a given good or service. In a study investigating the effects of unit price on choice responding, Madden et al. (2000) outlined three predictions, two of which are relevant to the proposed study. First, all else being equal, increasing the unit price of a reinforcer should decrease the consumption of that reinforcer at some future point (i.e., price elasticity of demand). Second, when choosing between two qualitatively identical reinforcers with different unit prices, behavior should be allocated towards the option with a lower unit price (i.e., the option conferring a larger magnitude of reinforcement). In other words, individuals substitute one good or service for another in a manner that maximizes reinforcement (Madden et al., 2000).

**Hypothetical Purchase Tasks**

The BPM and the operant demand framework posit that consumer choices are driven by the reinforcing value of different options and that these choices are also influenced by the consumer’s learning history and current context. Hypothetical purchase tasks (HPTs) have been used to evaluate individual consumer choices when presented with multiple options that differ in
reinforcing value (e.g., Jacobs & Bickel, 1999). In HPTs, a marketplace is simulated, and consumers (i.e., study participants) are presented with choices for various goods and services. HPTs often involve different conditions to assess various economic assumptions (see below for descriptions of alone- and cross-price conditions). Generally, in HPTs, products vary in price across conditions and consumers indicate how much they would hypothetically spend of their budget on each product (Jacobs & Bickel, 1999; Roma et al., 2017). The resulting analyses reveal the demand for particular products or services.

Applying this logic to a behavioral framework, demand can be conceptualized as the durability of a reinforcer’s effect on an individual’s behavior, or in other words, the degree to which that reinforcer consumption persists even when the price to do so increases (Hursh, 1980). When the consumption of goods and services in an HPT are presented at different price points, plotting consumption at each point yields a demand curve (Reed et al., 2013). The same can be done with reinforcers, with the resulting curve revealing how consumption of reinforcers varies as they become more expensive.

Methods such as HPTs have been used to investigate the consumption of a variety of goods, such as tobacco (Wilson et al., 2016), alcohol (Amlung et al., 2012; Kaplan et al., 2018; Zvorsky et al., 2019), illicit drugs (Jacobs & Bickel, 1999; MacKillop et al., 2019), and food (Epstein et al., 2018). Recently, HPTs have been used to examine the consumption of therapies. Gilroy and Picardo (2022) used a marketplace of therapy options to examine parent consumption of EBPs versus unsupported, “fad” therapies for behavior problems. Results of this study indicated that, in a closed economy, consumers chose to pursue high levels of EBPs (i.e., High UR/High IR). However, in an open economy and when EBPs became expensive to consume and alternatives without evidence became available (i.e., LVPs), consumers regularly substituted
EBPs with therapies with and without evidence. Furthermore, participants overall favored therapies associated with greater IR over UR, further suggesting that evidence was not the most critical factor underpinning therapeutic choices.

**Alone-Price Choice Tasks.** In alone-price choice tasks, a distinct form of HPT, demand for a commodity is evaluated when that commodity is the only one available in the marketplace (i.e., available alone; closed economy). This condition evaluates the demand for a specific good or service as prices range from free/low to high (i.e., alone-price demand). Alone-price choice tasks involve imposing constraints on hypothetical resources (i.e., time and money) and asking participants to allocate their limited resources. For example, Stein et al. (2015) asked cigarette smokers to allocate hypothetical money toward purchasing cigarettes for use over a 24-hour period. They presented cigarettes at different price points in ascending order. No alternative option to cigarettes was presented during this condition. An alone-price choice task examining teacher choices related to EBP consumption presents one EBP at various price points with no other intervention options available.

**Cross-Price Choice Tasks.** Cross-price choice tasks are useful for evaluating demand for a commodity when more than one option is available in the marketplace (i.e., open economy). Thus, this condition facilitates an examination of whether different patterns of consumption are observed (e.g., one substitutes another, both complement one another). Cross-price choice tasks involve manipulating the price points of one option (i.e., own-price) while the price of a concurrently available alternative remains constant (i.e., cross-price). Participants in this condition must again allocate hypothetical resources towards these concurrently available options, under constraint. However, in this task, the focus is on how the individual’s pattern of consumption across options changes as the price to consume a certain one of those options
increases. For example, in the cross-price condition of the aforementioned Stein et al. (2015) study, participants were given a hypothetical budget and were asked to allocate this money towards cigarettes and/or concurrently available e-cigarettes. While the prices of cigarettes varied, the price of e-cigarettes remained fixed. In a cross-price task examining teacher choices related to EBP consumption, one EBP is presented at varying price points while other alternatives (e.g., other EBPs, LVPs) are concurrently available but presented at fixed price points.

**Research Questions**

Because attitudes are often not strongly predictive of behaviors, understanding the external contingencies that maintain teacher preference for academic interventions is a crucial part of understanding how teachers make decisions in their classrooms. A consumer behavior analysis framework was used to examine how teachers make educational and intervention decisions when such decisions exist under constraint (i.e., limited time/resources) and the following questions were posed:

**RQ1:** In following with the expected form of a demand curve, does the consumption of EBPs correspond with the unit price necessary to consume that service?

**RQ2:** Assuming that the consumption of EBPs for reading interventions is sensitive to changes in unit price, to what degree are educators differentially sensitive to UR (i.e., evidence of efficacy) or IR (i.e., related to the social community) when selecting interventions for their classrooms?
Chapter 2. Methods

Participants and Study Power

Study participants consisted of 100 elementary, middle, and high school teachers (S. P. Gilroy & Picardo, 2022). This quantity was determined via a priori power simulations designed to detect an estimated ~5% difference in the levels of consumption between the High IR/Low UR and High UR/Low IR alternatives in a cross-price HPT (i.e., Price X Type interaction). A customized evaluation of power was necessary because the specification of interaction terms is limited in most power analysis tools, e.g. G Power. In this simulation, rates of consumption were based on those observed in Gilroy & Picardo (2022). Using population-level means in a linear model, the Price X Type interaction was set at 0.05 in log units (i.e., ~5%) and simulations were run to determine at which point the study achieved at least 95% power to detect the estimated effect. All the source code necessary to perform the power analysis is provided as supplemental materials (see Appendix C).

Inclusion and Exclusion Criteria

Eligible study participants were teachers of students from kindergarten to Grade 12, with active involvement in providing supplemental small-group (Tier 2) reading support or prior experience providing this support. Teachers with no experience providing Tier-2 reading support were excluded from this study. Study criteria were designed to address several considerations regarding educational decision-makers.

First, the preventive, less resource-intensive nature of Tier 2 reading intervention for K-12 students makes it more likely that general education teachers, in addition to special education or reading specialist teachers, have had experience delivering Tier-2 reading intervention. Given this fact, a range of different educational consumers (e.g., regular education, special education)
were appropriate for inclusion. Second, teachers and administrators are more likely to make choices about Tier 2 than Tier 1 reading programs. Choices related to core reading curricula (Tier 1) likely occur at the school, district, or even state level. Thus, choices about Tier 1 reading programs are likely made by principals, superintendents, or State Departments of Education rather than by individual teachers. Moreover, an important component of Tier 2 reading instruction is explicit instruction (Gersten et al., 2008). The hands-on nature of Tier 2 reading instruction likely implies that teachers would take an active role in the selection and implementation of interventions at this level.

**Materials and Measures**

Participants completed a short screener to evaluate their eligibility for participation. A copy of this screener can be found in Appendix B. Eligible participants completed an instrument consisting of four elements, which were presented in the following order: 1) a task designed to assess the IR for all reading intervention options; 2) an Own-Price hypothetical intervention choice task (HICT); 3) a Cross-Price HICT; and 4) a demographics survey. Each of these elements is discussed individually in the sections below. All tasks were designed using Qualtrics®, a web-based platform for administering survey data. Consistent with earlier work using this methodology (e.g., Gilroy & Picardo, 2022), data were collected using the crowdsourcing platform Prolific. This allowed researchers to disseminate study materials to participants with specific characteristics, specific inclusion and exclusion criteria, and verify participant eligibility.

**Demographic Survey**

In the demographics survey, eligible participants provided information about their teaching experience (e.g., years spent teaching, settings in which they teach). Participants also
documented their specific experiences with reading intervention (e.g., formal training experiences, years of experience in reading intervention). This information supported contextualization of participant decision-making. A copy of the demographics survey can be found in Appendix B.

**Characterization of IR/UR for Intervention Choices**

Outlining the HICTs necessitates a discussion of how Informational Reinforcement (IR) and Utilitarian Reinforcement (UR) was characterized for each intervention. IR was derived from participant input on the measure and UR was characterized a priori based on a review of the research literature.

**Utilitarian Reinforcement.** UR can be derived by examining the evidence base of various EBPs. This is because UR refers to the direct, practical benefits of consuming a good or service (Foxall, 2016), and interventions that have evidence supporting effectiveness are more likely to confer these benefits than other interventions. Therefore, EBPs can be considered to have higher UR than LVPs. High UR interventions (i.e., EBPs) in this study were selected based on their support against WWC standards. Interventions with studies meeting WWC criteria for scientific rigor, that supported positive or potentially positive effects on at least one reading outcome were chosen as the High UR interventions for the proposed study. The following interventions were chosen as High UR: 1) Sound Partners (Vadasy et al., 2006); 2) Success for All (Slavin et al., 1996); 3) Earobics (e.g., Gale, 2006); 4) Leveled Literacy Intervention (e.g., Ransford-Kaldon et al., 2010); and 5) Read Naturally (Hasbrouck et al., 1999). Further details about these interventions, including specific reading skills and grade levels examined in the evidence literature can be found in Appendix A.
In contrast, the interventions chosen as having Low UR (LVPs) for this study were those that appeared on WWC but are not supported by any studies meeting WWC criteria or the criteria of other systematic reviews. These interventions were important to include in this study, as they facilitated the exploration of how various forms of reinforcement (UR and IR) are maximized when participants cannot maximize both. In other words, these interventions were necessary to populate the lower half of the grid depicted in Figure 1. LVPs can be considered to have Low UR because interventions without evidence of effectiveness are less likely to confer benefits of intervention consumption. The following interventions were chosen as Low UR due to having no studies meeting WWC evidence standards per their Beginning Reading review protocol, which can be reviewed at the WWC website (https://ies.ed.gov/ncee/wwc/Document/27): 1) LiPS (Lindamood & Lindamood, 1998); 2) Houghton Mifflin Reading (e.g., Ryder et al., 2006); 3) Project Read Phonology ® (e.g., Greene, 1993); 4) unbranded Orton Gillingham ® based sensory approaches (e.g., Vickery et al., 1987); 5) Barton Reading and Spelling System ® (e.g., Mihandoost & Elias, 2011); 6) Words Their Way ™ (Bear & Others, 1996); 7) Hooked on Phonics ® (e.g., Singh & Singh, 1993); 8) Read Well ® (e.g., Gunn et al., 2010); 9) Academy of Reading ® (Palmer, 2016); and 10) LeapFrog Schoolhouse (Ogura et al., 2007). Some of these interventions are widely used, but none have a base of support from studies meeting WWC standards.

**Informational Reinforcement.** Given that IR is a function of one’s unique social community (i.e., the status elevation or social attention associated with consumption behavior; Oliveira-Castro & Foxall, 2017), the IR of any given good or service can be expected to vary among individuals. In this study, each participant ranked IR for each intervention by reading short vignettes about the intervention and answering two questions, presented on a sliding scale:
1) “How likely would you be to try this intervention?”; and 2) “How likely would you be to tell others (e.g., other teachers, your principal) about this intervention?” These questions briefly captured aspects deemed appropriate for characterizing IR, which can be defined as the indirect, social benefits of purchasing a good or service (Foxall, 2016; Oliveira-Castro & Foxall, 2017). Participants indicated their responses to these questions on a sliding scale from 0 to 100, with 0 labeled “Not at all likely” and 100 labeled “Definitely likely”. The numerical values resulting from responses to each question were summed to create a single numerical value (Total IR) representing the IR of each intervention.

Computer-based data collection using Qualtrics ® facilitated sensitive rankings of IR (e.g., sliders can be used instead of a point scale), and this was necessary for the personalization of the intervention options presented across participants: the Total IR score of each intervention was rank-ordered by the computer, revealing which EBP (High UR) and LVP (Low UR) ranked highest in IR, and which EBP and LVP ranked lowest. Figure 2 depicts the IR rankings of a hypothetical participant and illustrates how these rankings were used to populate the grid depicted in Figure 1.
Once participants indicated the levels of IR associated with intervention choices, a series of two HICTs was presented in the order of Own-Price HICT and then Cross-Price HICT. Further discussion of the HICTs presented to participants is presented below. Sample instructions for the own- and cross-price HICTs are available in Appendix B.

**Own-Price HICT.** The own-price HICT explored the demand for a reading intervention determined to be high in both UR and IR for each participant. The first task addressed RQ1 specifically. In this task, participants were asked to allocate resources towards a specific intervention determined to have strong direct (UR) and social (IR) reinforcing effects. Specifically, participants were presented with vignettes that communicated the following: 1) a general description of the intervention; 2) the reading skills addressed by the intervention; and 3) a statement about the evidence for the intervention (see Appendix B for sample vignettes). To simulate real-world contexts, all participants had a limited set of resources to spend. Specifically, teachers had a set monetary budget and limitations regarding the amount of instructional time.
available. Each participant was provided with a hypothetical budget of $100 and 150 minutes of instructional time (i.e., 10 15-minute lessons) available for each week. Participants were asked to allocate these resources across seven different price points, with the price per lesson ranging from $5 to $40. That is, participants were presented with the opportunity to consume (i.e., program for) the relevant intervention as the price to implement one lesson ranged from low to high (i.e., $5, $8, $10, $15, $20, $30, $40).

**Cross-Price HICT.** The cross-price HICT evaluated the consumption of interventions when the costs to consume each varied. Specifically, the costs to implement the primary intervention (i.e., High UR/High IR) varied as described in the Own-Price HICT but two intervention alternatives (i.e., High UR/Low IR, Low UR/High IR) were available concurrently at a fixed lower price ($10). This task elucidated which source of reinforcement most influenced consumption (i.e., UR or IR). As in the Own-Price HICT, participants had to spend a limited set of resources: a maximum of 10 lessons (150 minutes) and $100 was available to spend on intervention each week. Similarly, the cost to implement the optimal intervention increased from low to high (see Own-Price HICT for pricing arrangement).

**Analytical Strategy**

The analytical approach used in this study was guided by the results from several procedures. Prior to performing modeling, data was inspected for quality and consistency (i.e., that responding did not appear to occur at random). Additionally, different types of consumption were analyzed using different techniques. Specifically, the demand for the High UR/High IR (i.e., EBP) intervention option was evaluated using a multilevel modeling approach (Kaplan et al., 2021). That is, this technique allowed for an evaluation of changes in the elasticity of demand for this type of service at a population-level. Additionally, the consumption of alternatives to the...
EBP intervention option was evaluated using a Generalized Estimating Equation (GEE). The GEE procedure was used to characterize participant choices in the Cross-Price HICT (i.e., to determine if alternatives functioned as substitutes or complements to optimal intervention). Additional information on each of these steps is provided below.

**Data Quality and Screening**

Prior to study analyses, data was screened to evaluate the systematicity of responding, as task inattention or a lack of understanding instruction can be detrimental to the quality of data. That is, erred or random responding across price points affects the precision of the greater analysis (2015). Per Stein et al.’s (2015) best practice recommendations for nonsystematic purchase tasks, data in this study was checked against three criteria at recommended defaults. All data screening occurred in the R statistical program (R Core Team, 2018), using the beezdemand R package (Kaplan et al., 2019).

The first is called the trend criterion. If all else is equal, increasing the price of a commodity should decrease the consumption of that commodity (e.g., Afshin et al., 2017). Per the trend criterion, there should be a discernible change in consumption from the first (cheapest) to the last (most expensive) price point. The following formula was used to calculate this change:

\[
\Delta Q = \frac{\log Q_1 - \log Q_n}{\log P_n - \log P_1}
\]

In this formula, \(\Delta Q\) is the relative change in the quantity consumed, \(Q_1\) and \(Q_n\) are the quantities purchased at the first and last price points, respectively, and \(P_1\) and \(P_n\) are the first and last price points, respectively. To satisfy the trend criterion, \(\Delta Q\) should be greater than .025. A \(\Delta Q\) of 0 would indicate no change in consumption across prices, and a negative \(\Delta Q\) would indicate consumption that increases as price rises.
The second criterion is called the bounce criterion. This criterion describes how consumption changes from one price point to the next. Per this criterion, most increases in price should result in a decrease in consumption. A jump in consumption as the price point changes from low to high might indicate inattention, even if the trend criterion is met (i.e., even if the overall pattern indicates a decrease in consumption across price points). The last criterion is called reversals from zero. This criterion describes a situation in which a participant ceases consumption, then resumes it at a later price point. Two or more consecutive price points with no consumption, followed by a return to consumption, can indicate nonsystematic responding. This can occur even if the bounce and trend criteria are satisfied.

**Analytical Plan**

The Zero Bounded Exponential model of demand (ZBE; Gilroy et al., 2021) was used to evaluate the consumption of reading interventions. The ZBE model is a version of the framework presented in Hursh & Silberberg (2008) that uses a modified scale to accommodate a true lower bound when consumption is at zero. This deviation from the historical log scale was necessary because 0 values (i.e., non-consumption) are undefined on the log scale. The ZBE model has three forms. The base form (Equation 1) is a direct restatement of the original Hursh & Silberberg model but in IHS units rather than log units (i.e., non-zero lower bound). Additionally, there are forms of the ZBE model that accommodate a true lower bound at 0 (Equation 2) and another that reflects demand as purely inelastic (i.e., when demand is not sensitive to an economic factor such as price; Equation 3). The equations representing each form of the ZBE model are presented below:

1. \[ IHS(Q) = IHS(Q_0) + k (e^{-\alpha Q_0 P} - 1) \]
2. \[ IHS(Q) = IHS(Q_0) \cdot e^{-\frac{\alpha}{IHS(Q_0)} Q_0 P} \]
Equations 2 and 3 are considered restricted forms of Equation 1, and as such, can be directly compared using Sum of Squares F-Tests and the Akaike Information Criteria (Bozdogan, 1987).

Consumption of interventions in this study, as in the ZBE model, was defined in terms of units of intervention (i.e., lessons; \( Q \)) as a function of unit price (i.e., price per lesson; \( P \)). In this model, the span of the demand curve reflects the range of consumption in IHS units. Each different form represents this span differently. In Equation 1, a separate parameter \( k \) is used to accommodate a non-zero lower bound. In Equation 2, the intercept (\( Q_0 \)) serves as the span parameter because the lower bound is the 0 point. Equation 3, which reflects inelastic demand alone, does not have a span parameter, as it is not needed when demand is not sensitive to price. \( Q_0 \) and \( \alpha \) are interpreted similarly across all three forms: \( Q_0 \) represents the intensity of demand as \( P \) approaches infinity; \( \alpha \) reflects the overall sensitivity of \( Q \) to \( P \).

Study analyses were performed with R statistical software (R Core Team, 2018). For consumption in the Own-Price HICT, the \textit{nlme} (R Core Team, 2018) package was used to fit a mixed-effects model. Applying a mixed-effects model to investigations of demand was advantageous for several reasons. First, the analysis yielded population-level fixed effects (i.e., constant effects at the group level) and these were used to draw inferences to the greater population (i.e., rates of change in elasticity). Second, the inclusion of random effects (i.e., individual variability with respect to population-level effects) retained individual-level variance for further analysis (Kaplan et al., 2021). Fitting a mixed-effects model to a demand curve yielded several different metrics: \( Q_0 \) (i.e., estimated consumption at free) and \( \alpha \) (i.e., the rate of change in elasticity). From these estimates, indicators of elasticity were computed, i.e. \( P_{MAX} \) and \( O_{MAX} \). \( O_{MAX} \) is defined as the maximum amount spent, and \( P_{MAX} \) can either be defined as the price

\[
IHS(Q) = IHS(Q_0)
\]
associated with $O_{MAX}$, or the price at which an inelastic demand curve switches from inelastic to elastic. This former definition for $P_{MAX}$ was used in the proposed study. Three of these metrics were derived by direct observation of the data, supported by the use of open source tools (e.g., http://www.behavioraleconlab.com/resources---tools.html).

The ZBE modeling approach represents three nested models since each form is a simpler version of the base form (i.e., form 3 has fewer parameters than form 2, and form 2 has fewer parameters than form 1). The goodness of fit of alternative nested models of the ZBE was compared using the extra-sum-of-squares F test. This test assessed how, for each model with added parameters, the change in the sum of squares compared to the loss of degrees of freedom. The F ratio and $p$ value resulting from a sum of squares F-test between a simple and more complex model were then evaluated to facilitate model selection, with a $p > .05$ indicating that the simpler model should not be rejected.

A Generalized Estimating Equation (GEE) was used to evaluate factors that influenced the consumption of alternative intervention options (e.g., High UR/Low IR, Low UR/High IR). Briefly, GEE is an extension of the generalized linear model (GLM). Specifically, GEE extends the GLM by accounting for nesting within the data (i.e., multiple responses from specific individuals). Thus, GEEs are recommended as appropriate for use in studies wherein individual data points are not independent (Kaplan et al., 2021) as in the present study. The GEE was used to evaluate the effects of Price and the Type of contingency (i.e., High UR/Low IR, Low UR/High IR). Furthermore, the estimates for Price in the model was used to make inferences about the relationship between an optimal intervention (i.e., High UR/High IR) and others, thus allowing examination of whether an alternative served as a complement (i.e., consumed in
conjunction with the EBP) or as a substitute (i.e., consumed as a functional alternative to the EBP).

Unlike GLMs, GEEs do not assume that observed data are independent and intercorrelations are handled within the optimization, i.e. not based on typical Maximum Likelihood Estimation (Pan, 2001). Because of this, the AIC is not an applicable method for model selection. Instead, competing models were evaluated using the Quasi likelihood under the Independence model Criterion (QIC; Pan, 2001; Cui, 2007). The QIC is functionally similar to AIC (i.e., lower is better) but did not require a likelihood. The geepack package in R statistical software (R Core Team, 2018) was used to perform GEE with an exchangeable correlation structure and calculate the QIC metric.
Chapter 3. Results

Participants

A total of 73 participants met all criteria for systematic demand per the Stein et al. criteria (73 / 100 total participants = 73%). Model selection for these 73 participants revealed that the restricted ZBE model (Eq. 2) outperformed the full ZBE model (Eq. 1), F[1,508] = 0.034, p = 0.8539 as well as the intercept-only model (Eq. 3), F[1,509] = 302.9757, p = 0. Likelihood ratio tests favored the inclusion of random effects over a simpler version of the restricted model using a generalized nonlinear least squares approach, LR= 544.1153, p < .0001. Given that the multilevel model outperformed simpler alternatives, this approach was carried forward for all remaining analyses. Multilevel modelling approaches are also advantageous due to the robustness of the methodology to potential violations of assumptions (e.g., Schielzeth, 2020). The final model was subsequently re-fitted using the full data set (n=100; i.e., participants not meeting one or more checks for systematic responding), and model results revealed that the inclusion of these participants did not alter interpretations using the model. Due to the robustness of the methodology and the similarity in interpretations between models, the full data set was used to reduce the risk of experimenter bias. In other words, refitting the final model using the full data set did not change interpretations and avoided unduly emphasizing a specific subset of participants.

The demographic characteristics of the sample (n = 100) used in all analyses are listed in Table 1. The majority of the sample listed their occupation as teachers (n=94; 94%), with the remaining 6% of participants listing their occupation as other (e.g., school director, instructor, physical education teacher, consultant, community provider; n=5; 5%) or principal (n=1; 1%). Over half of the sample (n=52; 52%) endorsed having 10+ years of teaching experience and the
majority reported teaching multiple grades at either the elementary (grades K-5), middle (grades 6-8) or high school (grades 9-12) levels (n=63; 63%). Most participants reported having a Master’s degree (n=53; 53%), with the next most common level of education reported having a Bachelor’s (n=43; 43%). Most identified as women (n=64; 64%) and reported their race as White (n=81; 81%).

Table 1. Participant Demographics

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Race</th>
<th>Gender</th>
<th>Years Teaching</th>
<th>Grades Taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher 94 (94%)</td>
<td>Asian 9 (9%)</td>
<td>Woman 64 (64%)</td>
<td>&lt;5 23 (23%)</td>
<td>K-3 13 (13%)</td>
</tr>
<tr>
<td>Principal 1 (1%)</td>
<td>Black 5 (5%)</td>
<td>Man 36 (36%)</td>
<td>Between 5 and 10 25 (25%)</td>
<td>4-6 10 (10%)</td>
</tr>
<tr>
<td>Other 5 (5%)</td>
<td>Latinx 4 (4%)</td>
<td></td>
<td>10 or more 52 (52%)</td>
<td>7-9 7 (7%)</td>
</tr>
<tr>
<td>Education</td>
<td>White 81 (81%)</td>
<td></td>
<td>Multiple grades 63 (63%)</td>
<td>11-12 7 (7%)</td>
</tr>
<tr>
<td>Associate degree 2 (2%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bachelor’s degree 43 (43%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Master’s degree 53 (53%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctoral degree 1 (1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formal Coursework in Reading Instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undergraduate level 34 (34%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate level 24 (24%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading Specialist certificate 3 (3%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other 9 (9%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal coursework 30 (30%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: The participant sample of this study did not include any 10th grade teachers.

RQ1: Alone-Price Demand for EBPs

The two-parameter form of the ZBE model was used to estimate $Q_0$ and $\alpha$ with reported levels of teaching Experience and Gender (woman, man) as covariates. Experience was categorized into levels (new teachers: <5 years; experienced teachers: between 5-10 years;
veteran teachers: 10+ years) to facilitate contrasts and increase the generality of findings. Specifically, such groupings served to distinguish novice from experienced and veteran educators. No separate span parameter was included in the analysis. The results of this regression are listed in Table 2 and displayed in Figure 3. Model fits indicated no significant differences in baseline levels of demand ($Q_0$) for evidence-based therapies across levels of Experience or Gender. However, model results revealed that the more junior teachers rapidly decreased their

Figure 3. Alone-Price Demand for EBPs by Experience and Gender
Table 2. Results of multilevel modeling in Alone-Price demand task

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std. Err</th>
<th>T-value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q0 [Intercept; man, 10+ years]</td>
<td>7.7636</td>
<td>1.4692</td>
<td>5.2843</td>
<td>0.0000</td>
</tr>
<tr>
<td>Q0 [6-9 years]</td>
<td>-1.6431</td>
<td>1.9677</td>
<td>-0.8350</td>
<td>0.4040</td>
</tr>
<tr>
<td>Q0 [1-5 years]</td>
<td>2.9778</td>
<td>2.1480</td>
<td>1.3863</td>
<td>0.1662</td>
</tr>
<tr>
<td>Q0 [Woman]</td>
<td>1.269473</td>
<td>1.7236392</td>
<td>0.736507</td>
<td>0.4617</td>
</tr>
<tr>
<td>[Intercept; man, 10+ years]</td>
<td>0.0029</td>
<td>0.0005</td>
<td>5.6584</td>
<td>0.0000</td>
</tr>
<tr>
<td>Alpha [6-9 years]</td>
<td>-0.0003</td>
<td>0.0006975</td>
<td>0.401413</td>
<td>0.6883</td>
</tr>
<tr>
<td>Alpha [1-5 years]</td>
<td>0.001614</td>
<td>0.0006918</td>
<td>2.332386</td>
<td>0.0200*</td>
</tr>
<tr>
<td>Alpha [Woman]</td>
<td>0.000521</td>
<td>0.0005872</td>
<td>0.888124</td>
<td>0.3748</td>
</tr>
</tbody>
</table>

consumption of EBPs when compared to veteran teachers. In other words, a significant difference in $\alpha$ between experienced teachers (10+ years) and new teachers (1-5 years) ($\alpha$ [1-5 years] = 0.001614, T= 2.332386, p=.02) was observed. In more direct unit terms, peak resources ($O_{MAX}$) contributed to EBPs were recorded at 58.9, 64.0, and 70.4 for novice, experienced, and veteran educators, respectively. In simple terms, at a price of 0 in a closed market (i.e., when EBPs are “free” and no other options are available), there was no significant difference between EBP consumption between new, experienced, and veteran educators. However, when constraints were introduced (i.e., as price increased), new teachers more quickly decreased their consumption of EBPs compared to experienced or veteran teachers.
RQ2: Cross-Price Demand for Interventions

Modeling of cross-price demand for interventions was performed using the same participants in the Alone-Price tasks. Own-price demand for interventions was evaluated using the analytical strategy outlined in the Alone-Price analysis and the cross-price demand for intervention alternatives was analyzed via GEE.

Own-Price Demand for EBPs (MLM)

Baseline consumption of EBPs in an open market (i.e., when alternatives are available) was comparable to consumption in a closed market ($Q_0 = 7.82$, $T= 10.88$, $p= 0.000$). However, consumption of EBPs in an open market decreased more rapidly than in a closed market ($\alpha= 0.005558$), resulting in lower peak consumption in the open market. This result is illustrated in Figure 4.
Figure 4. Comparison of demand with and without intervention alternatives
Cross-Price Demand for Alternatives (GEE)

Factors in the GEE for cross-price demand for intervention alternatives include Price, Type (i.e., High UR/Low IR, Low UR/High IR), Gender, Experience, and all potential interactions. Model selection was performed using the QIC metric ((Barton & Barton, 2015)). Model selection revealed that the model with Price ($\beta[Price]= 0.02754$, $W=21.99$, $p<0.001$) was the most likely model that the data were to have been generated from. Although Price was the only significant factor, Type was included in model selection due to its relevancy for addressing RQ2. The results of model comparisons are listed in Table 3.

The cross-price demand for intervention alternatives revealed that teachers substituted a preferred EBP (own-price) with both types of alternatives, see Figure 5. As the price of the own-price EBP increased, consumption of both alternatives increased ($\alpha[Price] = 0.02754$, $T=21.99$, $p<0.0000$). No significant difference in slope between Type (High UR/ Low IR, Low UR/High IR) was found ($\alpha[High UR, Low IR] = 0.17357$, $T=0.25$, $p=0.62$). That is, when unable to maximize both UR and IR reinforcement contingencies, teachers overall did not appear to favor one source of reinforcement over the other.
Figure 5. Fits of generalized estimating equation in Cross-Price demand task

Table 3. Results of generalized estimating equation model comparisons

<table>
<thead>
<tr>
<th>Model</th>
<th>Delta</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 (Price + Type)</td>
<td>0.00</td>
<td>0.993</td>
</tr>
<tr>
<td>4 (Price + Type + Gender)</td>
<td>9.83</td>
<td>0.007</td>
</tr>
<tr>
<td>3 (Price + Type + Gender + Exp)</td>
<td>32.16</td>
<td>0.000</td>
</tr>
<tr>
<td>2 (Price * Type + Gender + Exp)</td>
<td>33.89</td>
<td>0.000</td>
</tr>
<tr>
<td>1 (Price * Type * Gender + Exp)</td>
<td>46.88</td>
<td>0.000</td>
</tr>
<tr>
<td>Full (Price * Type * Gender * Exp)</td>
<td>115.01</td>
<td>0.000</td>
</tr>
</tbody>
</table>
Table 4. Results of the generalized estimating equation in Cross-Price demand task

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std. Err</th>
<th>T-value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>2.18922</td>
<td>0.24266</td>
<td>81.39</td>
<td>&lt;0.0000</td>
</tr>
<tr>
<td>Price</td>
<td>0.02754</td>
<td>0.00587</td>
<td>21.99</td>
<td>&lt;0.0000</td>
</tr>
<tr>
<td>Type</td>
<td>0.17357</td>
<td>0.34799</td>
<td>0.25</td>
<td>0.62</td>
</tr>
</tbody>
</table>

*Note: The Low UR/High IR served as the primary contrast for the alternative intervention Type.
Chapter 4. Discussion

Literacy is a crucial skill for day-to-day functioning, yet many American adults do not demonstrate adequate literacy skills (Reder, 2010). Reading is a core skill for literacy, and like literacy, reading is comprised of a combination of many different but equally critical skills (White & Dillow, 2005). In schools, reading instruction has emphasized whole word and phonics approaches, with the popularity of each type of specific approach varying over time. Phonics approaches are more supported in the literature as being more effective than whole word approaches, which teach early readers to attend to graphical features of words and context cues in stories rather than the relationships between letters and sounds (Ehri et al., 2001). In the current educational landscape, scientific support is a necessary feature of interventions employed in classrooms, and it stands to reason that the use of EBPs such as phonics-based reading programs should be predominant. However, interventions that lack empirical support are still used widely in classrooms and across schools (e.g., Brady, 2011). Given this deviation from rational assumptions, further research on the contingencies that influence academic intervention choices is critical.

This study used methods from behavioral economics to investigate contingencies maintaining teacher behavior and intervention selection. The BPM is a framework that marries ABA with behavioral economics to characterize how individuals make decisions when confronted with several options for goods or services, with each good and service conferring different amounts of three different types of reinforcement (i.e., UR, IR; Foxall et al., 2011).

**RQ1: Characterizing Demand for Evidence-based Practices**

The first research question investigated educator consumption of EBPs for reading and evaluated whether any factors appeared to correspond with features of a demand curve. The
demand curve typically shows declining consumption as the price of a good or service increases. The results of analyses of demand for EBPs, when no alternatives were present (i.e., a closed economy), indicated that teacher choice was indeed consistent with the expected shape of the demand curve. Thus, as the prices of EBPs increased, consumption decreased. These results are consistent with the predicted effects of unit price on choice responding, which posits that all else being equal, increasing the price of a reinforcer decreases the consumption of that reinforcer. This finding also suggests that this framework could be a useful tool for simulating and exploring how educators make instructional choices under real-world constraints (i.e., limited time, resources).

To determine whether any individual differences influenced choice responding, teacher experience and gender were included in this analysis. No gender differences were found in sensitivity to price. That is, participants who identified as men did not differ from participants who identified as women in their consumption of EBPs as prices increased. However, there was a significant difference in the slope of consumption between new (1-5 years of experience) and veteran (10+ years of experience), whereby new teachers discontinued consumption of EBPs more rapidly than veteran teachers as prices rose. This difference was also noted between new and experienced (5-10 years of experience) teachers, but this contrast was nonsignificant. Overall, new teachers discontinued consumption of EBPs at lower price points than experienced and veteran teachers. Thus, the peak overall consumption of EBPs for new teachers was lower than for experienced and veteran teachers. Findings that more junior educators differentially endorsed their use of EBPs for reading warrants continued research.

There is a dearth of available literature on how teachers at any level of experience select academic interventions, but possible insights can be derived from a small body of research on
teacher selection of instructional materials (e.g., textbooks, activities, lesson plans; Davis, 2006). The early discontinuation of EBPs for new teachers in this study could have several explanations. First, compared to more experienced teachers, new teachers may face additional challenges such as higher stress levels, difficulty managing classroom behavior, uncertainty about curriculum standards, and lack of support (Dias-Lacy & Guirguis, 2017). These challenges may amplify the impact of constraints on time and money resources. Second, new teachers may struggle to implement EBPs due to insufficient preparation, lack of generalization, competing demands, absence of an EBP culture, and a lack of expertise on content (Scheeler et al., 2016). Such difficulty with the implementation of EBPs may result in resource-constrained new teachers discontinuing their use more quickly than their experienced counterparts. Third, new teachers may be in the process of developing their repertoire of instructional strategies and thus may cycle through these strategies more quickly regardless of supporting evidence.

Lastly, the effects of the COVID-19 pandemic on teacher training are currently unclear, but recent research has suggested a widespread waiver of student-teacher (i.e., in-classroom) experience during the pandemic (Choate et al., 2021). In this study, the most experienced teachers in the “new teacher” group entered their profession one to two years before the COVID-19 pandemic and the least experienced entered one year after the pandemic, when online teaching was still commonplace in many states. Thus, the new teachers in this study likely faced unprecedented challenges during the COVID-19 pandemic, including a lack of preparation for both online and in-classroom teaching, difficulties managing students’ learning environments, difficulty engaging students, limited access to collegial support, and difficulty tailoring instruction to meet the needs of diverse learners (Johnson et al., 2023). Further, evidence-based practice may have been de-emphasized during the COVID-19 pandemic, since teachers had to
adapt to unprecedented conditions without evidence-supported guidelines for best practices (Furlong et al., 2021). Thus, it is reasonable to conclude that the conditions under which new teachers received training and began teaching impacted their allocation of resources towards EBPs.

**RQ2: Teacher Substitutability of Reading Interventions**

The three-term contingency (i.e., ABC model) is central to understanding how behavior relates to various ecological factors. Teacher choice of reading interventions is complex and likely involves consideration of several different factors. This study investigated whether teacher choice was associated with distinct contingencies (i.e., concordance with evidence vs. alignment with the local educator community) and whether their behavior was differentially sensitive to contingencies.

The second research question evaluated the consumption of EBPs when two other alternatives, one high in UR but low in IR (i.e., a less-preferred EBP) and the other high in IR but low in UR (i.e., a highly-preferred LVP) were available for consumption in a cross-price purchase task. In this task, the price to consume an intervention high in both UR and IR become increasingly unaffordable and teachers had to then decide how to spend their limited resources across options that featured different types of consequences. Results indicated that the availability of intervention alternatives (i.e., open economy) led to overall lower levels of consumption for the primary EBP (i.e., high in both UR and IR). Analyses of how teachers consumed the alternatives revealed that both the low-IR EBP and the LVP reading interventions functioned as substitutes for the primary EBP. That is, as the unit price of the primary EBP increased, consumption of the primary approach (i.e., High UR/High IR) decreased while consumption of both alternatives increased, and participants did not seem to systematically favor
any one type of alternative over another. In other words, this result indicates that teachers did not appear to favor the evidence of effectiveness over reinforcement from their communities, as might be expected if evidence was penultimate for intervention selection.

Evidence of effectiveness did not emerge as the sole factor associated with the consumption of reading interventions and factors related to the reinforcement derived from teachers’ social/verbal communities appeared to be just as relevant as evidence of effectiveness. The finding that instructional choices may not be strongly aligned with scientific evidence has been documented in the literature (Bugler, 2017). For instance, Bugler (2017) explored how educators make curricular decisions and their research revealed that teachers have little formal training on how to select instructional materials and often rely on guidance from more experienced colleagues (i.e., from their community of educators). Furthermore, teachers trusted instructional materials created and/or vetted by teachers over remarks and reviews conducted by educational researchers.

The finding that evidence was not the sole or primary factor associated with teacher choice is consistent with other intervention-related decision-making (e.g., Gilroy & Picardo (2022) and Gilroy & Feck (2022)) and calls for further research on deviations from research-aligned practices. For example, teachers must adapt materials to meet the needs of diverse students in a context with limited resources and incomplete research (i.e., educational research may not be representative of their students; Bugler, 2017). Alternatively, even if an intervention is supported by good evidence, teacher behavior may also be strongly influenced by other factors emerging from their local community of educators (e.g., preferences of and/or support from peer educators). The limited but emerging literature on educator choice behavior has suggested that, all things considered, teachers favor materials and practices created/vetted by other educators
(Bugler, 2017). This ‘fitting in’ and alignment with a community of educators might be considered an extension of informational consequences and the acceptability of an intervention might have both local (i.e., teacher finds practice acceptable) and molar interpretations (i.e., acceptable to their field as well as local colleagues).

**Study Limitations and Future Directions**

There is a dearth of research on the immediate, day-to-day factors in schools that influence educational decision-making beyond evidence (i.e., informational reinforcement). This study was, to our knowledge, the first to examine teacher choice of competing reading interventions from a behavioral economic perspective. Although the use of the utilitarian vs. informational distinction in consumer behavior analysis has good face validity in this context, additional elaboration is necessary in this regard. For example, informational consequences are highly heterogeneous, and work on methods for empirically deriving this dimension of reinforcement is completely new in educational contexts. Additionally, informational contingencies are likely to vary within specific occupational contexts, and what may be sufficient to capture this effect with parents may be insufficient for educators (e.g., parents with other parents, teachers with other colleagues, administrators, etc.).

Additional information on how evidence and the degree to which teacher behavior is influenced by evidence continues to be necessary (i.e., utilitarian reinforcement). As highlighted in this discussion, evidence for effectiveness is not penultimate for teacher selection of reading interventions. Although this can be partially explained by considering the IR conferred from the social/verbal community, aspects of UR must also be considered. If teacher attitudes and beliefs towards EBPs are relevant for EBP implementation (e.g. Nelson et al., 2006; Lilienfeld at al., 2013; Reddy et al., 2017), it follows that cognitions underlying those attitudes and beliefs is also
relevant. It is worth noting that skeptical attitudes towards EBPs are likely to be relatively rare among teachers and most resistance to EBP use stems from real or perceived resource constraints (Diery et al., 2021). Still, skeptics of EBPs may have increased awareness of shortcomings in research. For example, they may feel that participant samples from studies supporting an intervention’s effectiveness do not adequately represent their classroom population or that these studies are conducted in disparate contexts.

A number of study and methodological limitations warrant discussion and are described here to support future research. First, this study was powered to detect a small but clinically meaningful difference related to differential sensitivity to types of reinforcement consequences. Analyses of various other covariates (e.g., such as level of education, formal reading intervention training, gender) were exploratory and are likely underpowered. Second, this study was an initial translation of behavioral economic methods to educational contexts and the tasks presented here may not correspond well to teaching in all real-world contexts. That is, real-world educational decisions likely entail considerably more variability and other factors. Lastly, teachers are just one subgroup of educational decision-makers and various other professionals such as principals, educational consultants, and other administrators (e.g., superintendents) continues to be warranted.
## Appendix A. Summary of Literacy EBPs

### Summary of Literacy EBPs Chosen

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Reading Skills Supported (Studies Meeting WWC Standards)</th>
<th>Grades Studied</th>
<th>Effects</th>
<th>Link to WWC Intervention Report</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fluency (2)</td>
<td>K-3</td>
<td>Potentially Positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Achievement (2)</td>
<td>K-2</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fluency (1)</td>
<td>K-2</td>
<td>Potentially Positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comprehension (4)</td>
<td>2-4</td>
<td>Potentially Negative</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Achievement (2)</td>
<td>2-4</td>
<td>Potentially Positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fluency (4)</td>
<td>2-4</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comprehension (4)</td>
<td>K-1</td>
<td>Potentially Positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Achievement (1)</td>
<td>1</td>
<td>None Discernable</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fluency (7)</td>
<td>K-1</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comprehension (8)</td>
<td>K-4</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Achievement (6)</td>
<td>K-4</td>
<td>Mixed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fluency (2)</td>
<td>K-4</td>
<td>Potentially Positive</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B. Study Materials

Participant Screening Questionnaire

1. Are you currently a teacher?    Y    N

2. Do you currently OR have you provided small-group reading instruction to your students?    Y    N

Example Instructions for Hypothetical Intervention Choice Tasks (HICTs)

Introduction to HICTs

Thank you for finishing Part 1: Rating the interventions for reading difficulties.

In Part 2, we will be asking you to make decisions about how you would spend hypothetical time and resources.

Imagine that your district is making a push towards improving reading intervention for students who are struggling with early reading skills, and was awarded a huge grant to support this effort. Your classroom will be provided with up to $100 per week to spend on small-group reading intervention.

The following questions will ask you to spend this money on different intervention options under various time and money constraints. The options provided are based on your earlier ratings, and the vignettes describing these options are provided to jog your memory. The price of interventions will change, so make sure to watch the price carefully!
Own-Price Demand for EBPs

You are given $100 to spend toward reading intervention with 2.5 hours per week that you can allocate towards this intervention without cutting into your other demands.

The cost of Earobics program is $5/hour.

How many hours of instruction would you put into this intervention, at this cost?

You may use whole and half-hours (e.g. 1, 1.5, 2, 2.5, etc.).

Cross-Price Demand for for EBPs

This next hypothetical purchasing task is slightly different. Based on your earlier preferences, the following options are now available: Earobics, LiPs and Unbranded Orton Gillingham approaches.

We will be asking you to make decisions about how you would spend hypothetical time and resources when multiple interventions are available at different prices.

Sample Vignettes

Sample EBP Vignette

Earobics ® is a software-based reading intervention that presents students with individualized, systematic literacy lessons. The core skills emphasized in this intervention are phonemic awareness, auditory processing, and phonics. Instruction is matched to a student’s skill level. This program is intended for use by students in grades K-3, but it may also benefit students in higher grades who are struggling to improve their basic reading skills. This program has research evidence supportive positive effects on acquisition of alphabetics skills and potentially positive effects on reading fluency.
Sample LVP Vignette

Words their Way™ is a developmental approach to phonics, vocabulary, and spelling instructions. This program emphasizes word study, which involves examining, manipulating, comparing, and categorizing words in order to reveal the underlying logic of language. This program is intended for use by students in grade K-12. This program currently does not have research evidence to support its effectiveness.
Demographics Survey

1. How many years have you been teaching? Please round to the nearest whole number.

2. What is your job title?
   a. Teacher
   b. Principal
   c. Reading Specialist
   d. Special Education Teacher/Resource Teacher
   e. Other (Please Specify):_________________

3. What grade do you currently teach, OR what grades did you teach in the past? If more than one, select all that apply (press down ctrl on a PC or command on a Mac to select more than one):
   a. K
   b. 1
   c. 2
   d. 3
   e. 4
   f. 5
   g. 6
   h. 7
   i. 8
   j. 9
   k. 10
   l. 11
m. 12
n. I’m not currently teaching

4. What is the highest level of school you completed or the highest degree you have received?
   a. Less than high school degree
   b. High school graduate (high school diploma)
   c. Some college but no degree
   d. Associate degree in college (2-year)
   e. Bachelor’s degree in college (4-year)
   f. Master’s degree
   g. Doctoral degree
   h. Other (Please Specify):__________________

5. Do you have formal education reading instruction?
   a. Yes
   b. No

6. If yes, please specify. Choose all that apply:
   a. Undergraduate-level coursework in reading instruction
   b. Graduate-level coursework in reading instruction
   c. Reading Specialist certification
   d. Other (Please Specify):__________________

7. What gender do you identify with?
   a. Man (cisgender)
   b. Woman (cisgender)
c. Transgender man

d. Transgender woman

e. Nonbinary/ gender noncomforming

f. Other

g. Would rather not say

8. What is your race/ ethnicity?

   a. White/Caucasian

   b. Black/African American

   c. Latinx

   d. Asian

   e. Native American

   f. Pacific Islander

   g. Other

   h. Would rather not say
Appendix C. Source Code

Source Code for Power Analysis

```r
library(tidyverse)

n_sims <- 100
alpha <- 0.05
result <- rep(FALSE, n_sims)

totalParticipantV <- c(25, 30, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95,
                       100, 125, 150, 175,
                       200)

pow = data.frame(
  Size = totalParticipantV,
  Power = NA)

result <- rep(FALSE, n_sims)

priceVector = c(50, 75, 100, 150, 200, 250, 300, 350)
typeVector = c("UR", "IR")

#dataFrameTemp = NULL

for (sizeInArray in totalParticipantV) {
  for (ii in 1:n_sims) {
    # code here
  }
}
```

set.seed(ii)

seedValueForURfromPastStudy = exp(-4.5)

dataFrameTemp = data.frame(
    ID = 1:sizeInArray,
    Price = rnorm(sizeInArray, seedValueForURfromPastStudy, 0.0025)
)

interactionTerm = abs(exp(-4.5) - exp(-4.45))

dataFrameTemp$Type = dataFrameTemp$Price + rnorm(sizeInArray, interactionTerm, 0.00001)

UR = dataFrameTemp[,"Price"] %o% priceVector %>%
    as.data.frame() %>%
    mutate(ID = dataFrameTemp$ID,
           Type = "UR")

IR = dataFrameTemp[,"Type"] %o% priceVector %>%
    as.data.frame() %>%
    mutate(ID = dataFrameTemp$ID,
           Type = "IR")
totalFrame = rbind(UR, IR)

colnames(totalFrame) <- c(priceVector, "ID", "Type")

totalFrame.long = totalFrame %>%
gather(Price, Consumption, `50`: `350`) %>%
mutate(Price = as.numeric(Price))

model <- lm(Consumption ~ Price * Type, data = totalFrame.long)

#summary(model)$coefficients[4,4]
result[ii] <- summary(model)$coefficients[4,4] < alpha

pow[pow$Size == sizeInArray, "Power"] = sum(result)/n_sims

pow

ggplot(pow, aes(Size, Power)) +
geom_point() +
geom_line() +
```
geom_hline(yintercept = .8,
            color = 'red',
            lty = 2) +

geom_smooth() +

geom_vline(xintercept = 85,
            color = 'green',
            lty = 2)
```
References


65


Noell, G. H., & Gansle, K. A. (2009). Moving from good ideas in educational systems change to sustainable program implementation: Coming to terms with some of the realities. *Psychology in the Schools, 46*(1), 79–89. https://doi.org/10.1002/pits.20355


Palmer, L. L. (n.d.). *ACADEMY OF READING® IMPACT ON STUDENT ACHIEVEMENT IN EXTENDED LEARNING PROGRAM.*


Vita

Rochelle Picardo was born in Mumbai, India and grew up in Vancouver, Canada. As a teenager, she developed a love of helping children and their families through volunteerism. An interest in child development motivated her to earn a Bachelor’s degree in Psychology and a Master’s degree in School Psychology from the University of British Columbia. Prior to beginning her doctorate, she completed an internship working as a School Psychologist for a Provincial Autism program. She decided to enter the School Psychology Program at Louisiana State University due to its opportunities to develop expertise on intervention at all tiers of psychological service delivery (i.e., individual, group, and systems). She anticipates completing her doctorate in August 2024. After her doctorate, she will pursue licensure as a clinical psychologist and she hopes to work at an academic medical center.