SONNY MAGAÑA
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Enhancing the Art & Science of Teaching With Technology

THE CLASSROOM STRATEGIES SERIES

CONTENTS

Italicized entries indicate reproducible forms.

Other factors may have contributed to the school's gains in achievement (for example, effective school leadership, district management, and instructional coaching in the building). Still, a reasonable inference can be made that the guidance provided to teachers on using existing technology tools to enhance instruction was a contributing factor to academic growth.

Our Instructional Model

Throughout this book, we discuss a variety of types of educational technology. However, we do so in concert with specific instructional strategies. That is, we do not discuss technology in isolation, nor do we discuss instruction in isolation. Rather, we discuss how specific technology tools can be used with specific instructional strategies.

We use the instructional framework articulated in *The Art and Science of Teaching* (Marzano, 2007) and further detailed in several additional books, including *A Handbook for the Art and Science of Teaching* (Marzano & Brown, 2009), *Effective Supervision* (Marzano et al., 2011), and *Becoming a Reflective Teacher* (Marzano, 2012). This framework presents three lesson segments, which signify the main types of procedures used in the classroom (routine events, content, and on the spot). Each lesson segment is further categorized into design questions, which organize the forty-one elements (or forty-one categories of specific classroom strategies and behaviors) that correlate with teacher proficiency in the classroom. Table 1.5 lists the forty-one elements of the framework presented in *The Art and Science of Teaching*.

Table 1.5: Forty-One Elements of *The Art and Science of Teaching* Framework

Lesson Segments Involving Routine Events
Design Question: What will I do to establish and communicate learning goals, track student progress, and celebrate success?
Element 1: Providing clear learning goals and scales (rubrics)
Element 2: Tracking student progress
Element 3: Celebrating success
Design Question: What will I do to establish and maintain classroom rules and procedures?
Element 4: Establishing and maintaining classroom rules and procedures
Element 5: Organizing the physical layout of the classroom
Lesson Segments Addressing Content
Design Question: What will I do to help students effectively interact with new knowledge?
Element 6: Identifying critical information
Element 7: Organizing students to interact with new knowledge
Element 8: Previewing new content
Element 9: Chunking content into digestible bites
Element 10: Helping students process new information
Element 11: Helping students elaborate on new information
Element 12: Helping students record and represent knowledge
Element 13: Helping students reflect on their learning

traffic jams? To maximize the potential of technology tools, it is important to carefully consider how and when they will be used.

Teachers can use digital recording technology to determine the optimal location of centers and resources in the classroom. Set up a video recording device—such as a digital video camera, document camera, or tablet—to record students as they access the learning centers and technology resources in your classroom. Analyze students' traffic patterns as they enter and exit these areas to improve the organization of classroom resources. Share sample clips with your students to prompt their involvement in identifying and generating resolutions to any perceived problems or issues. Teachers who wish to use this strategy should bear in mind that some schools may have limitations on videotaping students. Take the time to review your school's policies.

Involving Students in the Design Process

Although many teachers arrange the classroom before students arrive for the first day of class, asking students to be involved in the design process can help them feel invested and comfortable as they work in and move around the classroom. Technology offers many tools that students can use to collaborate and model their ideal classrooms.

Use online group generators, such as Team Maker, to randomly assign students into small groups to design their ideal classrooms. Encourage students to include areas in their design that support whole-group instruction, small-group interaction, and individual learning centers. Have each group share its completed designs with the class to stimulate group thinking and discussion. Students can use clickers or polling software on their mobile devices to vote on the best design to fit the learning needs of the entire class.

Involve groups of students in relatable, authentic problem-solving tasks to increase student participation and collaboration. Students can browse the Internet to research, locate, analyze, and discuss examples of appealing classroom designs. Once students have considered the advantages and disadvantages of other classroom designs, they can illustrate and present their ideal classroom using a digital drawing program, IWB software, Google Drive, or Prezi. Students can even consider issues of space and organization of classroom resources by creating three-dimensional representations of their blueprints using design software (such as SketchUp). When all designs have been considered, students can use clickers or their mobile devices to vote on a design that will meet the learning needs of everyone in the class.

Teaching With Technology

The design question addressed in this chapter emphasizes how technology can be used to support the formation of rules and procedures in the classroom, as well as the organization of the classroom's physical layout. The following vignette depicts a teacher using technology to enhance these elements, as well as others.

> Ms. Kushner has been teaching sixth grade in an urban school district for nine years. Visitors to her classroom notice a relaxed, active, and orderly atmosphere. Students appear to be monitoring and regulating their own behavior, at times reminding each other to keep their voices quiet to avoid disturbing others. At the end of the day, each student tracks his or her progress on behavioral, contribution, and effort goals using an app.
>
> What a visitor wouldn't see is the work that Ms. Kushner has done with her students to create such an environment. Her students feel secure enough to take learning risks and regularly challenge themselves beyond what they think they can do. Ms. Kushner's students make mistakes,

Chapter 5

PRACTICING AND DEEPENING KNOWLEDGE

In order for students to use new knowledge on their own, they must practice and deepen their understanding of the content after it has been introduced. This design question—How can I use technology to help students practice and deepen their understanding of new knowledge?—falls under lesson segments addressing content and includes seven elements.

Element 14: Reviewing content

Element 15: Organizing students to practice and deepen knowledge

Element 16: Using homework

Element 17: Helping students examine similarities and differences

Element 18: Helping students examine errors in reasoning

Element 19: Helping students practice skills, strategies, and processes

Element 20: Helping students revise knowledge

When considering this design question, it is important to remember that there are two types of knowledge—procedural and declarative. As discussed previously, *procedural knowledge* includes skills, strategies, and processes that students must be able to perform. The skills, strategies, and processes associated with procedural knowledge must be practiced in order for students to perform them with speed and accuracy. *Declarative knowledge*, on the other hand, includes the content-related details, facts, and principles that students must understand. Rather than be practiced, declarative knowledge is deepened or expanded as students gain a better understanding of the content. The elements and corresponding technology strategies outlined in this chapter have been developed from research on practice (Kumar, 1991; Ross, 1998), revising and analyzing errors (Halpern, 1984; Hillocks, 1986; Rovee-Collier, 1995), examining similarities and differences (Halpern, Hansen, & Reifer, 1990; McDaniel & Donnelly, 1996), and homework (Cooper, Robinson, & Patall, 2006). The specific strategies and behaviors associated with each element, as well as the ways in which the elements can be enhanced with technology, are provided here.

Examining Claims for Errors

Students must be taught to evaluate their claims for errors in reasoning, which include errors of faulty logic, attack, weak reference, and misinformation (see table 5.3, page 79). In addition, a number of errors commonly arise when statistics are involved. Table 6.2 displays the errors, or limitations, commonly found among statistical information.

Table 6.2: Five Types of Statistical Limitations

Category	Description
Analyzing regression toward the mean	Being aware that an extreme score on a measure is most commonly followed by a more moderate score that is closer to the mean
Evaluating errors of conjunction	Being aware that it is less likely that two or more independent events will occur simultaneously than it is that they will occur in isolation
Keeping aware of base rates	Using the general or typical pattern of occurrences in a category of events as the basis on which to predict what will happen in a specific situation
Understanding the limits of extrapolation	Realizing that using trends to make predictions (that is, extrapolating) is a useful practice as long as the prediction does not extend beyond the data for which trends have been observed
Adjusting estimates of risk to account for the cumulative nature of probabilistic events	Realizing that even though the probability of a risky event might be highly unlikely, the probability of the event occurring increases with time and the number of events

Source: Adapted from Marzano & Brown, 2009, pp. 127–128.

Students can also use technology to examine claims for errors. For instance, apply the interactive capabilities of polling technology and IWB software to enhance the process of examining claims for errors in reasoning. Display a set of criteria on IWB software to help students analyze online resources for accuracy, reliability, and usefulness. Students can then use clickers or mobile devices to submit self-assessments of their understanding of each type of error. Use the results of the polling data to prompt whole-class discussion.

Teachers and students can also take advantage of social media tools to increase collaboration in the process of examining claims for errors. Students could catalog and annotate online resources using social bookmarking tools, such as Diigo or Delicious, and then share the resources they find with their classmates, who add annotations that locate reasoning errors in the text, provide links to other online resources that contain similar errors, rewrite the same claim with grounds that do not contain errors, or uncover patterns of reasoning errors in a particular resource.

Scoring Scales

Students can use teacher-created scales to self-monitor their progress and track their improvement during cognitively complex tasks. Scales should include the target learning goal (3.0), a simpler learning goal (2.0), and a complex learning goal (4.0). Technology can enhance the creation and use of these scales.