# The Big Problem with Little Interruptions to Classroom Learning

Matthew A. Kraft*
*Brown University*

Manuel Monti-Nussbaum
*The Behaviouralist*

May 2020

## Abstract

Narrative accounts of classroom instruction suggest that external interruptions, such as intercom announcements and visits from staff, are a regular occurrence in U.S. public schools. We study the frequency, nature, and duration of external interruptions in the Providence Public School District (PPSD) using original data from a district-wide survey and classroom observations. We estimate that a typical classroom in PPSD is interrupted over 2,000 times per year, and that these interruptions and the disruptions they cause result in the loss of between 10 to 20 days of instructional time. Administrators appear to systematically underestimate the frequency and negative consequences of these interruptions. We propose several organizational approaches schools might adopt to reduce external interruptions to classroom instruction.

* Corresponding author. Matthew Kraft can be reached at mkraft@brown.edu. This study would not have been possible without the support and assistance of the Providence Public Schools, including Marco Andrade, Jessica Cigna, Jennifer Stoudt, Lindsay Lanteri and the PPSD principals and teachers who invited us into their classrooms. We would like to thank Jenna Knueppel, Sarah Lettes, Marianna McMurdock, Anna Meyer, Ruby Miller-Gootnick, Harrison Neuret, Sarah Newberger, Sarah Novikoff, and Suvy Qin for their excellent research assistance.

> *If the teacher is so important among the many items that are required for a successful school program, why are teachers seldom given more than 30 minutes of uninterrupted time to perform their very important functions? Teachers are forced to work in the midst of a continuing barrage of different interruptions . . . It is difficult to believe that there could be such a record of interruptions — unless it were planned by someone who wanted to wreck the school program.*
>
> - University of Wisconsin Professor of Education Glen C. Eye, 1955, p. 35-36.

Eye's sharp criticism of the frequent interruptions to classroom learning in U.S. public schools remains as relevant now as it was over six decades ago. Sociological studies (Lortie, 1975; Paisey, 1981) and educators' personal accounts describe external intrusions into the classroom as a regular phenomenon in schools (Armstrong, 1995; Clavel, 2003; Elovitz, 2001, 2002; Mathews, 2007). These authors narrate in vivid terms the "exasperating" and "constant annoyance" of external interruptions that are a "pedagogical disaster" and an "insidious waste of instructional time." Yet, we still have little information to judge whether external interruptions are a necessary but trivial annoyance or an avoidable and detrimental feature of the learning environment.

We define external interruptions as intrusions from outside the classroom that are not under the direct control of classroom teachers. This definition distinguishes our focus from the large body of literature on internal interruptions caused by off-task student behavior (Little & Akin-Little, 2008; McLeod, Fisher & Hoover, 2003). Unlike internal interruptions, many external interruptions are caused by school staff and are under the direct control of the school leadership. Commonly cited examples of external interruptions include announcements made through school intercom systems, calls to classroom phones, classroom "drive-bys" by school staff, and student pull-outs.

The best evidence available about the prevalence of external interruptions in U.S. public school classrooms comes from the nationally representative TIMSS video study of instruction from two decades ago. Stigler and his colleagues (2000) found that outside interruptions occurred during 30% of 8th grade mathematics lessons taught in the U.S., but were never once observed in Japanese lessons. More recent evidence from public schools in Louisiana and Western Canada suggests that instruction is interrupted at least several times a day (Leonard, 1999; 2001; 2003; 2008). These findings have received surprisingly little attention given the potential negative effects of even brief interruptions on students' opportunities to learn (Pianta et al., 2007) via lost instructional time and lesson momentum (Kennedy, 2005). Research from psychology clearly documents the negative impacts of interruptions on cognitive performance in laboratory settings (Altman, Trafton, Hambrick, 2014; Rosen et al, 2011; Cades, 2011; Gillie & Broadbent, 1989; Foerde, Knowlton & Poldrack, 2006).[1]

In this study, we provide large-scale descriptive evidence about the frequency, nature, and duration of external interruptions to classroom learning in a medium-size U.S. urban public school district. We examine interruptions in the Providence Public School District (PPSD), working in collaboration with the district to collect original data from school climate surveys and classroom observations. Over 13,800 students, 1,500 teachers, and 70 administrators responded to a range of survey items asking about the frequency of external interruptions and the degree to which they disrupt learning. We complement these survey data with observational data and field notes collected during 63 classroom observations in five PPSD high schools. Using an original observation instrument, our research team timed and cataloged external interruptions across ten teachers' classrooms, while also capturing the observable consequences of these interruptions for

instruction and learning. We use these survey and observational data to answer six primary research questions:

1) *How frequently do external interruptions occur?*
2) *What are the primary types of external interruptions?*
3) *When are external interruptions most likely to occur?*
4) *To what extent do external interruptions disrupt classroom learning?*
5) *How much instructional time is lost due to external interruptions?*
6) *Do principals accurately perceive the frequency and consequences of external interruptions?*

Our mixed-methods approach to studying external interruptions makes several contributions to the literature. Our quantitative data provide, for the first time, a precise accounting of the instructional time lost due to externally generated classroom interruptions and the resulting disruptions that these intrusions cause. We estimate that, over the course of an academic year, PPSD high school students experience over 2,000 instances of external interruptions. Both survey and observational data suggest that these interruptions and the subsequent disruptions they cause result in the loss of between 10 to 20 days of instructional time over the course of the academic year – enough time to consider all PPSD students truant or even chronically absent (Sutphen, Ford, & Flaherty, 2010).

Our qualitative field notes reveal new insights about the ways in which interruptions disrupt learning and shape the experience of teachers and students in schools. For example, we observed a frequent source of interruptions that has received little attention in the research literature: tardy and returning students who disrupt instruction when they (re)enter the classroom. We also observed how brief interruptions could lead to longer and distinct disruptions to learning, causing teachers to lose lesson momentum. Observations and interviews with teachers also illuminate how persistent interruptions during the beginning and end of class periods lead students and some teachers to effectively shorten class periods.

Our mixed-methods analyses document how interruptions are a malleable feature of the learning environment that are unequally distributed across schools. Some PPSD schools experienced three times as many interruptions as others. Such large differences within the same district and schooling level suggest there is substantial potential for organizational approaches to reduce the prevalence of interruptions, especially given that most interruptions are caused by school staff. We conclude by discussing a range of practical approaches that schools can employ to reduce the frequency and disruptive nature of external interruptions to classroom learning. Taken as a whole, our study suggests that minimizing intrusions into the classroom is among the most feasible and cost-effective ways schools can increase instructional time.

## Prior Research

### Instructional Time

Making the most of instructional time has been a focus of education researchers and reformers for over a century. In the 1920's, the classroom efficiency literature grew out of the application of scientific management principals to public education (Callahan, 1962). A related body of work emphasizing the importance of time on task emerged in the 1970s and 80s (e.g. Fisher et al., 1981; Karweit, 1984; Karweit & Slavin, 1981; Stallings, 1980). This research, which extended Carroll's (1963) seminal work, *A Model of School Learning,* characterized learning as a function of not only available time for learning, but also the amount of time used for instruction and the quality of that instruction. In 1983, the landmark report, *A Nation at Risk*, brought national attention to this issue by identifying the ineffective use of class time as one of four key factors contributing to America's declining educational performance.

A large body of literature has since focused on the distinct ways in which teachers and schools can maximize instructional time (Brophy & Good, 1986; Berliner, 1990; Fullan, Hill, & Crevola, 2006). Phelps and colleagues (2012) describe instructional time as a function of allocated time (length of school day and year), possible time (time in classes when both students and teachers are present) and enacted time (possible time spent on instruction). In a sample of over 1,800 teachers across 14 states, Phelps et al. found that students had roughly a 90% chance of actually receiving instruction during possible learning time. Estimates of off-task behavior and student wait-time during transitions suggest that these activities erode between 10% and 30% of possible learning time (Godwin et al. 2016; Imaraj et al. 2016; Phelps et al. 2012; Rosenshine 2015).

**External Interruptions to Classroom Learning**

Research on the frequency and nature of classroom interruptions dates back to the 1950's. Hartwell, Johnston, and Myers (1954) worked with 307 teachers to track interruptions and found that teachers reported a high percentage to be "unnecessary" or of "questionable importance" (p. 13). Eye (1955) categorized interruptions across 40 class periods, citing frequent examples such as "the use of the public-address system at unanticipated times," student "tardiness," and teachers "dropping in on a neighboring teacher for a chat" (p. 36). Prewett (1956) analyzed essay responses from over 400 teachers about the conditions that prevent them from doing their best teaching and found that interruptions were the most frequently cited challenge in the classroom. Dalton (1964) found that administrators underestimated the degree to which classrooms in their schools were disrupted by external interruptions and misidentified the most frequent types of interruptions.

Research by Lawrence Leonard conducted between 1999 and 2008 provides the most current evidence on the frequency of external interruptions to instructional time. In the first of his studies, Leonard (1999) observed 91 class periods across 12 schools in rural Western Canada and estimated that students experienced an average of 12 interruptions per school day. In follow-up studies, Leonard (2001, 2003) surveyed teachers in Saskatchewan (Canada) and Louisiana and found that more than half the teachers estimated their classes were interrupted three to four times each school day, with the majority of teachers identifying intercom announcements as the most frequent source of interruptions. Importantly, Leonard (2008) also documented how administrators in Louisiana perceived that classrooms in their schools were interrupted only once or twice daily, a substantially lower rate than that commonly reported by teachers.

**The Effects of External Interruptions**

Evidence on how external interruptions impact learning time remains both mixed and quite limited. Teachers' perceptions about the effect of interruptions differ, with approximately half reporting that external interruptions are a serious problem that "impedes educational progress" and requires them to "re-teach material," while a quarter see them as a "relatively harmless fact of school life" that has "little or no manner of effect" (Leonard, 2001; 2003). In a field-based study of 58 early-career teachers, Doyle (1997) concluded that external interruptions contributed to unpredictability in the sequence of classroom events, and that teachers frequently felt frustrated by interruptions. A study comparing organizational practices across schools where students exceeded vs. underperformed their predicted level of achievement found that positive outlier schools were much less likely to use intercom systems or pull students out of classes (Stringfield & Teddlie, 1991). Meta-analyses examining instructional leadership practices also

identify protecting learning time from external interruptions as a key leadership practice associated with higher student achievement (Robinson, Lloyd, & Rowe, 2008; Waters, Marzano & McNulty, 2003).

Lab experiments from the psychology literature suggest that the consequences of disrupting teachers' instruction and students' cognitive focus extend well beyond lost instructional time. Studies of resumption lag document how interruptions result in additional time lost due to the effort it takes to collect one's thoughts and resume the original task (Altmann & Trafton, 2004; Monk, Trafton, & Boehm-Davis, 2008). Other lab experiments illustrate how interruptions negatively affect knowledge acquisition and the ability to recall information flexibly, particularly when completing more complex tasks (Rosen et al, 2011, Cades, 2011, Gillie & Broadbent, 1989; Foerde, Knowlton & Poldrack, 2006). Even brief interruptions can drastically increase the number of errors made while completing a sequenced task (Altman, Trafton, Hambrick, 2014).

We build on and extend these literatures through a detailed accounting of the time lost to external interruptions, a portrait of how interruptions disrupt teaching and learning, and a discussion of what schools can do to reduce external interruptions.

## Research Design

### Site

We examine the frequency, nature, and consequences of outside interruptions to classrooms in PPSD. As the largest school district in Rhode Island, PPSD serves approximately 24,000 students across 41 schools. Students in the district come from predominantly low-income families and families of color; 80% of students are eligible for free or reduced-price lunch

(FRPL), and 81% of students are Hispanic or African American. As shown in Table 1, PPSD is broadly representative of other urban public-school systems in the United States, but serves a significantly greater percentage of Hispanic students. In comparison to other mostly rural and suburban districts in Rhode Island, schools in PPSD have larger enrollments, more students per teacher, and a greater percentage of English language learners.

A recent review of PPSD led by researchers at John Hopkins's Institute for Education Policy describes a struggling school system with structural deficiencies and low levels of academic instruction (John Hopkins, 2019). Indeed, only 15% of PPSD students in grades 3 through 10 were proficient in math and 18% were proficient in English language arts (ELA) on the 2016-17 Common-Core aligned Partnership for Assessment of Readiness for College and Careers (PARCC) achievement test. This context presents fertile ground to observe classroom interruptions. At the same time, our results may have more limited generalizability for different types of school settings.

**Sample and Data**

Our study involved two primary data collection sources and samples: respondents to the district-administered school climate survey and PPSD high schools and high-school teachers who volunteered to participate in our classroom observation study. The anonymous district climate surveys, developed by Panorama Education, are administered annually to administrators, teachers, and students in grades 3 through 12. We integrated a supplemental set of questions about external interruptions into teacher and student surveys in 2017 and into all three surveys in 2018. A total of 1,576 teachers and 13,958 students completed the online survey in January and February of 2017, a 75% response rate for teachers and 73% for students. The following year, 76

administrators, 1,480 teachers, and 13,875 students took the climate survey for response rates of 75%, 73%, and 75%, respectively.[2]

In January 2017, we recruited PPSD high-school principals to participate in our observational study. Our focus on high schools was motivated by exploratory interviews with Rhode Island teachers, which suggested that external interruptions were particularly frequent and disruptive in larger high schools (see Appendix A for detailed description of the exploratory interview process). Five PPSD principals accepted, two declined, and four did not respond to our attempts to contact them.

In Figure 1, we compare the five high schools that opted to participate in our classroom observation study relative to other PPSD schools on achievement and the percentage of students who are eligible for free- or reduced-price lunch (FRPL). With the exception of the clear outlier in our sample – a selective enrollment public high school with a 30% acceptance rate – schools that agreed to participate were broadly representative of the 11 high schools in the district across these dimensions. As shown in Table 1 Column 6, we find two statistically significant differences between participating and non-participating high schools across 15 measures based on school-level t-tests with limited statistical power. Participating high schools enrolled fewer English language learners and suspended students at lower rates than non-participating high schools. Proficiency rates in math and ELA at participating high schools were almost 15 percentage points higher than non-participating schools although these differences are not significant. These patterns suggest that the high schools in our observation sample faced fewer organizational challenges than other PPSD high schools and likely provide a conservative estimate of the frequency of external interruptions.

Principals of participating high schools nominated up to three teachers that would host observers at least four times during the 2017 spring semester. We asked principals to identify teachers that would provide a representative range of classroom environments in their school. We then approached the nominated teachers, described the purpose of our study, and coordinated directly with them to schedule observation dates. All ten of the teachers we contacted agreed to participate in the study. In Table 2, we report on the characteristics of the teachers that participated in our study and the classes they taught. Teachers were predominantly white and had an average of almost ten years of total teaching experience and six years of teaching experience in their current school. Similar to our sample of participating high schools, we might expect this relatively experienced sample of teachers to provide a conservative estimate of the time lost to interruptions – if more experienced teachers are better at keeping students on task during and after an interruption.

We observed a total of 63 class periods between March 10$^{th}$ to June 6$^{th}$. We sampled classes, observation days, and periods using a purposive approach to ensure we obtained broad coverage of grade levels and subject areas, as well as weeks in the semester, days in the week, and periods in the day. The number of observed class periods per visit ranged from one to four, depending on the availability of teachers and observers. As shown in Table 2, our sample of observed classes represents a wide range of subjects, grade levels, periods during the day, and days of the week. On average, classes were 66 minutes long and had 14 students in attendance. Out of all classes observed, 16% were Advanced Placement classes and 36% had a teaching assistant.

We combine these original survey and observational data with administrative data provided by PPSD on student performance, student demographics, and school characteristics

from the 2015-16 and 2016-17 school years. We measure achievement based on the percentage of 3rd through 10th grade students that are proficient on the PARCC assessment in math and ELA. We also predict a measure of the average student achievement at each school by applying a heteroskedastic ordered probit model to count data on the number of students that scored at each of the five performance levels on the PARCC exams (Reardon et al., 2017). These school-level means can be interpreted as averages of the underlying continuous test score distributions measured in student-level standard deviation units.

**Data Collection and Instruments**

*District Survey.* We worked with the PPSD Office of Research, Planning & Accountability to develop and include several supplemental items on their 2017 district-wide school climate surveys inquiring about teachers' and students' experiences and perspectives on external classroom interruptions. Before answering survey questions about interruptions, respondents were prompted to read a brief statement describing our focus on interruptions from outside the classroom and providing several examples. The non-exhaustive examples were "intercom announcements, visits from other teachers or aides, telephone calls to a classroom phone, and administrator visits." The statement also clarified that the definition did not include disruptions that originated from inside the classroom due to general student misbehavior such as the use of personal cell phones.

We developed the original survey items in partnership with PPSD. As part of the development process, we refined the questions based on feedback from cognitive interviews with current PPSD teachers and high school students about how they interpreted the survey items (Gelhbach & Brinkworth, 2011). To aid in comparisons across respondents, we used identical

item stems and response anchors whenever possible. We revised survey items for the 2018 administration based on insights from our observational data. Specifically, we included an expanded range of external interruption types including "students who enter class late and disrupt teaching and learning." See Appendix B, for the full survey protocol and items included in the 2017 and 2018 PPSD survey.

*Classroom Observations*. The authors and a team of undergraduate research assistants conducted the classroom observations.[3] At the beginning of each visit, teachers briefly introduced observers to the class without going into detail about the purpose of the study. During the class period, observers sat quietly at the side or in the back of the room and recorded all instances of external interruptions using an original data collection instrument we developed specifically for this purpose, the Classroom Interruptions Tracker. The Tracker structured the observation process in a way that facilitated an organized and formal data collection process to capture the timing, durations and types of interruptions that occurred. Observers also documented what occurred immediately after an interruption, timing and describing any disruption caused by the interruption. Finally, the observer recorded detailed notes about disruptions caused by an external interruptions that continued to influence the learning environment even after instruction resumed (See Appendix C for the full Classroom Interruptions Tracker instrument).[4]

We took a flexible, inductive approach to designing the data collection instrument to ensure that we captured all forms of external interruptions, including those that we did not anticipate. Data from several pilot classroom observations helped reveal the diverse ways in which classroom learning was interrupted from outside the classroom. We observed that students entering the classroom late or returning from being pulled out or going to the bathroom were a

major source of external interruptions. We chose to track and code instances of students arriving late or returning to classes *only if their (re)entry to the classroom interrupted instruction or learning*. We did *not* track and code instances in which students or staff entered the classroom after class had begun if they did so quietly and without interfering with the learning at hand.

Bi-weekly team meetings also served to ensure all observers continued to interpret and apply our coding scheme in a consistent manner throughout the data collection process. We assessed the internal validity of our observation protocol by having observers conduct several classroom observations in pairs. During these visits, observers independently recorded instances of interruptions using the Tracker and were instructed not to share or discuss their notes before entering their observations into our data system. Data from seven joint visits suggest observers were highly consistent when recording quantitative information about interruptions using the Tracker. Pearson correlation coefficients between independent recordings of the frequency and duration of interruptions were .93 and .96, respectively.[5]

**Analyses**

We answer our research questions using a combination of quantitative and qualitative methods. Our quantitative methods include a wide range of descriptive analyses such as tabulations, data visualizations, correlational analyses, and projections based on survey data and data collected during classroom observations. As a first step towards analyzing our field notes from classroom observations, observers wrote thematic summaries of the events they observed after each school visit. We then reviewed these summaries as a research team and identified the main themes and ideas that emerged (Maxwell, 2005). We draw on the insights from our field

notes to inform our descriptive analyses and to provide narrative examples of the events we recorded using the Classroom Interruptions Tracker.

## Findings

### How frequently do external interruptions occur?

Both survey reports and observational data confirm that external interruptions to classrooms are common during the school day. We present the incidence of external interruptions for a typical school day as reported by teachers and students on the 2018 climate survey in Table 3. On average, teachers and students estimate that they experience 11.9 and 16.3 total interruptions per day in a typical PPSD school, respectively.[6] Survey data also reveal that external interruptions to classroom learning are a substantially larger problem in some schools than in others. In Figure 2, we illustrate how the frequency of interruptions varies across individual schools and by schooling level. Among the 41 schools in the district, the average frequency ranges from 4.8 to 20.7 interruptions per day, as reported by teachers, with a corresponding school-level standard deviation of 4.8 interruptions. External interruptions appear to be much higher in middle and high schools than in elementary schools in PPSD. This pattern remains the same even when we exclude tardy students who interrupt instruction when they enter the class.

Observational data collected by our research team in five PPSD high schools confirm that external interruptions are a considerable problem. In the 63 high school classroom periods we observed, we recorded a total of 185 external interruptions. As we report in Table 3, this translates to 2.8 interruptions per hour of class, or 15.3 per school day, on average.[7] Consistent with survey results, we also find substantial variation in the frequency of classroom interruptions

across the five schools in our observation sample, ranging from as low as 8.7 to as high as 24.3. Our observation-based estimates also provide supporting evidence of the validity of teachers' and students' self-reports on the climate survey. Our average observation-based estimate of 15.3 interruptions per school day is quite close to teachers' and students' self-reported estimates of 13.9 and 12.3 in these five high schools.

**What are the primary types of external interruptions?**

Our detailed observational data from PPSD high schools reveal five major categories of external interruptions. These included three commonly thought of interruptions: intercom announcements, calls to classroom phones, and visits by teachers, staff, and administrators. We also observed frequent interruptions caused by students who (re)entered class in a disruptive way after class had started because they were tardy, left class to use the bathroom, or were pulled out of class by other teachers or staff. Students from other classes interrupted learning to deliver notes or make requests on behalf of staff members and to attempt to visit with friends.

As shown in Figure 3 Panel A, students entering the class late were a major source of additional disturbances to classroom learning. Among the five high schools in our observation sample, students arriving late to class amounted to 38% of all observed external interruptions. In many classrooms we observed, the doors were locked during class, which required the incoming student to knock and a teacher or another student to stop what they were doing and open the door.[8] Late students often resulted in taking the teacher away from whole-class instruction to orient the student to the current task. We also observed several instances where the tardy student was unclear about how to engage with the lesson mid-period and began to distract other students around them with off-topic conversations. In other instances, a student would arrive late and take

a moment to explain what had happened to the teacher. These sometimes became back and forth conversations that resulted in the teacher sending the student to the main office to return with a formal note. In more extreme examples, one student arrived late and was a continuing distraction to the class because he reportedly smelled of marijuana and another late arriving student was unable to open the door because a classmate was holding it closed as a prank.

The second most common form of external interruptions we observed were visits by other teachers, staff, and administrators (17%). There is value in an open-door culture where administrators conduct frequent observation and feedback cycles with teachers. However, none of the classroom "drive-bys" we observed were visits by district or school administrators for the purpose of observing teachers' instruction. Instead, teachers knocked on classroom doors to borrow materials or look for students to provide them with make-up work or have them take an exam. School staff such as guidance counselors, teachers' aids, and secretaries visited to get teachers' signatures on forms, deliver messages to students, or pull them out of class.

Intercom announcements were the third most common type of interruption at 14%. The content of intercom announcements ranged widely and included school-wide announcements about sports, social events, bus passes, and one request to hold students in class for security reasons; grade-specific events such as field trips, college fairs, or upcoming testing; and individual information such as the names of students who had detention or were missing permission slips as well as requests for individual students to come to the office or for a teacher to call the office. Our field notes suggest that more than half of the announcements we heard were not relevant for the students or teachers in the classes we observed.

Calls to classroom phones were also common, comprising 12% of the interruptions we observed. Some of the purposes for phone calls that we could discern were to ask about whether

a student was present in class, to ask to speak to a student to inform them about detention, and to ask for classroom supplies and materials such as extra textbooks, chairs, and laptop carts. We also found that students were called out of class frequently to meet with their college counselors, deliver materials to another class, turn in a permission slip, or take an exam they had missed. Visits by students that were not members of the class (9%), student returning to class from being pulled out or going to the bathroom (7%) and other outside interruptions (3%) comprised the remaining proportion of interruptions. Students often acted as messengers for the office or from other classrooms, and in a few cases were simply trying to socialize with friends in a classroom. We also observed five instances of outside noise in the hallways that were so severe they caused the teachers in the classrooms we observed to pause their lessons and leave their classes to address the issue.

Data on the frequency of specific external interruptions from the district climate survey largely support these findings from the field. As shown in Figure 3 Panel B, both middle school and high school teachers identified late students as the most common form of interruption. In elementary schools, where overall interruptions are less frequent, intercom announcements appear to be the most common form of interruptions. In fact, intercom announcements and calls to classroom phones were ranked in the top three types of interruptions across all three school levels. One notable difference is that teachers reported that visits by other teachers, staff, and administrators were among the least frequent types of interruptions, suggesting that these types of interruptions might be more common during the spring months we observed, when testing and college counseling meetings occur more frequently. Open-ended responses by principals, teachers, and students describing other types of interruptions that occurred through the school day included:

- Fire / intruder drills
- Special assemblies
- Early student pickups
- Student pull-outs for sports or clubs
- Janitorial disruptions
- Street / traffic noise
- Classroom volunteers / teacher aids
- Hallway fights or other disruptions
- Make-up tests
- Administrator walkthroughs
- Extra students added to classes in the absence of substitutes
- Ambulance / police sirens
- Technology issues / computer cart

**When are external interruptions most likely to occur?**

In the high school classrooms we observed, external interruptions occurred across entire periods and throughout the school day. We report the average total frequency of interruptions by the hour of the school day and portion of the class period in Panels A and B of Figure 4. Interruptions were most likely to occur in the first and last hours of the day. From 8-9AM and 2-3PM, classrooms were interrupted more than twice per hour, whereas in other hours of the day, classrooms were interrupted between 1 and 1.5 times per hour, on average. Tardy students were an acute problem in the first period and then declined throughout the school day. Intercom announcements occurred most frequently in the afternoon, particularly during the last period. All other types of interruptions appear to be distributed relatively evenly throughout the day.

During a given class period, interruptions occurred most frequently at the beginning of class. More than 45% of all interruptions took place during the first third of the class period, driven by tardy students. However, intercom announcements and other interruptions occurred regularly throughout a class period. Together, these data on the timing of interruptions suggest that classes were interrupted regularly and unexpectedly both throughout class periods and across the school day.

**To what extent do external interruptions disrupt classroom learning?**

Both survey and observational data suggest that interruptions negatively affected classroom learning in meaningful ways. As shown in Figure 5, 45% of teachers and 43% of students reported that interruptions were at least somewhat of an interference to learning. We also find that in schools where interruptions were more frequent, teachers were more likely to report that interruptions were detrimental to learning. In schools that averaged at least 17 interruptions per day (N schools = 6), over 64% of teachers reported that interruptions at least somewhat interfered with instruction. In schools that average less than six interruptions per day (N schools = 7), only 21% of teachers surveyed reported that interruptions were at least somewhat of an interference. These patterns reflect a strong school-level correlation, 0.80, between the frequency of interruptions and their perceived interference.

Field notes from observations inside PPSD classrooms reveal how even small interruptions can lead to big disruptions to instruction and learning. Over 50% of the interruptions we observed resulted in subsequent disruptions that extended the lost learning time beyond the interruption itself. In Figure 6, we report on the most common types of disruptions that occurred following an interruption. These disruption types are not mutually exclusive; often interruptions led to students being off-task and then the teacher having to pause the lesson to regain the attention of the students. In almost half of the disruptions we observed, teachers had to delay resuming their lesson to address misdirected attention or inappropriate behavior. Students speaking loudly about non-academic topics (often commenting on the interruption) occurred in almost 30% of the disruptions. In 9% of the cases, students stopped their work and were either idle, waiting for the teacher to resume the lesson, or were off-task as the teacher tried to restart class. In 7% of the observed disruptions students got up from their seats and walked around the classroom and in another 7% students left the classroom for no apparent reason.

About 15% of all classroom interruptions led to disruptions that continued to visibly interfere with instruction and learning for the remainder of the class period. These lasting consequences included students remaining disengaged from the lesson (50% of all instances with a prolonged disruption), students continuously distracting each other (25%), the teacher altering the class plan or not being able to finish (14%), and students being forced to leave the class (11%). Several examples from our observational data help to illustrate how a brief interruption can lead to a prolonged disruption in class:

> A brief intercom announcement requested that all students on the honor roll come to the cafeteria. This sparked confusion among students, which led to a lengthy conversation about who was on the honor roll, while students got up from their desks and talked loudly and moved around the class. The teacher ultimately decided to leave the classroom to confirm which of her students were on the honor roll.
>
> A phone call to a classroom about reserving a room for a talent show audition lasted for one minute. The call caused students to talk and joke about the talent show for a minute or two. Then the teacher who had called entered the classroom and talked with a few interested students about who can audition and how auditions have been thus far. The class's focus remained on the talent show for several minutes after the teacher left.
>
> Another teacher entered the classroom and sang happy birthday to the teacher in the middle of his class. This interruption by a staff member led students to speculate about how old their teacher was and devolved into a series of off-topic conversations.
>
> While some students in the classroom were taking a state standardized test, a knock at the door by a tardy student caused the student closest to the door to stop taking his test and let the late student in. Once inside, the late student began to chat with the other student, causing most of their classmates to turn around and become distracted and leading the teacher to scold both students and direct them to their respective tasks.

These examples demonstrate how interruptions can quickly derail students' focus as well as how teachers' decisions and classroom culture can either mitigate or exacerbate the effects of external interruptions.

Finally, we find a consistent negative relationship between the frequency of external interruptions and student academic achievement. Panels A and B of Figure 7 illustrate the

bivariate school-level relationships between the frequency of interruptions as reported by teachers and average achievement on the Math and ELA PARCC assessments. Across all PPSD schools, we find a partial correlation between achievement and frequency of interruptions of -0.53 in math and -0.48 in ELA conditional on schooling level (-0.34 math and -0.24 in ELA when excluding the selective enrollment high school). These strong negative relationships persist even when we exclude tardy students and focus on interruptions largely caused by the school staff (-0.41 math and -0.38 ELA). Perhaps most telling is the absence of schools that are both high achieving and that have high interruption rates (i.e. in the upper right quadrant of Figure 7). Although these correlations are far from evidence of a causal relationship, they are consistent with the large body of evidence in the psychology and organizational management literatures that documents how interruptions have significant negative effects on knowledge acquisition and task performance.

**How much instructional time is lost due to external interruptions?**

Detailed time records from our field notes and teachers' survey responses indicate that external interruptions are a major source of lost learning time in PPSD. In Table 4, we report on the instructional time lost due to classroom interruptions across the high schools in our observation sample. The interruptions we observed lasted for an average of 44 seconds. Subsequent disruptions lasted, on average, another 57 seconds. Accounting for the fact that interruptions do not always result in a disruption, the average length of time lost for each interruption and possible disruption it might cause is 78 seconds.

The duration of interruptions and subsequent disruptions, when they occur, differ meaningfully across interruption type as shown in Figure 8. Consistent with teachers'

perspectives from our exploratory interviews, calls to classroom phones were the most disruptive form of interruption as measured by total instructional time lost – almost 2 minutes per instance. Calls to classroom phones required teachers to move across the classroom to answer the phone, take the call, and then, often fulfill a request (ask a student to go to the office, for example). In many instances, this diversion of teachers' attention provided ample time for students to become off-task, requiring teachers to spend additional time regaining the class's focus.

We estimate the total amount of learning time lost due to interruptions based on these field-based records of the frequency and duration of interruptions and the additional time it takes students and teachers to regain their focus. This involves scaling the total average time lost per 60 minutes of class across a full school day (5.5 hours of actual class time) and academic year (180 days). As reported in Table 4, we project that across an academic year students lose 54.5 hours of instructional time, or nearly 10 days, due to external interruptions. The majority of this time is due to external interruptions that are largely under the direct control of schools such as intercom announcements, classroom phone calls, and classroom visits. Even when we remove students entering the class late in a disruptive way, we estimate a total of 6.7 days of lost instructional time.

One limitation of these estimates is that they assume the frequency and duration of interruptions we observed during the spring months is representative of the full academic year. It could be that interruptions occur more frequently in the spring when students take the PARCC and Advance Placement (AP) tests and seniors meet with counselors to make college decisions and career plans. It could also be that interruptions are more frequent in the fall months when students first enroll, schedules are adjusted, and clubs and sports teams recruit members.

Teachers' survey-based estimates suggest that our field-based estimates may substantially understate the full amount of lost instructional time. We asked teachers to estimate how many minutes in a typical 60-minute class are lost because of outside interruptions. Teachers' responses suggest that, across PPSD schools, an average of almost 7 minutes are lost to external interruptions in each class. Using the same scaling approach as above, this translates to 113.9 total hours or a shocking 20.7 days of lost instructional time across the school year. Survey-based estimates suggest that our field-based estimates at the high school level are likely to be informative for understanding lost instructional time in middle and elementary schools as well. Teachers' estimates of the amount of lost learning time per 60 minutes are very similar across middle and high school (7.24 minutes vs. 7.43 minutes), with elementary schools only modestly lower (6.51 minutes).

Although we cannot know with certainty how accurate teachers' estimates are, there are several reasons to believe that the true amount of lost instructional time is at least greater than the 10 days we estimate based on data from our Classroom Interruptions Tracker tool. First, teachers' responses to the climate survey suggest that the average frequency of interruptions among the five high schools that participated in our study is 26% lower than those that did not participate (6.3 vs. 8.4 per day), suggesting that interruptions are an even larger problem in other PPSD high schools. Second, principals might have volunteered teachers for our study that are more effective at inoculating their classrooms from interruptions and minimizing the disruptions they can cause. Third, our efforts to record the duration of disruptions were limited to the outward student behaviors we could observe. Literature from psychology suggests that even when students appear to return to their work, they experience a further delay in refocusing their attention and remembering where they left off (Altmann & Trafton, 2004; Monk, Trafton, &

Boehm-Davis, 2008). Finally, we did not track interruptions that occurred after a period had started but before a teacher had begun the class. As we discuss below, consistent interruptions at the beginning or end of class caused some teachers to regularly start class late and end class early.

Field notes and informal discussions with the teachers we observed suggest that regular external interruptions also led to the defacto shortening of some class periods. In several of the classrooms we observed, teachers waited to start instruction until five minutes or more after the period had begun. This was often because only a handful of students were present in class when the bell rang, particularly during first period. Teachers reported that starting the lesson on-time and then having to pause to repeatedly reorient students who trickled into class was more disruptive than starting late. Our observational data confirmed this challenge; we observed numerous instances when students entered class late and required individualized help to catch up. In many instances, these students quickly fell behind and disengaged from the lesson, distracting fellow classmates.

Intercom announcements further reinforced this pattern of late starts and often informally signaled the end of class before the period was over. In one classroom we observed, students and the teacher often spent the first minutes of class on small minutia, waiting for regularly scheduled announcements to end before engaging in focused work. This happened despite the fact that announcements occurred sometimes five minutes or more after the beginning of class. Even more common was the loss of the last five to ten minutes of the last period of the day during which some schools made daily announcements. Students would pack up their belongings when announcements began and then sit waiting for the period to end, even if the announcements finished several minutes

before the end of class. Although we don't provide a formal accounting of time loss caused by late starts and early endings to class periods, even a conservative calculation would suggest they increase lost learning time by an order of magnitude in schools where they are the norm.

**Do administrators accurately perceive the frequency and consequences of external interruptions?**

Survey data suggest that school administrators substantially underestimate the frequency and negative effects of external interruptions in their own schools. As reported in Table 3, Principals reported an average of 8.8 external interruptions per day relative to 11.9 for teachers and 16.3 for students. These differences are unlikely to be caused by differential perceptions about what constitutes an external interruption given all respondents read the same definition, answered identical items, and reported on the frequency of individual types of interruptions. In the high schools we observed, administrators estimated 58% fewer interruptions per day than we recorded using the Tracker tool (6.4 vs. 15.3).

Administrators also perceived that external interruptions interfered with learning in their schools much less than teachers and students did. Only 17% of administrators reported that external interruptions "somewhat" interfered with learning, compared to 45% of teachers and 43% of students (see Figure 5). Similarly, administrators estimated that substantially less time was lost to external interruptions than teachers, 4.5 minutes per hour compared to 6.9 minutes for teachers. These inaccurate perceptions by administrators are consistent with previous research (Dalton, 1964; Leonard, 2008) and likely help to explain why persistent interruptions to classroom learning go unaddressed.

Several factors likely explain this phenomenon. Most basically, principals may not observe the full range of ways in which classes are interrupted because they do not work in a classroom environment. They hear the intercom announcements but don't experience classroom "drive-bys" or phone calls in the same way. Bounded attention and self-enhancement motive may also contribute to principals' inaccurate beliefs. Principals may have trouble sustaining the attention needed to keep an accurate running tally of external interruptions given their focus on other priorities throughout the day (Simons & Chabris, 1999). They also are likely motivated to see their schools in a positive light given how central their work is to their identities (Sedikides, Gaertner & Toguchi, 2003).

## Discussion

### Lost Lesson Momentum

Brief external interruptions to classroom instruction might appear trivial and fleeting to a casual observer, but a closer look reveals their deleterious effects on classroom instruction. To start, interruptions take away from learning time. More importantly, they provide an opening for further disruptions to the classroom learning environment (Varley & Busher, 1989). We observed that seemingly small interruptions can have a "snow-balling" effect, disrupting instruction and distracting students' focus for much of the remainder of the period. In some instances, disruptions were a continuation of the issue raised by the interruption, while in others, the interruption provided a window for students to engage in off-task behavior while the teacher was occupied addressing the reason for the interruption. As Matthew Clavel (2003), a teacher in the South Bronx, described, "After each disruption had run its course, I had to fight to establish order again."

Mary Kennedy describes this phenomenon as the "loss of instructional momentum" in her book, *Inside Teaching* (2005). Drawing on extensive interviews with teachers, she writes about how teachers take great efforts to prevent distractions from occurring. Teachers repeatedly described to her how small distractions would escalate into larger ones. Losing lesson momentum often meant having to go back and start a lesson over. In this way, the negative effects of interruptions are even larger than simply the amount of instructional time they erode. Disrupting lesson momentum means that when teachers resume instruction, they likely have to spend additional time restating directions, reviewing earlier content, and reenergizing students to be active participants in their learning.

Teachers' concern over losing lesson momentum likely reflects the cognitive tax that small interruptions can levy on student learning. We know from the psychological literature that even small interruptions can negatively affect information recall and performance (Altman, Trafton, Hambrick, 2014; Rosen et al, 2011; Cades, 2011; Gillie & Broadbent, 1989; Foerde, Knowlton & Poldrack, 2006). Beyond the cognitive effects, we also find suggestive evidence that regular interruptions may cause some teachers to delay the start of class or cause students to stop engaging in class well before the period ends. These types of unintended consequences amplify the negative effects of brief interruptions.

**Teacher and Student Frustration**

In addition to lost time and momentum, frequent external interruptions can also undercut school community and culture. Allowing external interruptions to go unchecked communicates an implicit disregard for the value of teachers' work and students' learning. We heard time and again in our exploratory interviews and informal conversations with PPSD teachers that they felt

devalued when external interruptions were a regular occurrence. One teacher we spoke with as part of our exploratory interviews commented on how irritating it was that her school would make regular announcements seeking volunteers to cover classes when teachers were absent. Another spoke with frustration about the length of daily announcements during class that often included detailed sports scores and game synopses. In some instances teachers also commented about, and we observed, how students were annoyed by announcements that were not relevant to them.

These findings suggest that external interruptions can fray relationships and erode teacher satisfaction. Teachers felt disrespected by their peers and other staff members who interrupted their classes with impunity. They described how these "drive-bys" disregarded their instructional priorities and authority over their classroom. Teachers were resentful of the additional effort it took them to get students back on track after students' attention was distracted unnecessarily by external interruptions. They saw interruptions as a convenient practice for school staff and administrators that placed an unnecessary burden on teachers. In these ways, the small indignities of regular interruptions can add up to be a major source of frustration for teachers and students.

**Holding Instructional Time Sacred**

The existing evidence clearly suggests that teachers and students would benefit if they had the opportunity to work and learn in environments where external interruptions were less frequent. One encouraging result from our study is that frequent interruptions are not a necessary feature of schooling. Even within PPSD, we observed schools where external interruptions were the exception rather than the norm. Most of the types of external interruptions we observed were

directly under the control of administrators and teachers and often caused by educators themselves. As one teacher we observed suggested, schools need to do everything possible to "hold instructional time sacred".

How might schools adopt an organizational approach to reducing external interruptions? To start, administrators could immediately cut the cord of the school intercom system or prohibit unscheduled intercom announcements. Teachers reported that the majority (52%) of intercom announcements were unscheduled. Schools could also substantially circumscribe the type of announcements that are allowed over the intercom system. Distracting hundreds of students to call one student to the front office is an inexcusable practice. Some schools use daily assemblies and advisory periods as alternative ways to make announcements and deliver information to individual students. One Rhode Island teacher we interviewed explained how her school eliminated all in-school announcements by using an online communication and school information portal that houses grades, general announcements, and a calendar on which students keep track of sporting and social events.

Schools might also reduce or eliminate calls to classroom phones and classroom visits by shifting all non-urgent communication with teachers to email or text messages. Establishing clear, school-wide norms about when and for what purposes intercom announcements, phone calls, and classroom visits are acceptable could empower teachers to deter and deflect these interruptions. For example, schools can encourage teachers to protect learning time by making them comfortable saying no to some requests for materials or to pull students from class (Partin, 1987). Teachers might also designate a student to answer classroom phones and place signs on their doors requesting that visitors leave a note rather than knock on the door or pop-in.

For some school districts, student attendance and efficient transitions between classes are less of a concern, but for districts like PPSD they remain a major challenge. Locking classroom doors in an effort to protect student safety further exacerbates this challenge by requiring late arrivals to knock on doors to enter classrooms. Although schools have less control over student attendance and punctuality than they do over other types of external interruptions, there are steps that schools can take to bolster attendance. Research suggests that more frequent communication with parents, partnering with community mentors, strengthening student-teacher relationships, and establishing regular classroom routines for late-arriving students can all make a difference (Gottfried & Hutt, 2019).

Several studies have found that sending personalized letters to parents updating them about their child's attendance records, emphasizing parental efficacy, and highlighting the negative incremental effects of missing school can increase attendance (Rogers & Feller, 2018; Robinson et al, 2018). Teachers' efforts to build strong relationships with their students can motivate students to attend class regularly and enter without disrupting instruction when they are late. Systems as simple as having a tray for all lesson materials to designating a student to explain to late students what the class is doing can help them more seamlessly engage with the lesson. In some schools, teachers' aids accompany tardy students to their classes and help them get oriented to the lesson.

## Conclusions

A large body of evidence from the psychological and organizational management literatures documents the negative effects of even brief interruptions on learning and productivity. Teachers and scholars have written compelling accounts about the deleterious

effects of outside interruptions on instruction and student engagement. However, limited systematic information exists about the frequency of these external interruptions or the amount of instructional time they consume. This study documents that external interruptions are a regular feature of the school day in a mid-sized urban school district, and that these interruptions cause substantial disruptions to instruction and lost learning time. Although it is not clear how broadly our results generalize, our estimates of the frequency of interruptions in PPSD are surprisingly similar to the rate of interruptions Leonard (1999) observed over twenty years ago in rural Canadian public schools.

Although the challenges posed by frequent external interruptions are real, administrators and teachers have considerable agency in addressing them. Part of the solution is school-level systems, policies, and planning designed to shift communication to platforms and times other than when classes are in session. Equally important is establishing collective school norms that prioritize learning time by questioning the necessity of frequent, brief interruptions. Clearly some interruptions are necessary for classroom observations, student safety, and individualized support for students, but these are the exception rather than the norm. Reducing these unnecessary intrusions into classrooms is a simple and almost costless way to increase instructional time.

Future research will be central for understanding the prevalence of external interruptions in other district contexts and the organizational practices that limit these interruptions. Our findings also point to the need to study how interruptions might systematically affect teachers' pedagogical choices. It is possible that frequent interruptions lead teachers to prioritize approaches that are more robust to frequent interruptions, such as individual work, and eschew more enriching whole-class discussion or group work. Failing to better understand and reduce

external interruptions will continue to allow the cumulative total of these small intrusions to "wreck the school program."

## Endnotes

[1] As one measure, collectively these studies have been cited less than 50 times according to Google Scholar.

[2] Administrator responses are missing from five elementary schools and one high school. If anything, this pattern of missing responses inflates average principal estimates of the frequency, duration and severity of external interruptions given interruptions are less prevalent, on average, in elementary schools.

[3] We selected research assistants based on their prior experience with classroom observation, volunteering in schools, or ethnographic research. Before entering classrooms, observers completed background-check requirements and participated in training modules where they were briefed and tested on classroom sensitivity and etiquette and practiced observing and taking field notes of mock interruptions as well as entering observations into our data system.

[4] We decided against using tablets or computers to collect data in order to minimize distractions caused by observers.

[5] See Appendix Table B1 for inter-rater correlations across all quantitative variables we recorded.

[6] We assign the following numeric values to ordinal survey anchor ranges: 0 for *Almost Never*, 0.5 for *Once Every Couple Days*, 1.5 for *Once or Twice a Day*, 4 for *Three to Five Times a Day*, 8 for *Six to Ten Times a Day*, 15.5 for *Eleven to Twenty Times a Day*, and 21 for *More than Twenty Times a Day*.

[7] We estimate the number of interruptions per school day by multiplying the number of interruptions per hour by the hours of instruction per day that PPSD high school students have on average (5.5 hours).

[8] Out of the ten teachers we observed, four had the doors to their classrooms locked at all times, four had them unlocked, and two had them locked sometimes and unlocked others.

## References


Altmann, E. M., & Trafton, J. G. (2004, January). Task interruption: Resumption lag and the role of cues. In *Proceedings of the Cognitive Science Society* (Vol. 26, No. 26).

Altmann, E. M., Trafton, J. G., & Hambrick, D. Z. (2014). Momentary interruptions can derail the train of thought. *Journal of Experimental Psychology: General, 143*(1), 215–226

Armstrong, C. (1995, May). Do not disturb! *Teacher Magazine*, 45.

Berliner, D. C. (1990). What's all the fuss about instructional time. *The nature of time in schools: Theoretical concepts, practitioner perceptions*, 3-35.

Brophy, J., & Good, T. (1986). Teacher behavior and student achievement. In m. Wittrock (ed.), Handbook of research on teaching (pp. 328-375).

Cades, D. M. (2011). *Understanding the effects of interruptions on the quality of task performance* (Doctoral dissertation). George Mason University.

Callahan, R. E. (1962). *Education and the cult of efficiency*. University of Chicago Press.

Carroll, J. B. (1963). A model of school learning. *Teachers college record*.

Clavel, M. (2003). A recipe for school chaos. *American Enterprise*, *14*(3), 50-50.

Dalton, L. F. (1964). *Instruction Time Loss Due to Classroom Interruptions* (Doctoral dissertation, University of Southern California).

Doyle, W. (1977). Learning the classroom environment: An ecological analysis. *Journal of teacher education*, *28*(6), 51-55.

Elovitz, L. H. (2001). The sanctity of the classroom. *Principal Leadership*, 1(6), 5-7.

Elovitz, L. H. (2002, May). Do not disturb! *Teacher Magazine*, 45.

Eye, D. (1955). The importance of decreasing classroom interruptions. American School Board Journal, June, 35-36.

Fisher, C. W., Berliner, D. C., Filby, N. N., Marliave, R., Cahen, L. S., & Dishaw, M. M. (1981). Teaching behaviors, academic learning time, and student achievement: An overview. *The Journal of classroom interaction*, *17*(1), 2-15.

Foerde, K., Knowlton, B. J., & Poldrack, R. A. (2006). Modulation of competing memory systems by distraction. *Proceedings of the National Academy of Sciences*, *103*(31), 11778-11783.

Fullan, M., P. Hill, & C. Crevola. 2006. *Breakthrough.* Thousand Oaks, CA: Corwin.

Gehlbach, H., & Brinkworth, M. E. (2011). Measure twice, cut down error: A process for enhancing the validity of survey scales. *Review of General Psychology*, *15*(4), 380-387.

Gillie, T., & Broadbent, D. (1989). What makes interruptions disruptive? A study of length, similarity, and complexity. *Psychological research*, *50*(4), 243-250.

Godwin, K. E., Almeda, M. V., Seltman, H., Kai, S., Skerbetz, M. D., Baker, R. S., & Fisher, A. V. (2016). Off-task behavior in elementary school children. *Learning and Instruction*, *44*, 128-143.

Gottfried, M. A., & Hutt, E. L. (2019). *Absent from School: Understanding and Addressing Student Absenteeism*. Harvard Education Press. 8 Story Street First Floor, Cambridge, MA 02138.

Hartwell, W.W., Johnson, R. & Myers, M. 1954. National Elementary Principal, 23(6), 13-15.

John Hopkins (2019). Providence Public School District: A Review. Institute for Education Policy. https://edpolicy.education.jhu.edu/wp-content/uploads/2019/11/PPSD-REVISED-FINAL.pdf

Karweit, N. (1984). Time-on-Task Reconsidered: Synthesis of Research on Time and Learning. *Educational leadership*, *41*(8), 32-35.

Karweit, N. & Slavin, R. E. (1981). Measurement and modeling choices in studies of time and learning. *American Educational Research Journal*, *18*(2), 157 - 171.

Kennedy, M. M. (2005). *Inside teaching: How classroom life undermines reform*. Harvard University Press.

Leonard, L. J. (1999). Towards Maximizing Instructional Time: The Nature and Extent of Externally-Imposed Classroom Interruptions. *Journal of School Leadership*, *9*(5), 454-74.

Leonard, L. J. (2001). From indignation to indifference: Teacher concerns about externally imposed classroom interruptions. *The Journal of Educational Research*, *95*(2), 103-109.

Leonard, L. J. (2003). Optimising by minimising: interruptions and the erosion of teaching time. *The Journal of Educational Enquiry*, *4*(2).

Leonard, L. (2008). Preserving the Learning Environment: Leadership for Time. *International Electronic Journal for Leadership in learning*, *12*(16), n16.

Little, S. G., & Akin-Little, A. (2008). Psychology's contributions to classroom management. *Psychology in the Schools*, *45*(3), 227-234.

Lortie, D.C. (1975) *Schoolteacher: a sociological study* (Chicago, Ill., University of Chicago Press).

Mathews (2007, March 6th). The Case of the Silent Loudspeaker. *The Washington Post*. http://www.washingtonpost.com/wp-dyn/content/article/2007/03/06/AR2007030600429.html

Maxwell, J.A. (2005). *Qualitative research design: An interactive approach* (2nd ed.). Thousand Oaks: CA. Sage Publications.

McLeod, J., Fisher, J., & Hoover, G. (2003). *The key elements of classroom management: Managing time and space, student behavior, and instructional strategies*. ASCD.

Monk, C. A., Trafton, J. G., & Boehm-Davis, D. A. (2008). The effect of interruption duration and demand on resuming suspended goals. *Journal of Experimental Psychology: Applied*, *14*(4), 299.

Partin, R. L. (1987). Minimizing classroom interruptions. *The Clearing House*, *61*(1), 29-31.

Paisey, A. (1981) *Small Organisations. The Management of Primary and Middle Schools* (Windsor, NFER-Nelson).

Phelps, G., Corey, D., DeMonte, J., Harrison, D., & Loewenberg Ball, D. (2012). How much English language arts and mathematics instruction do students receive? Investigating variation in instructional time. *Educational Policy*, *26*(5), 631-662.

Pianta, R. C., Belsky, J., Houts, R., & Morrison, F. (2007). Opportunities to learn in America's elementary classrooms. *Science*, *315*(5820), 1795-1796.

Prewett, C.R. (1956). Let's remove the barriers to good teaching. *School Executive*, 76, May, 83-85.

Reardon, S. F., Shear, B. R., Castellano, K. E., & Ho, A. D. (2017). Using heteroskedastic ordered probit models to recover moments of continuous test score distributions from coarsened data. *Journal of Educational and Behavioral Statistics*, *42*(1), 3-45.

Robinson, C. D., Lee, M. G., Dearing, E., & Rogers, T. (2018). Reducing student absenteeism in the early grades by targeting parental beliefs. *American Educational Research Journal*, *55*(6), 1163-1192.

Robinson, V. M., Lloyd, C. A., & Rowe, K. J. (2008). The impact of leadership on student outcomes: An analysis of the differential effects of leadership types. *Educational administration quarterly*, *44*(5), 635-674.

Rogers, T., & Feller, A. (2018). Reducing student absences at scale by targeting parents' misbeliefs. *Nature Human Behaviour*, *2*(5), 335-342.

Rosen, L. D., Lim, A. F., Carrier, L. M., & Cheever, N. A. (2011). An empirical examination of the educational impact of text message-induced task switching in the classroom: Educational implications and strategies to enhance learning. *Psicología educativa, 17*(2), 163-177.

Rosenshine, B. V. (2015). How time is spent in elementary classrooms. *The Journal of Classroom Interaction*, *50*(1), 41-53.

Sedikides, C., Gaertner, L. & Toguchi, Y. (2003) Pancultural self-enhancement. *Journal of Personality and Social Psychology, 84*(1), 60.

Simons, D. J. & Chabris, C. F. (1999). Gorillas in our midst: Sustained inattentional blindness for dynamic events. *Perception*, *28*(9), 1059-1074.

Stallings, J. (1980). Allocated academic learning time revisited, or beyond time on task. *Educational researcher*, *9*(11), 11-16.

Stigler, J. W., Gallimore, R., & Hiebert, J. (2000). Using video surveys to compare classrooms and teaching across cultures: Examples and lessons from the TIMSS video studies. *Educational Psychologist*, *35*(2), 87-100.

Stringfield, S. & Teddlie, C. (1991). Schools as affectors of teacher effects. In *Effective Teaching: Current Research*, Waxman, H. and Wahlberg, H. (Eds.), Berkeley, CA: McCutchan Publishing, 161-179.

Sutphen, R. D., Ford, J. P., & Flaherty, C. (2010). Truancy interventions: A review of the research literature. *Research on Social Work Practice*, *20*(2), 161-171.

Varley, H. M., & Busher, H. (1989). 'Just a Minute...'—managing interruptions in the junior school classroom. *Educational Studies*, *15*(1), 53-66.

Waters, T., Marzano, R. J., & McNulty, B. (2003). Balanced Leadership: What 30 Years of Research Tells Us about the Effect of Leadership on Student Achievement. A Working Paper.

## Tables

Table 1. Student Characteristics

| | US Urban Schools | Rhode Island | PPSD | PPSD High Schools in Observational Sample | PPSD High Schools not in Observational Sample | *p*-value (4) vs. (5) |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Proficient in Math (%) | | 32.0 | 15.0 | 16.1 | 1.7 | 0.262 |
| Proficient in ELA (%) | | 39.0 | 17.9 | 20.4 | 6.4 | 0.314 |
| Male (%) | | 52.0 | 52.2 | 53.1 | 52.5 | 0.916 |
| Hispanic (%) | 24.9 | 24.2 | 63.9 | 60.9 | 71.8 | 0.115 |
| Black (%) | 15.6 | 8.3 | 17.1 | 18.3 | 15.8 | 0.444 |
| White (%) | 50.3 | 59.3 | 9.1 | 10.8 | 4.9 | 0.200 |
| Asian (%) | 4.8 | 3.4 | 5.1 | 6.3 | 3.6 | 0.148 |
| Free or Reduced Price Lunch (%) | 60.7 | 47.1 | 79.4 | 74.7 | 74.5 | 0.966 |
| Independent Education Plan (%) | 28.4 | 16.5 | 14.4 | 14.5 | 16.5 | 0.741 |
| English Language Learners (%) | 15.1 | 7.5 | 23.9 | 13.7 | 30.1 | 0.033 |
| Enrollment | | 492.8 | 683.1 | 911.0 | 622.2 | 0.130 |
| Students per teacher | 14.6 | 9.7 | 12.5 | 11.2 | 9.5 | 0.350 |
| Mobility index | | 0.14 | 0.23 | 0.21 | 0.36 | 0.130 |
| Suspensions per 100 students | | 14.5 | 25.0 | 14.2 | 32.0 | 0.035 |
| Highly qualified teachers (%) | | 97.7 | 94.6 | 94.3 | 94.7 | 0.934 |
| N (schools) | | 341 | 41 | 5 | 6 | |

Notes: Achievement is measured based on the 2017 PARCC assessment. The Mobility index measures the percent of students who moved into or out of the school during the school year. Classes with quality teachers refers to the percent of classes within the school that are taught by highly qualified teachers. P-values reported in column 6 are t-tests of the differences in average student characteristics at the school level, weighted by student enrollment. Source for U.S. Urban school data: U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Public Elementary/Secondary School Universe Survey," 2013–14 (version 1a).

Table 2. Characteristics of PPSD High School Teachers in Observational Sample and Classes Observed

| | Mean | Std. Dev. |
|---|---|---|
| **Panel A. Teachers** | | |
| Female (%) | 50.0 | |
| White (%) | 90.0 | |
| Hispanic (%) | 10.0 | |
| Experience in current school (years) | 6.0 | 6.8 |
| Experience teaching (years) | 9.9 | 10.4 |
| N (teachers) | 10 | |
| **Panel B. Classes Observed** | | |
| Math class (%) | 30.2 | |
| ELA class (%) | 44.4 | |
| Science class (%) | 23.8 | |
| 9th grade | 27.0 | |
| 10th grade | 22.2 | |
| 11th grade | 15.9 | |
| 11th & 12th grade | 11.1 | |
| 12th grade | 23.8 | |
| Morning (7am-10am) (%) | 36.5 | |
| Midday (10am-12pm) (%) | 42.9 | |
| Afternoon (12pm-2pm) (%) | 20.6 | |
| Monday (%) | 23.8 | |
| Tuesday (%) | 15.9 | |
| Wednesday (%) | 25.4 | |
| Thursday (%) | 6.3 | |
| Friday (%) | 28.6 | |
| AP class (%) | 15.9 | |
| Assistant in class (%) | 36.4 | |
| Students in attendance | 14.4 | 4.4 |
| Length (minutes) | 66.5 | 21.7 |
| N (classes) | 63 | |

Notes: Time of day of class is reported as the start of the class period.

Table 3. Frequency of External Interruptions to Classroom Instruction

| | All Schools | High Schools in Observational Sample | (2) Excluding Tardy Students | High Schools not in Observational Sample | High Schools | Middle Schools | Elementary Schools |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Teacher reported interruptions per day | 11.9 | 13.9 | 10.1 | 16.8 | 15.5 | 16.0 | 8.7 |
| Student reported interruptions per day | 16.3 | 12.3 | 10.0 | 13.3 | 12.9 | 16.7 | 18.0 |
| Principal reported interruptions per day | 8.8 | 6.4 | 4.9 | 12.1 | 9.3 | 11.0 | 7.5 |
| Observed interruptions per hour | | 2.8 | 1.7 | | | | |
| Observed interruptions per day | | 15.3 | 9.5 | | | | |
| Observed interruptions per year | | 2758.4 | 1709.4 | | | | |
| N (schools) | 41 | 5 | 5 | 6 | 11 | 8 | 22 |

Notes: Table reports average interruptions per day in a school as observed in the study and as reported on the 2018 district survey. N (Schools)=35 for principals. Observed interruptions per day and year are calculated by multiplying the observed number of interruptions per hour times the average hours of instruction per day (5.5 hours) and school year (990 hours). Frequency of interruptions as reported by staff and students are averages of Likert scale survey responses and are top coded at 21 interruptions per day. Reported interruptions by staff might be underreported given that teachers do not teach entire school days.

Table 4. Instruction Time Lost Due to Interruptions and Disruptions

| | All Schools | High Schools in Observation Sample | (2) Excluding Tardy Students | High Schools not in Observation Sample | High Schools | Middle Schools | Elementary Schools |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Observed duration of interruption (sec) | | | | | | | |
| 10th Percentile | | 5 | 5 | | | | |
| Average | | 44 | 41 | | | | |
| 90th Percentile | | 120 | 75 | | | | |
| Observed duration of disruption (sec) | | | | | | | |
| 10th Percentile | | 15 | 15 | | | | |
| Average | | 57 | 57 | | | | |
| 90th Percentile | | 120 | 140 | | | | |
| Observed time lost per interruption (sec) | | 71 | 78 | | | | |
| Observed time lost per hour (min) | | 3.3 | 2.2 | | | | |
| Observed time lost per day (min) | | 18.18 | 12.27 | | | | |
| Observed time lost per year (hours) | | 54.5 | 36.8 | | | | |
| Observed time lost per year (days) | | 9.9 | 6.7 | | | | |
| Teacher reported time lost per hour (min) | 6.90 | 6.30 | | 8.38 | 7.43 | 7.24 | 6.51 |
| Principal reported time lost per hour (min) | 4.45 | 3.38 | | 4.00 | 3.69 | 6.10 | 4.18 |
| N (schools) | 41 | 5 | 5 | 6 | 11 | 8 | 22 |

Notes: The estimated duration of disruption is an average of all instances in which we observed a disruption occur. Time lost estimates are calculated by multiplying the average time loss per interruption and any subsequent disruptions that occurred by the observed number of interruptions per hour. We multiply this figure by the average hours of instruction per day (5.5 hours) and school year (990 hours) in PPSD high schools. Teacher and principal average time lost estimates in a school are based on responses to the 2018 district survey. N (schools)=31 for principals.

## Figures

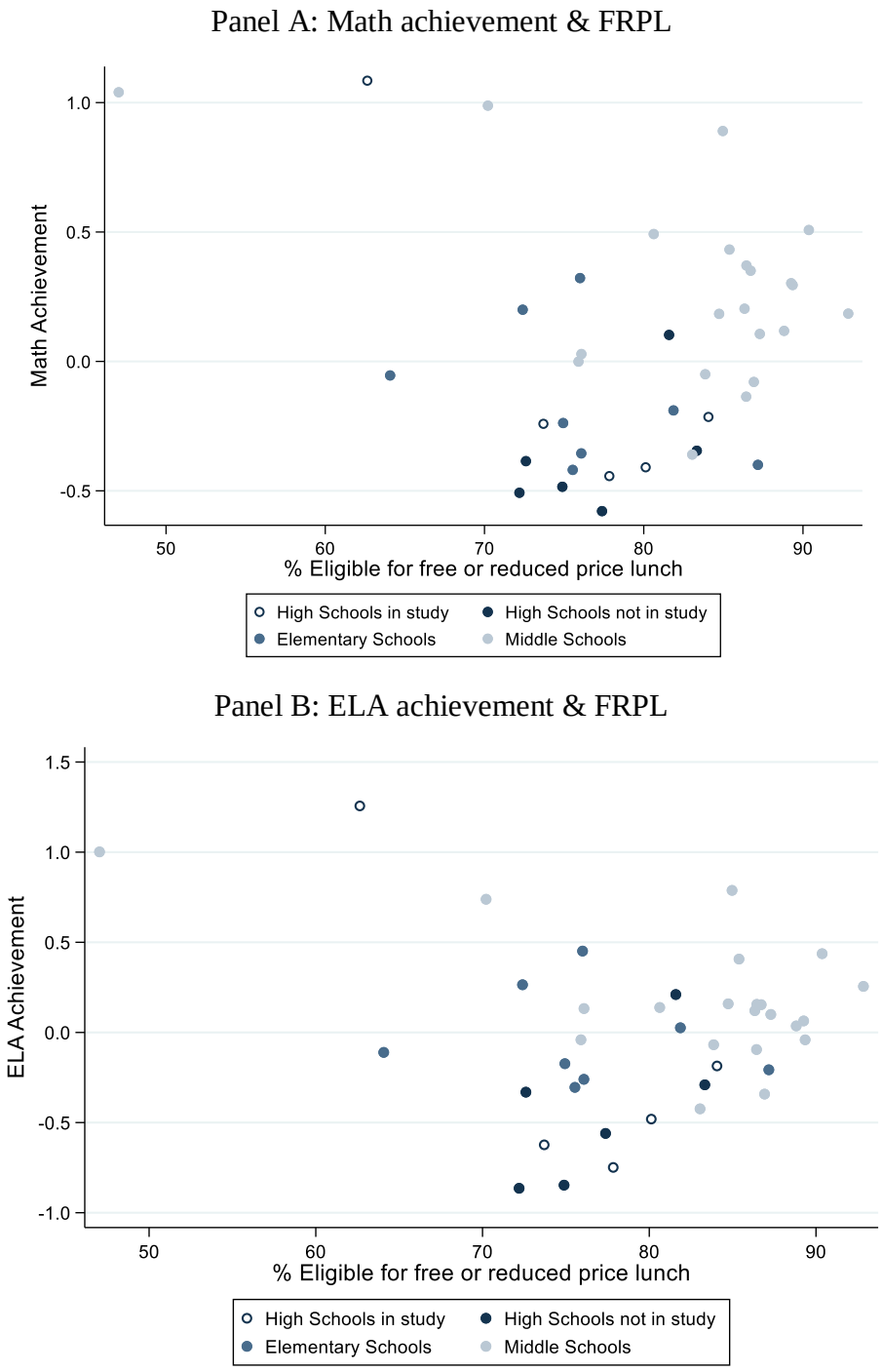



*Figure 1.* Student achievement and the percentage of students from low-income families in PPSD schools

Notes: Achievement measures are calculated with heteroskedastic ordered probit models from 2017 PARCC assessments.

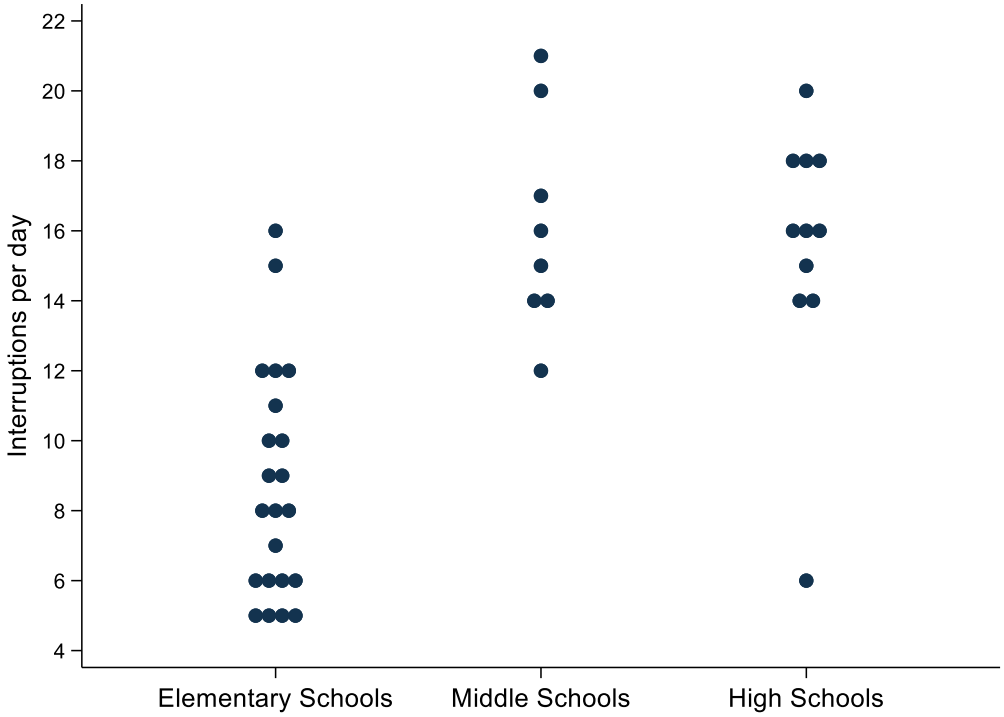
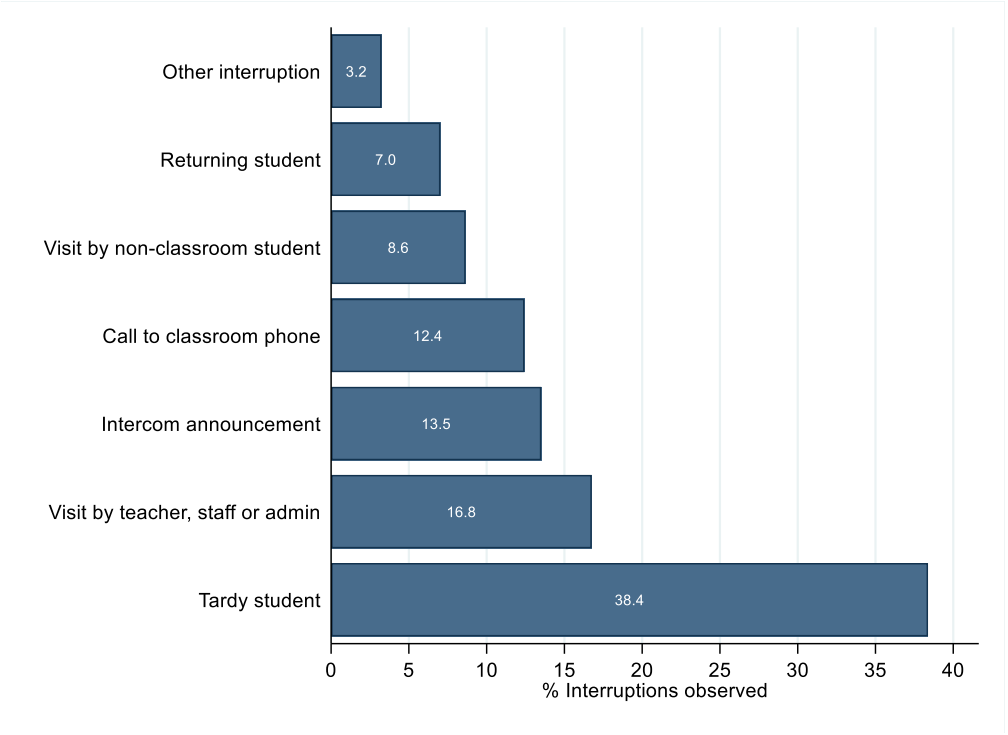



*Figure 2.* Average interruptions per day across all PPSD schools

Notes: Frequency of interruptions per day is based on teachers' 2018 district survey responses.

Panel A: Observational data in PPSD high schools




Panel B: Teacher survey data across all PPSD schools

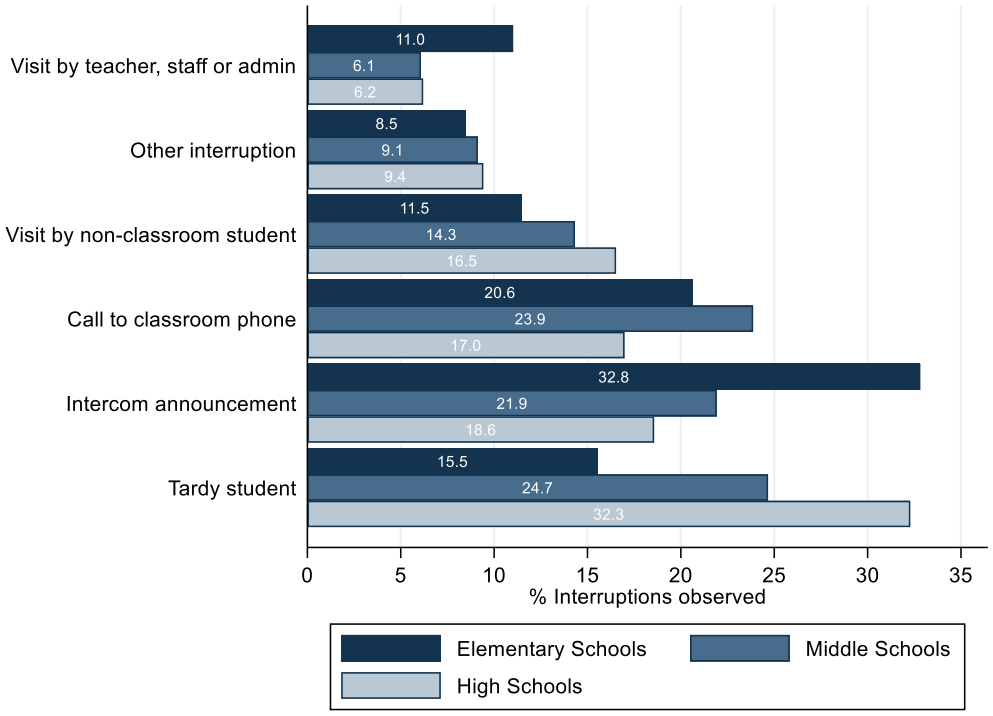
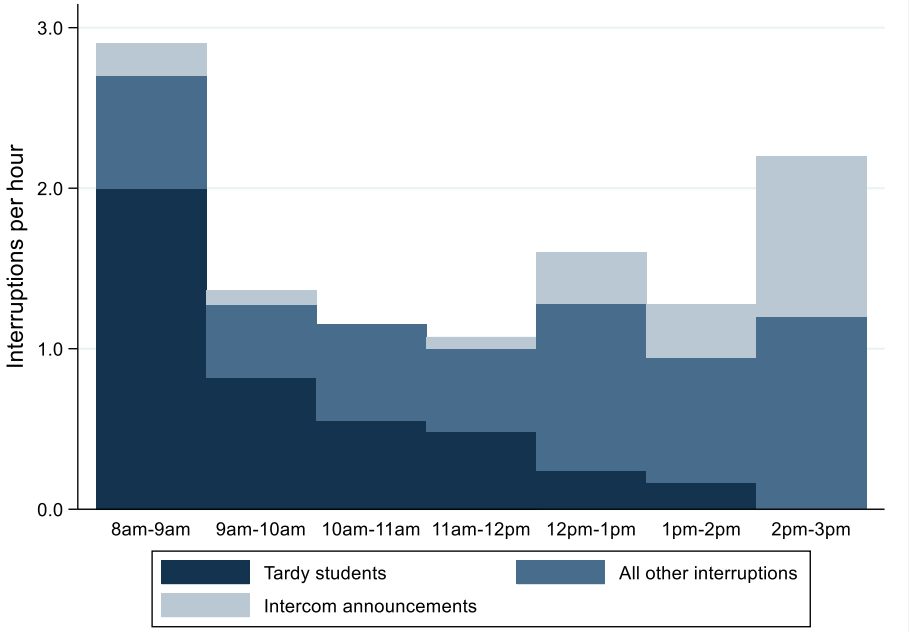



*Figure 3.* Proportion of external interruptions by type

Notes: Panel B is calculated using individual teacher responses on the 2018 district survey (N=1,480)

Panel A: Interruptions across a school day




Panel B: Interruptions across a class period

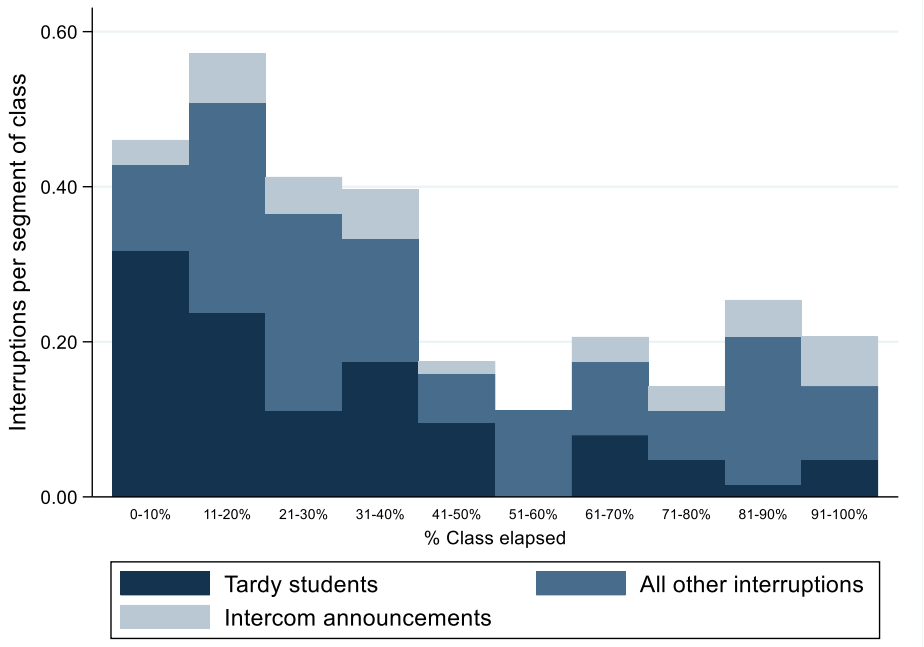



*Figure 4.* Timing of interruptions in PPSD high schools

Notes: Data are based on classroom observations. Class period is split in gaps of 10 percent to illustrate the timing of intercom announcements relative to the start and end of the class given differences in the duration of class periods across schools.

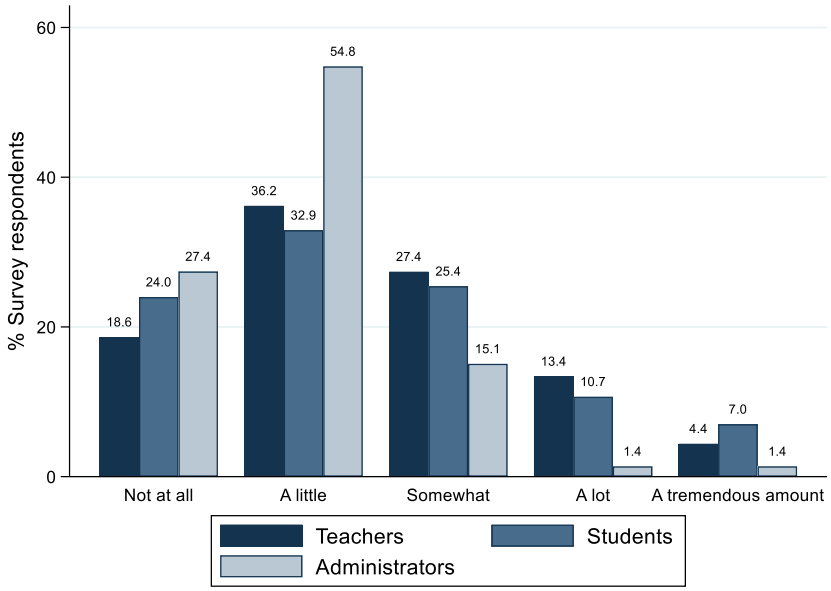



*Figure 5.* Perceived degree to which interruptions interfere with learning in the classroom across all PPSD schools

Notes: Student and teacher responses based on 2017 district survey (N students=13,682; N teachers=1,570). Principal responses based on 2018 district survey (N principal=76). The distribution of teacher responses to this item are nearly identical across the 2017 and 2018 district survey.

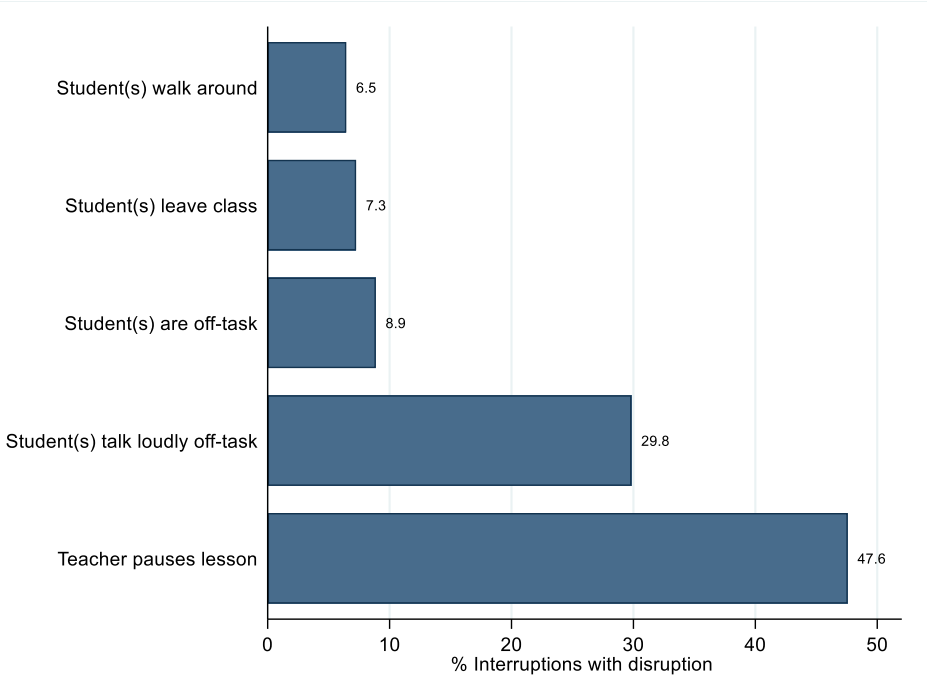
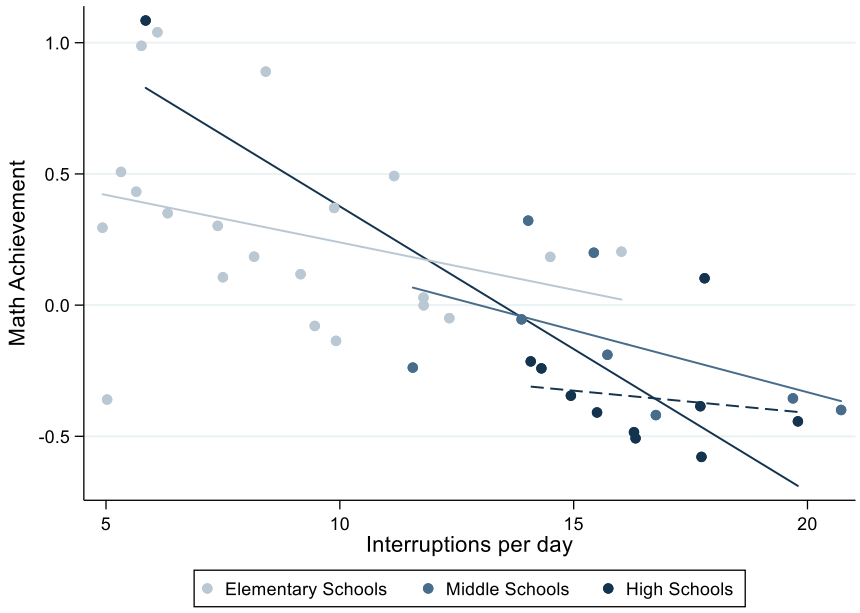



*Figure 6.* Types of disruptions in PPSD high schools

Notes: Type of disruption caused by an interruption is determined by observer and then confirmed by analyzing field notes. Up to three distinct types of disruption were observed for a single disruption instance.

Panel A: Math achievement




Panel B: ELA achievement

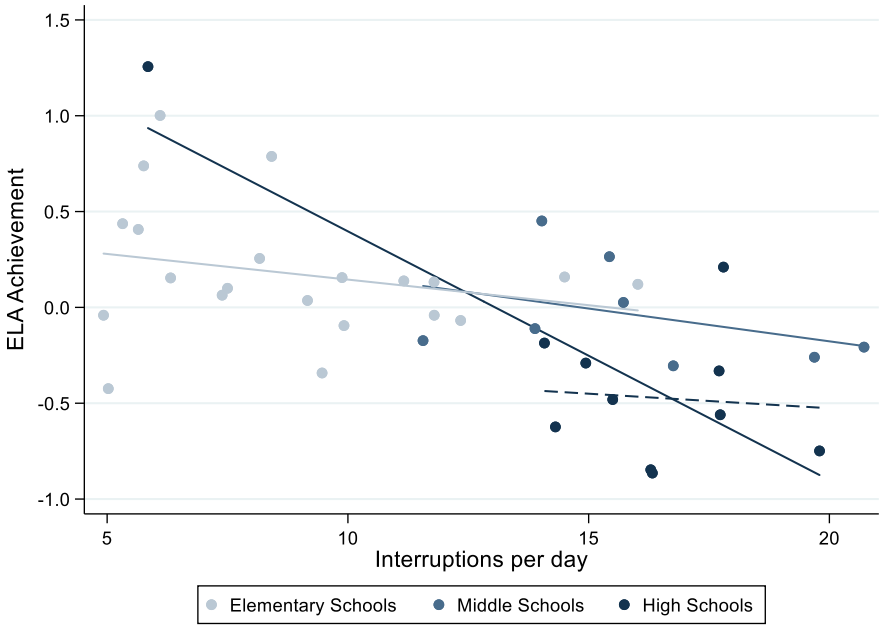



*Figure 7.* The relationships between student achievement and the frequency of interruptions per day in PPSD schools

NOTE: Achievement measures are calculated with heteroskedastic ordered probit models from 2017 PARCC assessments. Average interruptions per day are based on teachers' responses to the 2018 district survey. The dashed line captures the linear relationship between achievement and interruptions among PPSD high schools excluding the selective admissions high school.

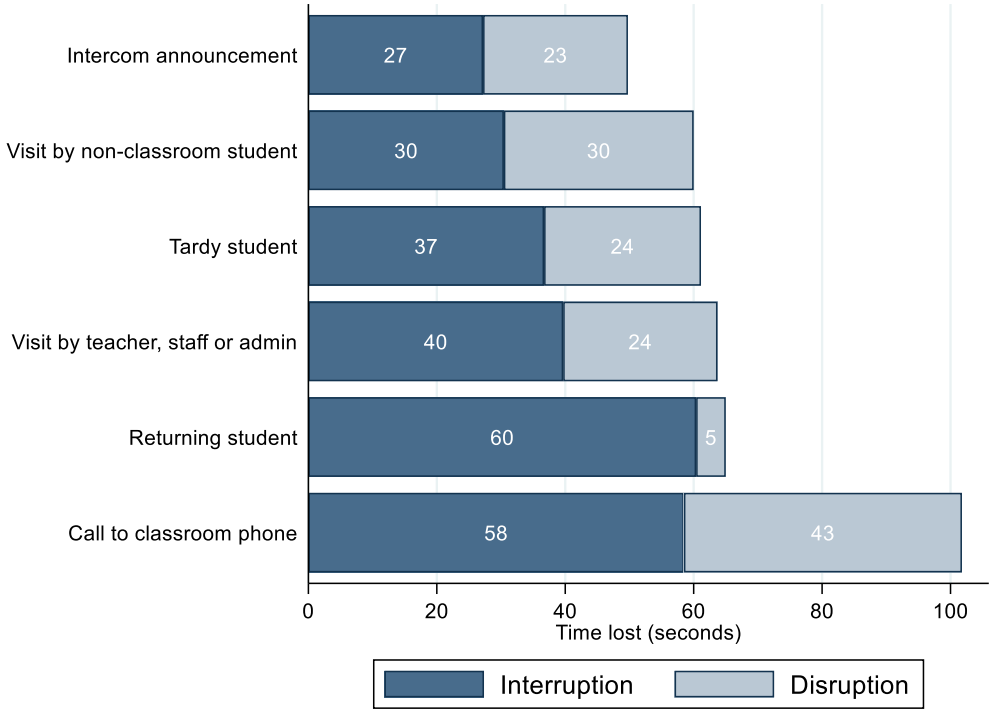



*Figure 8*. Time loss by interruption type in PPSD high schools

Notes: Type of interruption is determined by observer and then confirmed by analyzing field notes. Average disruption time is unconditional on a disruption occurring.

## Online Appendix

## Appendix A. Exploratory interviews and focus groups

In May 2016, we conducted a series of exploratory interviews and focus groups with Rhode Island school staff to learn more about their experiences with external interruptions to inform our research design. We interviewed a total of nine teachers who were current students or graduates of the Brown University MAT program working across eight different Rhode Island schools including independent, public-charter, and traditional public schools. Interviews followed a semi-structured protocol in which we asked teachers to describe their teaching placement and school environment, and to share their perspectives on external interruptions to their classrooms. While we followed the same structure in all interviews, we also allowed teachers to discuss their experiences more generally to gain a broader understanding of these issues.[1]

We also met with 11 college advisers placed in public high schools in Providence and the surrounding metropolitan area. Advisers were members of College Advising Corps, an organization that works to increase the number of low-income, first-generation college students, and underrepresented high school students who enter and complete higher education. College advisers first filled out an online questionnaire about their experience with external interruptions to classroom learning while working in schools. We then conducted a semi-structured group interview that elicited comparisons about their varied experiences with external interruptions across schools. Together, these informal interviews helped inform the scope of the study and the development of the survey items and classroom observation instrument we describe below.

[1] See Appendix A for our interview protocol.

Teacher Interview Protocol and Questions

Teacher Name:
School:
Interview Date/Location:

Opening Notes:

- Introduce Interviewer
- Working on a project to better understand school-initiated interruptions
- This interview is exploratory in nature
- We will take notes but won't use direct quotes

Topic 1: Tell me about your school and teaching placement.

- School size and location:
- Subject?
- Grade?
- Other

Topic 2: How do announcements work in your school?

- Do they always happen at the same time?
- What is the content?
- Who makes them?

Topic 3: Outside of regularly-scheduled announcements, is the intercom ever used? If so, for what?

- Who uses it?
- How often?
- During instructional time?

Topic 4: Are there other school-initiated interruptions that you feel disrupt instructional time?

- Examples might include administrators knocking on doors, fire drills, etc.

Topic 5: If we wanted to get more information about this, who could we talk to?

- May we follow up with you? Permanent email address?
- If we wanted to get recordings of announcements, or record them, who could we talk to?

Other thoughts:

## Appendix B. PPSD Survey Extension

## 2017 Supplemental Teacher & Student Survey

Below are questions asking about classroom interruptions for school purposes. By classroom interruptions, we mean when your class is interrupted from outside the classroom. Common examples **include but are not limited to intercom announcements, visits from other teachers or aides, telephone calls to a classroom phone, or administrator visits**. This does not include disruptions to a classroom caused by students in that class such as the use of cell phones in class or student misbehavior.

1. *During a typical school day, how many times in total are your classes interrupted?*

    - Never
    - Once or twice a day
    - Three to five times a day
    - Six to ten times a day
    - Eleven to twenty times a day
    - More than twenty times a day

2. *To what degree do outside interruptions interfere with learning in the classroom*

    - Not at all
    - A little
    - Somewhat
    - A lot
    - A tremendous amount

3. *Please rate the degree to which the following outside interruptions are disruptive to learning*

    a) Scheduled intercom announcements

    - N/A (Never happens)
    - Not at all disruptive
    - A little disruptive
    - Somewhat disruptive
    - Extremely disruptive

    b) Unscheduled intercom announcements

    - N/A (Never happens)
    - Not at all disruptive
    - A little disruptive
    - Somewhat disruptive
    - Extremely disruptive

    c) Telephone calls to the classroom phone

    - N/A (Never happens)

- Not at all disruptive
- A little disruptive
- Somewhat disruptive
- Extremely disruptive

d) Visits from teachers or aides

- N/A (Never happens)
- Not at all disruptive
- A little disruptive
- Somewhat disruptive
- Extremely disruptive

e) Visits from administrators

- N/A (Never happens)
- Not at all disruptive
- A little disruptive
- Somewhat disruptive
- Extremely disruptive

## 2018 Supplemental Administrator Teacher & Student Survey

### Survey Questions for Administrators

Some of the questions below will ask about outside interruptions to classrooms. By outside interruptions, we mean external intrusions into the classroom that teachers typically cannot control. Common examples include but are not limited to intercom announcements, telephone calls to a classroom phone, visits from administrators, staff, and other teachers, visits from students not in the class, and students who enter class late and disrupt teaching and learning. This does not include disruptions caused by students inside the classroom such as student misbehavior or the use of cell phones in class.

1. Think about a typical day for a teacher in your school. How many times do the following outside interruptions occur while they are teaching?

    a. Scheduled intercom announcements (during instructional time, not during additional time blocked for announcements)
        - Almost Never
        - Once every couple days
        - 1 to 2 times a day
        - 3 to 5 times a day
        - 6 to 10 times a day
        - 11 to 20 times a day
        - 21 or more times a day

    b. Unscheduled intercom announcements
        - Almost Never
        - Once every couple days
        - 1 to 2 times a day
        - 3 to 5 times a day
        - 6 to 10 times a day
        - 11 to 20 times a day
        - 21 or more times a day

    c. Telephone calls to the classroom phone
        - Almost Never
        - Once every couple days
        - 1 to 2 times a day
        - 3 to 5 times a day
        - 6 to 10 times a day
        - 11 to 20 times a day
        - 21 or more times a day

    d. Visits from administrators, staff, and other teachers
        - Almost Never

- Once every couple days
- 1 to 2 times a day
- 3 to 5 times a day
- 6 to 10 times a day
- 11 to 20 times a day
- 21 or more times a day

e. Visits from students not in the class
- Almost Never
- Once every couple days
- 1 to 2 times a day
- 3 to 5 times a day
- 6 to 10 times a day
- 11 to 20 times a day
- 21 or more times a day

f. Students who enter class late and disrupt teaching and learning
- Almost Never
- Once every couple days
- 1 to 2 times a day
- 3 to 5 times a day
- 6 to 10 times a day
- 11 to 20 times a day
- 21 or more times a day

g. All other outside interruptions (parent visits, outside noise, fire drills, etc.)
- Almost Never
- Once every couple days
- 1 to 2 times a day
- 3 to 5 times a day
- 6 to 10 times a day
- 11 to 20 times a day
- 21 or more times a day

2. Please describe any other types of outside interruption that occurs at your school:

| |
|---|
| |

3. *During 60 minutes of class, approximately how many minutes are lost because of outside interruptions?

_____ minutes per hour

4. *To what degree do outside interruptions interfere with learning in your school?
    - Not at all
    - A little
    - Somewhat
    - A lot
    - A tremendous amount

* Not included on student survey

Table B1. Reliability of Data Collected During Classroom Observations

| | Correlation Between Observers |
|---|---|
| Interruptions per hour | 0.93 |
| Interruptions that cause a disruption (%) | 0.83 |
| Interruptions that have a lasting implication on the class (%) | 0.70 |
| Duration of interruption (seconds) | 0.72 |
| Duration of disruption (seconds) | 0.77 |
| Total time lost per instance (seconds) | 0.96 |
| N (observations) | 14 |

Notes: Table shows correlations of observations recorded by seven pairs of observers who individually tracked interruptions. Lasting implication refers to interruptions that have an impact on the classroom for the remainder of class.

# Appendix C. Classroom Interruptions Tracker

## Classroom Interruptions Tracker - 1/2

| | Interruption 1 | Interruption 2 | Interruption 3 | Interruption 4 |
|---|---|---|---|---|
| B1) Describe interruption in Detail | | | | |
| C1) Describe Disruption in Detail | | | | |

Notes:
Use the columns to write anything you think is relevant to the interruptions and disruptions, use this information to complete the questions about the interruptions/disruptions in the next page.

## Classroom Interruptions Tracker - 2/2

| | Interruption 1 | Interruption 2 | Interruption 3 | Interruption 4 |
|---|---|---|---|---|
| B2) Start Time | | | | |
| B3) Instruction prior to Interruption | | | | |
| B4) Type of Interruption | | | | |
| B5) Reason for Interruption | | | | |
| B6) Number of Students the Interruption is intended for | | | | |
| B7) Perceived level of importance [scale of 1-4] | | | | |
| B8) Length of Interruption [in minutes] | | | | |
| C2) Type of Disruption | | | | |
| C3) Further Implication of the Disruption | | | | |
| C4) Number of students that became off-task | | | | |
| C5) Perceived level of Disruption [scale 1-4] | | | | |
| C6) End time | | | | |

Notes:
† Scale for B7: 1- not relevant for students in classroom; 2 - somewhat relevant and could have waited; 3- relevant but could have waited; 4 – couldn't have waited.
ᵛ Scale for C5: 1 - barely disrupted, class continues where it left off; 2 - disruption continues for a brief moment after the interruption but it does not affect lecture; 3 - disruption continues after interruption and requires teacher to address it; 4 – disruption affects a significant amount of lecture time.