

# NORTH CAROLINA LEA CASE STUDY

## ASSESSING CURRENT COURSE SCHEDULING PRACTICES OF HIGH SCHOOLS?

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**POLICY QUESTION:** How can North Carolina Department of Public Instruction and the State Board of Education modify the current high school scheduling practices to improve student achievement and encourage cost savings for North Carolina?

### PROBLEM STATEMENT

High school is a critical time for students. It helps to prepare them to graduate and enter the workforce or continue on in higher education. A key component in this path is the high school's scheduling practices. Creating a schedule that ensures students will graduate ready to move to their desired next step is a complex task. It is also an important component of school success because it necessitates that courses are in a format that is conducive to learning.

Block scheduling, specifically the 4x4 model, gained significant popularity in the 1990s as an alternative to the traditional schedule that had been in place, however concrete advantages are limited. Students attending a block scheduled school lose approximately 18 class periods over an academic year.<sup>i</sup> Research supporting the benefits of 4x4 block scheduling for students, teachers, administrators, or the government has shown inconclusive evidence of the superiority of block.<sup>ii</sup> It is also estimated that a block scheduled school costs substantially more to staff than other scheduling methods (See Table 1).

With all of the consequences of block scheduling for primary stakeholders, it is essential to reexamine the 4x4 method to determine if it is the best scheduling option for North Carolina public high schools.

### BACKGROUND

High school reform in terms of the use of the school day has been an important issue in education throughout the past one hundred years.<sup>iii</sup> Despite a unified goal of improving student learning, there continues to be mixed opinions on exactly how to most effectively implement scheduling reforms.<sup>iv</sup>

Block scheduling is a method of academic course scheduling that follows the assumption that there are economic, curricular, and other school-related efficiencies to be found in alterations of the traditional, six or seven class a day, five day a week schedule. There are many variations on block scheduling, incorporating different formats of when classes are offered and the length of the instructional periods. Robert Canady and Michael Rettig outlined numerous alternative block scheduling methods.<sup>v</sup> Nonetheless, block schedules typically fall under the 4x4 semester block for North Carolina high schools. This method allows students to complete four year-long courses with 90-minute classes over two semesters.

The mid-nineties saw the introduction of a widespread block scheduling movement in North Carolina that was supported by school boards and administrators alike because of the proposed benefits to student learning and teacher instruction. Based on surveys conducted by the North Carolina Department of Public Instruction, only



six schools in the state that had implemented block scheduling by 1993; however, by the end of the 1999-2000 school year, 288 schools were on the block schedule.<sup>vi, vii</sup>

## METHODOLOGY & RESULTS

The analysis in this study was conducted using The North Carolina Window of Information on Student Education (NC WISE). Based on the data collected from NC WISE, we sampled 30 traditional scheduled schools and 32 block scheduled schools from different counties throughout North Carolina. The study included high schools that taught exclusively grade levels 9-12. For purposes of comparability, science, technology, engineering, and mathematics, early and middle college and magnet schools were eliminated from the analysis. Of the remaining schools, blocked scheduled schools were classified as those where ninety percent of students were functioning under a blocked schedule. Traditional schools constituted those where ten percent or less of the student body were attending a blocked schedule. Statistical analysis was conducted using student and teacher characteristics to examine whether block scheduled high schools outperformed traditional scheduled high schools in terms of pass rates on 2007-08 Biology and Algebra I End-of-Course (EOC) exams.

Findings based on two models indicated that there was no significant difference in the percentage of students who passed the Biology EOC between block scheduled and traditional scheduled schools. However, compared to traditional schools, blocked schools had statistically higher percentages of students passing the Algebra I EOC exam.

## CRITERIA

The following criteria were used to evaluate the policy alternatives:

1. **Minimize marginal costs.** Policy options should minimize additional costs attributed to schools and to the state of North Carolina.
2. **Maximize equity.** Alternatives should consider the distribution of burdens and benefits to all stakeholders.
3. **Maximize implementation feasibility.** Policy options should take into account whether resources exist and are readily available to facilitate implementation by stakeholders.
4. **Maximize political acceptability and responsiveness.** Policy options should ensure political viability for the various stakeholders involved, including the State Board of Education, the Governor's office, the General Assembly, the Local Education Agency (LEA), individual teachers, administrators and students and parents.

## ALTERNATIVES

Based on our statistical findings and criterion rankings the following alternatives were proposed:

### ***ALTERNATIVE 1: ALLOW FOR CURRENT SCHEDULING POLICIES TO CONTINUE IN NORTH CAROLINA HIGH SCHOOLS***

In light of the current investigation's findings, the first alternative is to maintain current scheduling practices for North Carolina high schools. It is important to allow LEAs the authority to adopt the most appropriate scheduling practices for their individual students, whether traditional, blocked, or hybrid. That said, the majority of North Carolina schools have clearly adopted and integrated block scheduling as most relevant and applicable to the student's needs.<sup>viii</sup> The benefits to utilizing a block schedule range not only across academic parameters such as increased course time and opportunity for remediation, but also the financial ramifications of converting blocked to another scheduling method.

### ***ALTERNATIVE 2: IMPLEMENT A HYBRID SCHEDULE MODEL FOR ALL NORTH CAROLINA HIGH SCHOOLS.***

The proposed hybrid alternative combines the 4x4 block semester schedule structure with the traditional single period schedule. In hybrid schedules, classes are offered in varied lengths of time during a quarter, semester or entire year. The variations of are limitless. For example, students may take 9 courses throughout the school year including three blocked semester and three traditional year long classes.

Literature has suggested that block allows for more time in analytical/applied courses; whereas, traditional is most beneficial for technical courses such as mathematics and foreign language.<sup>ix</sup> Combining the two scheduling techniques allows students deeper understanding of the subject matter. It also gives teachers the opportunity to utilize a method that is most appropriate for their subject matter. Administrators implementing a hybrid schedule have the flexibility to alter the schedule to meet their schools' personal needs based on course offerings and the student population. It is plausible that the benefits shared by students, teachers and administrators will translate into increased academic achievement for all students.

### ***ALTERNATIVE 3: IMPLEMENT TRADITIONAL SCHEDULING FOR HIGH SCHOOLS IN NORTH CAROLINA.***

A traditional schedule is based a high school course meeting for a certain period of time daily throughout the year.<sup>x</sup> This policy option would require that schools operating with a block schedule shift to a traditional schedule. The schools presently operating with a traditional schedule would maintain their current structure.

Traditional scheduling has academic benefits for teachers and students such as smaller segments of curriculum to master or teach daily and an increase in information learned or taught over the course of the school year. Over the course of a school year teachers are responsible for fewer students, which allows for differential instruction.

## ANALYSIS

### OUTCOMES MATRIX

The matrix below assesses the suggested alternatives based on the previously established criterion. Alternatives are ranked on a 1 to 5 scale with 1 meaning the alternative does not meet the specific criterion, 2 denotes the alternative meets a small portion of the specific criterion, 3 signifies the alternative somewhat meets the specific criterion, 4 represents the alternative mostly meets the specific criterion, and 5 indicates that the alternative completely meets the specific criterion. The total score indicates the ability of the alternative to address the policy problem.

### POLITICAL ACCEPTABILITY AND RESPONSIVENESS

There are many stakeholders with different goals and responsibilities to consider when evaluating political feasibility and responsiveness; thus a separate evaluation was conducted for each of the individual stakeholders including the Governor, General Assembly, State Board of Education, LEA, school administrators, teachers, and students and parents. Each group received a score based on their individual objectives. After rating each group, the scores were averaged in order to obtain a composite score for the political feasibility and responsiveness of each alternative.

## RECOMMENDATION

The hybrid schedule, which combines many of the positive components from the block and traditional was ranked highest on the outcomes matrix. As such, implementing a hybrid schedule for all North Carolina high schools is recommended. The following will outline the rationale for implementing a hybrid model illustrating the benefits for all primary stakeholders in North Carolina.

Students attending a school with a hybrid schedule enjoy various academic benefits. First, they are allotted the opportunity to take additional courses over and beyond that of a traditional or block schedule. The amount of courses a student takes at a high school with a hybrid schedule is dependent upon how the schedule is structured. This benefits students who need to repeat courses as well as students who want to enrich their high school experience by learning additional content.

Teachers benefit under a hybrid schedule because of the flexibility it allows for course scheduling. Under this system teachers use the method that is most appropriate for their subject matter, which reduces the need for extensive planning and additional professional development workshops.

Administrators bear the responsibility of supervising and providing professional development for teachers to ensure that

### OUTCOMES MATRIX

CRITERIA					
Alternative Schedules	Minimize Marginal Costs	Maximize Equity	Maximize Implementation Feasibility	Maximize Political Acceptability & Responsiveness	Total
Current Policy	2	4	4	4	14
Hybrid	4	5	4	4	17
Traditional	5	4	4	3	16

**TABLE 1: COST SAVINGS UNDER DIFFERENT SCHEDULING MODELS**

COST SAVINGS UNDER TRADITIONAL AND HYBRID SCHEDULING MODELS				
	Bachelor's Degree	Bachelor's Degree with NBPTS	Master's Degree	Master's Degree with NBPTS
Moving from 4x4 to Traditional Scheduling (Difference in Teachers Required** Multiplied by North Carolina Teacher Salary*)	7.7 x \$34,910.00	7.7 x \$39,100.00	7.7 x \$38,400.00	7.7 x \$43,010.00
<b>Total Staff Savings</b>	\$268,807.00	\$301,070.00	\$295,680.00	\$331,177.00
Moving from 4x4 to Hybrid Scheduling (Difference in Teachers Required** Multiplied by North Carolina Teacher Salary*)	2.3 x \$34,910.00	2.3 x \$39,100.00	2.3 x \$38,400.00	2.3 x \$43,010.00
<b>Total Staff Savings</b>	\$80,293.00	\$89,930.00	\$88,320.00	\$98,923.00

NOTES: \* Salaries included are based on the 2007-2008 North Carolina Public School Salary Schedules for 5 years of experience; Source: [www.ncpublicschools.org/fbs/finance/salary](http://www.ncpublicschools.org/fbs/finance/salary); \*\* Moving from 4x4 to Traditional Scheduling, 7.7 teachers is the difference between the 61 teachers necessary under block and 53.3 teachers needed for the traditional schedule; \*\*\* Moving from 4x4 to Hybrid Scheduling, 2.3 teachers is the difference between the 61 teachers necessary under block and 58.7 teachers needed for the hybrid schedule

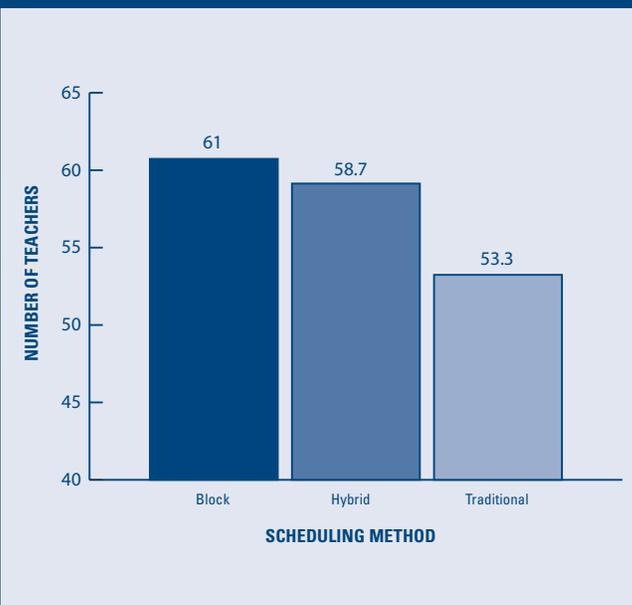
instruction is occurring in an efficient and effective way for student achievement. Consequently, a more structured academic environment may lead to improved student achievement, which is a major goal of every school administration.

The stakeholders within the state government would also benefit from transitioning to a hybrid schedule in high schools. The schedule change would save a significant amount of money for each school (see Table 1). The savings could be used to fund additional initiatives or programs that have been proven to improve student achievement. Additionally, the state government as well as all of their constituents benefit from improved student achievement. When students are successful in high school, they are more likely to graduate, enter the workforce or higher education.

Based on the evaluation of criteria dimensions, an enhanced learning environment, and financial considerations, transitioning to a hybrid schedule would be in the best interest of North Carolina public high schools.

Additional information regarding this study can be found at <http://www.ncpublicschools.org/intern-research/reports>.

**TABLE 2: TEACHERS REQUIRED UNDER DIFFERENT SCHEDULING METHODS**



**WORKS CITED**

<sup>i</sup> A traditional 50 minute period school has 9,000 minutes of potential instructional hours over the duration of a course, as opposed the block course where students receive only 8,100 minutes of instruction.

<sup>ii</sup> Rice, J. K., Croninger, R. G., & Roellke, C. F. (2002). The effect of block scheduling high school mathematics courses on student achievement and teachers’ use of time: Implications for educational productivity. *Economics of Education Review*, 21(6), 599-607.

<sup>iii</sup> Zepeda, S. J., & Mayers, R. S. (2006). An analysis of research on block scheduling. *Review of Educational Research*, 76, p.139.

<sup>iv</sup> Zepeda, S. J., & Mayers, R. S. (2006). An analysis of research on block scheduling. *Review of Educational Research*, 76, 137-170.

<sup>v</sup> Canady, R. L. & Rettig, M. D. (1995). *Block scheduling: A catalyst for change in high schools*. Princeton, New Jersey: Eye on Education.

<sup>vi</sup> Averett, C. (1994) Block scheduling in North Carolina high schools. Raleigh, NC: Division of Innovation and Development Services, North Carolina Department of Public Instruction.

<sup>vii</sup> Zhang, G. (2001). Academic differences between students in block and traditionally scheduled schools. Raleigh, NC: Evaluation Section, Accountability Division, North Carolina Department of Public Instruction.

<sup>viii</sup> North Carolina Department of Public Instruction (1998). Block scheduling in North Carolina high schools. Division of Innovation and Development Services.

<sup>ix</sup> Wronkovich, M., Hess, C. A., & Robinson, J. E. (1997). An objective look at math outcomes based on new research into block scheduling. *NASSP Bulletin*, 81(593), 32-41.

<sup>x</sup> Zepeda, S. J., & Mayers, R. S. (2006). An analysis of research on block scheduling. *Review of Educational Research*, 76, 137-170.

<sup>xi</sup> Queen, J. A. (2009). *The block scheduling handbook* (2nd ed.). Thousand Oaks, CA: Corwin Press.

<sup>xii</sup> Zepeda, S. J., & Mayers, R. S. (2001). New kids on the block schedule: Beginning teachers face challenges. *The High School Journal*, 84(4), 1-11.



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The Financial and Business Services Area is in its third year of the Research Intern Program. The Program is designed to help build a quality research program within DPI to supplement and supply data for discussions related to procedural, process, and policy changes. This year’s program included students from North Carolina Chapel Hill Doctorate Program in Public Policy and Education, and well as a Doctorate Candidate from North Carolina State University studying Psychology. The intern program is managed by Allison Anderson (919) 807-3731 | [intern\\_research@dpi.state.nc.us](mailto:intern_research@dpi.state.nc.us)

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## ***APPENDIX I – LITERATURE REVIEW***

Much of the research on block scheduling methods has yielded mixed results, such that there are relatively balanced numbers of studies that indicate both positive and negative academic and time-management outcomes for students, teachers, and administrators (Maltese, Dexter, Tai, and Sadler, 2007; Griffin & Nicholson, 2002; Gruber & Onweugbuzie, 2001; Queen, Algozzine & Eaddy, 1997). For students, Veal and Flinders (2001) suggest that block scheduling allows students more time for meaningful and engaged learning experiences. Meaningful learning refers to educational environments where students are not only engaged in the academic process, but also where teachers and administrators are allowed to approach education from a more holistic perspective. Their study looked at three high schools with different scheduling methods, and found that the primary areas that change significantly with block scheduling methods are not only the type of instruction provided, but also increased opportunities for reflection on the topics of study, increased student-teacher interactions, and lower anxiety levels among students and teachers.

Although there are some benefits to block scheduling, the effects on academic performance are not conclusively supported. In a study by Griffin and Nicholson (2002) high school students did not show improved grades after transitioning to block scheduling. Nonetheless, teachers and principals did report some benefits to the block schedule. They posited that they perceived block scheduling leads to increased time to fully lecture on materials, resulted in fewer disciplinary problems among students, and lowered the absenteeism rate. They also suggest that they perceived that dropout rates have also been moderated by the block scheduling system.

In the realm of attendance, Griffin and Nicholson (2002) also found that although students might show up to class more often, missing even one of the longer blocked courses resulted in keeping students significantly farther behind their peers. They also suggested that the students miss out on the full depth and breadth of information provided by the curriculum.

One of the primary arguments for implementing block scheduling is that it allows for deeper and more meaningful instruction of subject matter (Shortt and Thayer, 1999). Outlining the benefits of block scheduling as it pertains to being inclusive and supportive of using many instructional techniques. Shortt and Thayer suggest block scheduling meets the learning needs of individual students by accelerating the pace at which they can perform, and by increasing the student course load (1999). Queen, Algozzine, and Eaddy (1997) warn that because of the increased pressure of an accelerated course load students are apt to become mentally fatigued by accelerated academic environments.

Block scheduling has also been praised for providing teachers the opportunity to increase their preparation time and incorporate more hands-on approaches to learning (Wilson and Stokes, 1999). Student-centered approaches to education have also been a hot topic in education in the past decade, suggesting that students should be able to structure their educational experience in ways that provide an enriched academic environment for

themselves (Hackermann, 2004; Lauden and Hounshell, 2000). However, Eineder and Bishop (1997) would argue that longer periods of study will create additional disciplinary concerns negating all positive benefits from increased preparation time.

Just as there are benefits and drawbacks for students and teachers in the block, administrators also face gains and challenges. It has been suggested that block scheduling provides principals with additional time for observations and staff development (Zepeda, 1999). Further, they are able to reduce discipline problems at their school by choosing a scheduling method that moderates student transition time between classes (Canady and Rettig, 1995; Franka and Lindsey, 1995).

It is with all these concerns that the current investigation seeks to disambiguate the relationship between block scheduling and a concrete measure of academic performance, End-of-Course Algebra I and Biology scores for high school students in North Carolina. This study adds to the literature in four important ways. First, there is inconclusive information on the connection between student achievement and block scheduling practices; therefore, this literature adds breath to the previous works. Second, it highlights the role of teachers in a school's instructional climate. Third, understanding a student's success or challenges in specific subject matters will provide administrators with additional information for considering how to appropriately structure schedules. Finally, this study will assist schools in finding the most cost effective way to improve academic achievement.

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## ***APPENDIX II – METHODOLOGY & RESULTS***

### **Participants**

The data for the current study were primarily gathered using The North Carolina Window of Information on Student Education (NC WISE). NC WISE is an electronic student accounting system that is based on the Electronic Student Information System (eSIS), an Internet-based software package that provides student and school information management capabilities for all 115 school districts and 100 charter schools. The sample consisted of thirty traditionally scheduled and thirty-two block scheduled North Carolina high schools. The study only incorporated high schools that taught grade levels 9 – 12. Further, all science, technology, engineering, and mathematics, early and middle college and magnet schools were eliminated from the analysis to prevent outlying data points on these schools' End-of-Course Biology and Algebra I scores. Of the remaining schools, blocked scheduled schools were classified as those where ninety percent of students were functioning under a blocked schedule. Traditional schools as those where ten percent or less of the student body were attending a blocked schedule. This decision also improves the ability of the results to be generalized to most other North Carolina high schools.

### **Design**

Two multiple regressions were employed to assess the relationship between End-of-Course Biology and Algebra I scores and traditional and block scheduled North Carolina high schools. The dependent variables, End-of-Course Biology and Algebra I scores, were both continuous and normally distributed variables. Students were grouped into one of four categories ranging from 1 – 4 based on their raw scores. Categories one and two represent failing End-of-Course scores, whereas categories three and four represent passing scores. For the current analysis, the students who placed in the two passing categories (i.e., 3 and 4) were included in the data set. Converting these values to percentile scores allowed for the analyses to make comparisons based on the percentage of students from each of the schools who passed the End-of-Course exams.

The independent variables were school type (i.e., block or traditional), Limited English Proficiency (LEP), free and reduced lunch, and teachers with zero to three years of experience. School type was a dummy coded variable, with 0 representing traditional schools and 1 representing schools that are block scheduled. The study included the percent of LEP students at these high schools as a control for lower scores being related to unfamiliarity with the English language. Free and reduced lunch was a proxy for student socio-economic status at each school. This variable was represented by the percentage of students at each of the schools that qualified for the free and reduced lunch program. The final independent variable, teachers with zero to three, represented the percentage of teachers with between 0 and 3 years of experience at each sampled school. Although the NC WISE system had data for teachers with between 3 – 10 years of

experience as well as 11 years of experience and up, these two variables were so highly intercorrelated that they could not be included in the current regression model.

## Results

Two multiple linear regressions were used to analyze End-of-Course Biology and Algebra I scores (see Appendix III). The goal of these analyses was to determine the predictive power of each of the four independent variables on End-of-Course Biology and Algebra I passing scores.

There were no a priori predictions for the placements of the independent predictor variables in the current model, thus a direct multivariate linear regression was most appropriate. The result of the regression for Biology End-of-Course scores was significant overall ( $F(62) = 17.85, p = 0.0001$ ) with an  $R^2$  of 0.52. There were two significant predictor variables in the model, such that free and reduced lunch status ( $\beta = -0.66$ ) and teachers with zero to three years of experience ( $\beta = -0.38$ ) were both significant predictors of passing End-of-Course Biology scores. The strongest predictor in the model was free and reduced lunch status, such that for every percent increase in free and reduced lunch status there was a 66% decrease percent decrease in percentage passing Biology End-of-Course scores. The next significant predictors was teachers' years of experience, indicating that for a 1 percent increase in years teaching there is a 0.38 decrease in percentage of the students' Biology End-of-Course percentile scores.

The second linear regression was for Algebra I End-of-Course percentage passing scores, and the overall model was significant  $R^2$  of 0.59 ( $F(62) = 21.16, p = 0.0001$ ). However, this model displayed three significant predictor variables. The most highly predictive variable in Algebra I model was teachers' years of experience ( $\beta = -.67$ ), suggesting that for every unit change of 1 in the number of teachers with between 0 and 3 years of experience, there was a decrease of 0.67 in Algebra I percentage scores. The next most highly predictive independent variable in the model was free and reduced lunch status ( $\beta = -0.57$ ). This result indicates that for each unit change of 1 % in the number of students participating in the free and reduced lunch program, there was a decrease of 0.57 in Algebra I percentile passing scores. The last significant predictor in this model was the block status of schools ( $\beta = -0.44$ ), suggesting that schools that are blocked are slightly more likely to represent a decrease of 0.44 in percentage of students with passing Algebra I percentile scores.

### APPENDIX III – Regression Analysis

#### Regression Analysis of Block Scheduling

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Explanatory Variables	% Pass Biology EOC	% Pass Algebra I EOC
Traditional Schedule	0.0249 (0.027)	0.0504** (0.025)
% Students LEP	0.293 (0.490)	-0.442 (0.457)
% Free/Reduced Lunch	-0.660*** (0.084)	-0.572*** (0.078)
% Teacher Experience (0-3 yrs)	-0.387** (0.176)	-0.674*** (0.164)
Constant	0.985*** (0.052)	0.989*** (0.049)
Observations	62	62
Model ( <i>F</i> )	17.85	21.16
R-squared	0.556	0.598

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Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## **Assessing Current Course Scheduling Practice of North Carolina High Schools Study - Next Steps**

The following are a list of projects and addendums that can extend the FY 2008-2009 summer interns' work:

### Comparative Studies

1. Conduct a full cost effectiveness analysis of transitioning from a block to a hybrid schedule.
2. Analyze the different hybrid models used in North Carolina and propose a preferred method based on academic success of students, preferential treatment by teachers and flexibility given to administrators.
3. Consider whether students under the block schedule have higher dropout rates than non-block schools.
4. Conduct a comparative analysis of border states and North Carolina in regards to scheduling practices.
5. Analyze the impact of block scheduling on Advance Placement test scores.
6. Determine whether there are socio- or economic demographic groups that are particularly affected by different course scheduling?
7. Collect extensive qualitative data on the perceptions of different course scheduling methods.
8. Determine whether UNC system education programs successfully prepare pre-service teachers to effectively teach under different scheduling schedules.

### Re-examining the Current Study

1. Examine teachers' schedules as a proxy for blocked versus non block schools and conduct a similar study.
2. Analyze the course scheduling using student-level data.
3. Further examine the alternatives provided in the current course scheduling study.