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Teachers Talking and Students Listening: A New Solution for an Old Problem

A Research Summary prepared for Lightspeed Technologies, Inc.

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1.0 SUMMARY

Lightspeed Learning Technologies provides a unique "insights" framework that does for the classroom what the Hubble telescope has done for the cosmos—you can see things you never knew were there. Flexcat is a *teacher learning system*. It is a first-ever chance for teachers to peer unobtrusively into what kids are doing in groups and how they are doing it. This summary reviews the findings of a yearlong quantitative-qualitative analysis of nationally distributed groups of Flexcat users at all levels of K-12 schooling.

2.0 INTRODUCTION TO CLASSROOM AUDIO

Every teacher laments the too-frequent disconnect between what they say and what their students are able to hear. Listening to the teacher—auditory learning—can be up to 75% of a child's day. Teachers talk to their classes as much as 80% of the time. The noise that gets in the way of teacher-student and student-teacher communication isn't anyone's fault. It's the air-conditioner, the bare floors, the traffic outside, the classes passing in the hallway, the whirring of laptops, four kids murmuring, 10 desks being pushed, etc.

> "I've been teaching 14 years and this is my favorite piece of instructional technology, ever. I wear the mike all the time and they said they might take it away and I said 'NO WAY!' "
>
> —A teacher working with 22 kindergarteners including an assistant who was signing for two hearing-challenged students

If teachers can't simply talk louder—and they can't—what then are they to do? Lightspeed Technologies' Flexcat is a new solution for an old problem. Lightspeed Technologies' Flexcat has created the capability for every student to hear what the teacher says and, reciprocally, for teachers to a) listen and learn what their small groups are doing and b) communicate to either individual small groups or to the whole class, effortlessly and seamlessly.

Interactive, Inc.'s mixed-methods analysis followed the decisions that teachers make hourly, daily in classrooms: How do I get ideas across? How should students be grouped? How will I know what they are doing and how well they are doing it? The discussion is based on the quantitative data from self-reports and from extensive on-site observations and interviews with K-12 teachers in urban, suburban, and rural districts, nationally distributed.

3.0 HOW TEACHERS AND STUDENTS USE FLEXCAT

A classroom installation looks something like the following. There is a speaker 7 feet up on a bookcase and it projects "all-call" volume. Each small-group table for students has a pod with speaker/microphone capability. The pods are battery operated and last all day on a single charge. The sound from the pod in the middle of a small group is remarkably localized with unambiguous, unavoidable clarity. It does not distract other groups. The teacher's messages to one pod are not audible to students in other groups.

1. The on-task behavior of students has increased with the use of Flexcat.

2. Half of the teachers credit Flexcat with decreasing their class interruptions.

3. Two-thirds agreed: Management of multiple small groups is more efficient with Flexcat.

3.1 Instructional Presentation and Instructional Reception

A male teacher said, "I thought I had a loud voice, but I was wrong. It wasn't an effective voice. Now if I don't use the Lightspeed system, the kids prompt me. I use it all day now as a normal part of my instruction."

Asked how loud they thought their classrooms were, three-fourths of the respondents were in the middle range: if "10" equaled the loudest, they said 4 or 5. The average teacher reported using their "teacher voice" during 20% of the day, although a couple of respondents reported 80% and 85% of the time. Three out of four teachers reported that they had to manage noise levels with "class rules, constantly enforced."

Two-thirds of the teacher respondents thought that, "The on-task behavior of my students has increased since I started using Flexcat." Half of the teachers credit Flexcat with decreasing their class interruptions and increasing the amount of active learning by students.

3.2 Differentiating Instruction

"Differentiating" or "individualizing" instruction in a class of 18 to 28 students has always been an aspiration but not, until recently, a reality. Differentiating instruction requires grouping and re-grouping—and managing traffic among the groups. Of the responding teachers 88% used Flexcat with small groups "sometimes" or "often." Two-thirds agreed, "management of multiple small groups is more efficient with Flexcat." Half said that Flexcat helped to manage communications with different groups "a lot. Almost all used the system for instruction for the entire class."

We watched a 2nd-grade teacher lead her class through the "Daily 5": five stations with small groups rotating through five different literacy-related activities. Herding children among those stations could take time and effort, but this class had learned that their teacher could manage and monitor their responsiveness quickly and pervasively.

In a district that is particularly technology-rich (and a winner of a U.S. Department of Education *Race to the Top* grant), an early-grades math specialist was working with 20 "transitional first graders"—students who had almost not been promoted and who needed extra help. T*hat teacher was both circulating among table groups and using the pods to monitor.* When she noticed that one little girl was struggling, she relocated the pod right next to the girl and her Chromebook, thus individualizing instruction with extra encouragement and targeted comments.

Once the table groups have formed (and the pods are on each table), the teacher sits down with a single group. That group has her main attention but periodically, she pushes the monitoring button on her remote with the number of the table group that she is interested in. Without getting up, she says to one at-a-distance table, "I want you to be working collaboratively and that's not just everyone talking at once. I'm disappointed and want you to stop for 3 seconds and see where you are. Lionel, take charge of that. And then let's go back."

Another group dials into the teacher using the call button and asks a question and gets an immediate answer. At the teacher's request, one table group does a synthesis of their work for all the other tables.

"There's no by-play from the students in the small groups, e.g., "Here she comes so we'd better…" The fact is, they don't know when she is or isn't listening in. Moreover, in a conventional classroom, the expectation is that the teacher is arriving with The Answer so in a conventional classroom the group stops working and relies on the teacher."

—A literacy specialist working with 5th- and 6th- grade groups

An elementary-level literacy specialist had her days filled with hourly successions of classes of 20 or more 4th-graders. The classroom was organized with pods on each of six four-person tables. Each hour was broken into 15-minute segments. Each group had to arrive, find their places, get tasked and settled, and then repeat the process three more times within each hour, in addition to getting ready to return to their sending classrooms. The teacher was managing that commotion with Flexcat, e.g., "Avery, are you sure you're doing what we want in that book?" While she worked at her desk with a small group, she also unobtrusively dialled into the table pods and occasionally broadcast a message to the whole group. "This is a time check. The timer will go off in a minute and then please rotate to your new group."

3.3 Assessing and Monitoring Students

Teachers told us:

- "It's like you're in six places at once."
- "Flexcat opens doors because you can listen in on conversations that inform your teaching right now, on the spot. That's what formative assessment is supposed to be."
- "We use Flexcat to assess *Speaking and Listening Standards*, collaborative discussion… With Flexcat, we do formative assessment without being intrusive."
- "A window into their brain that you don't get from paper and pencil. Or from a standardized test. What, really, does a 'B' tell me? If I can listen to their logic and their train of thought, then I know where they went wrong and right."

The expected practice for teachers is to walk around the classroom to see what students are doing. Flexcat *might* allow a teacher to remain seated at a desk and still listen in on students' table work. But teachers don't work that way—they move around, they visit, they engage face-to-face. Nine out of ten teachers concluded that students were more likely to stay on task if they knew their teacher was watching and listening. About four out of ten of the responding teachers said that they got "more exact information about student learning" when they used the pods.

The average teacher used Flexcat to monitor students five times a day. And two-thirds of the teachers said they used Flexcat both to check on-task behavior and to confirm the quality of student work.

Flexcat's ability to manage sound gave teachers options about managing space. For example, three classes had been brought together in an atrium common space that was an architect's delight and an acoustical nightmare. The mic-wearing teachers had scattered pods among the 60+ students. The result was a manageable large group with total two-way clarity—teachers-to-students and students-to-teachers. Every one of the teachers who was involved in team teaching reported, *"Flexcat helps me manage very large class sizes, even combined classes with team teaching."*

3.4 Directing and Redirecting Student Attention to Learning

Eighty-eight percent of responding teachers thought, "Having the pods on student tables increases student attention to the work at hand." Two-thirds reported fewer behavior problems since they began to use this technology. One hundred percent of the teachers using Flexcat agreed that they were "better able to catch students doing good" because of the devices. And, as one teacher said, "When I see a group that's off-task, that's where I put the pod."

3.5 The Results of Flexcat Use for Students

A European analysis of hearing problems and cognition boiled down to "Muddy in, muddy out" (Kilgard and Merzenich 1998). Almost 90% of the teacher respondents agreed with one of the core premises of Lightspeed, that "Children who hear better, learn better."

We asked teachers if their students were using the pods to share with other students and other groups: 26% said "a lot" or "some," 37% said "a little," and 37% said "none." *Flexcat contributed to the self-esteem of some students: when they presented to others, they recognized their peer's interest and gained confidence.* We overheard kids encouraging each other to "go for it" using Flexcat to broadcast their ideas.

A majority of the responding teachers concluded that Flexcat had made some positive difference with their "hard-to-reach, hard-to-teach students." Teachers were virtually unanimous in reporting no difference between girls and boys, and a majority of teachers reported no differences in use between high- and low-achieving student groups or between "outspoken" and "reserved" students.

The possible impact of any schooling intervention on summative educational achievement is an understandable question. Flexcat supports and augments several aspects of teaching and of learning: It is designed to strengthen virtually any program that districts, schools, or teachers use, but it is not one of those test-changing events like the National Institute for Education's multi-faceted *Teacher Advancement Program* or Robert Slavin's *Success for All.* As one teacher told us, "If tests measured small-group work, then it [Flexcat's impact] might show up. But the tests are strictly individual and measure right/wrong answers." Flexcat does make formative assessment much more accessible and more illuminating. Teachers did not assign a test-score-improving impact to Flexcat, but the majority did think that it would contribute to students' staying on track toward promotion and graduation[1].

3.6 The Results of Flexcat Use for Teachers

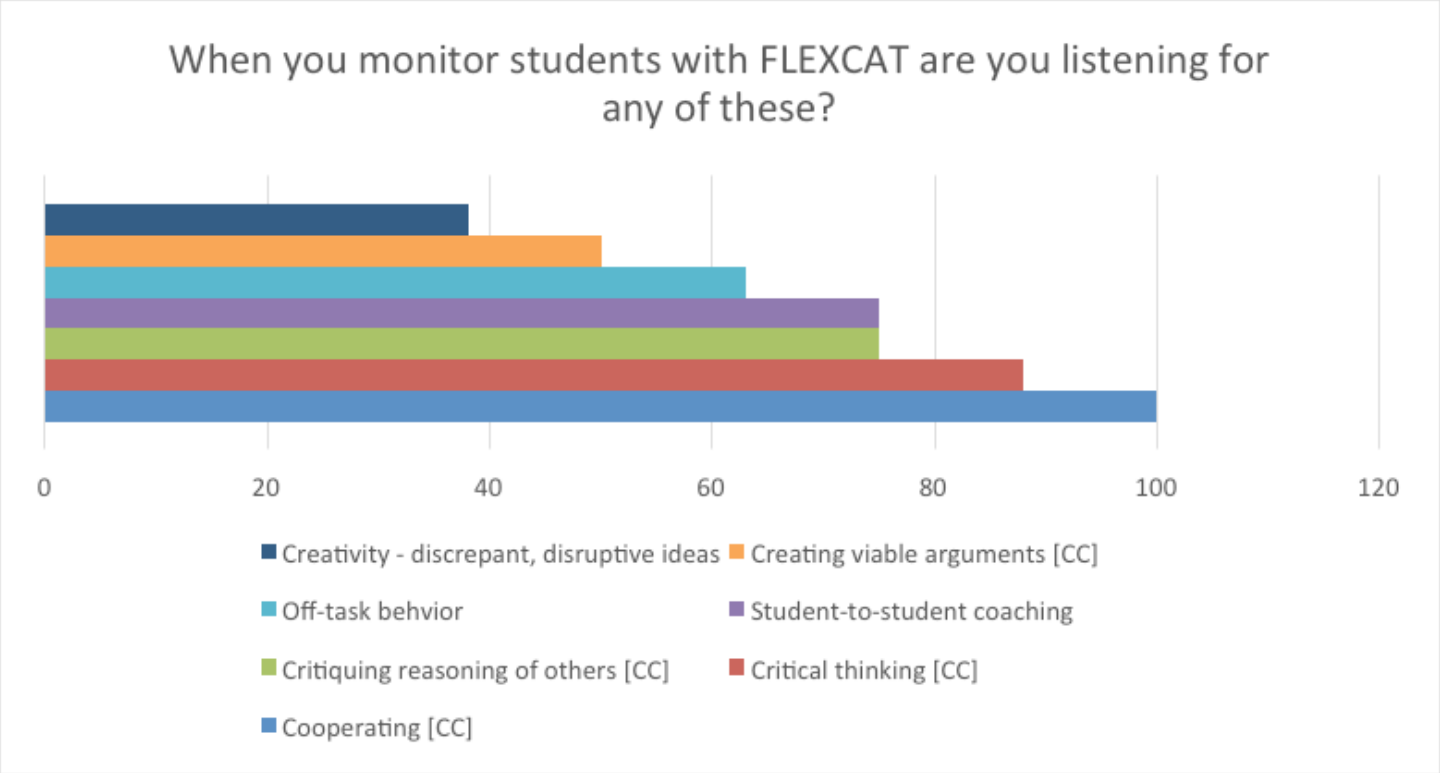
Teachers told us how they used Flexcat to support instruction in different curriculum areas. From most-to-least, the areas are: 1) Mathematics; 2) English/Language Arts; 3) Social Studies and History. Social studies and science are taught by talking, by primary source documents, by problem solving. A teacher commented, "You want kids digging into text and finding meaning, brainstorming, asking questions and being curious, even discrepant. If that can get done in small-group formats that foster teamwork and discussion and argumentation, what could be better at growing 21st-century skills?" *Two-thirds of the teacher respondents thought that Flexcat made project-based learning more feasible.*

Flexcat is easily integrated into other applications. Two out of three teachers said they used that functionality between one and three times a day. For example, we watched a middle-school teacher encouraging students to make reports to the whole class and then awarding *Class DOJO* points to the high performers. The shifting point totals for each small group appeared on an IWB scoreboard, to the delight of the students.

One hundred percent of the teachers using Flexcat agreed that they were "better able to catch students doing good" because of the devices.

[1] The achievement improving effects of the general classroom audio distribution systems (for example, Lightspeed's REDCAT) are well established. C.f., Flexer (2002); Chelius (2004), and Gertel et al., (2004) and the sources infra, 6.0 The Evidence Base About Teachers Talking and Students Hearing.

The table below shows what teachers were listening for when they used the monitoring function. Five of the seven functions are clearly related to Common Core standards that are otherwise difficult for a teacher to track.



3.7 Common Core State Standards

Most of the teachers we listened to talked about Common Core State Standards (CCSS). Comprehensive state testing was an important topic for all teachers regardless of whether they were in a Common Core state. Teachers felt pinched between an inclination to differentiate and individualize instruction and the imperative to get their students test-ready by pushing content to the whole group. For example, we watched as an upper elementary teacher worked through the following daunting CCSS items from her lesson plan:

"Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text." [CCSS ELA literacy RL.4.1] (and) "Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies" [CCS ELA literacy L.4.4].

As teaching becomes more complex, subtle, sophisticated and interactive, there is a premium on being able unobtrusively to monitor, interact and understand. Flexcat's ability to sample student work-in-progress made it possible for her to check those components.

The *Common Core State Standards* were developed by the Council of Chief State School Officers and the National Governors Association Center for Best practices as "…a set of expectations for student knowledge and skills that high school graduates need to master to succeed in college and careers." (NGA 2010) The standards are the next step in school improvement and in bridging students to college and career futures. They are also *very* difficult to realize, monitor, and assess in a conventional classroom.

The initiative sets the bar high for graduates because, "Whatever their intended major or profession, high school graduates will depend heavily on their ability to listen attentively to others so that they are able to build on others'

meritorious ideas while expressing their own clearly and persuasively" (p 48).

Flexcat makes formative assessment much more accessible and more illuminating.

But if, as *CCSS* recommends, these are standards for what students or graduates should understand and be able to do, then how can a teacher monitor, evaluate, or guarantee those performances? Flexcat is one resource. In a world of accountability and measurement, students *and* teachers will be assessed on related knowledge and skills. The initiative says that the *CCSS* impact teachers by "…allowing states to develop and provide better assessments that more accurately measure whether or not students have learned…."

As classrooms move to more active learning, the problem increases. The Institute for Enhanced Classroom Hearing found that "'working together/talking' activities were measured at 67 to 72 decibels, *more than double* that of quiet activities, [like] 'silent reading.' " If the students are working and talking in groups, the teacher would have to project (read "scream") at 80 to 87 decibels—about 57% of the sound of a jet engine! The Institute concludes, "It is inconceivable that a teacher can project his or her voice to the back of the room all day… for all students." Nonetheless, *Common Core* standards and other state-mandated standards make new demands on communication.

4.0 LIGHTSPEED'S FLEXCAT TECHNOLOGY SOLUTION

Lightspeed has created a two-way communication system that enhances teacher-student and student-teacher communication. Flexcat is a new capability for classrooms: Each small group gets a pod; the teacher wears a microphone with an earpiece and carries a remote. The teacher can speak to the whole class or small groups individually through the speaker pods via a two-way communication link.

"It's phenomenal…the ability to hear how they're thinking when they're thinking with each other has made me understand how kids learn and how I can tailor things to their individual needs."

—A Flexcat-using teacher

5.0 SUMMARY, COMMENDATIONS AND RECOMMENDATIONS

5.1 Summary

As the work of teaching becomes more complex, subtle, sophisticated, and interactive, there is a premium on the ability to unobtrusively monitor and interact. Without Flexcat, the teacher, located with one group, would need to disengage in order to monitor, direct, and re-direct the work of other groups. For example, 25 feet from a small group, you can see the heads and lips moving but can't distinguish what is being said. Flexcat is a pair of ears for every group, an extra window into the process of learning. And it is more efficient, faster, and more valid than walking around the room.

Flexcat supports most effective learning and evaluation models. Charlotte Danielson's *Framework for Teaching* (Danielson, 2009) is the most widely used teacher evaluation taxonomy in American schooling. Hundreds of thousands of teachers have their performance box-scored by the framework. In order to be 'highly effective' on the Danielson framework, a teacher has to emphasize collaborative learning—group work. The domain items that are directly supported by FLEXCAT are indicated below.

FLEXCAT Contributions to the Danielson Domains
Domain
1: PLANNING AND PREPARATION
1b. Demonstrating knowledge of students
1f. Designing student assessments
2: THE CLASSROOM ENVIRONMENT
2c. Managing classroom procedures
2d. Managing student behavior
3: INSTRUCTION
3a. Communicating with students
3b. Using questioning and discussion techniques
3d. Using assessment in instruction

5.2 Commendations

A lot of things conspire against teachers and students: Both have natural limits to what they can project and what they can hear; most school construction was completed before acoustic standards were in place; and much of standard classroom practice was developed before modern, 21st-century and *Common Core* teaching and learning, which emphasize active student participation and interchange—and therefore noise.

Flexcat is a response to those ubiquitous needs and, as documented in this analysis, it has the ability to support and strengthen a range of critical functions in teaching and learning. Lightspeed's corporate commitment to schooling is evident in its willingness progressively to grapple with the complications of schooling and the complexity of teaching.

6.0 THE EVIDENCE BASE ABOUT TEACHERS TALKING AND STUDENTS HEARING

Since Ned Flanders' documentation of classroom talk beginning in the 1960s, it has been widely understood that teacher talk varies between 80% of the classroom time for lower-achieving student and 55% for higher achieving students (Flanders 1970, p.171). Flanders' work can be summarized in the "rule of two-thirds," The rule is this: about two-thirds of the time spent in a classroom, someone is talking. Next, the chances are two out of three that the person talking is the teacher. Finally, when the teacher is talking, two-thirds of the time she will be lecturing, giving directions, and controlling students.

Teacher talk makes a difference in student achievement. Miami-Dade County Public School's Research Services says, "(H)ow well children hear their teacher affects how well they learn (Cole, 2006; Ross & Levitt, 2002)" (Miami-Dade County Public Schools). And, "Studies have found positive effects for students in amplified classrooms, including improved academic achievement and speech perception and increased on-task behavior." (ibid.) Rosenberg (1999) reported that there were fewer behavioral/discipline referrals from classrooms with sound amplification.

The Flexcat system

But there is a big gap between teachers talking and students hearing. Most of the time, teachers strain to close that gap by talking more loudly, but consider that a jet engine from 75 feet away is 140 decibels. To be heard by all children in an ordinary early-grades classroom, a teacher would have to project at half the volume of a jet engine, all day long, every day. In terms of noise or decibel level, here is how classrooms at different organizational levels rank:

- Elementary classrooms: 55 to 65 decibels
- High school classrooms: 60 to 70 decibels
- Kindergarten classrooms: 65 to 75 decibels

When classroom sound levels are compared to teachers' "projected voice levels" (60 to 70 decibels), two of the three typical kinds of classrooms overwhelm teacher voices. To be heard effectively, the teacher's voice needs to be 15 decibels above the ambient sound of the classroom[2] but also, the farther sound travels, the less intelligible it is. That means that the farther students are from the teacher, the more of the message that is lost.

Auditory learning can be up to 75% of a child's day (Dahlquist [1998] in Miami-Dade). But, critically, "Students in today's classrooms are unable to understand 25 to 30% of what their teacher said because of excessive noise and reverberation." Jackson (1968) reported 1,000 verbal exchanges from teachers to students every day. What if only 300 of the 1,000 messages are received? In print, that loss of 30% of a message would look like this:

Question: "Wh-t do-s th-s se-te-ce -ay?"

The greater the distance between the teacher and the student, the more intelligibility is lost. Crandell and Smaldino (1995) reported that, "Word recognition scores of 95%, 75%, and 60% were found at distances of 5, 12, and 24 feet, respectively." (Miami-Dade, p. 2) Crandell and Bess documented a similar price paid by children who sat at a distance from the teacher. If they were 6 feet away, their "mean recognition scores" were 89%; at 12 feet, 55%; and at 24 feet [only half way to the back of most classrooms], 36%.

The research department of the Dade Public Schools in Florida puts the price paid by students in the back of the class as follows: "…(S)tudents sitting in the back of the class…may miss up to 30% of what their teacher says…" (Miami, p 3) That's like being absent from an hour and half of instruction during each five-hour instructional day.

Worse, the most important information is the least likely to be heard. Consonants carry the most meaning but are also the "softest" sounds. Those hard-to-hear consonants are plurals, verb tenses, possessives, and other components that are key to word recognition. The gap between the sound of consonants and the classroom noise is doubled if the student is as little as 9 feet from the teacher, or two desks away. Thus, the most important information is the hardest to pick up. This problem is most acute for early grades because young children lack experience with context, a range of vocabulary, and the ability to fill in missing signals.

[2] Teachers pay a price in health and wellness for this vocal effort. But "Schools using classroom amplification systems have reported significant decreases in teacher absences due to voice-related problems." (Miami-Dade, *Ibid.*) And, "The Mainstream Amplification Resource Room Study (2005b, 2005e) found that teacher absences due to vocal strain and voice fatigue in amplified classrooms decreased from 15% to an average of 2 to 3 percent in one year." (Miami-Dade *op cit*). Similar improvements for teachers have been reported in Iowa and Florida.

Also, young children have not yet learned how to supplement hearing each word with context and other cues to meaning. Recall that their classrooms are the loudest. They are, therefore, more dependent on good acoustics and on the teacher's ability to project.
Since most of the meaning of a word is carried by the "softest" sounds of the word (consonants), English Language Learners are most vulnerable to the loss of useful, interpretable sounds from the teacher.

7.0 Methods

This evaluation research is an exploratory analysis of sites and teachers using the second generation of Lightspeed Flexcat solution for small groups. The sample of sites was chosen to represent the general characteristics of American public schooling: the urban, suburban, and rural sites were nationally distributed. Participation by sites and teachers was voluntary and reflected a shared interest in the outcomes of this new capability. The number of Flexcat units placed in the study schools ranged from two to 20. Our evaluation research plan used web-survey self-reports for 2014-2015 and extensive on-site visits, observations, and interviews with teachers, school building administrators, and district administrators.

8.0 About Interactive, Inc.

Interactive, Inc. is listed on the U.S. Department of Education's Institute of Education Science's *Registry of Outcome Evaluators* and was one of the Department's contractors for a longitudinal, statewide documentation of the effects of technology on student achievement and school improvement. The firm's 200+ past and present R&E sites and clients include eight states, 15 districts, 20 corporations, and international clients.

Dale Mann, Ph.D., is Professor Emeritus at Columbia University (Teachers College and the School for International & Public Affairs) and Managing Director of Interactive, Inc. Since 1985, he has concentrated in developing and evaluating the gains from e-learning, a field in which Dr. Mann has been identified as one of America's ten most influential leaders.

Dr. Mann has been involved with school improvement since the 1960s, when his Washington service included responsibility as Special Analyst for Education in the Executive Office of President Lyndon Johnson and work implementing the Elementary and Secondary Education Act. Dr. Mann is the author of books and articles on school reform including *Policy Decision Making in Education and Making Change Happen?* He is the founding chair of the International Congress for School Effectiveness, an organization with members from 66 countries focused on improving schools for the most-needy children.

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