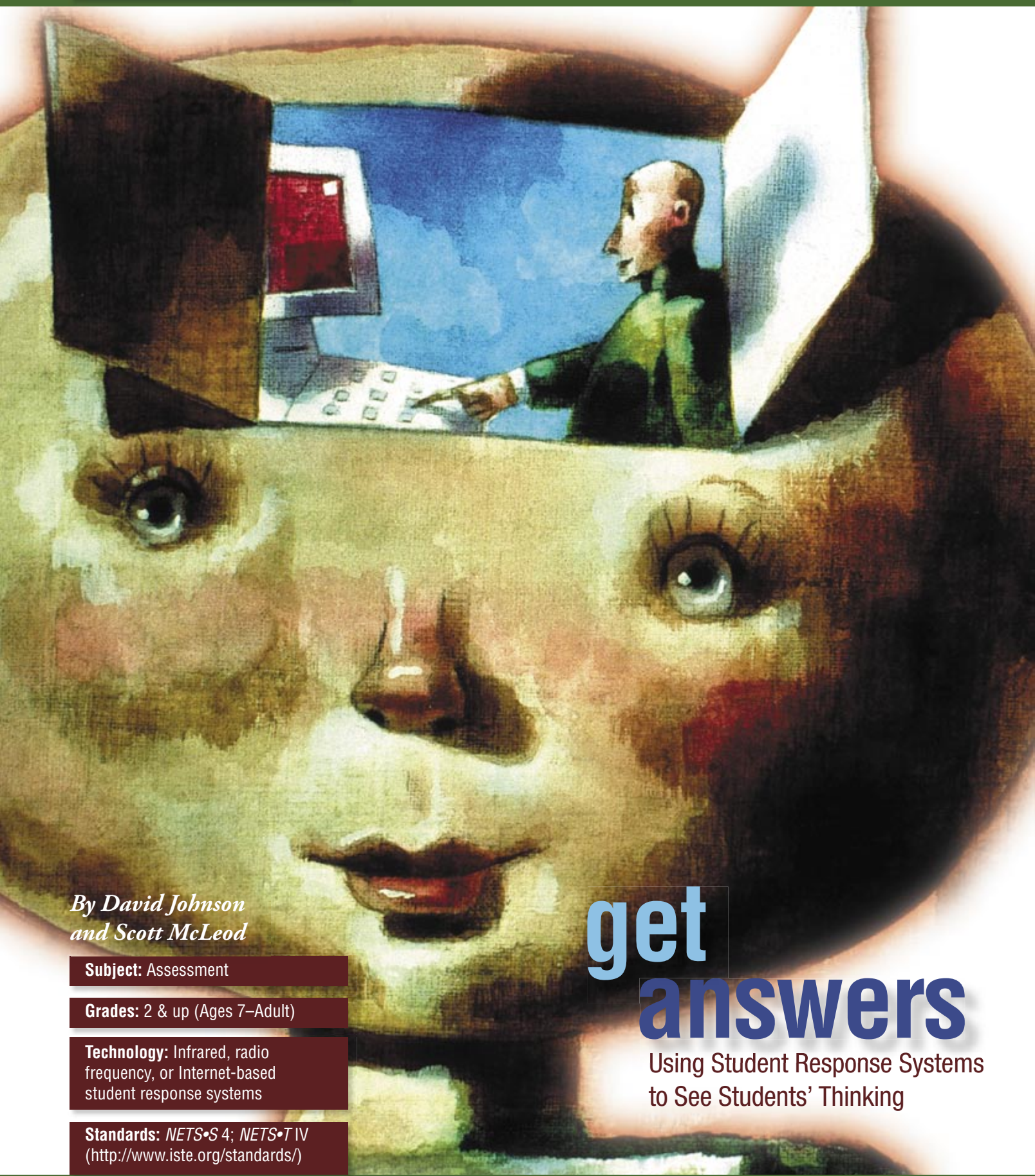

get answers

Using Student Response Systems to See Students' Thinking

By David Johnson and Scott McLeod

Subject: Assessment

Grades: 2 & up (Ages 7–Adult)

Technology: Infrared, radio frequency, or Internet-based student response systems

Standards: *NETS•S* 4; *NETS•T* IV (http://www.iste.org/standards/)

Who Is Using Student Response Systems?

Imagine if you could view your students' thinking, like peeking inside a pot of cooking stew to see if it is done. Wouldn't it be nice if you could know what your students were learning, while you were teaching them?

Most teachers use a variety of classroom techniques to understand what their students know and can do. Tests, quizzes, papers, and projects are time-honored ways to assess student learning, but they often are time consuming to administer and grade, and there are inherent delays between submission, assessment, and feedback. Teachers also use interactive questioning techniques, class discussions, and one-on-one meetings to assess students' knowledge and skills, but these often are neither systematic nor all-inclusive. As a result, in its report *Knowing What Students Know,* the National Research Council (NRC) has noted that feedback opportunities occur relatively infrequently in many classrooms.

The ability to gain insight into students' knowledge and understanding takes on new importance in today's accountability climate. According to the NRC report, to enable school and district compliance with federal and state accountability mandates, teachers' classroom assessments should "focus on making students' thinking visible to both their teachers and themselves so that instructional strategies can be selected to support an appropriate course for future learning." Teacher implementation of effective in-class feedback mechanisms allows for the ongoing modification of teaching strategies and content coverage to maximize student performance on

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We profile two school organizations currently using student response systems: Highwood Hills Elementary in St. Paul, Minnesota, and the University of Cincinnati.

Highwood Hills Elementary. This school is a nationally recognized technology innovator that has used Discourse student response software in the classroom for more than seven years. Students use portable infrared keyboards with small displays. Discourse allows many types of questions, including those that are completely open-ended. The teacher watches his or her computer as the students respond. The teacher can transmit feedback to the student keyboard and may display responses with or without names on a TV monitor. (See the table on pp. 20–21 for more on the features of Discourse and other student response systems.)

In Kathy Wettschreck's second-grade Word Work class, the students play a vocabulary game with Discourse. One student is "it" and leaves the classroom for a moment. Kathy selects a word and shares it with the class. The student returns and tries to guess the word. The other students type hints on their keyboards, which Wettschreck displays on the TV monitor. "That way students are reading all the time," she explains. "For English as a Second Language students it's great because many are afraid to speak in class."

In Leah Stern's fourth-grade reading class, the students journal for 10 minutes with Discourse. As they type, Stern watches the sentences form on her screen. She can quickly interact, telling one student to place a period at the end of the sentence and another to amplify a point with more detail. She selects certain students' work to show publicly. "Kids love to see their work projected on the monitor," she says. "Many would much rather communicate with me through the keyboard. Plus, Discourse focuses students' attention, especially those with attention deficit problems." According to literacy coordinator Sara Benedett, "You can see what students know and don't know. If you have a class of 30 children, it's almost like you are one-on-one with each child at the same time."

The composition of Highwood Hills' student body has changed recently, with an influx of immigrant families from Somalia and Laos. "We are dealing with so many children who are learning English as a second language," Benedett says. "Often, children are afraid to speak up for fear they won't say it properly. As an example, I had one student in the second grade who posted a response on her keyboard that was excellent. I showed her response anonymously to the class. I said, 'Look what this student did. I'm so proud of this work.' The next time, her hand sneaks up, and she wants to respond verbally, overcoming her fear of talking in class. That is huge because a sense of community forms, and the learning becomes social."

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Which Student Response System Is Right for You?

In the table on pp. 20–21, we have compiled the key features for all student response systems currently available. You can use this table as a starting point in choosing the right system for your school or district.

STUDENT RESPONSE SYSTEMS COMPARED

Title/URL	Price	Hardware Required	
ClassInHand http://classinhand.wfu.edu	Software is free. (Hardware not included.)	Instructor uses PocketPC with a wireless card, and students use any device (handheld, laptop, or desktop) connected to the Internet.	
Classroom Performance System http://www.einstruction.com	$1,995, includes 32 keypads, receiver, carrying case, software site license, free software upgrades, online training. technical support, and lifetime warranty on hardware.	Keypads and receiver(s) sold by eInstruction	
Discourse http://www.ets.org/discourse/	$3,000 software license for a 30-workstation system. (Hardware not included.) School site licenses available.	Portable infrared keyboards or any PC or Apple device (handheld, laptop, or desktop). The student devices may be PC, Apple, Palm, or PocketPC, but the teacher device must be a PC.	
Hyper Interactive Teaching Technology (H-ITT) http://www.h-itt.com	$890, includes software, 30 keypads, receiver, and cabling.	Keypads and receiver(s) sold by Hyper-Interactive Teaching Technology	
InterWrite PRS (Personal Response System) http://www.gtcocalcomp.com/interwriteprs.htm	$1,240, includes software, 30 keypads, receiver, and cables	Keypads and receiver(s) sold by GTCO CalComp	
Numina II student response systems http://aa.uncw.edu/numina/srs/	Free, Web-based solution that runs on a server at UNCW (Hardware is not included.)	Any wired or wireless device with a browser connected to the Internet	
PocketClassroom (PocketPC)/LearnTrac (Palm) http://www.readinessco.com	$8,499 PocketClassroom software license for first 50 seats. (Doesn't include hardware.) School site licenses available. $7,899 LearnTracPro software license for first 50 seats. (Doesn't include hardware.) School site licenses available.	Any Pocket PC or Palm OS device	
Qwizdom Interactive Learning System http://www.qwizdom.com	$195 for software alone. $2,255 for package, includes software, 30 keypads, instructor keypad, receiver, carrying case, and cable.	Keypads and receiver(s) sold by Qwizdom	
RxShow http://www.rxshow.com/index.htm	$949 software license for Full Function RxShow. $379 software license for RxShow Lite. (Hardware not included. K–12 customers receive 10% discount.)	Keypads and receiver(s) sold by other vendors	
TI-Navigator http://education.ti.com/navigator	$4,000 for 32-student system, includes software license, access point, four hubs, and a charging bay. (TI graphing calculators not included.)	Classroom PC, TI access point, wireless hubs, TI graphing handhelds, and hub charging bay (all but PC and graphing handhelds sold in TI-Navigator Classroom kit)	
TurningPoint http://turningtechnologies.com	$1,995, includes software, 32 keypads, receiver, and carrying case.	Keypads and receiver packaged with software or laptops, desktops, or handhelds connected through school intranet or a virtual keypad (vPad) connected wired or wirelessly through Internet)	

	Transmission Method	Input Allowed	Special Features
	Internet	Full text entry from keyboard	Developed by the Information Systems Department at Wake Forest University. Instructors can remotely control PowerPoint presentations and receive feedback in three forms.
	One-way infrared	Single-key entry from eight-key keypad	Instructors can associate their questions with state standards provided with software and can integrate questions from 2,800 textbooks.
	Wired or wireless (802.11 standard) network, Internet or intranet	Full text entry from keyboard	Wide variety of question formats, including completely open-ended questions. Instructors can assess understanding by viewing open-ended responses as students type and can save all responses to a database. Instructors can select any response to show publicly on a screen or TV. Students receive feedback on their keyboard or computer.
	Infrared technology	Multi-key entry from five-key keypad with one modifier key	Students e-mail their keypad ID and name to the instructor, and the software builds the roster automatically. Software loads multiple question file formats, including book publisher test banks, and integrates with WebCT and Blackboard.
	One-way infrared	Single-key or multiple-digit entry from 10-key keypad with two modifier keys	
	Internet	Single-key entry from mouse or keyboard	Cooperative effort among faculty at the University of North Carolina at Wilmington and several corporate and government sponsors.
	Infrared, WiFi, wide area network, and Internet	Full text entry from keyboard	Offers file exchange, device management, document workflow, homework management, polling, quizzing, aligned assessments, testing, gradebook, analysis, reporting, syllabus, automated attendance, and test reviews and report cards. Content-neutral platform allowing import or input of desired content. The vendor offers customized content services.
	Two-way infrared	Multiple key entry from 19-key keypad	With two-way infrared transmission, students receive visual confirmation from a light on the keypad. Software permits open-ended numeric answers, including fractions and decimals, and open-ended text answers when used in a local area network. Vendor sells extensive library of standards-based curriculum software, customizable by user, which contains lessons, quizzes, questions and answers, photographs and illustrations, and nine different learning games.
	One-way infrared or two-way radio frequency	Single- and multiple-key entry from keypads	Instructors embed PowerPoint questions and tests, receive answers, plot graphs within slide shows, and save student answers in Access and Excel. The vendor supplies PowerPoint-ready visuals called Popins.
	802.11b wireless access points	Multiple-digit entry from TI graphing handhelds	LearningCheck for assessing student understanding, Cabri Jr. predrawn geometry figures, CellSheet spreadsheet compatible with Excel, and NoteFolio for lecture notes. The vendor offers more than 600 free classroom activities on the Internet.
	One-way infrared, two-way radio frequency, intranet or Internet	Single-key entry from keypads	TurningPoint tool bar integrates into the MS Office Suite (PowerPoint, Excel, Word, and Outlook). Instructors can view results with preformatted reports or transfer to external applications, such as gradebook software. Content-ready templates provided; optional content provided through Thomson Learning Corporation.

Who Is Using Student Response Systems?

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The University of Cincinnati. Malcolm Montgomery is a former high school teacher who now works at the University of Cincinnati as an educational systems technologist and adjunct instructor. He teaches Basic Electric Circuits and Electronics Fundamentals and uses the TurningPoint student response system in his classes. Turning Point includes hardware and software and boasts easy integration into Microsoft Office software.

"TurningPoint provides a beautiful add-in to PowerPoint, which makes it so easy to create the question slides and the response slides," Montgomery explains. An instructor can give a presentation, intersperse it with questions, obtain student responses from keypads, and display the results, all within PowerPoint.

"TurningPoint gives me feedback about what the students understand," Montgomery says. "For example, I can present a concept in basic electricity. After covering the topic, I'll give them a numeric problem and ask them to solve it. I'll put up a TurningPoint slide that has the question and four answers. The four answers I've picked are good ones if they contain some common misconceptions. Answer B might show the relationship backwards or inverted, and Answer C might include a decimal point error. Depending on their answer, I get a sense of what the mistake was in their thinking."

Montgomery doesn't always display the correct answer immediately; he may first ask students to discuss their answers with each other. "Students are more likely to ask a question or admit that they don't know if they see there are other people in the same boat," he says. "I'll get more participation after using TurningPoint." The student response system seems to raise student engagement. It also provides an easy way for teachers to record quiz grades, eliminating data entry.

Montgomery believes that student response systems are not just for math and science classes but lend themselves to courses that feature open-ended discussions. For example, TurningPoint provides opinion survey questions that permit the instructor to poll the class on a current event before discussing it. As Montgomery notes, "The first opinion voiced in a discussion seems to carry the most weight. It's important to get a divergence of opinions on the table at the beginning of a discussion to prevent the first response from becoming the dominant point of view."

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yearly summative assessments. Ongoing technology-facilitated assessment through the use of student response systems can be a powerful means of responding to schools' accountability needs.

What Are Student Response Systems?

Student response systems are interactive technologies that enable teachers to conduct ongoing formative assessments. These systems allow teachers to ask questions, receive student answers, and display the results electronically. Although student response systems are a fairly new technology, nearly 30 studies have now reported learning benefits from early implementation of these systems, including enhanced student engagement, increased subject matter understanding, and improved classroom discussion.

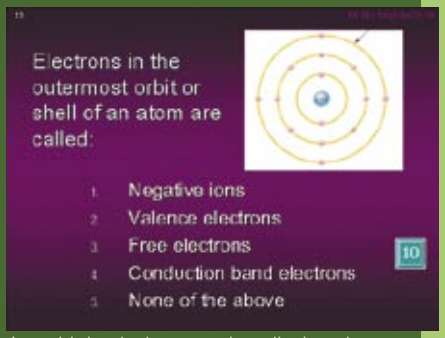
Student response systems can be grouped into several categories. Some use a keypad and receiver to communicate from student to teacher; others use handheld, laptop, or desktop computers with wireless or wired connections to the Internet. Some systems only allow selected-response questions (e.g., multiple choice, true/false, or opinion survey), while others allow both selected- and constructed-response questions (e.g., short-answer or essay).

What Equipment Is Required?

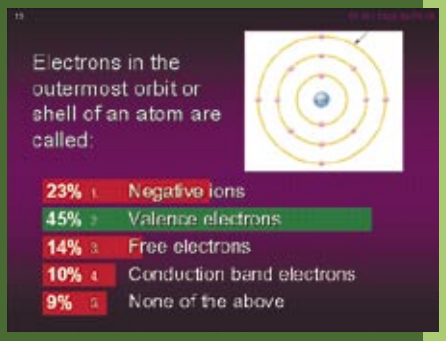
Hardware. With keypad and receiver equipment, a teacher develops selected-response questions in the software and then displays them with a projector connected to the teacher's computer. Students point their keypads, a small handheld device like a TV remote control, toward the receiver and press a key to answer. The receiver is about the size of a paperback book and is connected to the teacher's computer through a USB or serial port.

Keypads employ one-way infrared, two-way infrared, or radio frequency technology. With a one-way infrared keypad, students must watch the projected screen to determine if their responses registered. The screen displays a table containing a cell for each device; the cell turns blue when the transmission is received. One-way infrared technology processes keypad transmissions sequentially, so simultaneous transmissions collide. As a result, students may have to transmit repeatedly before the student response system receives the signal. This is not the case with two-way infrared and radio frequency keypads. These devices provide bidirectional communication, sending confirmation back to students that their responses have been received. Several researchers have cautioned about using one-way infrared devices in very large classrooms where student responses are recorded

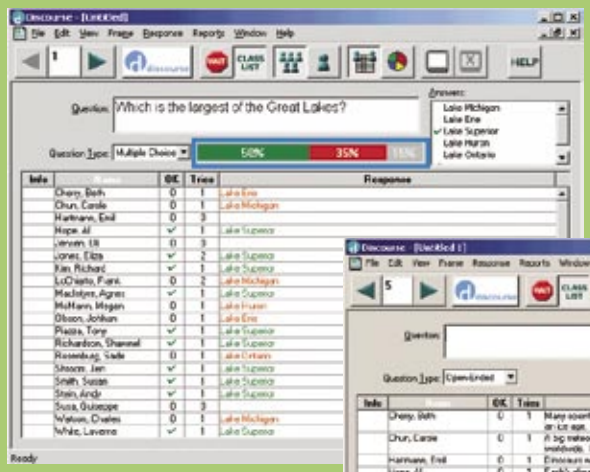
Keypads included with some student response systems look like TV remotes.



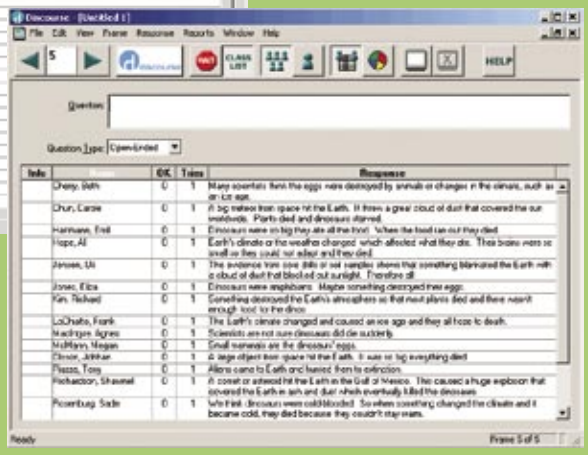
A multiple-choice question displayed by TurningPoint software.



Student responses summarized by TurningPoint software.



Discourse software allows the instructor to view students' answers to multiple choice questions. The software automatically grades the answers and sends feedback to the students.



The instructor's monitor displays students' responses, as they are typed, to an open-ended question from Discourse software.

for grading purposes because students become anxious that the system may miss their response.

With wireless or wired equipment, students respond with handhelds, laptops, or desktop computers that transmit through the Internet. The results are displayed on the teacher's computer and shown through a screen projector.

Software. Typically, student response systems allow teachers to create selected response questions in advance or while teaching.

Teachers may record student responses in a gradebook, which also serves as a record of attendance. To record scores, the teacher creates a table mapping student names to device numbers. Other student response system features include:

- Integrating questions from textbooks
- Associating questions with state standards
- Offering remotely controlled presentations and assessments by instructor
- Integrating student response assessments within PowerPoint presentations

Conclusion

Student response systems provide an easy and convenient way to conduct ongoing formative assessments.

Benefits of using such systems include:

- Providing quick feedback about student comprehension for both teacher and student
- Permitting timely remediation by teacher
- Reducing clerical work for teachers, eliminating the need to grade quizzes and record scores by hand
- Promoting participation from all students
- Stimulating classroom community
- Providing practice reading and writing
- Promoting communication for students afraid to speak in class

Although teachers cannot always see how students think, the use of ongoing, formative assessments, facilitated by student response systems, brings them ever closer to that elusive goal. With current educational stakes so high, schools would be wise to explore the utility of such systems for their own organizations.

David Johnson is a doctoral student in the Instructional Systems and Technology program at the University of Minnesota and technology coordinator for the School Technology Leadership Initiative. The initiative is designed to help school administrators effectively facilitate the implementation of technology in schools and school districts and is the only graduate program in the country that comprehensively addresses the full spectrum of ISTE's National Educational Technology Standards for Administrators.

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