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Searching for Evidence-Based Practice: A Survey of Empirical Studies on Curricular Interventions Measuring and Reporting Fidelity of Implementation Published During 2004-2013

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Abstract

In an environment of accountability, the development of evidence-based practices is expected. To demonstrate that a practice is evidence-based, quality indicators of rigorous methodology should be present including a showing that teachers implementing an intervention have done so with fidelity to its design (FOI). Because evidence-based practices assume FOI, failure to establish FOI limits the conclusions that can be drawn from any outcome evaluation. This study surveys the gifted education literature to ascertain the degree to which FOI has been assessed and reported in curriculum intervention efficacy studies and outcome evaluations. Of the eleven curriculum intervention studies included in this survey, each addressed FOI. The nature and quality of the methods used however to measure FOI, as well as the degree to which fidelity data were reported, varied widely among these studies which suggests the need for increased methodological rigor in gifted curriculum research.

Keywords: fidelity of implementation, gifted education, curriculum, evidence-based practices

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Fidelity of implementation (FOI) is broadly defined as determination of how well an intervention is implemented in comparison with the original program design during an efficacy and/or effectiveness study (see O'Donnell, 2008, for a thorough review of the fidelity literature). In certain traditional fields of research, including public health, measuring FOI and establishing its relation to outcomes have been recognized as essential to demonstrating the effectiveness of an intervention. This is because it is only by gauging whether all elements of an intervention have been faithfully implemented that researchers and practitioners can understand whether it has contributed to intervention outcomes (Carroll, Patterson, Wood, Booth, Rick, & Ballain, 2007; Keller-Margulis, 2012).

In contrast to its more robust consideration in the public health literature, FOI is a relatively nascent construct in K-12 curriculum research. In fact, surveys of reported large-scale studies examining the efficacy and effectiveness of K-12 curriculum interventions rarely report FOI, and even more rarely report how FOI enhances or limits the effects of the intervention on outcomes thus limiting confidence that external and internal validity have been established (Mowbray, Holter, Teague, & Bybee, 2003). In light of these findings, educators, researchers, and policy makers increasingly expect educational researchers to measure and report FOI to K-12 curriculum intervention efficacy or effectiveness studies in the development and adoption of evidence-based practices (Cook & Cook, 2011; Jolly & Kettler, 2009; Slavin, 2002; Walsh, Kemp, Hodge, & Bowes, 2012). For example, the Institute of Education Sciences (IES) at the United States Department of Education requires researchers to evaluate and report FOI, at least

to a basic extent, in funded curriculum intervention efficacy research to demonstrate that a practice is evidence-based (U.S. Department of Education, 2003a).

O'Donnell's (2008) review of FOI literature addressed K-12 curriculum interventions broadly. It did not specifically delineate curriculum interventions for gifted learners. Additionally, the way FOI is studied has developed and changed significantly in the last six years. Thus, the degree to which FOI has been measured and reported in curriculum intervention studies implemented in gifted classrooms is poorly understood and warrants exploration at this time.

Fidelity of Implementation in Evidence-Based Practices

The importance of measuring and reporting FOI can be understood in the more general context of establishing that a curricular intervention constitutes an evidence-based practice. Broadly speaking, evidence-based practices consist of clearly described curricular interventions, programs, and instructional techniques with methodologically rigorous research bases supporting their effectiveness (Cook & Cook, 2011; Horner, Sugai, & Anderson, 2010; Walsh et al., 2012). In order for an educational practice to be considered evidence-based, certain quality indicators of rigorous methodology should be present (Cook, Tankersley, & Landrum, 2009; Gersten et al., 2005). These quality indicators for evaluating research typically address (a) the nature of the *research design* (e.g., group experimental, quasi-experimental), (b) the *quality of the research study* (e.g., adequate fidelity of implementation shown, psychometrically sound outcome measures used), (c) the *quantity* of studies documenting an experimental effect (i.e., replicated findings), and (d) a consequential *magnitude of effect* on student outcomes.

When evaluating whether a K-12 curriculum intervention study satisfies the *quality of research study* criterion, there is growing recognition among educational researchers of the value

of both measuring and reporting FOI, particularly since the O'Donnell (2008) review (Century, Rudnick, & Freeman, 2010). Because it refers to the extent to which delivery of a curricular intervention is consistent with the intervention as originally designed, FOI seeks to answer the question of whether teachers charged with implementing an intervention have done so with integrity to its curricular design and theoretical underpinnings (Azano et al., 2011). The failure to establish FOI in a curriculum intervention study limits the conclusions and generalizations that can be drawn from any outcome evaluation, and limits any assertion of methodological rigor (Carroll et al., 2007; O'Donnell, 2008).

To determine whether a study adequately establishes FOI for purposes of documenting its methodological quality, it is important to assess not only *whether* FOI was measured but *how* it was measured (Gersten et al., 2005; O'Donnell, 2008). At a minimum, researchers should explicitly identify the most central or "critical" components of an intervention, differentiate the intervention from business-as-usual conditions, and then regularly observe and record teachers utilizing those components over the course of the study (Century et al., 2010). **While observing and recording teacher methods for FOI may or may not translate to effect on student outcomes, it is essential to collect this data to understand any such effects.** Preferably, methods for fidelity assessment should be multidimensional (*e.g.*, researcher observation checklists, teacher self-report instruments, student work-product) and multi-informant (*e.g.*, teachers, students, researchers). Records generated by researchers through observations, as well as the methods used to record fidelity, should be described. Ideally, these records should provide a measure of inter-observer reliability that is reported with the results of a study (Gersten et al., 2005). Researchers (Keller-Margulis, 2012) further recommend that fidelity observations should be scheduled to appear at both predictable and unpredictable times to capture **actual** teacher implementation.

Additionally, researchers are encouraged to both measure and report the quality with which teachers employ the techniques embedded within an intervention along with moderating variables that constrained implementation fidelity such as lack of time, lack of resources, and/or low teacher expectations about student ability to engage with an intervention (Little, Feng, VanTassel-Baska, Rogers, & Avery, 2007). Finally, using fidelity data to determine their relation to student outcomes has been recommended (Azano et al., 2011; Century et al., 2010; O'Donnell, 2008).

Evidence-Based Practices in Gifted Education

In the era of accountability, a principle contention in the field of gifted education is that gifted students require comprehensive differentiated curricula and instruction shown to effectively develop their abilities (Hertberg-Davis & Callahan, 2013). Thus, researchers in the field (Azano et al., 2011; Callahan, 2013; VanTassel-Baska, Robinson, Coleman, Shore & Subotnik, 2006; Walsh et al., 2012) urge the development and deployment of rigorously conducted curriculum intervention studies to demonstrate that recommended curricula and practices for gifted learners are evidence-based. Additional specific recommendations are that curriculum evaluation studies should be designed to provide data that both demonstrate measurable academic growth for gifted learners (Gallagher, 2011; VanTassel-Baska & Brown, 2007), and allow teachers and educational decision makers to support their use in gifted education classrooms (Coleman, Gallagher, & Job, 2012; Klimis & VanTassel-Baska, 2013) thereby bridging the research to practice gap. Replication studies that provide documentation of a valued effect across multiple contexts and diverse groups have also been encouraged (Dai, Swanson, & Cheng, 2011; VanTassel-Baska, 2006). Finally, several researchers have identified FOI as a critical indicator of evidence-based practices in gifted education (Callahan & Moon,

2007, VanTassel-Baska, 2013), and problems associated with inconsistent treatment fidelity in implementing curriculum interventions (such as teacher drop out and lack of time and resources) have been recognized (Ambrose, VanTassel-Baska, Coleman, & Cross, 2010; Azano et al., 2011; Feng et al., 2007).

To understand the state of the field's engagement in methodologically rigorous research, some researchers have surveyed the extant empiric literature. Generally, these surveys report the scarcity of research where quality indicators of evidence-based practices are present (Callahan & Moon, 2007; White, Fletcher, Campbell, & Ridley, 2003). For example, limited reporting of effect size estimates has been identified as a serious issue undermining the quality of empiric research in the gifted education literature (Gentry & Peters, 2009; Matthews, Gentry, McCoach, Worrell, Matthews, & Dixon, 2008). The limited number of studies conducted using experimental designs (Dai et al., 2011; Walsh et al., 2012), as well as the absence of a well-established empiric research base supported by replication studies (Jolly & Kettler, 2008; VanTassel-Baska, 2006) have also been documented in the field. Collectively, these surveys have drawn attention to the state of evidence-based practices in gifted education research and the need to develop a more rigorous research base documenting the efficacy of curricular interventions for gifted students (Dai et al., 2011; VanTassel-Baska & Brown, 2007). However, while ease of implementation and teacher receptivity to curricular interventions have been described as critical to demonstrating effectiveness (VanTassel-Baska & Brown, 2007), the degree to which researchers in the field have systematically addressed, measured, and reported FOI data in the context of curriculum interventions studies remains unclear, and no survey on this indicator of evidence-based practices in the gifted education literature has been undertaken.

The purpose of this article is to add to the literature addressing the use of quality indicators of evidence-based practices in gifted education research (Jolly & Kettler, 2008; Matthews et al., 2008). More specifically, we survey the gifted education literature to ascertain the degree to which FOI has been assessed and reported in curriculum intervention efficacy studies and outcome evaluations in the field of gifted education.

Methods

Search Procedures

We engaged in an examination of the extant literature reporting studies evaluating the efficacy of experimental curriculum units, frameworks, and/or lessons designed for gifted students on learning outcomes. The review of the literature reported here first involved an examination of four journals: *Gifted Child Quarterly (GCQ)*, *Journal of Advanced Academics (JAA)*, *Journal for the Education of the Gifted (JEG)*, and *Roeper Review (RR)*. The rationale for using these databases was that most publications in them contain peer-reviewed journal articles that report original empirical studies (Dai et al., 2011). Moreover, these journals are often cited as leading peer-reviewed journals publishing primary research in the field of gifted education (Jolly & Kettler, 2008; Matthews et al., 2008; Walsh et al., 2012). We examined hard copies of all issues of these journals published from 2004 through 2013. The year 2004 was selected as it immediately followed the release of the *Study Design and Implementation Assessment Device (DIAD)*: Valentine & Cooper, 2003) by the What Works Clearinghouse of the U.S. Department of Education. A major goal of the *DIAD* is to assist researchers in their ability to evaluate whether published research demonstrates sufficient quality to be considered an evidence-based practice. Thus, this survey addresses research in the decade since the release of the *DIAD*.

To locate additional empirical studies from 2004 through 2013 evaluating the efficacy of specific curriculum units and/or lessons designed for gifted learners reported outside of the leading gifted education journals, we also completed keyword and title searches of EBSCO Research Complete and Google Scholar using combinations of the following keywords: *gifted, high ability, advanced learner, curriculum, lessons, experimental design, quasi-experimental design, fidelity, implementation, treatment fidelity, treatment integrity, intervention, efficacy, effectiveness, and adherence.*

Inclusion Criteria

For inclusion in this survey, a publication had to meet several criteria reflecting the quality indicators described above. First, to increase the likely selection of methodically rigorous research (Jolly & Kettler, 2008; Walsh et al., 2012), the publication had to be a primary research paper evaluating the outcomes of a curriculum intervention for gifted learners published in a peer-reviewed journal between 2004 and 2013. Second, as an additional indicator of methodological quality, the curriculum intervention study had to have utilized an experimental or quasi-experimental research design. Although randomized control designed studies are considered to be the “gold standard” in demonstrating that a practice is evidence-based (Cook & Cook, 2013), the difficulties of conducting these studies in K-12 classrooms has been acknowledged. Consequently, reported studies utilizing either experimental or quasi-experimental designs were included in this survey as they are generally considered of sufficient quality in educational research to support a determination that a practice is evidence-based (Cook et al., 2009). As a third inclusion criterion, the study had to report efficacy or effectiveness data on the curriculum intervention as an additional indicator of quality (Walsh et al., 2011).

All empiric studies from 2004 through 2013 that satisfied the inclusion criteria were incorporated into a matrix. In all, 11 curriculum intervention studies were located that met the specified criteria, and were indicated in the matrix according to the relevant authors, titles, journals, and curriculum models.

Categories of FOI Assessment and Reporting

Next, we adapted the matrix by categorizing studies according to the method(s) of their FOI assessment and the degree to which the study reported FOI data (if at all) (Century et al., 2010; Gersten et al., 2005; Keller-Margulis, 2012). More specifically, we first categorized studies according to whether the authors of a study indicated that FOI had been assessed. For example, researchers in one study included in this survey represented they were “on site once a month to monitor implementation” (VanTassel-Baska, 2008, p. 292), and authors of another study represented that “professional development staff visited each classroom once a week across the approximate 12 weeks of the intervention to document fidelity of implementation including adherence to the unit content and instructional strategies” (Gavin, Casa, Firmender, & Carroll, 2013, p. 77). Thus, a simple representation by the researchers of a published study that FOI had been considered sufficed for inclusion in this category.

Next, we again adapted the matrix to indicate whether a study identified the critical components of the intervention (“Critical Components”). Those studies addressing critical components provided specific descriptions of the theoretical and pedagogical underpinnings of an intervention, the curricular materials used, and the specific instructional strategies employed (Century et al., 2010) as they were intended to influence outcomes of an intervention.

Additionally, we delineated the matrix to indicate whether the authors differentiated the

intervention from “business as usual” conditions (Century et al., 2010) in control classrooms by describing the curricula and instructional strategies used in them (“Program Differentiation”).

Next, we further adapted the matrix according to whether the authors identified the method(s) used to measure FOI (“Method for FOI Assessment”) and, if so, how FOI was measured. Within the “Methods for FOI Assessment” category, we established codes to identify the variety of methods used by the researchers to assess FOI that have been recommended in the literature (Century et al., 2010; Gersten et al., 2005) as follows: researcher observation of experimental teachers (ROET), researcher observation of control teachers (ROCT), frequency of observation described (FO), observation protocol or fidelity instrument used (OP), observation protocol or fidelity instrument described (FID), researcher interview of experimental teacher (RIET), predictable and unpredictable times for observation used (P/U), intra-observer or inter-rater reliability of teacher implementation observation established (IR), teacher self-report of FOI (TS), moderating variables limiting implementation fidelity identified (MV), and quality of teacher implementation assessed (QI). Finally, we adapted the matrix to indicate whether (and how) FOI data were reported (“FOI Reported”). For example, this category identified those studies where qualitative or quantitative fidelity data were reported or where FOI data were related to measured outcomes.

The matrix illustrating the development of these categories is reported in Table 1 and is discussed in the Results section.

Results

As indicated in Table 1, 11 experimental or quasi-experimental curriculum intervention studies developed for gifted learners were located that satisfied inclusion criteria for this survey.

Each of the studies included in this survey contained representations that the authors considered FOI in connection with their curriculum intervention research.¹

Of the 11 studies included in this survey, ten described the critical components of the intervention. Of those, three provided specific information of the business as usual conditions in control group classrooms.

Each of the studies included in this survey reported assessing FOI through researcher observations of experimental teachers during implementation of the intervention. Two studies additionally reported that control group teachers were observed. Eight reported the frequency of observations, and one reported using both predictable and unpredictable times for conducting observations. Seven studies reported the use of observation protocols, and six studies described the fidelity protocols or instruments used during observations. Six studies reported the use of multiple fidelity observers (teachers and researchers) as well a teacher self-report. Four studies established intra-observer reliability among observers in the use of fidelity instruments. Six studies assessed the quality with which the teachers implemented interventions. Two studies also identified variables that moderated the degree to which teachers implemented with fidelity. Six studies reported qualitative and/or quantitative data related to FOI, and two reported FOI data in relation to measured outcomes from the intervention.

----- Insert Table 1 about here -----

Discussion

Results from this survey illuminate recent practices in measuring and reporting FOI in outcome evaluations of curricular interventions developed for gifted learners. This survey of the extant literature indicates that researchers engaged in gifted curriculum intervention studies

¹ Because authors of each of the studies included in this review represented that they considered FOI, this category was eliminated from Table 1.

broadly address teacher fidelity of implementation when reporting the results of curriculum intervention outcome evaluations. This result suggests researchers' growing recognition of the importance of treatment fidelity in establishing the efficacy of a curriculum intervention, and that FOI is an important feature of evidence-based practices (Azano et al., 2011; Century et al., 2010; O'Donnell, 2008). Because the studies included in this survey also employed quality research designs (experimental and quasi-experimental) and reported effect sizes, the results of this survey further suggest that the field is increasing its engagement in methodologically rigorous curriculum intervention research as recommended by experts in the field (VanTassel-Baska, 2007; White, Kim, Kingston, & Foster, 2014).

Nevertheless, the nature and quality of the methods used to measure FOI, as well as the degree to which fidelity data were reported, if reported at all, varied widely among the studies included in this survey. First, the majority of studies included described the critical components of the curriculum being evaluated by providing the theoretical underpinnings of the interventions, as well as the curriculum materials and instructional strategies used. Clearly, identifying the critical components of curriculum interventions provides important information to educators that is useful for identifying specific curricula and instructional strategies that can help bridge the research to practice gap. However, only three studies either observed control group classrooms or provided any information about business as usual curricula and instructional strategies utilized in control classrooms, which precludes the ability to differentiate between experimental and control group classroom conditions. Consequently, it is difficult draw conclusions about which component(s) of the interventions, whether curricular or instructional, included in this survey actually impacted student outcomes (Century et al., 2010). Thus, researchers are encouraged to more explicitly differentiate the critical components of an

intervention from the business as usual conditions in control classrooms by describing both fully. This would enable evaluators and consumers of research to make more rigorous determinations of the relationships among specific elements of an intervention and student outcomes and understand which components support student growth (Reis, McCoach, Little, Muller, & Kaniskan, 2011). This will also facilitate the implementation of replication studies to further deepen the understanding of evidence-based practices for gifted learners.

The results of this survey also suggest that many researchers do not systematically measure implementation fidelity as recommended by educational researchers (Century et al., 2010; O'Donnell, 2008), or they do not articulate these methods in reporting data. While researcher observation of experimental teachers served as the primary method for assessing FOI, several studies neither used multidimensional methods for assessing FOI nor described fidelity instruments. Moreover, few reported any means of analysis related to assessing fidelity or measured the impact of FOI on measured outcomes. The lack of articulating the methods for measuring fidelity and the limited reporting of FOI data limit both the conclusions that can be drawn about the efficacy of reported curriculum interventions and the ability to generalize findings (Century et al., 2010; Keller-Margulis, 2012). Finally, few studies explored the variables that serve as barriers to implementation fidelity for teachers; possibly because FOI was not the focus of these studies. Understanding the contextual factors that might limit treatment integrity could provide direction for adapting curriculum materials that support the degree to which teachers successfully implement research-based practices in diverse settings and also guide professional development efforts (Achinstein & Ogawa, 2006; Azano et al., 2011; Fogelman, McNeill, & Krajcik, 2010; Foster, 2011).

Limitations and Implications

Before turning to the broader implications of this study, potential limitations should be noted. Different members of the research team examined different journals and conducted independent database searches. We did not include dissertations, papers presented at research conferences, or studies reported outside of peer-reviewed journals databases or conducted outside of the United States, nor did we calculate the number of articles which did not satisfy the inclusion criteria. Moreover, we acknowledge that examining the extant gifted education literature across a broader date range may have illuminated trends in how researchers in the field have addressed FOI. Finally, this study's focus was on the inclusion and reporting of FOI in efficacy and effectiveness studies to address validity, not on the determination of effectiveness itself.

Turning to the implications of this study, this survey is consistent with other reviews of the gifted education literature as it broadly demonstrates the need to deepen the quality of reported research in the field, and the more specific need for systematic curriculum intervention research that moves the field forward in developing a well-established research base upon which to build practice (Feng, VanTassel-Baska, Quek, Bai, & O'Neill, 2005; Jolly & Kettler, 2008; Matthews et al., 2008). Thus, it is clear that establishing evidence-based practices in curriculum research remains a work in progress (Matthews et al., 2008). In an era of accountability where the use of evidence-based practices dominates the educational agenda, educators and parents of gifted children expect to have both knowledge of and access to curricula proven to be effective.

In order to determine which curricular interventions have a deep evidence base establishing their effectiveness and deliver the best outcomes for gifted learners, it remains essential that researchers conduct efficacy studies indicating methodological rigor and quality; establishing FOI is a key indicator of rigor (Cook et al., 2009; Foster, 2011; VanTassel-Baska,

2013). Explicitly differentiating the critical components of a curriculum intervention from the curriculum materials and instructional strategies commonly used in gifted classrooms is vital when assessing FOI. Researchers are encouraged to consistently describe with specificity the methods used to assess treatment fidelity and the FOI data collected, and then report these methods and data **so that conclusions as to their impact on outcomes can be determined**. Doing so will facilitate scale-up and replication research, and also aid stakeholders in evaluating whether interventions were implemented as program developers intended and/or impacted student outcomes (Century et al., 2010). Additionally, the development of fidelity instruments that could be used across multiple curriculum efficacy studies is warranted as such instruments have the potential to serve as a foundation or framework for measuring FOI **and for deepening the understanding of which specific components of interventions in gifted classroom are effective** (Century et al., 2010; Foster, *in press*; Reis et al., 2011; VanTassel-Baska et al., 2009). We hope these recommendations will allow researchers to conduct replication studies and identify curricula for gifted students that are evidence-based, which in turn will culminate in the consistent implementation of the most effective curricula and practices for gifted students and thereby bridge the research to practice gap. The failure to do so may “marginalize the field of gifted education from more rigorous educational research and limit the possible applications of powerful meta-analytic techniques to the study” of evidence-based curricular interventions and practices (Matthews et al., 2008, p. 64).

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