

Monitor That Progress!

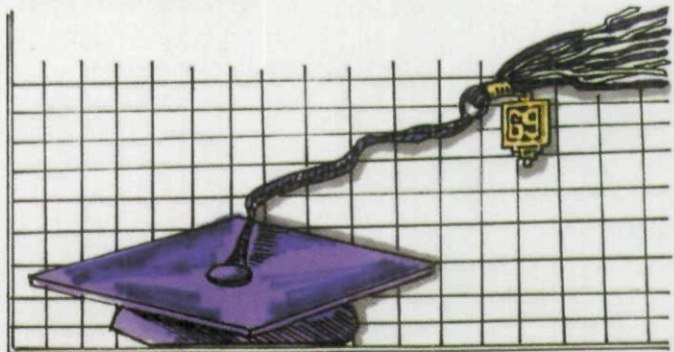
Interpreting Data Trends for Assistive Technology Decision Making

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Although IDEA requires consideration of assistive technology (AT) when developing individualized education programs (IEPs) for all students with disabilities, little guidance has been offered to date regarding the role of data in the AT decision-making process. How can IEP teams use classroom data to help them evaluate the effectiveness of AT solutions—both when considering implementation and assessing the usefulness of continuing AT use?

The mandate of the No Child Left Behind Act of 2001 (NCLB) has placed increasing pressure on public schools to ensure that students with disabilities make progress in the general education curriculum. For the approximately 7 million school-age children with disabilities in the United States, “taking full advantage of their rights to a high quality education requires support to learn in ways that work with their needs” (Silver-Pacuilla, 2005, p. 3). The role of AT in supporting such progress has emerged as an important factor for teachers and policy makers to ensure that all students demonstrate progress. The federal definition of AT is often cited; the Individuals With Disabilities Education Improvement Act of 2004 (IDEA) describes it as “any item, piece of equipment, or product system,

whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities” (20 U.S.C. § 1401(251)). A working definition for teachers in the context of progress monitoring might be “a tool or strategy that allows a person to do a task they could not do without the tool *at the expected performance level*” (Parette, 2006).

IDEA requires that AT devices (20 U.S.C. § 1401(1)) and AT services (20 U.S.C. 1401(2)) be “considered” when developing student IEPs. Although some guidance has been provided regarding the consideration process (cf. Center for Technology in Education & Technology and Media Division, 2005; Chambers, 1997; Edyburn, 2005; Watts, O’Brien, & Wojcik, 2004; Zabala, 1995), teachers have relatively little direction regarding how to use individual student data in this process. Others have described subjective data tools for AT consideration (see box, “Additional Resources”) that reflect sensitivity to the importance of students being self-determined and self-aware AT users. Such uses of AT, however, are beyond the scope of this article, where the

emphasis is on assessment data clearly linked to classroom curricula.

Curriculum-based measurement (CBM; Deno, 1985, 2003) provides a framework for understanding the role of regular classroom assessment in tracking student competency in basic skill areas such as reading, spelling, written language (Deno, 2003) and mathematics (Calhoun & Fuchs, 2003). With CBM, “student performance is assessed frequently on standardized tasks representing year-long curriculum and scores on these reliable and valid tests . . . are displayed graphically” (Stecker & Fuchs, 2000, p. 128). Teachers apply decision-making rules to the graphed data to determine whether instructional program adjustments are needed (Stecker & Fuchs). CBM resources are available both in print (Shinn, 1998; Shinn & Hubbard, 1992) and online (AIMSweb, 2007). Because AT is compensatory rather than instructional, it is not always clearly linked to CBM measures, though CBM does provide a framework for understanding the role of the teacher in collecting classroom data to make decisions about student progress. We also note that the expected performance levels established by CBM (e.g., words per minute when handwriting) may not

be applicable to AT use (e.g., words per minute when using a keyboard or voice recognition system), and thus a "normed" grade-level performance is not available.

The Importance of Data in AT Consideration

Arguably, the question must be asked, "How can an effective AT decision be made without data to support its impact on basic skill acquisition by the student?" There are two important phases in the AT consideration process when data is crucial. The first phase is the period *before* a decision is made to try, acquire, or purchase a particular AT solution (i.e., during the IEP development process). It is well recognized that AT abandonment often results when inappropriate or ineffective AT devices are selected for students with disabilities (Galvin & Donnell, 2002; Phillips & Zhao, 1993). The need to make effective decisions, then, is especially important given most schools' limited fiscal resources for purchasing AT; they have a vested interest in being good stewards of these resources. The IEP team collaboratively performs decision making at this level, essentially completing a problem-solving process (Friend & Cook, 2003) that begins by identifying the problem. This involves more than naming the problem (e.g., the student cannot communicate or has difficulty writing); problem identification requires that the extent of the discrepancy between current and desired performance is identified and confirmed through multiple sources of information (i.e., data; Friend & Cook). Taken together, these issues provide a sound justification for the need for data that supports the team decision to try, acquire, or purchase AT.

The second important phase is *after* implementing the AT solution. Once a team decides to move forward with trying a strategy or acquiring or purchasing a particular tool, it is important to collect ongoing data while the student uses the AT solution. There are two separate questions to answer during the implementation phase:

Additional Resources

Wisconsin Assistive Technology Initiative (<http://www.wati.org>)

The Family Center on Technology and Disability (<http://www.fctd.info>)

Assistive Technology Training Online Project, School of Public Health and Health Professions, University of Buffalo (<http://atto.buffalo.edu>)

- ✓ Does the AT enhance performance?
- ✓ Is the AT needed over time to support continued educational progress?

Data provide trends that either support the immediate effectiveness of AT in enhancing performance and support ongoing use, or signal that the AT should be discontinued and/or reconsidered, either short- or long-term. In all instances, data can assist teachers in making effective decisions regarding whether a particular AT solution makes sense for a student, appears to be effective and enhances the child's performance in an academic area, and continues to support educational progress.

A Classroom Approach for Evidence-Based Practice

Most teachers are familiar with classroom assessment approaches (cf. Howell & Nolet, 2000; Oosterhof, 1999; Popham, 2002), although they may be less familiar with implementing such approaches when students use AT to perform academic tasks. The data collection approach should accommodate several considerations when documenting whether a particular AT strategy or device is effectively helping the student develop competencies in basic skill areas. The student's performance should be documented both using the AT solution and without using the AT solution, thus providing performance lines for comparison to the student's expected performance on an academic task. This approach constitutes what AT outcomes researchers call a *concurrent time series* design (Smith, 2000). "Concurrent," assumes that comparisons are made both with and without the AT. The "time" element implies that a reasonable period of time is allotted for data collection to ascertain whether the AT is effective. The "series" component assumes that multiple assessments occur during the allotted time period to

develop a student performance line (what the student actually does) that is compared to an expected performance line (level of acceptable student performance).

The question of whether AT initially enhances performance is similar to the question of whether a behavioral intervention changes student behavior. When a behavior change is needed, a teacher will implement an intensive set of procedures thought to enhance behavioral performance after establishing a stable baseline of performance. This is followed by one of several design variations whose purpose is to establish whether the intervention is responsible for any behavior change (Barlow & Hersen, 1984; Tawney & Gast, 1984). One method is the withdrawal design (ABAB) in which the intervention is withdrawn for a period of time (often equal to the period of the intervention), then reinstated. For AT users with high-tech solutions this often occurs naturally (albeit unintentionally) when an augmentative and alternative communication (AAC) device or computer malfunctions for several days. Seeking to minimize the time spent without any intervention in place (multiple withdrawal sessions), the alternating treatments design uses rapidly alternating conditions of intervention and no intervention, or alternates two different interventions. During an initial AT intervention, this might mean alternating the text-to-speech screen reader or portable keyboarding device (such as an Alphasmart™ Neo) between available and not available. In this design, the time of day (morning vs. afternoon) or content subject (language arts vs. social studies) must be counterbalanced across days so that the AT is available and not available an equal number of times each morning or for each content subject. Although these assessment designs

Table 1. Issues for IEP Team Consideration

When using . . .	The team should ask . . .
Preassessments and ongoing assessments	<ul style="list-style-type: none"> • Are the assessments measuring the same thing? If not, how do they differ (e.g., fluency vs. comprehension; computation vs. reasoning; narrative vs. expository writing)? • What are the practicalities for implementation of data-gathering? Has a standard procedure been developed and documented? How long does it take? • Who will gather the data? If teachers, aides, and others, is interrater reliability an issue? • If the student skill being assessed using AT is a CBM measure, how is it determined? What resources are available to the teacher? How does the team know that the CBM measures what is intended to be measured? • What is the expected level of performance of the student on the targeted tasks being assessed? Are expected levels available when use of AT changes the response mode?
Data-based decision making	<ul style="list-style-type: none"> • If a concurrent time series design is used, what design features need to be considered to ensure that conditions such as time of day, instructional format, setting, medications, or other factors are not affecting student performance? • How can we assure cost-effective use of teacher and student time? • Are scoring rules available? Are graphs being maintained? Are decisions being made using the graphed data?

would establish the initial effectiveness of an AT in enhancing performance, a number of substantive criticisms weigh against their use.

When the behavior or skill is of clear social or academic significance, the ABAB design—withholding treatment (in this case the AT) for 3 to 5 days to establish a data trend—is not supportable; an alternating treatments design will produce the same evaluation. However, although the alternating treatments design produces a demonstration of effectiveness, it requires that the student be without the AT for as many days or sessions as it is available. Again, for a socially or academically significant skill, is this a cost-effective solution? Neither of these designs addresses the question of whether the AT should be maintained over time, beyond the initial demonstration of effectiveness. If AT is a *compensatory* intervention, then the student needs it over time. If, on the other hand, the student acquires the skill for which the AT was compensating, either through continued direct instruction or as a result of using the AT, then the AT is either no longer needed or it was actually an *instructional* intervention, not compensatory.

Modeled on the multiple baseline probe design (Tawney & Gast, 1984),

the concurrent time series design addresses all of the previous concerns. Using scheduled, concurrent probes of student performance without the AT, it can assess the initial effectiveness of the AT in enhancing the performance while minimizing the effect of AT withdrawal, and it also can assess the long-term effect on student performance in the academic area. As we will discuss, these two separate questions can be addressed through scheduling of the no-AT probes. There are other considerations in using this approach:

- *Similar conditions need to be maintained between AT and no-AT probes.* For example, a writing sample collected during daily journal writing with no AT cannot be compared to a book report collected with AT (different genre); a math sample collected in the general education class without AT cannot be compared to a math sample collected in 1:1 instruction in the resource room with AT (different instructional conditions).
- *The assessments should be cost effective.* Scheduling of probes also requires considering their cost-effectiveness. If a 5- or 10-minute writing sample produces a 50 to 100 word sample, then a 30-minute sample is not needed.

- *Data samples must be scored and graphed immediately* after they have been collected to be useful in decision making.

Collecting Data

During IEP development, where the question is the effectiveness of the AT in enhancing performance, conduct frequent (daily or weekly) assessments to gather the necessary information for decision making. This data is used to determine whether a particular AT solution effects a difference in student performance on a targeted curricular task. Data may be collected by a teacher or an aide, depending on the nature of the data (e.g., spelling performance can easily be assessed by an aide, whereas observational data such as increased communication interactions with others in a group activity might better be assessed by a teacher during a classroom activity).

During AT implementation, where the question is whether to continue the AT, the teacher or aide (again, depending on the complexity of the task and the form of the classroom data) should collect assessment data on at least a monthly basis. At this point, it's appropriate to consider the school district's scheduling of CBM (e.g., concurrently

conduct the AT/no AT probes in conjunction with the district's quarterly assessments). Regularly scheduled data collection ensures that the AT solution continues to positively impact student performance on targeted curricular tasks across time. The key to scheduling is to be cost-effective, assessing often enough to be sensitive to behavior changes and infrequently enough to conserve time and resources. Table 1 presents some considerations for an IEP team when making decisions about assessing and implementing AT solutions.

Interpreting Classroom AT Data Trends

The following sections present case scenarios regarding specific types of AT being considered for students with disabilities, both during the first phase (IEP development) and second phase (implementation). Each graph (see Figures 1 through 8) assumes a concurrent time series design for data collection, and incorporates multiple data points. The straight line in each graph represents an expected level of student performance deemed appropriate for any particular task (e.g., 8 out of 10 correct math problems; 15 out of 20 correct spelling words).

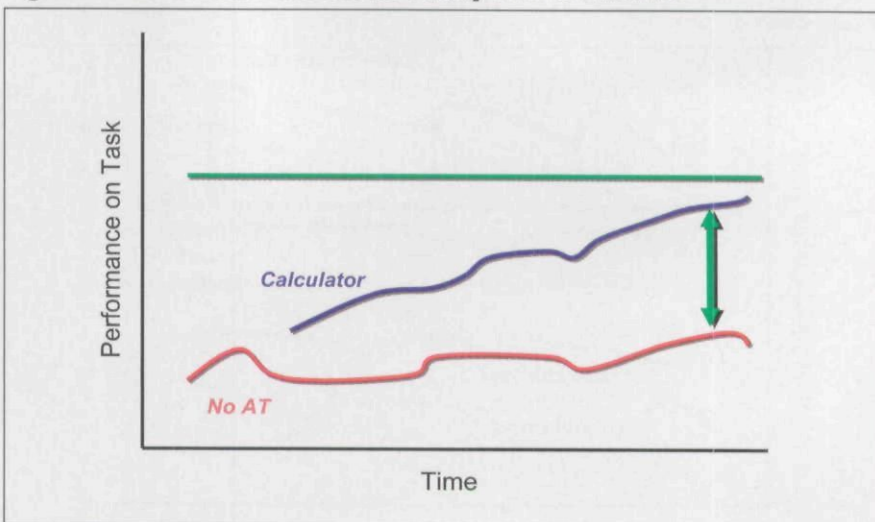
Regularly scheduled data collection ensures that the AT solution continues to positively impact student performance on targeted curricular tasks across time.

Data for Initial IEP Consideration

Is the AT Effective?

Jimmy's IEP team wants to consider purchasing a talking calculator to assist him in completing 2-digit subtraction problems. Jimmy's learning disability inhibits his ability to understand the process of completing these types of problems, and the talking calculator is viewed as a means of potentially compensating for the disability. The class-

Figure 1. Classroom Data Shows Jimmy's AT Is Effective



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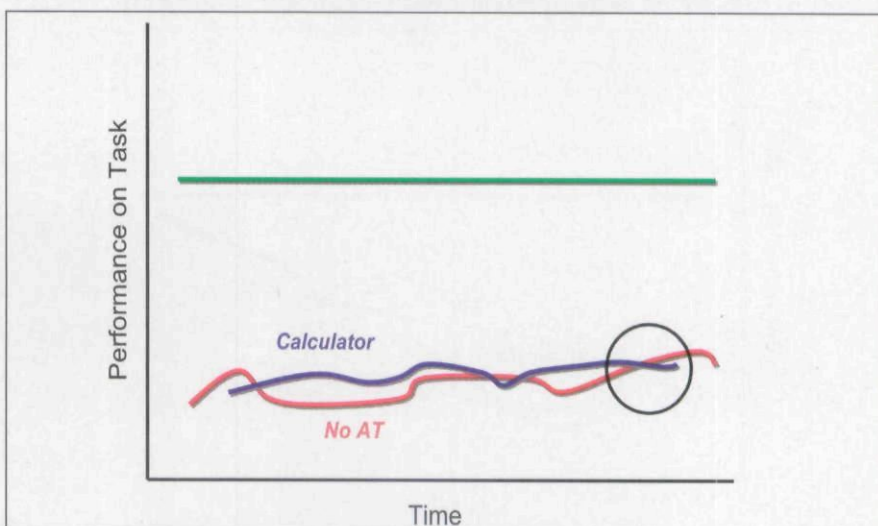
room teacher takes one assessment of his performance in the morning, having Jimmy complete a worksheet of 10 two-digit subtraction problems without using the calculator. In the afternoon, another assessment is taken while allowing Jimmy to use the talking calculator. She continues to take assessments over a 3-week period, using the same format (a worksheet with 10 two-digit subtraction problems). What might the data show?

The AT Is Effective. Over the 3-week period, the data trend of Jimmy's performance using the calculator reflects a positive trend, with a substantial gap

between his performance with and without the calculator (see Figure 1). Based on this data, the team could reasonably assume that the talking calculator had a positive influence on his performance level for this specific academic task.

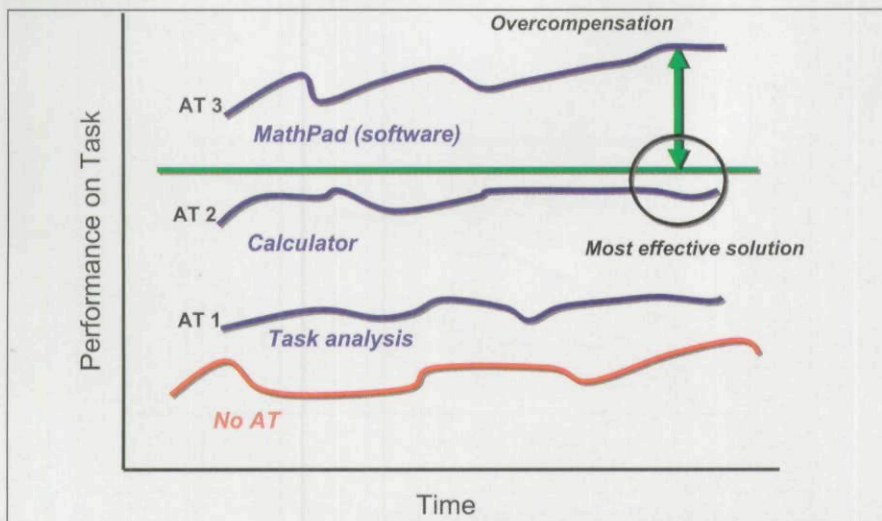
The AT Is Ineffective. Alternatively, over the 3-week period, the trend lines suggest that Jimmy's performance is comparable with and without the talking calculator (Figure 2). Because the AT seems to make no appreciable difference in Jimmy's performance, the team may reasonably assume that the talking calculator is ineffective and should not

Figure 2. Classroom Data Shows Jimmy's AT Is Ineffective



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Figure 3. Classroom Data for Juanita Shows One AT Solution Is Better Than Others



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be considered for purchase and continued implementation. Interestingly, at a later point in the data collection process the two trend lines cross (inside circle) and it appears that Jimmy's ability to perform the academic task may actually be improving. The team might explore why this is occurring—is direct instruction beginning to have an impact, or can some other influence account for the data trend?

One AT Solution Is Better Than Others

Juanita has difficulty with 3-digit division problems having a 2-digit divisor.

Her IEP team has discussed three different options that might increase her academic performance on a 10-problem worksheet. First, the team wanted to examine use of a task-analysis procedure incorporating visual strategies (i.e., pictures associated with components of completing this type of division problem). Second, the team thought that using a large-face calculator might prove effective. Third, the team recommended a trial period of a software application that would require Juanita to use appropriate place value and location of numerals in the division process. The teacher implemented each of these

potential solutions, including no AT use, with worksheet completion daily over a 4-week period. Four very distinct trend lines emerged when the data were charted (see Figure 3).

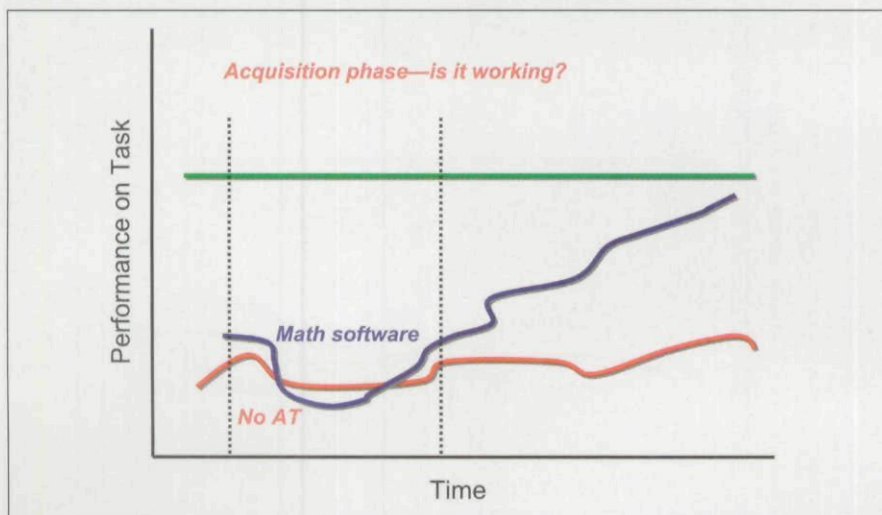
It appears that each of the three AT solutions resulted in higher performance on the division task than no AT. The large-face calculator resulted in performance that was closest to the expectations for students. Interestingly, the software application resulted in performance that exceeded expectations and thus may be overcompensating for the student; it does more than is needed. Overcompensation can be problematic in that children may rely on the technology to such an extent that learning new skills or maintaining those previously learned is not deemed to be important. Thus, in this particular scenario, the most effective solution for Juanita was the calculator, and the team could reasonably move forward with its purchase and implementation in her daily classroom activities.

Acquisition Phase—Is It Working?

Yolanda continues to have difficulty with 3-digit multiplication problems. Her IEP team decided to see if implementing the MathPad™ software program would increase her performance in completing daily worksheet problems. Over a 2-week period the data reflected relatively little difference in performance whether Yolanda used the software or not, although after 2 weeks a positive trend line began to appear in favor of the software (see Figure 4).

The classroom data reflects a real-life phenomenon that all teachers and students confront when working with technology: It takes time to learn how to use a device, and our performance may actually decrease initially during that learning curve! In Yolanda's case there was a slight dip in performance early on when MathPad™ was first implemented, followed by a steady rise until her performance crossed the no-AT trend line. Teachers should be aware that when testing certain AT solutions, they may not be able to make decisions in just a few days or weeks. There is no rule of thumb regarding how long a team should continue implementing an AT

Figure 4. Classroom Data Reflects Yolanda's AT Learning Curve



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solution to ascertain whether it will be effective. The more complex the device and its features, the greater the probability that an acquisition phase will be embedded in a data trend that shows no or little improvement until the child is familiar with its features and comfortable using the device.

Continuing Use of the AT

Once data have provided support necessary to justify purchase, acquisition, and/or implementation of an AT solution (whether it is a strategy or device), it is necessary to ensure that the AT continues to be effective over time. The student's IEP should include statements regarding use of the device, and teachers have an obligation to monitor the student's use of the AT in academic settings to facilitate decision making regarding progress and performance. The following sections present examples of data trends for particular students over the course of an academic year, followed by interpretation discussions.

The AT Continues to Be Effective

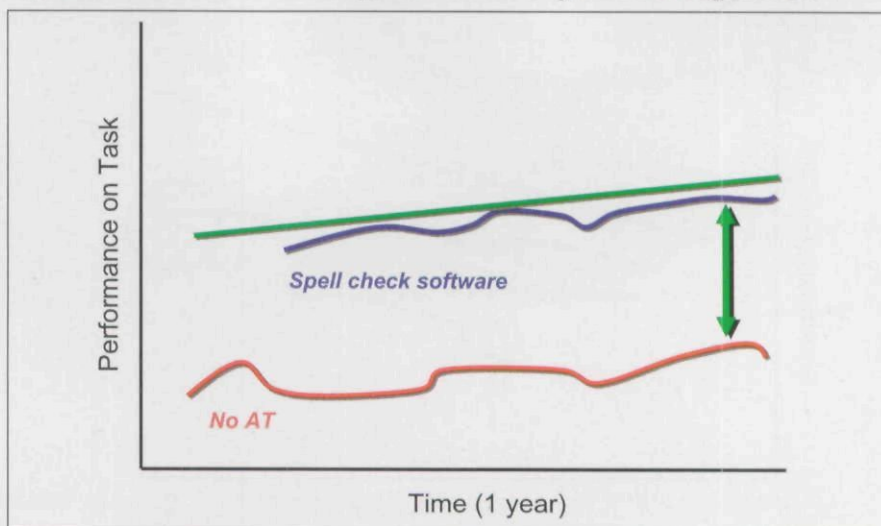
Dargan had problems with spelling accuracy in one-page composition English assignments. The IEP team approved use of spell-check software early in the year, when initial data indicated that it made a difference in expected performance. Over time, the teacher continued to obtain data regarding Dargan's spelling accuracy in one-page composition assignments, both with and without use of the spell-check software.

The data trends indicated a substantial gap between performance both with and without use of the spell check software (see Figure 5). When using the software, Dargan's performance consistently approached what would be expected; thus, the team unequivocally accepted AT as effective, and Dargan's IEP reflected ongoing use of the spell-check software in writing assignments.

Direct Instruction Makes A Difference!

Let's assume that over the course of the academic year, Dargan's teacher administers writing probes on a regular basis, both after direct instruction (no AT) is

Figure 5. Classroom Data Supports Continuing Use of Dargan's AT



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routinely provided and while he uses the spell-check software for targeted writing assignments. The resulting data reflect two interesting trends: Both direct instruction (no AT) and use of the spell-check software enable Dargan to approach an expected level of performance (see Figure 6).

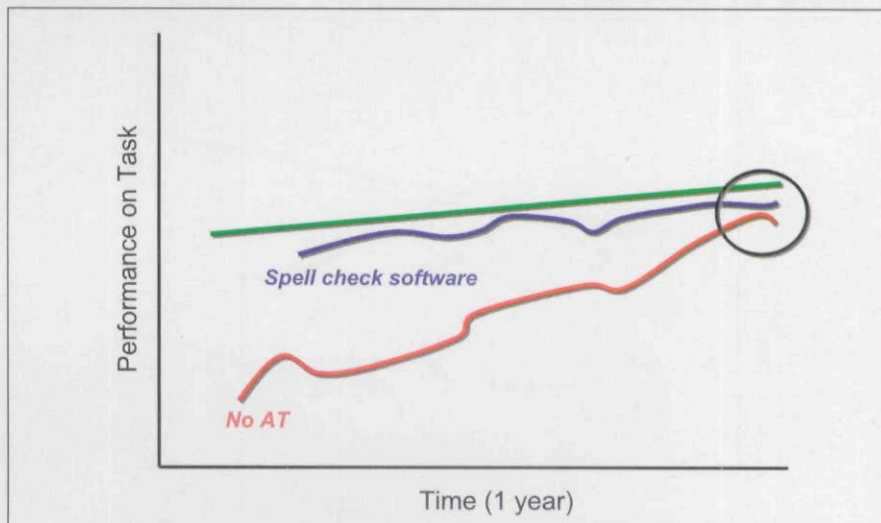
Without maintaining such data, a teacher may not be aware that a student's proficiency in a particular academic skill area is actually increasing over time without reliance on the AT. In Figure 6, the performance line for the no-AT strategy (direct instruction)

almost crosses the performance line for Dargan's use of the spell-check software. When such a trend is reflected, the IEP team may wish to reconsider continuing use of the AT in favor of more traditional classroom teaching strategies.

Reevaluate and Change!

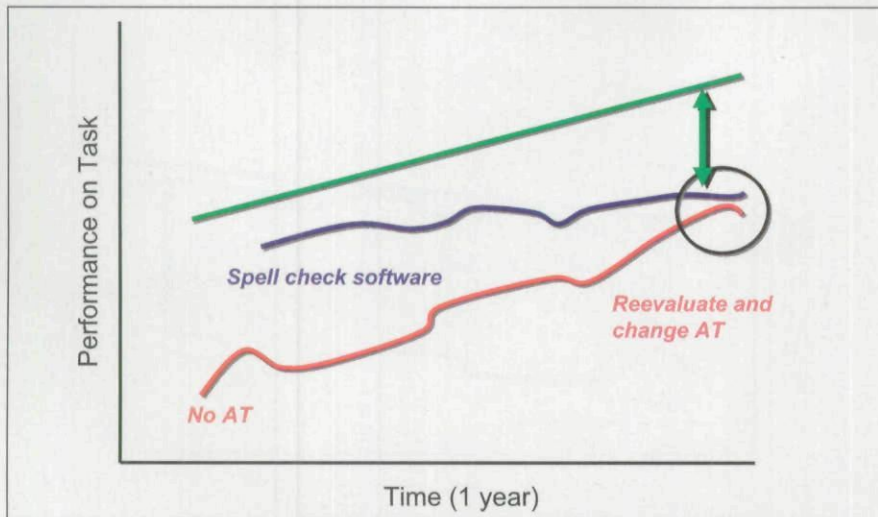
What if, over the course of the academic year, the teacher's classroom data indicate a different kind of trend (see Figure 7)? Initially, the spell-check software indicated a substantial difference in Dargan's performance, but over time

Figure 6. Classroom Data for Dargan Reflects Impact of AT and Direct Instruction



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Figure 7. Classroom Data Indicates Dargan's AT Should Be Reevaluated



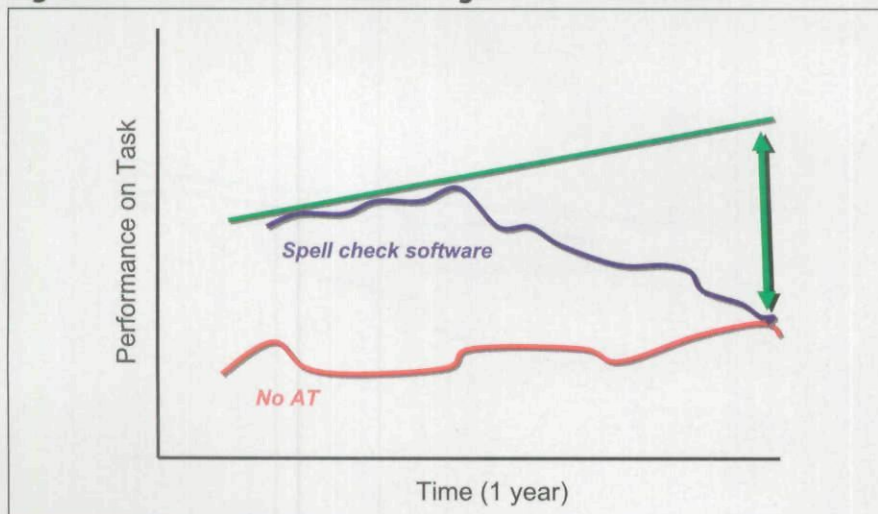
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the trend line stabilized and became somewhat flat. The no-AT strategy (direct instruction) impact continued to increase until they both began to level off in close proximity to one another. In this instance, the team might reconsider use of the spell-check software, as near the end of the data collection period its effect appeared to be comparable to the no-AT strategy. The team might wish to reevaluate Dargan's AT options regarding supporting spelling skills. They might also infer that direct instruction is having a positive effect and may be preferred to using AT.

The AT Is Ineffective

Ideally, after a team invests time and effort into the AT consideration process and makes a decision regarding strategies and devices to be implemented in classroom settings, the student would continue to show progress when using the device. However, in an alternative Dargan scenario the data trends over time indicate a decline in spelling skill proficiency using the spell-check software (see Figure 8). Although his performance trend line continues to exceed the performance line for no AT (direct instruction) until later in the data col-

Figure 8. Classroom Data Shows Dargan's AT Is Ineffective



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lection process, at one point the performance is comparable.

Understanding data trends generated by use of a concurrent time series approach can contribute immensely to more effective AT consideration.

AT strategies or devices are intended to help students do things they could not do without the device, at an expected performance level. Thus, a team could reasonably assume that as long as data indicates that the student's performance level using AT exceeds the performance level without the AT, use of the strategy or device should be maintained. In instances such as those presented in Figure 8, however, the decrease in proficiency reflected by a declining trend line for the spell-check software is an area of concern for the IEP team, and requires close monitoring to establish the cause of the decline. It may be, for example, that new demands to use more difficult vocabulary have had a negative impact on spelling performance, even with assistance.

Final Thoughts

The role of curriculum-based data in educational decision making, particularly with regard to the AT consideration process, has become increasingly important. NCLB and other demands for school accountability require teachers to be more thoughtful about all decisions regarding students with disabilities; progress and success in the general education curriculum has become an integral societal expectation (Behavioral Research and Teaching & American Institutes for Research, 2006). Teachers can increase their effectiveness as participants in IEP meetings by collecting and sharing meaningful data that drives decision making. Understanding data trends generated by use of a concurrent time series approach can contribute immensely to more effective AT consideration.

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