Class Size and Teacher Work: Research Provided to the BCTF in their Struggle to Negotiate Teacher Working Conditions

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Abstract

This paper presents an update of a 2010-literature review on class size research completed as background in preparation of an affidavit on class size provided by the lead author in the case of *British Columbia Teachers' Federation v. British Columbia,* argued before the Supreme Court of British Columbia in 2010, appealed ultimately to the Supreme Court of Canada and ruled on November 10, 2016. We find that smaller classes can improve teacher-student interactions and individualized instruction, decreasing time spent on discipline issues, leading to better student behaviour, attitude, and efforts. Smaller classes generally have greater advantages for younger students, and effects are more observable in class sizes of less than 20. Small classes may shrink achievement gaps, decrease dropout rates, and increase high school graduation rates, and appear to enhance academic outcomes, particularly for marginalized groups. Researchers have detected class size effects many years later. Small classes have been found to boost teachers' morale and job satisfaction. While some studies have found effects at the secondary and post-secondary level, results are generally inconclusive at this level. Finally, some researchers have argued that class size reductions are an inefficient use of funds which might be better spent elsewhere in the system. The paper concludes with a brief reflection on the process of providing this research for Supreme Court case.

Keywords: class size, teachers unions, working conditions, labour conditions, research use, court litigation

Introduction

In April 2010, the BCTF asked us to conduct a literature review on class size research to be used as background in their court case challenging the legality of the Liberal Government's stripping of class size and composition language from their collective agreement (Bill 22, passed in 2002). The literature review was used in the preparation of an affidavit provided by the lead author in the case of *British Columbia Teachers' Federation v. British Columbia,* argued before the Supreme Court of British Columbia in 2010, appealed ultimately to the Supreme Court of Canada and ruled on November 10, 2016. This paper includes an update of the original research review and reflections on the process of providing research for the case.

The impacts of class size have been debated in academic literature for over a century, dating back to the early 1900s (Glass & Smith, 1979), and continue to attract attention from education policymakers, parents, educators, and researchers alike. Recent literature related to class size, which is referred to as the number of students regularly in a classroom with a qualified teacher (Achilles et al., 2002), is frequently couched in the politically loaded context of "smaller class size" or "class size reduction" (CSR).

There are a wealth of studies, including a number of comprehensive reviews, devoted to the effects of class size. The general consensus is that smaller classes promise to facilitate increased student-teacher interactions, benefit students at risk, and improve students' academic achievement and students' engagement (Blatchford et al., 2003; Finn & Achilles, 1990; Finn et al., 1991; Glass & Smith, 1978, 1979; Iversen & Bonesrønning, 2013; Konstantopoulos & Chung, 2009; Molnar et al., 1999; Shin & Chung, 2009; Smith & Glass, 1980; Wenglinsky, 1997). Some research suggests that smaller classes may also have beneficial effects on achievement at the secondary level (Krassel & Heinesen, 2014) and even in the post-secondary context (De Paola et al., 2013). However, there have been criticisms that smaller classes are not cost-effective and actually play little role in improving students' outcomes and in closing the gap between learning opportunities for traditionally over- and under-achieving students (Altinok & Kingdon 2012; Bosworth, 2014; Guillemette, 2005; Hanushek, 1986, 1998; Koniewski, 2013; Nandrup, 2016; Phelps, 2011).

Our purpose in conducting this research was to provide a review of class size research to inform the BCTF's positions in the court case. It is important to note that the review was intended to provide a summary of our best understanding of the research base to ensure that the BCTF was fully apprised of current issues in the research, not to present a particular view of the research. As specified in the retainer agreement, the purpose was to present an "expert opinion with respect to academic studies and publications considering the impact of class size on learning conditions of students in elementary and secondary schools." Further, "to at all times bear in mind that your role is not that of an advocate, but rather to express the independently-formed expert opinions that you genuinely hold."

The research question we created to guide this work was, "What is the current state of knowledge regarding the impact of class size on learning conditions of students in elementary and secondary schools?"

Method

The bulk of the work required for this project was the creation of a literature review designed to answer the research question. Our review was constrained in two ways, first by an extremely tight timeframe for completion (effectively one week once the purpose and scope had been agreed to and funding for the review arranged), and second, a small budget ($1500 to hire a research assistant). These two constraints influenced our decisions regarding the type of literature review to undertake.

Pare et al. (2015) identified nine different types of reviews in their typology of literature reviews: narrative; descriptive; scoping; qualitative systematic; meta-analysis; realist review; umbrella; theoretical; and critical. Because we were interested in summarizing the current state of knowledge regarding class size and learning conditions; had a tight timeline for a turnaround, and limited budget, we decided that full systematic reviews would not be appropriate (qualitative systematic; meta-analysis; realist review; and umbrella reviews). Further, theory building/interrogating reviews (including theoretical and critical reviews) were also deemed inappropriate for responding to our research question within the timeframe, which left us with summary review options (narrative, descriptive, or scoping).

All three summary review types were appropriate for our focus and scope and could be conducted within a very tight time frame. Because of the importance of credibility and objectivity, we decided against a narrative review (which is less concerned with transparency in the review process). A descriptive review, which is concerned with codification and frequency analyses, was deemed too narrow in its approach to the synthesis. This left us with the scoping review.

Scoping reviews offer an overview of the nature and scope of the research base related to the topic and are flexible in purpose. There are generally four purposes to choose from for a scoping review: consideration of gaps in the research; mapping the range and extent of the research base; determining the value of engaging in a full systematic research review; or summarizing and disseminating research to a specific audience (Arksey & O'Malley, 2005; Pare et al., 2013). Our review embraced this last type of scoping review.

Arksey and O'Malley (2005) offer five stages for conducting the scoping review: identify the research question; identify the research studies; study selection; charting the data; and synthesizing and reporting the results. Pare et al. (2013) took a slightly different tack, identifying seven constructs generally shared across review types: review goal; scope of the question; search strategy; nature of the primary sources used; study selection/exclusion; quality appraisal; synthesis/analysis methods. For our review,

we adopted Arksey and O'Malley's five stages but considered Pare et al.'s nature of the primary sources and quality appraisal within the study selection section.

Five Stages

The first stage, identify the research question, was discussed earlier and resulted in the question, "What is the current state of knowledge regarding the impact of class size on learning conditions of students in elementary and secondary schools?"

The second stage in the process was to identify the research studies to use in the review. To do this, we used the descriptor phrases "class size", "class size effects" and "class size reduction" to search the following online databases subscribed to by the Simon Fraser Library: ERIC, Education Full-Test, ProQuest, EBSCO, Ingenta, JSTOR, and Wilson Education Abstracts. We also conducted a general web search using Google and Yahoo search engines and the same terms. Again because of the short time frame, other strategies typically used in research syntheses, such as consultation with other researchers, organizations, and knowledge networks, were not used in this study. The broad initial search generated several hundred articles.

We used the third stage, study selection, to begin narrowing the research base. Because we were interested in research evidence, we emphasized published peer-reviewed empirical research articles. We expanded this initial body to include other synthesis studies published in journals as well as research in the "grey" literature (research published by organizations, like think tanks, residing outside of the traditional scholarly sphere). Our quality appraisal efforts were limited because of the short timeframe for the work, so we used peer review as the primary arbiter of quality for journal articles and organization identity and reputation for the grey literature. This left us with approximately 200 articles. This body of articles was further reduced by eliminating duplicate entries and ensuring the article focused on learning conditions, learning outcomes, teaching conditions, and students in the K-12 system. We also excluded research that did not provide well-defined research evidence and adequate explanations of the study purpose. After this last reduction, we reviewed article bibliographies to look for other research we may have missed in the simple keyword searches.

This ultimately left us with 74 articles used for the initial review. The paper was updated in 2020 to include 25 new studies published after 2009, and again at the request of a reviewer of this article to ensure Ontario's 2004-08 class size reduction efforts we included, which added three more studies. This left us with a final body of 112 research articles for this review.

Charting the data is the fourth stage in Pare et al., framework. This is the initial stage of analysis and is similar to qualitative theming or narrative review. We noted specific findings related to class size in the early grades; class size in later grades; academic achievement; academic environment; funding; implementation; and regional/national CSR programs. While class size reduction is one of the most researched topics in public education; a large proportion of publications and studies on this topic have been conducted by researchers and scholars in the U.S.A. To ensure a broad review, we also sought out research from Britain, Canada and other countries.

The final stage involves the collating, summarizing, and reporting of results. Unlike systematic reviews, we were not trying to definitively state generalizable outcomes of effect sizes; rather our goal was to present a thematic overview of the charted research. This stage forms the bulk of the rest of this paper and is presented as "Findings."

Findings: Summary of Class Size Reduction Research

Research on class size and its relationship to achievement dates as far back as 1895 (Glass & Smith, 1979). In the late 1970s, Glass and Smith (1978) used a sophisticated and ground-breaking meta-analysis method to study the impacts of class size on student achievement. The study was published in 1978 by the Far West Laboratory for Educational Research and Development, and set the foundation for future studies on the impact of class size on student achievement. By combining 77 separate studies, which yielded 725 comparisons of achievement in classes of different sizes, Glass and Smith (1978) found that smaller class sizes are linked to increases in students' achievement. They found that the greatest gains in achievement occurred among students who were taught in classes of 15 or fewer for more than 100 hours; however, class size had a less dramatic impact on students' achievement in classes of more than

20 students. They concluded that small classes improved students' engagement, teachers' morale, and the quality of the instructional environment. A recent reanalysis of the Glass and Smith study confirmed findings of effectiveness but suggested the high cost of reducing class size in not commensurate with the academic outcomes (Phelps, 2011).

Many other research studies on class size have also tried to answer the question, "does class size reduction improve student achievement?" Those studies tended to focus on a specific jurisdiction or across several jurisdictions where class size reduction was implemented; and evidence for improved student achievement was measured using some form of standardized test results (Blatchford & Mortimore, 1994; Edmonton/ University of Alberta, 2001; Finn & Achilles, 1990; Finn et al., 1990; Iversen & Bonesrønning, 2013; Konstantopoulos & Chung, 2009; Kruger & Whitmore, 2001; Molnar et al., 1998; Shapson et al., 1980; Wenglinsky, 1997; Word et al., 1990); high school graduation rates (Pete-Bain et al., 1999); and/or social indicators, such as mental health, teen pregnancy and incarceration rates (Arum & LaFree, 2008; Jakobsson et al., 2013; Kruger & Whitmore, 2001). A number of researchers found that smaller class sizes were linked with positive effects on students' achievement (Finn & Achilles, 1990; Glass & Smith, 1979; Grissmer, 1999; Iversen & Bonesrønning, 2013; Konstantopoulos & Chung, 2009; Molnar et al., 1999), and both students and teachers' attitudes and relationships (Folmer-Annevelink et al., 2010; Smith & Glass, 1980; Zahorik et al., 2003). The effects of small classes seemed to be most positive in the early years, for African-American students, students of lower socioeconomic status, or in single-parent families (Biddle & Berliner, 2002; Bowne et al., 2017; Finn et al., 2001; Iversen & Bonesrønning, 2013; Smith et al., 2003) and appeared to persist beyond the primary grades (Ehrenberg et al., 2001; Finn et al., 2001; Konstantopoulos & Chung, 2009; Nye et al., 2001).

Meanwhile, other researchers (Hanushek, 1981, 1998; Odden, 1990; Tomlinson, 1988) concluded that class size reduction did not have an appreciable effect on students' academic performance, particularly at the secondary level (Alharbi & Stoet, 2017; Coupé et al., 2016). Hanushek (1981, 1998) twice reviewed the available studies that compared various school resource inputs and concluded that reducing class size should not be expected to produce better student performance. His analyses found that the relationship between class size reduction and student achievement was weak, and the class size reduction programs were too costly, leading him to call for education policy alternatives such as retraining teachers. Tomlinson (1988) examined trend data from the 1950s to 1986 in the USA and did not find any relationship between class size and standardized test scores. He concluded that the existing research did not justify a policy to reduce class size, especially when considering the cost involved and the potential negative impact on the quality of teachers. Later, Odden (1990) reviewed the existing research and argued that the system-wide class size reduction policy would produce only modest improvement in students' academic achievement and incur unjustifiably high costs. However, Achilles (1996) and Finn (1998) responded to Hanushek and Tomlinson by pointing out that their studies had flaws in the analytical methods and that the use of student/teacher ratios was an inadequate measure of class size.

Adding to the complexity of the class size reduction findings, several researchers (Blatchford et al., 2002; Finn, 1998; Haughey et al., 2001; Iversen & Bonesrønning, 2013; Kruger & Whitmore, 2001; Robinson & Wittebols, 1986; Wenglinsky, 1997) have analyzed class size outcomes using students' demographic characteristics, such as race, socioeconomic status, and membership in a single-parent family. They concluded that the clearest evidence of positive effects was in the primary grades (K-3), and that reducing class size was especially promising for disadvantaged and minority students. Wenglinsky (1997) also found that at the fourth-grade level, small class sizes were positively related to mathematic achievement, especially in districts where there were below-average socioeconomic status students; and at the eighth-grade level, small class sizes improved the school's social environment, which in turn led to higher academic achievement.

Class Size Reduction in the Primary Grades

Several experimental studies have added considerable evidence and information to the literature on class size reduction in the early primary grades. While many large-scale studies have been conducted in the USA, scholars, and researchers from Britain, Canada, and Poland have also contributed to this pool of information with their own studies on class size reduction in early grades (Bennett, 1996; Blatchford et al., 2003; Blatchford et al., 2004; Ding & Lehrer, 2011; Edmonton/ University of Alberta, 2001; Haughey et al., 2001; Koniewski, 2013; Shapson et al., 1980).

Program Studies

Indiana's Prime Time. Indiana's Prime Time was a two-year study that began in 1981 with a sample of 24 public schools where class sizes in the early grades (K-3) were reduced to 18 pupils per class. The implementation of Prime Time was not rigorously controlled, lacking the random assignment of pupils; therefore, the results were criticised as flawed. The results of this study showed the greatest improvement in reading for first graders but little improvement in mathematics (Mueller et al., 1988).

The Tennessee STAR (Student-Teacher Achievement Ratio). The Tennesee STAR project was funded by the Tennessee legislature to carry out an experiment on class size in 1985. Conducted by high profile scholars and researchers (Word et al., 1990), the study is one of the most influential class size studies for its careful design and the wealth of subsequent follow-up studies. Project STAR was a four-year longitudinal class-size study that involved 11,600 students in 79 schools and 42 districts in the State of Tennessee (Finn & Achilles, 1990; Kruger & Whitmore, 2001; Word et al., 1990). The research project was designed to provide information related to the effect of early elementary (K-3) small-sized classes on students' performance. The experiment began in 1985 with the random assignment of 6,328 kindergarten students to one of three class sizes: small (13 to 17 students); regular (22-25 students); and regular with a full-time teacher aide. Out of 11,600 participating students, 1842 remained in the same class-size condition for the whole four years (K-3), and 2571 remained in the same class-size condition for grade 1 through grade 3 (Pate-Bain et al., 1999). The results indicated that there were statistically significant differences in student achievement in reading and mathematics, with students in the smaller classes consistently outperforming students in the larger classes on both standardized (Stanford Achievement Test) and curriculum-based tests. This finding was true for both whites and minority students in smaller classes from inner-city, urban, suburban and rural schools (Finn & Achilles, 1990; Word et al., 1990). The positive achievement effect of smaller classes on minority students was initially double that for majority students, and then tapered off to a similar level (Mosteller, 1995; Nye et al., 2004). A later reanalysis of STAR data provided somewhat contrary findings, suggesting that high achieving students benefitted more from the small classes (Ding & Lehrer, 2011).

The improved academic achievement was established in Kindergarten and continued through the following years without the introduction of new material or curricula and without retraining teachers (Finn & Achilles, 1990; Finn et al., 1989). The STAR study also examined the effects of adding a teacher's aide to the larger classrooms, and found no effect on student achievement (Finn et al., 1990; Gerber et al., 2001; Word et al., 1990). Later research that used the data set from the STAR study found that long term exposure to smaller class sizes had a greater effect on achievement for students who were traditionally disadvantaged in education (Finn et al., 1990; McRobbie et al., 1998; Nye et al., 2004); that positive effects continued to be detected many years later as students entered higher grades, and those students were found to take more advanced courses and graduate from high school at higher rates (Finn et al., 2006; Finn et al., 2005; Kruger & Whitmore, 2001; Nye et al., 2001).

Wisconsin's SAGE (Student Achievement Guarantee in Education). Wisconsin's SAGE program focused on class size reduction in Kindergarten through third grade in school districts serving students from low-income families and minority backgrounds. The SAGE program started in the 1996-1997 school year by reducing class sizes in Kindergarten and first grade; introduced class size reductions in the second grade in the following school year (1997-1998); and then added class size reductions to the third grade in 1998-1999. The program aimed to reduce class sizes to 15 or fewer students. SAGE classroom arrangements in the first two years of implementation included a regular classroom with one teacher and 15 students, two teachers and 30 students in a classroom, and other classroom arrangements that reflected the existing classroom settings and teacher assignments. In the 1997-1998 school year, there were 30 schools from 21 school districts participating in the SAGE program, and 14 schools in seven districts providing comparative background and achievement data as a control group for the evaluation study. The results showed that SAGE first graders consistently outperformed the control group in mathematics, reading, arts, and total scores for the Comprehensive Tests of Basic Skills. The achievement gap between white and African-American students lessened in the SAGE smaller classes in comparison to those in the larger classes of the control group schools. At the second grade level, SAGE participants' academic achievement continued to be higher than that of second graders in the control group, but the difference wasn't substantial (Molnar et al., 1998; Molnar et al., 1999).

The California Class Size Reduction (CSR). The CSR program was enacted by the legislature based on Governor Pete Wilson's proposal to reduce class sizes throughout the state in 1996. The program aimed to reduce class sizes in the early grades (K-3) from an average of 28 to not more than 20. If the reduction in class size was carried out, the school districts received $650 per student in the initial year, increasing to $800 in the following year. They also received facilities grants of $25,000, which increased to $40,000 in the following year. The study involved 2.6 million students, 432 schools, surveys of 1,485 teachers, 336 principals, and 2,113 parents of third-graders. In the second year (1997-1998), 1.6 million students were in small classes at an annual cost of 1.5 billion U.S. dollars (Bohrnstedt & Stecher, 1999, 2002; Brewer et al., 1999). Data collection included Stanford Achievement Test scores; administrative data; data on students with disabilities; parents, teachers, principals, and district superintendent surveys; and classroom observations and case studies. There was no random assignment, so schools could only be matched on whether or not they had implemented small class sizes. The results indicated that CSR had positive impacts on parent-teacher communication, individual instruction, and student achievement.

These gains came at a substantial cost in terms of equity. School districts that served minorities, low-income families, and ESL students were found to have received fewer benefits. These districts found it more expensive to implement CSR, and the need for more teachers often resulted in the hiring of under-qualified teachers (Stecher et al., 2001). Research by Jespen and Rivkin (2009) found that the speed of implementation of CSR initiative resulted in an increase in teachers without experience or full certification, likely limiting full realization of the benefits of small classes, particularly in schools with economically disadvantaged and/or minority students.

British Class Size Reduction Studies. Different from the American counterparts, the British government argued that students' academic achievement hinged on teacher quality rather than class sizes; therefore, studies about class size reduction in Britain tended to focus on different aspects (Bennett, 1996; Graue et al., 2005; Hall & Nuttall, 1999). The most complete British analysis of educational consequences of class size reduction was conducted by Blatchford and colleagues between 2000 and 2003 (Blatchford et al., 2003). The study aimed to investigate the effects of class size differences on the academic achievement of students aged 4-7 (junior Kindergarten to second grade), and to understand the connections between class size and classroom processes. The researchers followed a cohort of 10,000 pupils aged from 4 to 7 years for three years. Schools were selected randomly and reflected the diversity in the general population with regard to social background, ethnicity/race, and geographic location of schools in terms of urban, suburban, and rural areas. A variety of information was collected, including child, school and teacher characteristics; academic attainment (measured using Avon Reception Entry Assessment); class grouping practices; teacher estimates of time allowed for teaching; systematic observation of classrooms and teacher experiences of class size; case studies of selected small and large classes; and Pupil Behaviour Ratings (PBR). The results showed that there was a clear effect of class size differences on children's academic attainment over the (first) Reception year. In the case of literacy, the lowest attainers on entry to school benefited most from classes with less than 25 pupils. In terms of the relationship between class size and classroom processes, researchers found that smaller classes allowed more individual student-teacher interactions, more support for learning, and easier classroom management; at the same time, there was increased student inattentiveness and off-task behaviour in larger classes. Results supported a contextual approach to classroom learning within which class size differences had effects on both teachers and students. Researchers concluded that much would depend on how teachers adapted their teaching to different class sizes.

Canadian Class Size Reduction Studies. Although the issue of class size had been a focus of discussions in British Columbia since at least 1960 when the Chant Royal Commission on Education called for reductions in class size (Robertson, 2005), research regarding class size in Canada is still far less developed than in other countries. In late 1970s, a short-term two-year experimental study of the effects of class size was conducted in metropolitan Toronto (Shapson et al., 1980). In the first year of the study, fourth-graders were assigned to 34 classes, some containing 16 students, some 23, some 30, and some 37. In the second year of the study, these students and teachers were assigned to classes that differed in size from their previous assignments. This experimental design enabled the researchers to study the same teachers and students in different class sizes and to observe the ways in which class size influenced classroom processes. The researchers found that class size did not significantly influence student-teacher interactions or teaching methods. There were no differences in students' achievement test

scores, although students in the smallest classes had significantly higher mathematic concept scores than their peers in the two largest classes. Teachers in two smaller-sized classes reported more individualized instruction, improved in-class student behaviour, and more manageable workloads.

In 1989, Edmonton Public Schools and the University of Alberta's Faculty of Education formed a partnership to design and implement class size reduction in several "high-need" schools in the district. The project aimed to examine the impact of small class size on student growth and achievement at the Grade 1 level in high-need schools, with a focus on teaching practices (Edmonton/University of Alberta, 2001). The study involved ten schools with the highest transience rate and highest percentage of families living in poverty. First graders were assigned to classes of 15 students or fewer with a qualified teacher. Various standardized tests such as Canadian Test of Basic Skills (CTBS), Developmental Reading Assessment (DRA), and Highest Level of Achievement Test (HLAT) were used to measure the academic progress of participating students. The results showed substantial gains in test scores five months after the first tests were administered in 2000. The data analysis suggested that teachers were able to individualize their teaching, develop a productive learning environment, and spend more time to support students' personal skill development. As a result, students behaved better in classrooms and concentrated on their work more; teachers felt more confident and satisfied with their work; and parents were pleased with frequent parent-teacher interactions.

Another contribution to the literature on class size reduction in Canada was an experimental study on the effects of class size and student achievement conducted by Margaret Haughey et al. (2001). The study explored the influence of three interventions (small class size, literacy, and teachers' continuing professional development) on the literacy achievement of grade one students in 10 schools in high poverty environments. Data collected for this research was from individual interviews with teachers in their classrooms, and monthly group sessions with the teachers. Students' achievement was measured by test results. Due to the timing of funding, the research lasted only four months, but researchers found significant improvement in teaching practices, in-classroom environment, student achievement in reading and writing, teacher-parent communication, and teacher-student in-class interactions. Other important findings included increased individualized instruction, reduced discipline issues, greater autonomy for teachers, and more access to classroom resources.

Other non-experimental studies included a report, *Making Sense of the Class Size Debate,* commissioned by the Canadian Council on Learning in 2005 (CCL, 2005), and an extensive literature review conducted by Dr. Nina Bascia and Eric Fredua-Kwarteng of the Ontario Institute for Studies in Education and funded by the Ontario Ministry of Education (Bascia & Fredua-Kwarteng, 2008). The CCL report concluded that smaller class size is better; class sizes should be reduced carefully and strategically; the impact should be monitored; and cost-benefits determined. Bascia and Fredua-Kwarteng provided a detailed review of various views on the topic.

From 2004-2008 the Ontario government embarked on a four-year effort to reduce class sizes. Unlike the California CSR program highlighted above, the Ontario program was rolled out over four years and included support for hiring new teachers and building new facilities, and additional work on data reporting and planning was also undertaken to support implementation. Research on this initiative began to emerge in early 2010 (Canadian Education Association, 2010), but unfortunately was not discovered during the initial review (and much of the peer review content was published in a 2012 special issue of *Leadership and Policy in Schools*). Beyond these two sources, and despite the intensity of this CSR effort, we were unable to find other research looking at the longer-term outcomes of the change or linking changes to measures of student learning.

Researchers found that the program was largely successful at reducing class sizes to the stated goal of 20 students or fewer in the primary grades (from 25 students prior to the intervention), with 90% of classes reaching the target by 2008/09 and all classes having 23 or fewer students in the class. A report on early implementation looked at the process of change and the experience of implementation for stakeholders (districts, principals, teachers, and parents). The report also looked at teaching practices in primary classrooms and teacher perceptions of the impact of the program on the quality of teaching and learning conditions. Teacher self-reports suggested that smaller classes supported the implementation of recent literacy initiatives and gave them more time to help individual students experiencing learning difficulties, although observations found mixed implementation of student-centred reforms. Teachers also reported more time to get to know students one on one, although again, observations suggested

some teachers needed more professional development in working closely with families. Teachers reported fewer discipline issues and better student peer relationships, and greater use of instructional strategies associated with improved literacy learning, which was also supported by researcher observations (CEA, 2010).

Speaking directly to working conditions, teachers reported improvements to classroom conditions and better access to resource teachers and specialized support staff. They also reported a higher quality of relationships with students and overall feelings of success (Bascia & Rottmann, 2011; CEA, 2010).

Finally, many of these outcomes were related to the district's capacity to support change. Districts with greater interest in innovation, stronger capacity for school-level planning and monitoring, and a better human and fiscal resource base were able to maximize implementation of PCS (Mascall & Leung, 2012).

Other International Research. Researchers in Norway also looked at the effects of class size and found effects similar to those found in the STAR study (Iversen & Bonesrønning, 2013). A recent study in Germany found small class size effects, showing males in elementary schools as 3% less likely to take an academic path in middle school for every 10 student increase in class size (Argaw & Puhani, 2018). Contrarily, researchers looking at results on the 2012 PISA test across 63 nations found that in most countries smaller classes were associated with lower scores in reading comprehension, although they noted some (but not all) of the difference is the result of ability grouping and SES (Alharbi & Stoet, 2017).

Effects of Class Size Reduction in Higher Grades

In contrast with the number of large-scale research studies that focused on the effects of class size on primary grades, the number of research studies focusing on class size in higher grades is much less robust. Research becomes more challenging to conduct at higher grades because students go to different classes based on the subject. Research conducted by Pong and Pallas (2001) used data from the Third International Math and Science Study (TIMS) to examine the relationship between class size and mathematic achievement of eighth-grade students from nine different countries, and found little evidence that linked class size with student achievement. Wyss and colleagues (Wyss et al., 2007) also conducted a study that involved 2754 biology, 3521 chemistry and 1903 physics students from 36 public and 19 private high schools from 31 different states in the USA. The first analysis included a cross-tabulation of six different class sizes and the frequencies of teacher practices reported by students. The second analysis included a multiple linear regression of class size and student achievement. Results showed no differences in pedagogy and students' academic achievement until class size fell to 10 or fewer students. These findings suggested that incremental reduction in class size at higher grades were unlikely to have a significant impact on students' achievement.

Other researchers have found more positive outcomes at the secondary and postsecondary levels. In Italy, researchers looking at university classes found significant negative effects of large mathematics classes (primarily on weaker students), but no negative effects for stronger students, or for either group in language classes (De Paola et al., 2013). Using a regression discontinuity design with control for lagged achievement and fixed school effects, researchers in Denmark found statistically significant negative effects of increasing class sizes on academic achievement at the secondary level generally (Krassel & Heinesen, 2014).

This weak link between class size and student achievement at the higher grades may be because such research is focused on the wrong sizing variable. Because students are organized by subjects and transition from class to class throughout the day, teachers are required to teach multiple course offerings. As a result, student load (the total number of students teachers instruct throughout the day) may be a more appropriate variable for study. Secondary teachers may maintain a daily load of well over 100 students, making it difficult to develop the types of relationships that elementary educators are able to establish with a teaching load of 20 or fewer students, or provide a similar level of academic engagement and feedback. For example, a 20% reduction in a student load of 25 (in an elementary level classroom) results in teachers working with 20 students, which may enhance the quality of individual relationships that can develop. At the secondary level, however, a 20% reduction in a student load of 150 (five 30 student classes) still leaves the teacher working with 120 individual students. Although it had been a popular

topic for research between 1930 and 1970 (Douglass & Parkhurst, 1940), with the shift in research to class size, very few studies have looked at the relationship between teaching load and student outcomes. Student load could be an interesting perspective for researchers to interrogate again in future studies.

Class Size Reduction and Teacher Working Conditions

The number of students teachers work with can affect the conditions of teacher work in many ways. Among other aspects of their job, it can constrain the type and frequency of learning activities; the relationships teachers can develop with students and their families; and the amount of non-instructional work teachers are required to engage in. Workload can also affect teacher morale, collegiality, and their work within a learning community, as well as student engagement.

Teacher-student interactions and instructional behaviour

Researchers (Achilles et al., 2002; Tienken & Achilles, 2009; Zahorik et al., 2003) have recognized that teacher activity in class creates opportunities for student learning, and that student outcomes are leveraged through instructional practice. For example, Anderson (2002) noted that small classes would not, in and of themselves, solve all educational problems. What teachers do in those classes is what matters. Other researchers (Molnar et al., 1998) have drawn attention to the *quality* of teaching in smaller classes, rather than the *quantity*. The *SAGE* evaluation study used teacher interviews, classroom observation, and other data-gathering techniques to study what happened in smaller classes, and these researchers suggested that students were benefiting from more *individualized* attention. Small classes enable teachers to know each of their students better, therefore, they can keep track of how each student is doing on the learning task of the moment and intervene more effectively to help the individual student make progress. This assumption has been consistent with teachers' views in previous research (Cooper, 1989; Glass et al., 1982; Pate-Bain et al., 1992). Achilles (1999) found, through a systematic observation study of two schools matched on background factors, that teachers in small K-2 classes (about 14 students) engaged in more on-task behavior, while teachers in larger classes (about 24 students) spent more time on off-task behavior.

Furthermore, teachers in small classes report using more hands-on activities and supplemental materials than do teachers in large classes (Pate-Bain et al., 1992), which can be an important predictor of math and science achievement (Wenglinsky, 2000). When math classes are larger, teachers are less likely to use such methods because they have less time to spend on both whole-group discussions and on working with small groups (Rice, 1999).

Using observations and interviews with teachers and students, researchers found that students in four secondary-level language classes in Hong Kong were more motivated and engaged in learning when in small classes (Harfitt & Tsui, 2015). However, other researchers (Blatchford et al., 2005; Shapson et al., 1980) found that results from systematic observations conflicted with teachers' own views; there were no statistically significant differences between class sizes for most teacher activities, and teachers did not alter the proportion of time spent interacting with the whole class, with groups or with individuals. There was, therefore, a gap between professional judgment and observational research findings in some research.

Other studies agreed that the most important classroom process affected by the reduced class size was the shift from group instruction to individual instruction, especially stronger in classes with more below-average students (Betts & Shkolnik, 1999; Molnar et al., 1999). In addition, Betts and Shkolnik (1999) found in a study that combined surveys and observations of 2,170 math classes in middle schools and high schools, that teachers in reduced size classes did not spend more time on new materials, nor did they finish more of the assigned text book. However, time spent on discipline and routine administration declined, while time spent on review of material increased. Overall, these results indicated that there's more likelihood of students receiving more attention and learning supports from teachers in smaller classes than in larger classes.

Educator Outcomes

Research suggests that teachers with smaller classes have higher morale than do those with larger classes (Wenglinsky, 1997; Zahorik, 1999), in part because they are better able to complete daily lesson plans,

feeling more relaxed and less pressured. Teachers in smaller classes report being more satisfied with their jobs because they have more personal and academic interactions with students, fewer classroom discipline issues, and more opportunities to accommodate individual needs (Johnston, 1989). Wenglinsky (1997) presented evidence-based on national data that small class size benefits teacher morale, student morale, and teacher principal relationships. Harfitt and Tsui (2015) found that the characteristics of a community of practice were also more apparent in smaller classes. Together, those aspects helped create a positive school environment, which in turn can strengthen student outcomes.

Students' Engagement and Classroom Behaviour

The phrase "student engagement" is often cited as an essential component of dropout prevention programs or other interventions for students at risk; therefore, discussions on the construct "student engagement" often assume that a primary objective of instructional practice should be to maximize the engagement of individual students in the learning process. Finn (1989, 1993) presented a model of student engagement with two central components, "participation" and "identification". *Participation*, the behavioral component, includes basic behaviors such as the student's acquiescence to school and class rules, arriving at school and class on time, attending to the teacher, and responding to teacher-initiated directions and questions. Noncompliant behavior (for example: inattentiveness, disruptive behavior, or refusing to complete assigned work) represents a student's failure to meet these basic requisites (Finn et al., 1995). Other levels of participation include initiative-taking and participation in the social, extracurricular, and athletic aspects of school life. *Identification*, the affective component, refers to the students' feelings of belonging in the school setting and valuing the outcomes that school will provide, for example, access to post-school opportunities.

Studies have shown that the relationship between specific engagement behaviors with academic performance is strong and consistent across populations defined by background characteristics and grade level (Finn, 1989, 1993; Finn & Rock, 1997). Results of these studies also showed the link between positive engagement behaviors and favourable academic achievement in students at risks or academically resilient students.

Logic and common sense suggest that with more students in the class, there will be more distractions and more possibility of being off-task, and conversely, smaller classes will provide more opportunity to engage students and keep them on task. Indeed, Finn and Achilles (1999) have linked small classes with increased student engagement in learning, because small classes are seen as more friendly places, where students can develop better relationships with their classmates and with their teacher, fostering students' willingness to engage in classroom learning activities. Other researchers confirm the increased student and teacher interactions that come from smaller classes (Folmer-Annevelink et al., 2010); differential classroom practices associated with different conceptions of classroom space and numbers (Bascia & Faubert, 2012); more opportunities for high quality classroom practices provided by smaller class sizes (Graue et al., 2009); and the mechanisms of changing practices associated with changing class sizes (Graue & Rauscher, 2009).

The focus on class size reduction in the early grades also suggests that smaller classes represent a preventive, rather than a remedial, approach. If smaller classes help students start off on the right foot in learning by setting clear academic and behavioral expectations, students are less likely to fall behind or misbehave in classrooms (Finn, 1998; Molnar et al., 1998; Zahorik et al., 2003).

Cost Implications of Class Size Reduction

There's no doubt that the greatest obstacle to widespread implementation of class size reduction is the cost brought about by the need for additional teachers, classrooms, facilities, and services. The cost issue has been raised by several critiques of class size reduction policy (Guillemette, 2005; Hanushek, 1981, 1986; McRobbie et al., 1998; Tomlinson, 1990), even though many researchers questioning the cost of class size reductions also acknowledge the positive effects on students (Mishel & Rothstein, 2002; Nandrup, 2016; Phelps, 2011). While many of these researchers warn against the use of tax dollars on class size reduction until it has proven its value, there has been little effort to try to determine standards related to cost-benefit or cost-effectiveness for education reforms more broadly. Researchers have argued about the methods, assumptions, and scope used in much of the economic research (Guillemette, 2005;

Hanushek, 1981, 1986; Hedges et al., 1994; Krueger, 2003). Hanushek (1986) examined the effect of instructional expenditure on student achievement and concluded that student/ teacher ratio was not an important correlation of student achievement. However, other researchers have argued that small classes can be cost-effective in the long term (Ilon & Normore, 2006; Kruger, 2003). By linking inputs into the educational process with labour market success, Card and Krueger (1992) suggested that a careful analysis of all educational policies would be needed if the United States was to maintain a productive workforce. Using a public health framework for analysis, Muennig and Woolf (2007) linked education attainment to the cost and benefits of future earning and health outcomes per additional high school graduate produced over time, and suggested that reducing class size may be a more cost-effective intervention than other means of intervention. McRobbie et al. (1998) and Odden (1990) also proposed two creative scheduling strategies. One is parallel block scheduling, by which half of a class is taught subjects such as reading and math in small groups, while the other half attend specialty classes such as music, art, or computer lab. Alternatively, small-size classes can be offered for core subjects such as math, science, and language arts, while other non-core subjects could be taught in larger classes.

Class size research in the courts

Class size (or student/teacher ratio) plays a key role in the learning conditions of students, and the working conditions of teachers and has played an important supporting role in school finance litigation and adequacy lawsuits in the United States (Odden et al., 2008). Because class sizes (or student-teacher ratios) are relatively easy to establish and have been linked to student outcomes, they can easily be considered in calculations of adequate educational spending and determinations of inequality (Biddle & Berliner, 2002; Odden et al., 2008). Research looking at the outcomes of these adequacy lawsuits suggests that student achievement, particularly for lower SES students, does increase as a result changes in funding (Glenn, 2008). Some work has also been done suggesting this Evidence-Based Adequacy Model can be applied to schools in the Canadian context (Faubert et al., 2019), although such calculations have not been a part of school funding lawsuits in Canada.

Discussion

Summary of Class Size Findings

This research overview started with the question, "What is the current state of knowledge regarding the impact of class size on learning conditions of students in elementary and secondary schools?" The answer varies based on the context, but in general, research suggests that students in classes in the early grades benefit greatly from enrollment in classes with fewer than 20 students. Research is less certain regarding optimal class sizes in later grades; however, there is evidence to suggest that as enrollments increase, student achievement decreases and that as enrollments decrease, instructional strategies, learning opportunities, and achievement outcomes increase. Teachers in smaller classes report greater engagement with learning activities and better relations with students and parents, as well as spending less time on administrative and disciplinary processes.

It should be noted that the research referenced here by its nature deals with averages and ranges, not hard caps. The research referenced here cannot be interpreted to suggest that specific limits on class size negatively affects student learning or the classroom experience, although such limits may restrict institutional flexibility if class sizes are kept at or near the upper end of the established limit. Such a decision, however, is related more to resource allocation than to student learning.

Because class size is closely related to staffing and facilities, changes in class size carry significant budgetary impacts, and as such, class sizes tend to decrease during times of budget surplus, and increase during times of budget shortfalls. Such decisions however, generally reflect political and economic challenges and not educational goals. Because of the close link between system costs and class size, policymakers should avoid creating situations that radically alter class sizes, instead looking at incremental change over time that allows the system to adjust to such changes to ensure schools have adequate class space that can be staffed by appropriately trained professionals (Bohrnstedt & Stecher, 2002). Successful implementation of reductions is also influence by district capacity regarding planning, monitoring, and supporting change processes and outcomes.

Policymakers and educators should also consider looking at class size in more complex ways (Bascia & Faubert, 2012; Bascia & Rottmann, 2011; Englehart, 2011). Class size is not necessarily the causal link in improving outcomes, rather it is likely the changes in practice that may be supported by smaller classes that result in improved outcomes. How educators perceive their practice as related to class size (and changes in class size) is an important consideration—assuming that practices change in response to increasing or decreasing workload (i.e., student numbers). Some researchers have linked teachers' feelings of success (in improved relations with students and time on task, for example) to their perception of the changes in students' opportunities to learn brought about by class size reductions. Policymakers should also consider how other policies (i.e., staffing, professional development, curricular change, etc.) might interact with class size reductions. Additionally, physical space (availability and quality) and its distribution can impact class size application and outcomes. Finally, research and policymakers should look at all of these aspects of the education policy environment and how they interact, both with each other and with efforts to alter class sizes (Bascia & Faubert, 2012; Bascia & Rottmann, 2011).

Contextual Observations on Research and the BC Court Challenge

As mentioned earlier, the initial review was funded by the British Columbia Teachers Federation as background research for use, if needed, in a long-running legal battle with the BC Provincial Government regarding the right to negotiate in good faith class size and composition as a working condition. In 2002, a newly elected BC Government passed two laws dealing with collective agreements in education, deleting collective agreement terms regarding class size and composition and prohibiting future bargaining on these issues. Believing these changes violated their Charter right to association, the BCTF challenged the changes in court that same year, and arguments were eventually heard by the Supreme Court of British Columbia[1] in 2010.

In 2011, the Supreme Court of BC found that the legislation was unconstitutional because it infringed Section 2(d) of the Charter, which ensures the freedom of association—in short, the stripping of bargained language violated the rights of teachers to organize and bargain their work collectively. The judge in the case, the Honourable Madam Justice Susan Griffin, suspended the decision for a year to give the parties time to negotiate a new agreement in good faith. One year later, the parties had failed to reach an agreement, and the government passed new legislation essentially restoring the language previously ruled unconstitutional. Justice Griffin quickly ruled against the government, restoring the originally bargained language (from 2002) and fining the government $2 million. The Government appealed the ruling to the Province's top court, the BC Court of Appeal. In 2015, in a split decision, the BC Court of Appeal found in favour of the Government, and the BCTF appealed to the Supreme Court of Canada. In an unusual ruling from the bench, the Supreme Court found in favour of the BCTF, agreed with the dissenting judge at the BC Court of Appeal, and restored the trial judge's decision (British Columbia Teachers' Federation v. British Columbia, 2016).

While testimony on class size research was provided by the lead author on this paper in response to a submission by a witness for the Government, Thomas Flemming, class-size research ultimately played very little role in the case. The research was referenced twice in the trial judge's decision, neither time referring to class size research. Student achievement and outcomes as related to class sizes were also not referenced.

While the affidavit evidence supplied by Thomas Flemming was referenced in the initial decision, it was summarily dismissed as over-reaching in its claim that the BCTF was seeking "control over class size," since the desire was to negotiate class sizes, not control them (British Columbia Teachers' Federation v. British Columbia, 2011, p. 31). The affidavit response supplied to the BCTF was not referenced, and none of this research was referenced in either of the appeals.

In large part, the lack of attention to the class size research may stem more from the nature of the case, than the value of research. While the issue of contention between the BCTF and government involved class size and composition, issues with a substantial (if contentious) research based in education, the issue for the courts was the right to negotiate working conditions.

In other words, the research of interest to the courts would have been research on the role of class size as a working condition of teachers. While much of the research provided by the Government's

[1] In BC, the Supreme Court is a trial court that hears some appeals, but the BC Court of Appeal is actually the highest court in the Province.

witness and the BCTF's response dealt with the costs and outcomes of class size adjustments, the judicial concern was more related to the extent to which class sizes effect the work of teachers, and whether the Government illegally restricted the Union's right to bargain working conditions (or bargained in bad faith). Indeed, the two references to research in the trial judge's opinion focused on working conditions—on page 23, the reference is to research conducted by the BCTF regarding member priorities for bargaining (class size being one); while on page 64 of the decision the reference to research refers to the Government of Canada's *Report of the Task Force on Labour Relations*, which emphasized the importance of collective bargaining.

Class size in this context is a secondary issue to the question of free and fair collective bargaining. While the BC government chose to strip class size limits from the collective agreement, it wasn't class size per se that was the issue, rather it was working conditions (class size being one) that was the issue. Class composition, or any other working condition stripped from the collective agreement could have been relevant for the court. The significant aspect of the decision in *BCTF vs.B.C* was its contribution to the collective bargaining literature, not the class size literature. Even here, however, scholars have suggested that the extent to which governments can intervene in the collective bargaining processes remains uncertain (Thornicroft, 2017). Governments can adjust wage increases and limit the right to strike in carefully defined cases, but they cannot deny access to a collective bargaining regime. Interpreting requirements for meaningful bargaining was a major component of the case; however, in ruling from the bench rather than on the substance of the appeal, the Supreme Court failed to address that point, leaving a great deal of uncertainty regarding the extent to which governments can intervene in the collective bargaining process (Thornicroft, 2017).

In hindsight, rather than looking at the academic research on class size outcomes, the review should have focused on whether changes in class size should be considered to affect the working conditions of teachers, and therefore be something open to negotiation. Looking back at the review of class size research, there is a strong body of research indicating that the work of teachers is indeed influenced by class size (Achilles, 1999; Bascia & Faubert, 2012; Cooper, 1989; Folmer-Annevelink et al., 2010; Glass et al., 1982; Graue et al., 2009; Harfitt & Tsui, 2015; Johnston, 1989; Pate-Bain et al., 1992; Rice, 1999; Wenglinsky, 1997). While the end result of the case aligns well with the available research on class size, in most respects this effort represents a missed opportunity to link research to policy.

Previous research on research use identifies this as a common challenge, as external agents supplying research to policymaking bodies generally run into three challenges: they may be viewed as outsiders without knowledge of the local context; they may incorrectly identify the research users or user needs; or they may lack credibility or be viewed as having motives beyond the presentation of the research data (Krist, 2000). In this case, the research, while credible and applicable to the local context, did not correctly address the user's need.

Additional research looking at the intersection of research in American jurisprudence has identified four key priorities where researchers and courts tend to diverge:

a. differences in the goals,
b. differences in how information is valued,
c. differences in the conclusions drawn from that information, and finally,
d. differences in the assumptions made (Tropp et al., 2007).

Many of these tensions can be seen in this case as well. The class size review above presents the diversity of class size research and uncertainty regarding its implementation, a key point (a) in the difference in goals between researchers (nuance) and courts (factual certainty). Similarly, justices value information stemming from precedent, whereas researchers are interested in convergence of findings across multiple studies and replications (b). Courts have difficulty reconciling "truth" through divergent research studies. The nature of how the research was used in the BC case illustrates this challenge, as both litigants brought in external agents to synthesize and interpret the divergent body of class size research—essentially presenting two contrasting views of the "truth." This results in a divergence in the conclusions we can draw from research—leaving justices in the uncomfortable position of choosing a side rather than applying facts. The final challenge (d) faced in bridging the divide between researchers and the courts is well beyond the scope of this paper, but deals with the nature of knowledge and reality, and whether we can, as researchers or the judiciary, ever really engage in knowing in an impartial or value free manner. In point of fact, this may represent more of a similarity, as both groups seek to wear

the garb of impartiality while also frequently failing to acknowledge the foundational values upon which their work is based.

Conclusions

As identified in this paper, class size is an important aspect of the working conditions of teachers and has a real impact on the educational and individual development of students. While the degree and cost-efficiency/effectiveness of class size changes can be debated, smaller classes generally result in better outcomes for students as teachers are able to alter the nature of the work they do to better engage students in learning.

Additionally, it is evident from the way research was presented and used in this case that great care needs to be taken when interpreting research outcomes for non-researchers, in this instance court judges. Researchers need to keep focused not only on what the research "says," but in how that body of knowledge can best be leveraged to address the legal questions at issue. While we as researchers might take for granted the role of class size in the working conditions of teachers, and therefore seek to examine the outcomes involved in changing that condition, that explicit link in this case was what the courts were seeking. Had the testimony paid closer attention to the needs of the judge by explicitly defining class size as a variable in the working conditions of teachers, and as something teachers collectively valued having input on, it is possible that the research gathered and presented through this review would have been more directly useful and applied in resolving the case.

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