

Class Size: Perceptions of K-3 Teachers, Principals, and Superintendents in a Rural, Midwest State

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Identifying an appropriate class size is an important decision public schools face as they weigh balancing their budget with the impact class size may have on student achievement. This study examined perceptions of South Dakota kindergarten through third-grade teachers, elementary principals, and superintendents concerning optimal class size and the extent to which they felt the following factors influenced their optimal class size selection: classroom experience, class size research, financial implications, classroom management, and instructional quality. 97 superintendents, 73 elementary principals, and 264 elementary teachers in South Dakota were surveyed.

Teachers provided significantly smaller optimal class size estimates for all grade levels (K-3) than principals and superintendents. Teachers, principals, and superintendents revealed class size research had little influence on their choice about optimal class size whereas instructional quality was identified as the most influential factor. Only superintendents identified financial implications to be a predominant factor influencing their optimal class size selection. This research reveals the discrepancies in perceptions among teachers, principals, and superintendents regarding optimal class size and the factors influencing their optimal class size selection. This information has the capacity to provide state governments and school leaders the insight needed to develop class size policies and professional development opportunities to build a common approach to addressing class size while reflecting on best practices identified in class size research.

Identifying an appropriate class size is an important decision public schools face as they weigh balancing their budget with the impact class size may have on student achievement. A vast amount of research has been conducted in this realm with one of the more influential studies being the Tennessee STAR study (Filges et al., 2018; Pate-Bain et al., 1997; Weili & Lehrer, 2011). Much of the research regarding class size reduction (CSR) does not dispute that smaller class sizes influence student achievement gains. The argument predominantly lies in how large of an impact CSR has on student achievement gains and how small classes need to be to realize gains (Biddle & Berliner, 2008; Bosworth, 2014; Fan, 2012; Filges et al., 2018; Weili & Lehrer, 2011).

In 2015, South Dakota's Governor created the Blue Ribbon Task Force to evaluate the state's funding formula and to make recommendations on its inadequacies (Soholt & Sly, 2015). The results of their work laid the groundwork for an entirely new funding formula centered on a student to teacher ratio (Soholt & Sly, 2015; Woodmansey, 2017). Unlike California's legislation that specifically targeted funding to reduce class sizes to 20 or fewer students to increase student achievement outcomes, South Dakota took an approach on a student to teacher ratio based simply around creating a new funding formula (Sims, 2008; Soholt & Sly, 2015; Woodmansey, 2017). South Dakota's funding formula establishes a target number of teachers by dividing the district's fall enrollment by the target student-to-staff ratio. South Dakota established the following population ranges to serve as the target student-to-staff ratio: a) less than 200 students equals 12 students to one teacher, b) between 200 and 600 students equals a sliding scale between 12 students to one teacher and 15 students to one teacher, and c) greater than 600 students equals 15 students to one teacher (Woodmansey, 2017). However, this funding formula is not sufficient for all schools in South Dakota. In fact, 44.3% of school districts had an opt-out in place for 2019 to support their general fund expenditures (South Dakota Department of Education, 2019).

Funding initiatives that encourage schools to reduce class size without considering other contextual factors may not align with what research demonstrates to be best practice. Although research on class size reduction (CSR) as a means for boosting student achievement returns uneven results, the research consistently reveals that CSR is associated with gains in achievement for students in some contexts (Biddle & Berliner, 2008; Bosworth, 2014; Filges et al., 2018; Hattie, 2012). It is therefore imperative school leaders and policymakers reflect on available CSR research to guide decisions about class size.

Theoretical Frameworks

Expectancy Theory

This study is framed through the theoretical lens of expectancy theory which is a motivational theory developed by Victor Vroom in 1964 (Caulfield, 2007; Vroom, 1964). According to expectancy theory, the amount of effort or action a person will take to accomplish a task depends greatly on their perceived ability to accomplish the task (Hamington, 2010, p. 677). Expectancy theory provides a robust framework in which to explore the perceptions of educators as class size may impact teacher efficacy in larger classes (Laine et al., 2000). That is, teachers' levels of effort and motivation may depend on their perception of how well they can manage their classes' size (Solheim & Opheim, 2019). Because experiences often shape perceptions, a teacher's choice about the optimal class size is likely influenced by their experience and perceived ability to manage larger classes.

Furthermore, expectancy theory helps explain why states have invested significant amounts of money to reduce class size as it has been assumed small class sizes net better teaching and therefore higher student achievement levels (Salgado et al., 2018). However, according to expectancy theory, this relation may only hold if class sizes are aligned with teachers' expectations about the size of class they are prepared to teach (Salgado et al., 2018).

Self-determination Theory

This study also leans on the theory of self-determination, which emphasizes the role of intrinsic motivation in human behavior (Wagner & French, 2010). When looking at the role class size plays in student achievement levels, it is important to not only reflect on student motivation to learn but also the teacher's motivation to teach.

Higher pay may motivate teachers extrinsically to accept teaching in larger class sizes but may result in lower student achievement if they do not adapt how they teach (Laine et al, 2000). According to self-determination theory, a better way to motivate teachers is to focus on intrinsic motivation through developing competence, connection, and autonomy. Therefore, a high teacher efficacy developed through quality professional development may promote a teacher's intrinsic motivation to teach in a wider range of class sizes effectively (Althausen, 2015; Klassen, Tze, Betts, & Gordon, 2011; Lee et al., 2012; Hoy & Spero, 2005; Tschannen-Moran & Hoy, 2001).

The expectancy and self-determination theories establish a framework for understanding how various factors may influence the perceptions of educators concerning optimal class size. This research explores superintendents', elementary principals', and kindergarten through third-grade teachers' perceptions of optimal class size and their ratings of how much their perceptions are based upon the following factors: experience, research, financial implications, classroom management, and instructional quality.

Review of Related Literature

Seminal Class Size Research

Although class size reduction (CSR) may not always result in gains in student achievement, a majority of CSR research suggests that small classes have the greatest effect on increased student achievement in the primary grades, when class sizes are reduced below 20, and for gap groups, more specifically, minority and economically disadvantaged students (Biddle & Berliner, 2008; Bosworth, 2014; Fan, 2012; Filges et al., 2018; Finn & Achilles, 1999; Hattie, 2012; In-Soo & Young, 2009; Lapsley et al., 2002; Molnar et al., 1999; Reichardt & Mid-Continent Research for Education and Learning, 2001). In these contexts, reductions in class size appear to benefit students.

However, understanding the way CSR is defined is important for interpreting the literature about its effectiveness. Discussion and reflection on research become cloudy when small class size is expressed as either a 15:1 student-teacher ratio or a 30:2 student-teacher ratio. Both examples suggest a per pupil-teacher ratio of 15:1, but a classroom with 30 students and 2 teachers looks much different than a classroom with only 15 students and 1 teacher (Filges et al., 2018; Lapsley, Daytner, Kelly, & Maxwell, 2002). Indiana's project prime time serves as a good example of how a lack of distinction between these two ways of reporting class size can cause a CSR initiatives to

largely become a reduction of the per pupil-teacher ratio through the use of a classroom aide (Biddle & Berliner, 2008).

As school districts reflect on available research to guide policy on class size and potentially explore CSR initiatives, it is important to understand the dynamics of CSR efforts to help determine what is effective. In a review of Wisconsin's SAGE program, Molnar, Smith, Zahorik, & Wisconsin University (1999) concluded that except for language arts and mathematics performance in second-grade, classrooms with a 30:2 student-teacher ratio performed as well as classrooms with a 15:1 student-teacher ratio (p. 106). However, more recent studies have indicated that adding aides to classrooms is often not effective. Biddle and Berliner (2008) found that preliminary results from Indiana's project prime time indicated smaller gains for larger classrooms assigned to two teachers (p. 20). In addition, Tennessee's project STAR indicated that regular size classrooms (22-25 students) with an aide did not produce any better achievement results than regular size classrooms without an aide (Biddle & Berliner, 2008; Filges et al., 2018; Finn & Achilles, 1999; Reichardt & Mid-Continent Research for Education and Learning, 2001).

Financial Implications

While creativity in resource allocation may help to meet the basic requirements for CSR reform in a cost-effectively way, deviating from what research suggests as best practices in CSR will likely net undesirable student achievement results (Solheim & Opheim, 2019). That is, introducing classroom aides may not result in increased student achievement. Likewise, when classroom space becomes limited, creative thinking may lead to proposals for shared space among two teachers (Solheim & Opheim, 2019). This may solve classroom space woes, but according to Biddle and Berliner (2008), doing so may defeat the desired achievement results.

CSR efforts require careful planning and consideration for associated costs paired with an honest reflection of what research says is the best practice for utilizing CSR as a means for improving student achievement (Mathis, 2017). The most promising results for instituting CSR initiatives will come when school leaders who understand the budget and dynamics of their schools are involved in the planning process (Achilles, Regional Educational Laboratory Southeast, & SERVE Center at the University of North Carolina at Greensboro, 2005). No matter the creativity utilized in implementing CSR, policymakers must evaluate and understand the inevitable upfront and ongoing costs associated with CSR programs (Mathis, 2017).

Teacher Efficacy, Quality, and Recruitment

Teacher quality has an elusive definition that cannot be described as simply holding a certificate obtained through a teacher preparation program (Hattie, 2012). Furthermore, an evaluation of key characteristics for highly qualified teachers described within the previous federal mandate of No Child Left Behind (NCLB) demonstrated these characteristics had no consistent connection with student achievement gains (Phillips, 2010). However, Phillips (2010) did observe increased student achievement with extended teacher training or specialization.

When CSR policies are implemented, developing teachers through quality professional development may offer the greatest opportunity for improving the quality of teachers on larger staffs. Hattie's (2009) meta-analysis found that professional development has an effect size of $d = .62$ regarding its impact on student achievement. Professional development paired with teacher mentoring also has fostered increased teacher efficacy (Klassen et al., 2011; Lee et al., 2012;

Tschannen-Moran & Hoy, 2001). Therefore, policymakers and district officials contemplating CSR may see the most impact of these policies if they provide professional development opportunities.

Purpose of the Study

The purpose of this study was to evaluate the perceptions of superintendents, elementary principals, and kindergarten through third-grade teachers concerning what they believe is the optimal class size for kindergarten, first-grade, second-grade, and third-grade, and to compare these groups' ratings of how much the following categories influence their perceptions: their experience, their knowledge of research on class size, their concern for financial implication, the teacher's classroom management ability, and instructional quality or ability to improve student outcomes. Understanding the differing perspectives of school personnel regarding optimal class size and the factors they view as most important for informing these perspectives may help administrators craft better policies and professional development opportunities for their staff.

Research Questions

A quantitative survey was distributed to K-3 teachers, elementary principals, and superintendents (Appendix A). The information collected on the survey was designed to address the following research questions.

1. What are the differences in K-3 teachers', elementary principals', and superintendents' perceptions of optimal class size for grades K-3?
2. What are the differences in the factors these groups report as influencing their optimal class size perceptions?

Methodology

Population

The population included South Dakota K-12 public school district superintendents, elementary principals, and kindergarten through third-grade teachers during the 2019-2020 school year. At the time of this study, there were 149 public school districts in South Dakota. There were 149 superintendents, 247 elementary principals, and 2,274 teachers coded as a self-contained classroom teacher for either kindergarten, first, second, or third grade ("Address List Principals," 2019; "Address List Superintendents," 2019; J. Nelson-Stastny, personal communication, December 17, 2019).

In 2019, 40 school districts had a K-12 enrollment of 601 or greater, 80 school districts had a K-12 enrollment between 200 and 600, and 29 school districts had a K-12 enrollment of 199 or less ("History of State Aid," n.d.). South Dakota distributes state aid to schools based on a student to teacher ratio of 12 to 1 for K-12 enrollments of ≤ 199 students, between 12 and 14 to 1 for K-12 enrollments between 200 and 600 students, and 15 to 1 for K-12 enrollments ≥ 601 students. Every district superintendent, elementary principal, and kindergarten through third-grade self-contained classroom teacher was offered the opportunity to take the survey except for those employed in the first author's district.

A power analysis was conducted based on a similar dissertation to ensure adequate power (Rasmussen, 2015). Utilizing GPower 3.1, it was determined a total sample size of 339 superintendents, principals and teachers was needed with an effect size ($f = .17$) to achieve a power of .8 with alpha at .05.

Data Collection

The survey used in this study contained demographic questions, including the respondent's position within their school district, how many years they served in their current position, and the K-12 enrollment range of their district. Following the demographic portion of the survey, respondents were asked to identify what they believed was the optimal class size for kindergarten, first-grade, second-grade, and third-grade. Finally, respondents were asked to rate on a four-point Likert scale how much the following factors influenced their choice for selecting the optimal class size for each grade level evaluated: personal experience, research on class size, financial implications, classroom management, and instructional quality. Respondents could choose from a range identified as (1) no influence, (2) somewhat influenced, (3) strongly influenced, and (4) extremely influenced.

Superintendent and principal names and email addresses for the 149 public school districts in South Dakota were available through the South Dakota Department of Education. Superintendents and principals were emailed a letter of invitation containing a formal request to participate in the study and directions for participating in the study by clicking an embedded hotlink to access the survey through Qualtrics. Also included in the email to elementary principals was a letter of invitation to teachers, which the elementary principals were asked to distribute by forwarding an email to kindergarten through third-grade teachers in their building. Consent to participate was implied by the completion of the survey.

After two weeks, a follow-up email was sent to superintendents and elementary principals expressing gratitude to those who had participated in the study and reminding those who had not completed the survey to please do so. Elementary principals were asked to please forward a reminder to their teachers serving in kindergarten through third grade.

Validity and Reliability

A survey matrix (see Appendix B) and pilot study were created and implemented to establish validity and reliability. The survey matrix includes the fifty sources used to identify common themes within the review of literature. After the survey was created, it was vetted by three educational experts before being sent to the researcher's Institutional Review Board (IRB) for approval.

Findings

Perceptions Regarding Optimal Class Size

Analyses of variance showed statistically significant differences were present between the perceived optimal class sizes of teachers, principals, and superintendents at all grade levels, K through 3 (Table 1). Games-Howell post hoc analyses indicated no statistically significant differences were present between superintendents and principals for any grade level.

Teachers reported significantly smaller optimal class sizes than principals for all grade levels (kindergarten, $p = .009$, first grade, $p = .02$, second grade, $p = .034$, third grade, $p = .008$). Teachers only differed from superintendents in their optimal class sizes for kindergarten, $p = .003$, for which teachers' optimal class sizes were smaller than superintendents (Table 1).

Table 1

Optimal Class Size Mean Responses Among Job Positions

Grade Level	Superintendent		Principal		Teacher		W	p	η^2	df
	M	SD	M	SD	M	SD				
K	17.62	3.090	17.62	3.008	16.47 ^{ab}	2.264	8.77	< .001	.044	2
First	18.59	3.188	18.75	2.803	17.78 ^b	2.315	5.47	.005	.027	2
Second	19.34	3.412	19.67	3.019	18.68 ^b	2.722	3.98	.021	.019	2
Third	20.02	3.611	20.88	3.197	19.59 ^b	3.007	4.79	.010	.021	2

^aSignificant difference between teachers and superintendents, $p = .003$.

^bSignificant difference between teachers and principals, $ps < .05$.

Influences Impacting Optimal Class Size

Analyses of variance indicated statistically significant differences were present between ratings provided by teachers, principals, and superintendents for all influencing factors except class size research (Table 2). Games-Howell post-hoc tests indicated there was only one significant difference between principals and superintendents. Superintendents rated financial implications significantly higher than principals, $p = .002$. Superintendents also rated financial implications significantly higher than teachers, $p < .001$.

For the remaining three influencing factors, teachers' ratings were significantly higher than those given by principals: prior classroom experience ($p = .008$), classroom management ($p < .001$), and instructional quality ($p = .002$). For all three factors, teachers' ratings were also higher than superintendents' ratings, all $ps < .001$.

Table 2

Influences Rated as Impacting Optimal Class Size

Influences	Superintendent		Principal		Teacher		W	p	η^2	df
	M	SD	M	SD	M	SD				
Classroom Experience	2.43	.999	2.74	1.000	3.53 ^{ab}	.719	60.74	<.001	.247	2
Class Size Research	1.92	.886	1.97	.881	1.86	.980	.52	.595	.002	2
Financial Implications	2.57	.945	2.07 ^c	.948	1.82 ^a	.866	23.34	<.001	.103	2
Classroom Management	3.01	.669	2.97	.833	3.40 ^{ab}	.743	15.36	<.001	.066	2
Instructional	3.37	.618	3.49	.626	3.77 ^{ab}	.446	20.95	<.001	.101	2

Quality

^a Significant difference between teachers and superintendents, $ps < .001$.

^b Significant difference between teachers and principals, $ps < .01$.

^c Significant difference between superintendents and principals, $p = .002$.

Discussion

The purpose of this study was to determine whether teachers, principals, and superintendents had different perceptions of optimal class size, and to identify differences in the factors they rated as influencing their class size perceptions. The data analysis shows that superintendents, elementary principals, and K-3 teachers differed in their perceptions of optimal class size for kindergarten, first grade, second grade, and third grade. The Games-Howell post-hoc analysis helped clarify where these statistically significant differences existed.

Superintendents and principals shared a common view about optimal class size. Significant differences existed between principals and teachers at each grade level, and between superintendents and teachers for kindergarten only. In all cases that differences were present, teachers provided significantly smaller optimal class sizes than administrators. These differences likely exist due to the different job roles these people have, which lead them to consider different factors when making these estimates. The administrators' experience as a classroom teacher may have also influenced their perceptions, which may potentially serve as rationale for the difference between superintendents and teachers regarding kindergarten estimates.

An analysis of the factors educators rated as influencing their choice about optimal class size revealed that teachers, principals, and superintendents viewed the class size research factor similarly. Further examination of this factor shows this to be one of the lowest influences among teachers. This suggests teachers, principals, and superintendents in general rely very little on class size research when evaluating optimal class size. The lack of recent research of the magnitude of Tennessee's STAR study may provide some rationale for minimal attention to this particular influence (Filges et al., 2018). It is also plausible educator perceptions rely more on their personal experiences than research, as prior classroom experience was rated as fairly influential for superintendents, principals, and teachers.

A consistent theme throughout the literature on class size is that teacher efficacy, quality, and recruitment are important concerns for schools when evaluating class size (Reichardt & Mid-Continent Research for Education and Learning, 2001). In this study, instructional quality was rated as the most influential factor impacting optimal class size for superintendents, principals, and teachers. It is evident all educators share an equal concern for how class size may impact instructional quality. Even though high ratings were given by all groups, teachers rated this factor as especially influential. Teachers also provided higher ratings than administrators for classroom management concerns. According to both expectancy and self-determination theory, attention should be given to teachers' self-efficacy for providing instruction and managing larger classes, as this may impact instructional quality as class sizes grow (Laine et al., 2000).

Research has indicated class size reduction is an expensive initiative (Achilles et al., 2005; Filges et al., 2018). With the exception of superintendents, financial implications were reported to have little influence on optimal class size selection. By the nature of their role, superintendents likely weigh more on the impact reducing class size will have on the budget. Superintendents must have a systemic perspective when making decisions, and superintendents are ultimately

responsible for balancing a budget that is oftentimes in the millions of dollars (Decman et al., 2018).

Research from seminal works such as project STAR have provided state governments and school leaders with common themes to inform class size policy and action. Similarly, this research offers school officials a new lens in which to evaluate class size policy. Furthermore, it gives first-hand insight into how administrators and teachers report how key themes within the literature impact their perceptions about optimal class size. This in turn has the capacity to guide critical conversations about state funding, class size research, as well as shape professional development opportunities to enhance teacher success in all class sizes.

Recommendations for Practice

Based on the results of this research, school districts evaluating optimal class size should carefully vet factors influencing perceptions of all educators in the school system (Solheim & Opheim, 2019). Administrators should be aware that teachers may have different priorities. For example, teachers are not responsible for balancing a budget funded by the taxpayers of their community. However, teachers should be informed about budget constraints and how class sizes impact available dollars (Higgins & Paul, 2019).

Superintendents might consider creating a committee involving teachers and principals to discuss budget implications in relation to class size as well as review findings from class size research (Decman et al., 2018). This may help build transparency in the budgeting process while also reducing tensions during negotiations. Additionally, intentional committee dialogue about class size research and the budget will help keep all educators focused on making research driven decisions which was shown to be of minimal importance to all educators in this study.

Classroom management had a large influence on all educator perceptions when evaluating optimal class size. Introducing teacher aides to the classroom may assist with classroom management concerns and potentially boost teacher efficacy. However, research has shown this to have a minimal impact on student achievement (Balestra & Backes-Gellner, 2017). Administrators should reflect on the purpose and expected outcomes for adding teacher aides to the classroom (Balestra & Backes-Gellner, 2017). A better approach to healing classroom management concerns and building stronger teacher efficacy is through job-embedded professional development (Althausen, 2015; Tschannen-Moran & Hoy, 2001). Findings from research conducted by Choi and Kang (2019), suggest collaborative group professional development where teachers collaborate and have the opportunity to share ideas may provide the greatest impact on increasing teacher efficacy.

Limitations

While this study was deemed to have adequate power, it serves as a small sample in a rural Midwest state. The trends established in this survey research may fluctuate when replicated in other rural and urban areas across the nation. An assumption was made that respondents interpreted the survey questions in the same manner. Slight deviations in interpreting each question, specifically regarding factors influencing optimal class size choice may limit the claims that can be drawn from the information collected. A qualitative component such as an interview process may help clarify teacher, principal, and superintendent perceptions.

Recommendations for Future Research

Appendix C reveals an observable trend that as district enrollment grew so did the estimates for optimal class size. It may be worthwhile for future researchers to examine if a correlation exists between district enrollment and optimal class size estimates. We also recommend further studies that explore the ramifications tight budgets may have on influencing school district decisions to increase class size. A final recommendation is to study teachers', principals', and superintendents' perceptions of the effectiveness of teacher aides on student achievement in elementary classrooms.

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Appendix A
Class Size Survey



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Default Question Block

Q1. Please select the option which best describes your current role in your district.

- Self-Contained Kindergarten Teacher
 - Self-Contained First Grade-Teacher
 - Self-Contained Second-Grade Teacher
 - Self-Contained Third-Grade Teacher
 - Elementary Principal
 - District Superintendent
 - Other (e.g., art,music, PE)
-

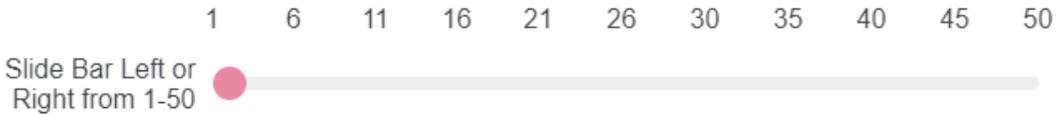
Q2. Please identify how many years you have served in your current position.

- 0-6 years
 - 7-15 years
 - 16 or more
-

Q3. Please select the K-12 student enrollment range for your school district.

- 0-199 Students
 - 200-600 Students
 - \geq 601 Students
-

Q4. Please select what you believe is the optimal class size for a kindergarten classroom by sliding the bar to the left or right.



Q5. Please select what you believe is the optimal class size for a first grade classroom by sliding the bar to the left or right



Q6. Please select what you believe is the optimal class size for a second grade classroom by sliding the bar to the left or right.



Q7. Please select what you believe is the optimal class size for a third grade classroom by sliding the bar to the left or right.



Q8.

To what extent did the following items influence your decision in identifying optimal class sizes for kindergarten through third grade?

	No Influence (1)	Somewhat Influenced (2)	Strongly Influenced (3)	Extremely Influenced (4)
Classroom teaching experience (personal belief based on your experiences in the classroom)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Research on class size (such as: Tennessee STAR, Wisconsin SAGE, Indiana Prime Time)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial impact on class size and managing the school budget	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
What I believe a teacher can manage in terms of behavior (classroom management)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Instructional quality (ability to improve student outcomes)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9. Please provide any additional information as it relates to how you answered question eight.

**Appendix B
Survey Matrix**

Question Content	Demographics	Teacher Experience	Class Size Research	Financial Implications	Classroom Management	Instructional Quality
Question Number	1, 2 & 3	8	4, 5, 6, 7, 8	8	8	8
Matrix of Literature and Research Informing Survey Questions						
Achilles, 2005			x			
Alsaudi, 2016	x	x	x		x	x
Alspaugh, 1994			x			
Althausser, 2015		x			x	
Bascia & Faubert, 2012				x		
Biddle & Berliner, 2008	x	x	x	x	x	x
Borland, Howsen & Trawick, 2005			x			
Bosworth, 2014			x			
Brewer, Krop, Gill, & Reichardt, 1999				x		
Caulfield, 2007		x			x	
Chingos, 2013			x	x		
Deci & Ryan, 1985		x				
Fan, 2012		x	x		x	

Finn & Achilles, 1999			x			
Garland, Garland, & Vasquez, 2013	x		x			x
Glass & Smith 1978			x	x		
Hanushek, 2010			x			x
Hattie, 2009	x	x	x	x	x	x
Hattie, 2012	x	x	x	x	x	x
Helding & Fraser 2013					x	x
Hetrick, 1999			x			
Hoy & Spero, 2005	x	x	x		x	x
Hruz, 2000	x		x	x		x
In-Soo & Jae Young, 2009			x			
Johnson, 2011			x			
Klassen, Tze, Betts & Gordon, 2011		x			x	
Klusmann , Richter & Lüdtke, 2016		x				
Krueger, 2003			x	x		
Laine & Ward, 2000	x	x	x	x	x	x

Lapsley, Daytner, Kelly & Maxwell, 2002			x			
Lee, Tice, Collins, Brown, Smith & Fox, 2012	x	x			x	x
Levin, Glass & Meister, 1984			x	x		
McGiveri n, Gilman & Tillitski, 1989			x	x		
Molnar, Smith & Zahorik, 1999			x			
Odden & Picus, 2011			x	x		
Pate-Bain, Boyd- Zaharias, Cain, Word & Binkley, 1997			x			
Phillips, 2010		x				x
Ratcliff, Jones, Costner, Savage- Davis & Hunt, 2010			x			
Ratcliff, Costner, Carroll, Jones,			x		x	x

Sheehan & Hunt, 2016						
Reichardt, 2001	x	x	x	x	x	x
Sims, 2008						
Smith, Molnar & Zahorik, 2003			x			
Sohn, 2010			x			
Soholt & Sly, 2015	x					
Tschannen-Moran & Hoy, 2001		x	x		x	x
Vroom, 1964		x				
Wagner & French, 2010	x	x			x	x
Weili & Lehrer, 2011			x			
Wiseman & Al-bakr, (2013	x	x				x
Woodmansey, 2017	x					

Appendix C
Optimal Class Size and District Population

Optimal Class Size in Relation to Job Positions and District Population

District Size Population of Students	Superintendents			Principals			K-3 Teachers		
	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>
Kindergarten									
0-199	14.40	3.18	15	15.88	2.64	8	14.98	2.58	43
200-600	17.74	2.63	50	17.44	2.60	36	16.18	2.34	89
≥ 601	18.94	2.70	32	18.31	3.41	29	17.16	1.79	132
First Grade									
0-199	15.00	3.67	15	17.75	1.91	8	16.49	2.93	43
200-600	18.76	2.65	50	18.50	2.66	36	17.22	2.15	89
≥ 601	20.00	2.45	32	19.34	3.12	29	18.57	1.87	132
Second Grade									
0-199	15.60	3.78	15	18.38	2.00	8	17.14	3.44	43
200-600	19.50	3.07	50	19.36	2.80	36	17.72	2.27	89
≥ 601	20.84	2.36	32	20.41	3.39	29	19.83	2.20	132
Third Grade									
0-199	15.93	4.15	15	18.87	1.81	8	18.05	3.56	43
200-600	20.22	3.18	50	20.94	3.11	36	18.49	2.52	89
≥ 601	21.63	2.41	32	21.34	3.47	29	20.84	2.58	132