3

A Guaranteed and Viable Curriculum

The first school-level factor is a "guaranteed and viable curriculum." I rank this as the first factor, having the most impact on student achievement. As indicated in Figure 2.3 (p. 19), a guaranteed and viable curriculum is primarily a combination of my factors "opportunity to learn" and "time" (Marzano, 2000a). Both have strong correlations with academic achievement, yet they are so interdependent that they constitute one factor.

Opportunity to Learn

Opportunity to learn (OTL) has the strongest relationship with student achievement of all school-level factors identified in Marzano (2000a). It was first introduced to the research literature more than 30 years ago by the International Association for the Evaluation of Educational Achievement (Wilkins, 1997) when it became a component of the First, and then later, the Second International Mathematics Study (FIMS and SIMS, respectively) (Burstein, 1992; Husen, 1967a, 1967b). Apparently, OTL began as an afterthought in FIMS when researchers became concerned that all students might not have had an equal opportunity to learn the items being used to assess their mathematics achievement (Wilkins, 1997). Consequently, various measures of OTL were devised and its relationship to mathematics achievement examined. The findings, which seem self-evident now, were somewhat of a surprise to the FIMS researchers as indicated by the following quote from a FIMS technical report (Husen, 1967b):

> One of the factors which may influence scores on an achievement examination is whether or not students have had an opportunity to study a particular topic or learn how to solve a particular type of problem presented by the test. (pp. 162–163)

Within a relatively short period of time, OTL had a profound impact on the thinking of researchers and practitioners alike. According to Jesse Wilkins (1997), "This new idea of OTL changed the course of educational research" (p. 13).

Although OTL was first introduced during FIMS, three types of curricula were identified in SIMS: the *intended curriculum*, the *implemented curriculum*, and the *attained curriculum*. The intended curriculum is content specified by the state, district, or school to be addressed in a particular course or at a particular grade level. The implemented curriculum is content actually delivered by the teacher, and the attained curriculum is content actually learned by students. The discrepancy between the intended curriculum and the implemented curriculum makes OTL a prominent factor in student achievement—a factor that since SIMS has continued to show a very strong relationship with student achievement (Brewer & Stacz, 1996; Herman, Klein, & Abedi, 2000; Robitaille, 1993).

The possible discrepancy between the intended curriculum and the implemented curriculum comes as a surprise to noneducators and educators alike. The surprise is probably because public education provides so much guidance on content standards for specific courses and specific grade levels. The existence of state-level standards documents and district-level or school-level curriculum guides does not necessarily imply that the implemented curriculum and the intended curriculum are identical. E. D. Hirsch, in *The Schools We Need and Why We Don't Have Them* (1996), noted this situation:

> We know, of course, that there exists no national curriculum, but we assume, quite reasonably, that agreement has been reached locally regarding what should be taught to children at each grade level—if not within the whole district, then certainly within an individual school. . . . The idea that there exists a coherent plan for teaching content within the local district, or even within the individual school, is a gravely misleading myth. (p. 26)

Hirsch explains that the notion of a coherent implemented curriculum is simply accepted by most educators as a matter of faith. Upon examination, however, most who hold this notion find that it is a myth. To illustrate, Hirsch relates the following anecdote:

> Recently, a district superintendent told me that for twenty years he had mistakenly assumed each of his schools was determining what would be taught to children at each grade level, but was shocked to find that assumption entirely false; he discovered that no principal in his district could tell him what minimal content each child in a grade was expected to learn. (pp. 26-27)

Although I find Hirsch's solution to this problem flawed (see Marzano, Kendall, & Gaddy, 1999), I strongly agree with his framing of the issue primarily because research supports his assertions. For example, studies (Doyle, 1992; Stodolsky, 1989; Yoon, Burstein, & Gold, n.d.) indicate that even when highly structured textbooks are used as the basis for a curriculum, teachers commonly make independent and idiosyncratic decisions regarding what should be covered and to what extent. This practice frequently creates huge holes in the continuum of content. In their book *The Learning Gap*, Stevenson and Stigler (1992) illustrate the point:

> Daunted by the length of most textbooks and knowing that the children's future teachers will be likely to return to the material, American teachers often omit some topics. Different topics are omitted by different teachers thereby making it impossible for the children's later teachers to know what has been covered at earlier grades—they cannot be sure what their students know and do not know. (p. 140)

The concept of OTL, then, is a simple but powerful one—if students do not have the opportunity to learn the content expected of them, there is little chance that they will. OTL addresses the extent to which the curriculum in a school is "guaranteed." This means that states and districts give clear guidance to teachers regarding the content to be addressed in specific courses and at specific grade levels. It also means that individual teachers do not have the option to disregard or replace assigned content.

Time and Viability

A viable curriculum is unattainable without the benefit of time. The content that teachers are expected to address must be adequately covered in the instructional time teachers have available. This might sound obvious, and you might assume that the content identified in state standards documents and district- and school-level curriculum guides fits nicely into the school day. However, this is not the case. To illustrate, researchers at Mid-continent Research for Education and Learning (McREL) identified some 200 standards and 3,093 benchmarks in national- and state-level documents for 14 different subject areas (Kendall & Marzano, 2000). Classroom teachers then estimated that the amount of time it would take to *adequately* address the content articulated in these documents was 15,465 hours (Marzano, Kendall, & Gaddy, 1999).

Just how much time is actually available for instruction?

In general, K–12 schools employ a 180-day school year. However, some noteworthy variations exist. For example, Karweit (1983) found that the number of scheduled school days in the U.S. ranged from 175 to 184 days, with an average of 179. The *Prisoners of Time* study (National Education Commission on Time and Learning, 1994), found that, as of 1994, 11 states permitted school terms of 175 days or less, and only one state required more than 180 days.

The length of the school day is far less standard. Reuter (1963) found that length varied from four to six hours. In the late 1970s, a large-scale study known as the Beginning Teachers Evaluation Study (BTES) found that 2nd graders were in school 5.5 hours, whereas 5th graders were in school for 6.0 hours (Fisher et al., 1978). One study even found that the length of the school day within the same district could vary as much as 45 minutes (Harnischfeger & Wiley, 1978). The 1994 *Prisoners of Time* study reported that, on average, schools offer a six-period day with about 5.6 hours of class time per day.

If we assume that 5.6 hours each day are devoted to classroom time and 180 days are spent in school per year, then K–12 students spend about 13,104 total hours in class (13 years of instruction x 1,008 hours per year). Thus, teachers have a maximum of 13,104 hours to address the 200 standards and 3,093 benchmarks identified by the McREL researchers.

And not all of the available classroom time is actually *used* for instruction. Classroom disruptions, socializing, informal breaks, and other noninstructional activities use up some of the classroom time. Estimates of how much class time is actually devoted to instruction vary widely from a low of 21 percent to a high of 69 percent (Conant, 1973; Marzano & Riley, 1984; National Education Commission on Time and Learning, 1994; Park, 1976). If we take the highest estimate of 69 percent as the upper boundary, we can conclude that of the 13,104 classroom hours theoretically available, only 9,042 hours are actually used for instruction. This comes to about 695.5 hours per year (9,042 hours ÷ 13 years of instruction) or about 3.9 hours per day (695.5 hours ÷ 180 days).

We now have a quantitative basis with which to answer the question: Can the 200 standards and 3,093 benchmarks be taught in the actual time available for instruction? The answer is a resounding *no*! Quite obviously, 15,465 hours of standards do not fit into 9,042 hours of instructional time.

These calculations put a new face on the concept of viability. In the current era of standards-driven curriculum, viability means ensuring that the articulated curriculum content for a given course or given grade level can be adequately addressed in the time available. However, the standards movement as currently implemented has created a situation that violates the viability criterion.

In summary, the first school-level factor is a straightforward one: implement a curriculum that is both guaranteed and viable. Yet, enacting this research-based principle of school reform is one of the most significant challenges currently facing U.S. schools.

Action Steps

I recommend five action steps to implement a guaranteed and viable curriculum.

Action Step 1. Identify and communicate the content considered essential for all students versus that considered supplemental or necessary only for those seeking postsecondary education.

The preceding discussion dramatically demonstrates that there is simply not enough time in the current system to address all the content in state-mandated standards and benchmarks. One obvious solution is to increase the amount of available instructional time. In fact, from the beginning of the standards movement, professionals from the various subject areas assumed that more time for instruction would be needed. To illustrate, during hearings by the National Education Commission on Time and Learning (1994) regarding what would be required to implement various national-level standards, subject matter representatives made the following comments:

> Arts: "I am here to pound the table for 15 percent of school time devoted to arts instruction," declared Paul Lehman of the Consortium of National Arts Education Association.
>
> English: "These standards will require a huge amount of time, for both students and teachers," Miles Myers of the National Council of Teachers of English told the Commission.
>
> Geography: "Implementing our standards will require more time. Geography is hardly taught at all in American schools today," was

> the conclusion of Anthony DeSouza of the National Geographic Society.
>
> Science: "There is a consensus view that new standards will require more time," said David Florio of the National Academy of Sciences. (p. 21)

Indeed, this option seems imminently logical especially when one compares the amount of time U.S. students spend in school versus students in countries such as Japan, Germany, and France. Commenting on this disparity, the *Prisoners of Time* study (National Education Commission on Time and Learning, 1994) notes:

> No matter how the assumptions underlying the figure are modified, the result is always the same—students abroad are required to work on demanding subject matter at least twice as long [as U.S. students]. (p. 25)

The research generally supports the positive impact of increasing the amount of student instructional time. For example, Herbert Walberg (1997) found a positive relationship between increased instructional time and learning in 97 percent of 130 studies.

Although increasing the amount of instructional time appears to be a straightforward solution, it is an impractical one for U.S. schools, at least at the present time. To illustrate, I have shown that the standards identified across 14 subject areas would require 15,465 hours to address adequately, but there are only 9,042 hours of instruction currently available. This means that schools would have to increase the amount of instructional time by about 71 percent. As the current school year is structured, schooling would have to be extended from kindergarten to grade 21 or 22 to accommodate all the standards and benchmarks in the national documents. In other words, the change required is impractical if not impossible to implement, especially given the extreme cost involved in adding even a few days to the length of a school year (Walberg, 1997).

Even if it were possible to lengthen the school year, it may not be wise to teach all the content identified in the national and state standards documents. This point was dramatically illustrated in the *Third International Mathematics and Science Survey* (TIMSS). Specifically, one conclusion of TIMSS was that U.S. teachers are expected to cover far more content than teachers in other countries. For example, U.S. 4th and 8th grade mathematics textbooks cover between 30 and 35 topics, whereas textbooks in Germany and Japan cover 20 and 10 topics, respectively. Although U.S. 4th, 8th, and 12th grade science textbooks address between 50 and 65 topics, Japanese textbooks cover between 5 and 15 topics, and German textbooks cover 7 topics (at least at the 8th grade level). In short, the TIMSS study indicates that U.S. mathematics textbooks address 175 percent as many topics as do German textbooks and 350 percent as many topics as do Japanese textbooks. The science textbooks used in the United States cover more than nine times as many topics as do German textbooks and more than four times as many topics as do Japanese textbooks. Yet German and Japanese students significantly outperform U.S. students in mathematics and science (Schmidt, McKnight, & Raizen, 1996).

What, then, is a school to do if it cannot lengthen the school year and should not attempt to teach all the standard content?

The answer is straightforward: *Schools should drastically reduce the amount of content teachers are required to address in class.* To illustrate how this might be done, consider the following study I conducted on mathematics content (Marzano, 2002).

My first step was to "unpack" the benchmark statements in the standards document. This is necessary because most benchmark statements contain multiple types of knowledge and skill. The following benchmark from the mathematics standards published by the National Council of Teachers of Mathematics (NCTM) (2000) represents what students should know and be able to do by the end of the 5th grade:

- Develop fluency in adding, subtracting, multiplying, and dividing whole numbers. (p. 392)

This benchmark contains at least four elements that might be the focus of a unified set of lessons: adding whole numbers, subtracting whole numbers, multiplying whole numbers, and dividing whole numbers. When I performed this "unpacking" process on the mathematics standards and benchmarks, I identified 741 "instructional concepts."

This in itself is quite interesting. There are only 241 benchmark statements in the NCTM (2000, pp. 392–402) standards document—a number that appears quite manageable given the 9,042 hours of actual instruction time available. However, this number is misleading because there are more than three times as many instructional concepts that would logically form individual sets of lessons. This is a pattern I have observed in virtually every state and national standards document I have analyzed. Although the number of benchmarks might be small, the actual number of instructional concepts is quite large.

My next step was to present the 741 instructional concepts to 10 mathematics educators. (A school or district performing the same process would undoubtedly use a larger pool of educators. For a discussion of how one district surveyed all members of its community, see Marzano & Kendall, 1996). The question I posed to the educators was quite simple: Which of these 741 instructional concepts are essential for students to know, regardless of whether they intend to go to college? The results are depicted in Figure 3.1, p. 28.

To interpret Figure 3.1, consider the first row of the figure. The first row indicates that 299 concepts (column 2) were identified by 10 educators (column 1) as essential for all high school graduates to know. The percentage of concepts identified as essential (299 out of 741 potential concepts) is 40.4 percent.

Row 2 shows 17 additional math concepts were identified by 9 educators as essential for high school graduates to know. If we combine the results of row 1 and row 2, we find that 316 concepts were identified as essential by nine or more educators (299 + 17 + 316). Column 4 gives that result as a cumulative number of concepts identified as essential by the given number of educators (9 or more educators identified 316 concepts as essential).

The survey results are interesting in that they indicate that there was not a great deal of agreement as to which concepts are essential. Of course, the criterion as to the percentage of mathematics educators who must identify an instructional concept as essential is arbitrary. However, if one accepts

FIGURE 3.1

Mathematics Concepts Deemed Essential for All High School Graduates

Number of educators who agreed that a given concept is essential	Number of concepts on which they agreed	Percentage	Cumulative agreement
10	299	40.4	
9	17	2.3	9 or more 316
8	39	5.3	8 or more 355
7	26	3.5	7 or more 381
6	23	3.1	6 or more 404
5	69	9.3	5 or more 473
4	53	7.2	4 or more 526
3	8	1.4	3 or more 534
2	23	3.1	2 or more 598
1	41	5.5	
0	143	19.3	

the intuitively appealing criterion of "a majority of mathematics educators" (i.e., six or more in the context of my study), then 404 of the 741 instructional concepts are necessary for all students to know prior to high school graduation (see Figure 3.1, column 4).

Whatever the appropriate criterion might be, these findings indicate that not all of the content in the mathematics standards is considered essential. Indeed, 143 or 19.3 percent of the instructional concepts were not identified by any of the mathematics educators as essential (see the last row of Figure 3.1). Again, this finding underscores the problem inherent in the current standards movement in the U.S.—there is simply too much content to address in an adequate manner.

Thus, schools should provide clear delineation of content that is essential versus that which is supplemental or intended for those seeking postsecondary education only.

Action Step 2. Ensure that the essential content can be addressed in the amount of time available for instruction.

The most straightforward way to address this issue is simply to ask teachers how much time it would take to adequately address essential content. In a study conducted at McREL (Marzano, 1998b), 350 teachers were asked how many hours it would take them to adequately address each benchmark articulated for a variety of standards and subject areas. (If benchmarks are unpacked as I recommend, it is better to ask teachers to comment on each instructional concept.) The average number of hours for each benchmark was then considered the most stable estimate of the amount of time it would take to address the content. Other researchers have used this process to obtain viable estimates of time needed for coverage (Florian, 1999).

Fenwick English (2000) recommends another useful approach. His method requires teachers to estimate how many "class periods" are required for students to reach mastery for each instructional concept. He casts these estimates in terms of "least amount of time" and "most amount of time." According to English, the *least amount of time* estimate represents an ideal, that is "when everything goes right" (p. 55). The *most amount of time* estimate "essentially should be seen in terms of Murphy's Law; that is, given the likelihood that everything could go wrong, it does!" (p. 55).

Obviously, the time necessary to address content standards should not exceed the time available for instruction. Referring to his technique, English notes

> When the "least amount of time" column is summed, the total number of class periods should not exceed the total possible in a quarter, semester, or year (whatever the official length of time is for the class) or *there is too much curriculum for the real time available*. [original emphasis] (p. 55)

To determine how much time is available for instruction, a school might undertake a formal "time audit," the process for which has been described elsewhere (Marzano, Kendall, & Gaddy, 1999). At a less formal level, a school can simply determine how much time in the day is devoted to actual instruction within scheduled classes. The school then estimates how much time in class is generally taken up by noninstructional class time such as taking roll, transitioning between activities, collecting or passing out material, socializing, and disciplining.

Armed with these time estimates, a school might be tempted to assume that all is well if the necessary instructional time is less than the available instructional classroom time. To illustrate, one middle school determined that over a three-year period about 2,200 hours of classroom instructional time were available, and the essential content would take about 2,000 hours to adequately address. At first blush, the issue was solved. However, the teachers involved in the study quickly realized that the essential content took up about 91 percent of the available instructional time. This meant that there was very little time left to address topics that arose serendipitously but were important to address (e.g., the War on Terrorism), even if it meant straying from the intended curriculum. These teachers decided that they wanted to keep at least 30 percent of the instructional class time available for such eventualities. They then went back to the task of deleting more "essential content" to make room for serendipitous instructional opportunities. The point is that schools should consider carefully how much of their available classroom instructional time they wish to fill with essential content.

Action Step 3. Sequence and organize the essential content in such a way that students have ample opportunity to learn it.

Once a viable amount of essential content has been established, it should be organized and sequenced to optimize the learning experience. It is useful to follow a basic curriculum principle articulated by NCTM (2000): "Big ideas encountered in a variety of contexts should be established carefully, with important elements such as terminology, definitions, notations, concepts, and skills emerging in the process" (p.15). The message here is to organize the essential instructional concepts into categories that form a realistic and logical sequence—fortunately, much of this work has already been done by John Kendall (Kendall, 2000). He and other researchers at McREL have organized the content from 14 different subject areas into categories that he refers to as "topics."

To understand a topic's nature (i.e., NCTM's "big idea"), consider the following instructional concepts I identified for mathematics study (Marzano, 2002):

- unit differences,
- standard versus nonstandard units,
- cubic units,
- linear units,
- square units,
- unit size, and
- unit analysis.

These instructional concepts quite logically can be organized into a single topic or category with the title *units*. In my study, I organized the 741 instructional concepts into 52 topics. I then sequenced them across four grade-level intervals: K–2, 3–5, 6–8, 9–12. This is depicted in Figure 3.2 (pp. 32–33).

As indicated in Figure 3.2, some topics (like *probability*) are addressed across all grade level intervals; some topics (like *direction, position, location*) are at the K–2 level only; some topics (like the *Pythagorean theorem*) are at the 9–12 level only.

Of course a school or district might articulate a very different scope and sequence from that depicted in Figure 3.2. The important point is that a school or district has taken the time to (1) identify the essential instructional concepts, (2) organize these into "big ideas" or "topics," and (3) establish a sequence for the topics or big ideas.

Action Step 4. Ensure that teachers address the essential content.

Ensuring that teachers address the essential content is necessary to implement a guaranteed and viable curriculum. As discussed, it is not uncommon for teachers to make idiosyncratic decisions regarding what to cover and what to leave out even within the context of highly structured curricula.

To implement this criterion, administrators must monitor the coverage of the essential content. This does not necessarily mean that administrators have to "observe" the actual teaching of the content. This would be so labor intensive as to be impossible.

However, an administrator could ask teachers for evidence of adequate coverage in the form of lesson plans, unit plans, or both. Administrators might also have a conference with teachers on a quarterly or semester basis. These conferences could be used as a platform for fruitful discussions not only about essential content coverage but also about effective instructional practices and engaging learning experiences for students. Monitoring should not be a police action, but it can be a powerful professional development tool executed in the spirit of what Jo Blase and Joseph Blase (1998) refer to as "reflective supervision," in which the administrator poses questions that help teachers think through their instructional decisions.

Action Step 5. Protect the instructional time that is available.

Lengthening the school year or the school day is probably impractical given the current resource constraints in public education. Consequently, I have (partially) addressed the issue of time by recommending a reduction in content considered essential. Schools can also protect the instructional time by decreasing the amount of scheduled time not devoted to actual instruction. This means being as efficient as possible about lunch, recess, breaks between classes, and announcements. Schools should make every effort to convey the message that class time is sacred time and should be interrupted for important events only, a message that is commonly conveyed in other countries. For example, in their book *The Teaching Gap*, James Stigler and James Hiebert (1999) relate the following incident that occurred when a group of Japanese teachers were observing a videotaped lesson from a U.S. 8th grade mathematics class:

> The teacher in the video was standing at the chalkboard, in the midst of demonstrating a procedure, when a voice came over the public address system: "May I have your attention, please. All students riding in bus thirty-one, you will meet your bus in the rear of the school today, not in the front of the school. Teacher's please take note of this and remind your students."
>
> A Japanese member of our team reached over and pushed STOP on the VCR. "What was that?" he asked. "Oh nothing," we replied as we pushed the PLAY button. "Wait," protested our Japanese colleague. "What do you mean, nothing?" As we patiently tried to explain that it was just a P.A. announcement, he became more and more incredulous. Were we implying that it was normal to interrupt a lesson? How could that ever happen? Such interruptions would never happen in Japan, he said, because it would ruin the flow of the lesson. (p. 55)

Although Stigler and Hiebert warn that it is dangerous to draw inferences from single examples like this one, they did find that lessons in the United States are more frequently interrupted than lessons in Japan: "As claimed by our Japanese colleague, this never occurred during the Japanese lessons. But they did occur in . . . 33 percent of the American lessons" (p. 62).

The sanctity of instructional time might be communicated in a variety of ways. Here are some of the more creative methods of preserving instructional time: (1) providing teachers with a sign they can place outside their door when they wish no interruptions, (2) decreasing or eliminating announcements,

FIGURE 3.2

Mathematics Topics by Grade-Level Intervals

Topic	Grade-Level Interval			
	K–2	3–5	6–8	9–12
Addition	•	•		
Area		•	•	•
Central tendency & variability		•	•	•
Charts & graphs	•	•	•	
Computation (general)	•	•	•	
Coordinate systems		•	•	•
Data collection & samples	•	•	•	•
Data distributions		•	•	•
Decimals		•	•	
Direction, position, location	•			
Division		•	•	
Equations & inequalities		•	•	•
Estimation	•	•	•	
Experiments		•	•	•
Exponents, logs, roots			•	•
Expressions			•	•
Factors, multiples, primes		•		
Figures & shapes	•	•	•	•
Fractions		•	•	
Functions		•	•	•
Length, width, height	•	•	•	
Lines & angles		•	•	•
Math reasoning	•	•	•	•
Matrices & vectors				•
Measurement	•	•	•	•
Metric system		•	•	
Money	•			

FIGURE 3.2 *(continued)*

Mathematics Topics by Grade-Level Intervals

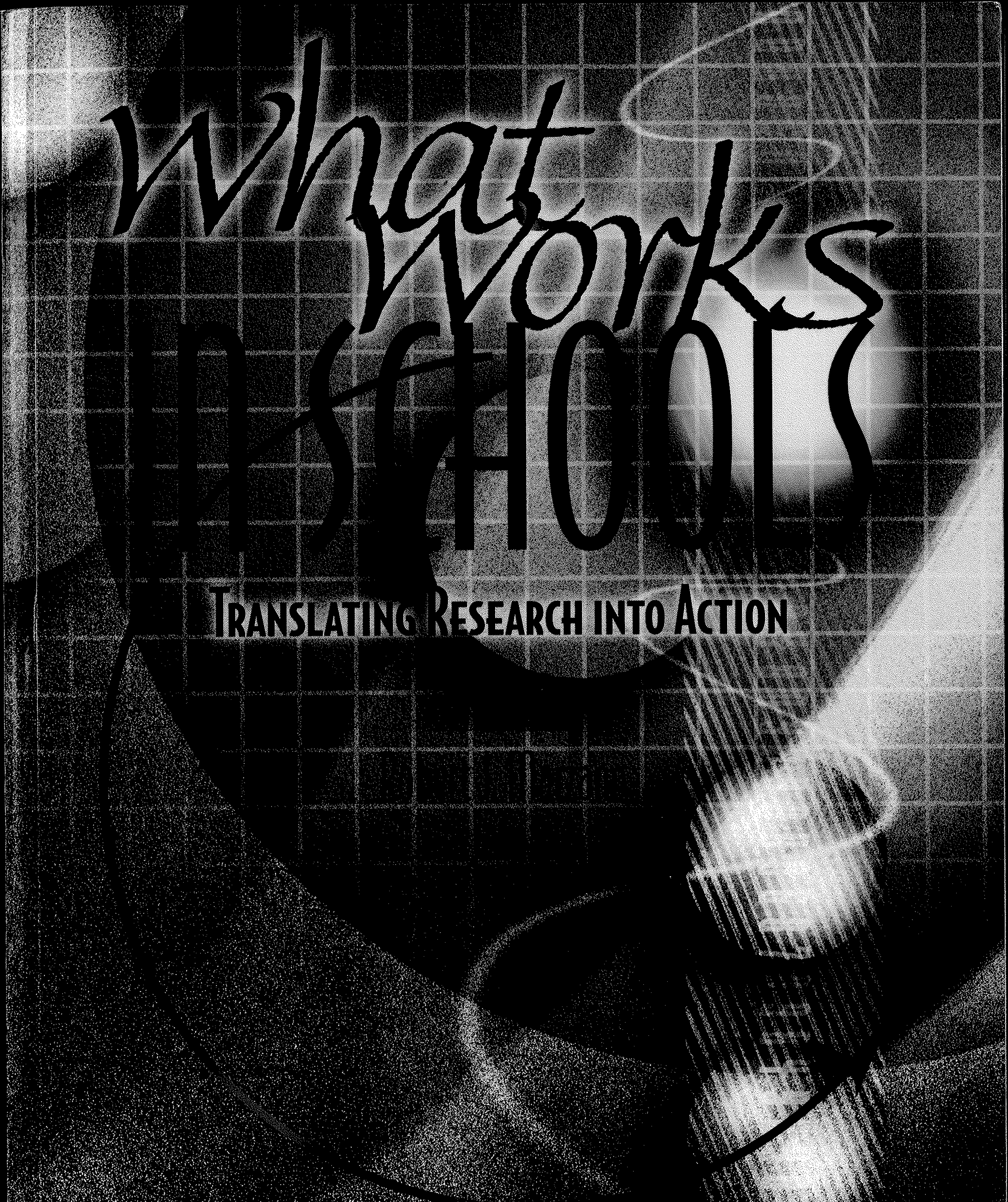
Topic	Grade-Level Interval K–2	3–5	6–8	9–12
Motion geometry	•	•	•	•
Multiplication	•	•	•	•
Numbers & number systems	•	•	•	•
Patterns	•	•	•	
Perimeter & circumference		•	•	
Polynomials				•
Precision & accuracy				•
Probability	•	•	•	•
Problem-solving strategies	•	•	•	•
Proof			•	•
Pythagorean theorem				•
Rate & velocity			•	•
Ratio, proportion, percent		•	•	
Regression & correlation				•
Scale		•	•	
Sequences & series			•	•
Similarity & congruence		•	•	•
Statistics				•
Subtraction	•	•		
Temperature	•			
Time	•	•		•
Trigonometry				
Units	•	•	•	
Volume, mass, capacity	•	•	•	
Weight	•	•		

Source: R. J. Marzano. (2002). *Identifying the primary instructional concepts in mathematics: A linguistic approach.* Englewood, CO: Marzano & Associates.

and (3) referring to specific parts of class time as "academic learning time" so students understand that these times require more attention than others.

Summary

A guaranteed and viable curriculum is, for the most part, a composite of OTL and time. Although this school-level factor has the most impact on student achievement, it probably is the hardest to implement, especially within the context of the current standards movement. Schools must identify essential versus supplemental content and ensure that the essential content is sequenced appropriately and can be adequately addressed in the instructional time available. Schools must also ensure that teachers cover the essential content and protect the instructional time available.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