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Examining the Definition and Measurement of Quality in Early Childhood Education: A Review of Studies Using the ECERS-R from 2003 to 2010

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Abstract

The field of early childhood education continues to grapple with the issue of understanding quality in classrooms. The lack of clarity in definition (or conceptualization) and related ability to assess (or operationalize) quality has contributed to a reliance on the Early Childhood Environment Rating Scale (ECERS-R), which is often interpreted to be synonymous with the quality of a classroom. Likewise, the ECERS-R (although a measurement tool) is often used to define quality. Because of the widespread use of this measure as an evaluation tool, early childhood programs have strived to achieve high ratings on this measure, and subsequently the item content of the ECERS-R has often become a focus for quality enhancement initiatives. The present study examines the definitions of quality (i.e., how quality is operationalized) in research studies using the ECERS-R over the past 8 years (2003-2010). A content analysis of 76 studies conducted in the United States indicates that studies using the ECERS-R to operationalize quality do not use a consistent definition; instead they conceptualize quality in a variety of ways ranging from "quality is ECERs" or "classroom quality" to "environmental quality." In light of these varying definitions, implications for research and policy in early childhood education are discussed.

Quality in Early Childhood Education

The study of *quality* in early childhood education (ECE) is increasingly relevant because research has continued to demonstrate consistent associations between various aspects of classroom quality and improved social and academic outcomes for young children (Belsky et al., 2007; Helburn et al., 1995; Howes et al., 2008; Mashburn et al., 2008). In response to such findings, national and state policies in the United States have focused on improving the quality of care and education for young children. Although *quality* continues to be a major focus of research in ECE, defining this construct and measuring it continue to challenge the field both methodologically in research and practically in quality enhancement initiatives aimed at ensuring optimal experiences for children in early childhood education programs.

Overview of ECERS-R Use

The original version of the Early Childhood Environment Rating Scale-Revised

(ECERS-R), developed in the United States, was an effort to provide a self-assessment tool for programs and to identify program strengths and weaknesses for continuous quality improvement (Harms, Clifford, & Cryer, 1998). However, over time, the ECERS-R has become a primary measure used in research to assess quality and to inform policy and programmatic decisions. As a pioneering self-assessment tool in early childhood education, it has been a primary means of obtaining an operationalized view of child care quality in large-scale national studies, such as the Cost, Quality, and Child Outcomes in Child Care Centers study (CQCO; Helburn et al., 1995) and the National Child Care Staffing Study (NCCSS; Whitebook, Howes, & Phillips, 1989). Accordingly, numerous policies were informed and programs were developed and revised based on results from these studies. More recent large studies of classroom quality such as the NCEDL's Multi-State Study of Pre-Kindergarten and Study of State-Wide Early Education Programs (SWEEP) (e.g., Early et al., 2005) also use the ECERS-R as a primary measure or operationalization of quality in early childhood classrooms. Predominant use of the ECERS-R in large national studies and the adoption of the ECERS-R by many states for quality enhancement initiatives including Tiered Quality Rating and Improvement Systems (TQRISs; Tout, Starr, Soli, Moodie, Kirby, & Boller, 2010; Caronongan, Kirby, Malone, & Boller, 2011) or regulatory systems have led to the perception that ECERS-R scores are virtually synonymous with levels of quality in early childhood education. This perception has further yielded unprecedented reliance on the ECERS-R as a defining tool of the multidimensional construct of *quality*.

Because the ECERS-R is frequently used in research, the authors of the current study were interested in how studies that used the ECERS-R as a measure (i.e., operationalization of quality) were defining the intended construct (i.e., conceptualization) to be measured. The link between conceptualization and operationalization of constructs is essential to ensuring the construct validity of a study (Shadish, Cook, & Campbell, 2002). Therefore, an understanding of what is being measured is a critical component for research and determining policy implications from research. Given the widespread use of the ECERS-R and the limited availability of alternative measures, it was hypothesized that there would be wide variation in the definition or conceptualization of quality across studies that used the ECERS-R. Subsequently, it is critical that definitions used within studies that include the ECERS-R are examined in order to better understand the way that researchers are overlaying their conceptualizations (or related characteristics) with measurement by the ECERS-R (i.e., the operationalization). Accordingly, the research aims for the current study are (1) to analyze the definitions (i.e., methodological conceptualizations) of ECERS-R as a measure of quality over a recent 8-year span and (2) to discuss the implications of operationalizing quality using the ECERS-R and varied definitions for policy and quality enhancement in ECE.

Definitions of Quality

Historically, definitions of quality in ECE have included multiple proximal (e.g., curriculum and classroom interactions) and distal (e.g., program and state policies) features of classrooms that promote children's development in various domains (Dunn, 1993). However, because of the multitude of perspectives regarding what indicators of either proximal or distal features are most important, the resulting definitions of quality are often broad or nonspecific (Layzer & Goodson, 2006). In response to such broad definitions, some researchers have conceptualized ECE quality in terms of global quality with two primary components—"structural" and "process" quality (see Vandell & Wolfe, 2000 for a review of the literature). Examples of indicators of structural quality include classroom materials, curriculum, teacher education, and teacher-child ratio. These indicators are often the regulated aspects of classrooms and programs. Indicators of process quality focus on the more dynamic aspects of early childhood education, including human interactions occurring in the classrooms such as teacher-child and peer-to-peer interactions (Cassidy et al., 2005a; Hamre & Pianta, 2007; Vandell & Wolfe, 2000).

Several studies have reported correlations between variables of process, structural, and global quality (Burchinal, Cryer, Clifford, & Howes, 2002; Phillipsen, Burchinal, Howes, & Cryer, 1997; Phillips, Mekos, Scarr, McCartney, & Abbot-Shim, 2000). Structural quality and process quality, each a component of global quality, provide unique and essential information to understanding early childhood classrooms, yet these terms are often defined differently in research and policy reports (Layzer & Goodson, 2006). Furthermore, other components of early childhood education environments important to children's development may be excluded from or diluted in broad conceptualizations and unclear operationalizations of quality. Precision in both conceptualization and operationalization is necessary to capture an intended construct (e.g., within quality) that will allow the field to move forward in its understanding of what is best for children in early childhood education programs. Because of the multidimensional nature of quality, it is likely that such definitions and measurement cannot be captured by one all-encompassing or "global" term or limited to measurement by one instrument. For example, outdoor learning environments (Chakravarthi, 2009) and emotional climate (Howes, 2000; Raver, 2004; Raver, Garner, & Smith-Donald, 2007) are among important features of quality that may influence children's development but are not currently captured in depth in the ECERS-R.

Measuring Quality and the Reliance on the ECERS-R

For over 25 years, the ECERS, and subsequently the ECERS-R, have been heralded as "the" standard. The ECERS-R was designed to rate global quality of environments serving children ages 2-1/2 through 5 and is part of a family of Environment Rating Scales (ERS). Thus, it provides an overall assessment of the environment in which young children spend time. The scale assesses classrooms on 43 items across 7 subscales: Space and Furnishings, Personal Care Routines, Language/Reasoning, Activities, Interaction, Program Structure, and Parents and Staff. Each item is scored from 1 (*inadequate*) to 7 (*excellent*). Factor analyses of the ECERS-R generally indicate a two-factor structure—"Language/Interactions" and "Materials/Activities" (Cassidy, Hestenes, Hegde, Hestenes, & Mims, 2005b; Clifford et al., 2005; Sakai, Whitebook, Wishard, & Howes, 2003). Similarly, results from a content analysis conducted by Cassidy and colleagues (2005a) found that half of the indicators on the ECERS-R measured structural quality, materials, and activities; the other half measured elements of process quality, language, and interactions. Based on the identified factors, the ECERS-R seems to capture two distinct components of quality—structural and process.

The breadth of information measured by the ECERS-R as well as limited alternative and supplemental measures have contributed to widespread use of the ECERS-R as the primary measure of quality in ECE programs and has resulted in its influence on practice and policy-related decisions in the field (Tout, Zaslow, Halle, & Forrey, 2009). One example is the widespread use of the ECERS-R and family of measures as the measure of quality in Tiered Quality Rating and Improvement Systems (TQRISs) (Tout et al., 2009); these systems provide accountability in ECE program quality with ratings of individual early care and education programs in order to help parents choose a high-quality program for their children. These ratings systems also serve as the basis for professional development and frequently have strong ties to funding decisions for programs (NAEYC, 2009). Currently, 22 states in the United States, the District of Columbia, and the U.S. military services have TQRISs (Tout et al., 2010; NACCRRA, 2009). Additionally, all but four states are operating, piloting, or exploring the use of a TQRIS (Mitchell, 2009). Each TQRIS addresses five basic elements—quality standards, accountability, program support, parent education, and financial incentives (Mitchell, 2005; NACCRRA, 2009; NCCIC, 2010). The vast majority of statewide TQRISs use the ECERS-R and its family of measures to assess quality (Tout et al., 2010; NACCRRA, 2009; Tout et al., 2009). Subsequently, quality enhancement, including trainings and consultation, is often geared toward scoring well on the ECERS-R.

In sum, quality continues to be an amorphous term with varying definitions within ECE. Utilizing the ECERS-R to determine quality from high (7) to low (1) is a broad characterization that dilutes the potential impact of more specific definitions of characteristics of early childhood programs that are important to children's outcomes. Continued reliance on the ECERS-R as the predominant measure of quality to inform practice and policy does not challenge the field to develop more explicit conceptualizations of dimensions of quality and develop subsequent operationalizations that appropriately capture the dimensions defined. It is critical that the field reexamine the use of the term "*quality"* and consider additional conceptualizations of characteristics in early childhood education that may be important for children's experiences and their subsequent outcomes. Additional characteristics of quality need to be explored and included in definitions that guide research and policy. The current study aims to begin the discussion of defining and measuring quality more explicitly by examining how quality is defined in research studies using the ECERS-R from 2003 to 2010.

Method

Published, peer-reviewed research articles that used the ECERS-R to measure ECE quality between 2003 to 2010 were included in this study. This time span was selected because of the substantial increase in the use of the ECERS-R in both research and states' TQRISs (NCCIC, 2010) during this time. To ensure that all relevant articles were included, the authors conducted thorough searches of ERIC, PsycINFO, and Google Scholar using the following keywords: quality (global, structure, and process), ECERS-R, child care, and early childhood education. Any articles identified through these searches that did not use the ECERS-R to measure a component of the quality of early childhood education were excluded from the sample. Additionally, because the focus of this study was on the use of the ECERS-R and the implications of its use within the United States (e.g., TQRIS or policy decisions, professional development for teachers), international articles were excluded. Based upon these criteria, a total of 76 studies were included in the current analysis.

All 76 articles were organized according to year of publication. Each member of the research team then read the articles from an assigned year to gain a general understanding of each article's focus. Initial coding categories were developed during this first reading of each article by listing all definitions of quality used throughout the articles. After listing all possible definitions of quality used in the studies, the research team collapsed the definitions into conceptually similar categories. For example, the initial codes of observed quality and observational quality were collapsed into the category of "observed quality," and program quality and center quality were collapsed into the category of "program quality." Although some categories were collapsed, the majority of the categories reflect the exact words used in the articles' definitions of quality. When studies used multiple references and wording related to quality, the definition presented in the method section of the original article was coded for use in the present examination.

Before determining the final codes, the research team randomly selected and coded 20% of the articles to

establish reliability. Articles were read and coded independently, and then codes and definitions were discussed and final consensus codes were decided upon. Following the reliability process, the research team read through the methods and results sections for the remaining articles a third time and assigned final codes. The final codes for the definition of quality included *global, global classroom, observed, classroom, program, overall, environmental, process, global classroom process quality, quality is ECERS-R score,* and *other*. With the exception of *quality is ECERS-R score* and *other,* these final codes were the exact phrases used to define the conceptualizations of quality within the articles analyzed. Often, these phrases were the only definitions of quality provided in the studies. The code *quality is ECERS-R score* was used when a research article offered no specific definition of quality but simply noted that the ECERS-R was used to measure quality or stated that high-quality environments were identified by high ECERS-R scores.

Coding Results

The analysis of these 76 articles indicated that a wide variety of definitions are used to conceptualize and operationalize quality. The Appendix presents the definitions used and the number and percentage of articles that utilized each definition (or conceptualization). The two definition categories used most frequently among the articles were “quality is ECERS” (23.68%) and “classroom quality” (18.42%). “Process quality” was the definition category of quality appearing least frequently. The 18 articles coded as “quality is ECERS” did not specify any definition of quality and simply noted that child care quality was indicated by high ECERS-R scores, highlighting the reliance on the ECERS-R as both defining quality and as the measure of quality. Fourteen other articles defined quality broadly as classroom quality. Similarly, 10 articles (13.16%) used the term global quality to describe the classroom environment, and nine articles (11.84%) combined global and classroom quality to define the environment as global classroom quality. Program quality, observed quality, and overall quality were each used as definitions in four separate studies (5.26%, respectively). Environmental and process quality was used to define quality in three articles (3.95%).

Perhaps the most unclear definition used included multiple descriptors; specifically, two articles (2.63%) defined the quality of the ECE environment as “global classroom process quality” and one article used the phrase “global classroom environmental quality” as definitions. Finally, five articles each used a unique definition of quality (6.58%); these included structural quality, the presence of developmentally appropriate practices, and global developmental quality (see the Appendix). It is also important to note that in the studies that did not define quality or defined quality as ECERS-R scores, the use of the ECERS-R was justified primarily by noting that the measure has been “related to child outcomes” previously and is a “widely used and validated measure of quality.”

Discussion

The examination of these studies demonstrates that current research utilizes the ECERS-R to operationalize a broad array of conceptualizations of quality. In the research literature using the ECERS-R, the conceptualization or the way in which quality is defined is not consistent. For example, quality was defined in at least 10 different ways in the studies examined for this paper, even though the same primary measure (ECERS-R) was used as a measurement tool. Specifically, the ECERS authors state, “Our scales are designed to assess process quality in an early childhood or school age care group” (Frank Porter Graham Child Development Institute, 2005). It is notable that the definition provided by the authors (i.e., “process quality”) was rarely used in the research.

Although the ECERS-R has solid psychometric information and adequate reliability, the global focus of the measure has resulted in varied and vague accompanying definitions of quality (Beller, Stahnke, Butz, Stahl, & Wessels, 1996; Clifford et al., 2005; Cassidy et al., 2005b; Munton, Rowland, Mooney, & Lera, 1997; Perlman, Zellman, & Le, 2004; Sakai et al., 2003). As the examination of the research literature revealed, there are multiple definitions used related to the ECERS-R. If a global definition of quality is used in a study, then it is difficult to inform policy or contribute to quality initiatives because the study’s results may not provide the level of specificity required to guide such initiatives. That is, nonspecific definitions or conceptualizations do not provide the information necessary to understanding what characteristics of classrooms are most important to child outcomes and positive experiences for young children. Subsequently, interventions and programs may be developed and implemented with limited and/or missing information.

Other Dimensions of Quality

Although research has shown associations between higher ECERS-R ratings and positive child outcomes (e.g., Early et al., 2005; Howes et al., 2008; Mashburn et al., 2008), as previously suggested, additional components of quality may be important to consider that would contribute to a more comprehensive definition. For example, research in the areas of outdoor play and activity, teacher characteristics, and teacher-child relationships indicates promising directions to consider in assessing quality (DeBord, Hestenes, Moore, Cosco, & McGinnis, 2002; Gerber, Whitebook, & Weinstein, 2007; Williams, Carter, Kibbe, & Dennison, 2009; Chakravarthi, 2009). For example, Finn and colleagues (2002) found that some characteristics of child care centers were predictors of children's activity level, meaning that children differed in the amount of physical

activity depending on the specific characteristics of the center in which they were enrolled. Although there has not been a great deal of study in this area, the implications of outdoor play and physical activity for young children warrant consideration in a model of quality in ECE.

Additionally, characteristics of teachers and the relationships between teachers and children have been related to quality in the literature. As the field continues to move toward examining the central role of the teacher in classroom quality, individual teacher characteristics such as personality and depression are increasingly being studied as possible predictors of classroom effectiveness (Decker & Rimm-Kaufmann, 2008; Hamre & Pianta, 2004). Findings from recent studies focused on teacher-child interactions suggest that these relationships play a critical role in children's development (Howes, 2000; Howes, James, & Ritchie, 2003; Gerber et al., 2007; Mashburn et al., 2008). Currently, these important elements of quality are addressed only to a limited degree in discussions of quality and not as components of measures assessing classroom quality, including the ECERS-R.

Additional research that includes a multidimensional perspective of quality and new and refined conceptualizations will also inform policy. Over the past several years, it has become abundantly clear that it is important to capture not only the breadth of quality but the depth of quality in early care and education classrooms. Current studies considering alternative measures as well as future research using a “toolkit” approach to measuring child outcomes and the breadth and depth of quality (Dickinson, 2006) can provide information about conceptualizations and operationalizations that best address features of early childhood education. A toolkit approach could include global classroom measures and more narrowly focused measures, as well as measures across content or domain areas. Different combinations available within the toolkit could assess different aspects of quality and address different research questions (Dickinson, 2006). Related to both the conceptualization and operationalization of quality, current assessments of quality generally provide a snapshot of the classroom. Although data from some studies indicate some stability in ratings and assessments over time (NICHD Early Child Care Research Network, 2002), sustained long-term comprehensive assessments of quality are rarely undertaken in ECE. The ECERS-R seems to address the breadth of classroom quality and provide adequate information at the global level of classrooms, but it fails to capture the depth needed to truly understand what teachers and administrators need to know to fundamentally affect child outcomes.

Tiered Quality Rating and Improvement Systems serve as a primary example of how current forms of quality assessment have major implications for child care programs across the nation. As states continue to develop and revise TQRISs, the importance of better conceptualizations of quality increases. Although program participation in TQRISs is often voluntary, many states have established incentives to encourage program participation. One such incentive is tiered reimbursement for subsidy payments, including the provision of higher funding rates for children receiving subsidy to programs scoring higher on state TQRIS assessments therefore establishing high stakes for programs and state agencies developing these systems. “Getting it right” with regard to how these programs are evaluated is important in determining the dollars available to programs, enrollment numbers, and ultimately the well-being of the children educated and cared for in these programs.

Overall, addressing quality in ECE is a critical focus in the field. The experiences that young children have in early environments are tied to their development and their future success in school and beyond (Cunha & Heckman, 2006). Using varying definitions or conceptualizations of quality in ECE operationalized by a single measure has a range of implications and consequences for research, policy, and practice. Given the high stakes implications of quality experiences and the assessment of quality in early childhood education programs, especially as part of TQRISs, particular attention should be paid to defining, matching, and understanding the construct to be measured. There is also a critical need to understand the specific characteristics of classrooms that predict positive child outcomes. Although it seems clear that the ECERS-R is providing some proxy for at least one broad dimension of quality, uncertainty remains regarding the extent to which child outcomes could be predicted with a better match between important child outcomes and other or additional dimensions of quality.

Recommendations

Consumers and policy makers continue to seek accountability in early education. They question the quality of programs and, ultimately, the related outcomes for children in relation to the money being invested (Mitchell, 2009). However, the current assessments of quality tend to be global in nature and provide little information related to improvements. The overarching recommendations for assessing quality focus on putting time and resources into examining the current conceptualization and operationalization of quality in ECE with the potential outcome of additional specificity to assist in improved programs and more positive early education experiences for young children. As states continue to devote resources to assessing the quality of programs for young children and the number of TQRISs increase across the nation, addressing the definition of quality becomes critical to focus on the improvements and recommendations necessary to improve children's developmental outcomes.

Administrators, policy makers, and researchers must better understand what is being measured in terms of quality and the limitations of global assessments. They should also consider alternative assessments of quality before moving forward with program improvement recommendations and interventions. Although North

Carolina's Smart Start program showed that preschool-age children who attended higher-quality centers (as measured by the ECERS-R) scored higher on school readiness measures than did children who attended lower-quality centers (Bryant et al., 2003), the use of the ECERS-R allows only global recommendations about improvements for these lower-quality centers. Unfortunately, only limited information is currently available specific to the areas of improvement for centers, such as support for teachers, outdoor play environments, instructional strategies, or approaches to literacy, math, science, and social studies—all of which are related to positive outcomes for children.

As previously mentioned, a “toolkit” approach may be useful to tap into individual characteristics of programs and contexts in which they operate; there may not be a one-size-fits-all assessment for quality. Programs operate in different contexts, have different workforce characteristics, and serve a variety of children and families. It stands to reason that "quality" may have different implications for different programs, and assessing quality may have different purposes. If we use the one-size-fits-all approach, we gather similar information across programs, but the recommendations and interventions for improvement are less informed. Without a more focused assessment, we have a general overview of quality, but we may be missing components specific to a program. Additional research should be focused on conceptualizing additional components of quality and on accurately and adequately assessing those components and their associations with children’s experiences and outcomes. Results and information from such studies can then provide additional tools for programs and policy makers working toward continuous quality improvement of early education programs.

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Appendix
Definitions of Quality Arranged by Code

Code	Number (%)	Authors (year)
Quality is ECERS	18 (23.68)	Bailet, Repper, Piasta, & Murphy (2009); Bassok, French, Fuller, & Kagan (2008); Cassidy, Lower, Kintner, & Hestenes (2009); Collins & Dennis (2009); Dowda et al. (2009); Dowda, Pate, Trost, Almeida, & Sirard (2004); Feil et al. (2009); Hallam, Grisham-Brown, Gao, & Brookshire (2007); Henry & Rickman (2007); Kantrowitz & Evans (2004); Poe, Burchinal, & Roberts (2004); Rigby, Ryan, & Brooks-Gunn (2007); Roach, Kim, & Riley (2006); Wachs, Gurkas, & Kontos (2004); Watamura, Kryzer, & Robertson (2009); Winsler et al. (2008); Yen & Chen (2005); Zan (2005)
Classroom quality	14 (18.42)	Alkon, Ramler, & MacLennan (2003); Beardslee, Ayoub, Avery, Watts, & O'Carroll (2010); Burchinal et al. (2008); Campbell, Milbourne, Silverman, & Feller (2005); Castro, Bryant, Peisner-Feinberg, & Skinner (2004); Corapci (2008); Lloyd & Howe (2003); Miller & Bogatova (2009); Moller, Forbes-Jones, Hightower, & Friedman (2008); Montes, Hightower, Brugger, & Moustafa (2005); Raver et al. (2008); Raver et al. (2009); Roach, Riley, Adams, & Edie (2005); Sakai, Whitebook, Wishard, & Howes (2003)
Global quality	10 (13.16)	Barnett, Yarosz, Thomas, Jung, & Blanco (2007); Barnett et al. (2008); Burchinal & Cryer (2003); Cassidy, Hestenes, Hegde, Hestenes, & Mims (2005); Clawson & Luze (2008); Cunningham (2010); Grisham-Brown, Cox, Gravil, & Missall (2010); Lower & Cassidy (2007); Shim, Hestenes, & Cassidy (2004); Weinraub, Shlay, Harmon, & Tran (2005)
Global classroom quality	9 (11.84)	Bracken & Fischel (2006); Powell, Diamond, & Koehler (2010); Early et al. (2007); Jeon et al. (2010); La Paro et al. (2009); LoCasale-Crouch et al. (2007); Pianta et al. (2005); Powell, Burchinal, File, & Kontos (2008); Powell, Steed, & Diamond (2010)
Program quality	4 (5.26)	Henry, Gordon, & Rickman (2006); Hooks, Scott-Little, Marshall, & Brown (2006); Howes, Shivers, & Ritchie (2004); Jones-Branch, Torquati, Raikes, & Edwards (2004)
Observed quality	4 (5.26)	Early et al. (2006); Knoche, Peterson, Edwards, & Jeon (2006); Loeb, Fuller, Kagan, & Carrol (2004); Torquati, Raikes, & Huddleston-Casas (2007)
Overall quality	4 (5.26)	Jackson et al. (2006); Mashburn, Pianta, Hamre, Downer, Barbarin, Bryant, et al. (2008); Shivers, Howes, Wishard, & Ritchie (2004); Wall, Kisker, Peterson, Carta, & Jeon (2006)
Environmental quality	3 (3.95)	Gross, Fogg, Garvey, & Julion (2004); Tonyan & Howes (2003); Wishard, Shivers, Howes, & Ritchie (2003)
Process quality	3 (3.95)	Howes et al. (2008); Mashburn (2008); Warash, Ward, & Rotilie (2008)
Global classroom process quality	2 (2.63)	Chang et al. (2007); Clifford et al. (2005)
Other	5 (6.58)	Fuller, Kagan, Loeb, & Chang (2004)—structural; Chien et al. (2010)—global classroom environmental quality; Li-Grining & Coley (2006)—developmentally appropriate practices; Votruba-Drzal, Coley, & Chase-Lansdale (2004) and Votruba-Drzal, Coley, Maldonado-Carreno, Li-Grining, & Chase-Lansdale (2010)—global developmental quality

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