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Test Scores and Learning Styles: Understanding Student Achievement

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Abstract

This two year study explored the academic lives of three boys in a combined fifth-sixth grade classroom. As these case studies illustrate, viewing student's academic worlds from multiple perspectives can lead to more accurate, comprehensive evaluations and efficacious adaptations of students' learning environments. Richard Snow's aptitude theory and Robert Sternberg's learning styles framework provided frameworks for data analysis and interpretation (Snow, Corno, Cronbach, Kupermintz, Lohman, Mandinach, Porteus, Talbert, 2002; Sternberg, 1997).

Test Scores and Learning Styles: Understanding Student Achievement

In the current high stakes test environment, students' test scores in academic domains are a primary concern for educators. The test scores are often noted in quantitative terms, indicating how a student or group of students is doing relative to other students. In this study we considered outcome scores that were derived through quantitative assessment in light of the learning styles of students that were identified through qualitative assessment. We analyzed the attributes of three elementary school students using Richard Snow's Aptitude Theory (Snow et al., 2002) and Robert Sternberg's Learning Styles Framework (1997). In this way, we were able to demonstrate that the standardized assessments were not necessarily reflective of the profiles of the students that were developed through studying them in their classroom environment.

Snow's Aptitude Theory

Richard Snow's conception of aptitude can assist educators in the assessment and remodeling of students' academic worlds (Snow et al., 2002). Snow did not view aptitude as ability or IQ. Snow and colleagues (2002) defined aptitude as the "degree of readiness to learn and to perform well in a particular situation or in a fixed domain.… [Aptitude] should refer to being equipped to work at a particular kind of task or in a particular kind of situation (p.3)." Aptitudes are human attributes that can facilitate or impair goal attainment in the cognitive, conative, and affective domains. Aptitudes are intrinsic to a given situation and cannot be abstracted from it.

To Snow, the most important raw material of education was aptitudes and the most important outcome of education was aptitudes. Snow claimed that "society needs to provide equality of educational opportunity so that all persons have the chance to develop their own aptitudes to the maximum each one desires and can reach. It needs also to provide for optimal

diversity of educational programs, so that all aptitudes useful to individual and society can be developed" (Snow, et. al., p.xxii). To accomplish these goals, Snow urged educational researchers and practitioners to focus on processes instead of traits and outcomes, and to continually review, reconceptualize, and expand aptitude constructs in view of new information and relevant psychological and educational theories. Ongoing review and reconceptualization can enhance our understanding of learner characteristics and help teachers design and modify tasks, instruction, and academic environments in ways that optimize learning, retention, and retrieval of information and skills.

In addition to Richard Snow's aptitude theory, Robert Sternberg's learning styles (Sternberg, 1997) perspective provided a framework for data analysis and interpretation. Sternberg's perspective is much more focused than Snow's theory in that Sternberg's perspective highlights students' academic preferences while Snow's theory incorporates all acknowledged variables that affect student learning and academic success.

Sternberg's Learning Styles

Robert Sternberg (1997) advised educators to view their students in terms of their learning styles. Learning styles refer to the way people use the abilities that they have. Learning styles refer to what a person prefers to do, whereas skill, ability, and achievement refer to what a person can do. The optimal conditions for learning include a good fit between learning styles and learning environments. When a person's learning styles are compatible with their learning environments (i.e., affordances of the tasks, tools, instruction, etc.), the task seems easy and the person is motivated, energized, and productive. When a person is engaged in academic work that does not mesh with their learning styles, the work is arduous and draining (Sternberg, 1997). As illustration, consider an analogy between a personality trait and learning style. When an

introverted person attends a social function he converses with other people; however, the experience requires effort and the person tires quickly. In contrast, an extroverted person finds the social experience enjoyable and energizing. As a second illustration, think of smiling as a learning style and envision two vice presidential candidates. Both are capable of smiling; however, for the first, smiling comes easy and he smiles frequently. For the second, smiling is a real chore and something that he only does when he absolutely has to.

Sometimes a person who is productive may be perceived as high in ability when the better explanation is the good fit between the person's learning styles and their environments. Some people can adapt well to a wide variety of environments even when a given environment does not augment their preferred learning styles. Other people are less flexible (Sternberg, 1995).

Many types of learning styles exist and each person has a profile of learning styles. Three styles that Sternberg refers to as the functions of self government are the legislative, executive, and judicial styles (1997). A person with the legislative style prefers to devise an original approach to a task rather than adopt a prefabricated one. Legislative people like to make the rules, come up with new ideas, and do it their way. They tend to be innovative and creative. Educators tend to view students with legislative styles as nonconformists and rebels. Unlike legislative people, people with executive styles like operating within the confines of externally imposed rules. Rather than coming up with original problems and frameworks, executive people adopt preexisting ones. Executive people evaluate their work by how well they follow directions and play by the rules. Students with executive styles thrive in most academic environments. People with judicial styles like to critically analyze and evaluate ideas, rules, theories, programs, systems, and frameworks. They are not particularly interested in generating rules and ideas or in adopting prefabricated ones. In most schools, students with judicial styles are short changed.

Rather than simply remembering large amounts of information, judicial people want to analyze it (Sternberg, 1995).

The goal of this study was to compare the qualitatively determined learning styles of three sixth-grade boys with their outcomes on a standardized test. The study addressed the following question: What was the relationship between the qualitative assessment of these three sixth-grade boys and their standardized test scores?

Methods

Participants

Participants included three boys who attended a combined fifth-sixth grade classroom in a Basic School (Boyer, 1995) in a small Midwestern city during the 2002-2003 and 2003-2004 school years. These three students were part of a larger study in that included 70 students, of whom 8 participated both years. The three boys were selected as the focus of this investigation because gender differences have been observed in students' writing and learning styles (Persky, Daane, & Jen, 2002). By studying only boys we have reduced the effect of this confounding variable. In addition, vast variations in academic performance were observed among students in this untracked classroom. The three boys in this study earned low, medium, and high test scores, thus maximizing the range of the Iowa Test of Basic Skills (ITBS) scores. In 2003, the boys' ITBS reading scores ranged from 54th to the 93rd percentile, and in 2004 they ranged from the 20th to the 99th percentile.

Procedure

Classroom observations and interviews with students and teacher revolved around expository writing papers that the students wrote each spring in 2003 and 2004. The papers represented their most ambitious attempts at expository writing. In 2003 each student wrote two

papers on rainforest animals. For one paper they used exclusively electronic resources and for the other paper they used exclusively print resources. In 2004 each student wrote one paper on a sea mammal using both electronic and print resources.

The second author conducted three structured interviews with each student at intermediate points during their expository writing projects. She queried students regarding note taking, drafting, and revision of their papers. She also obtained copies of the resources students accessed, their notes, drafts, and final copies of their papers. .The teacher commented on the 2003 and 2004 papers.

In the Spring of 2003 and again in the Winter of 2003 students completed the Thinking About Writing Questionnaire (TAWQ) and an open-ended writing task. On the TAWQ, students listed the steps in the writing process and answered related questions. On the open-ended writing exercise, students identified common features among entities that appear to be very different. Also, in the Winter of 2003, students took long term retention tests on their rainforest animals. The contents of the tests differed for each student; however, a common blueprint was employed to construct the tests. The tests were designed by professors and doctoral students in educational psychology and science education.

The teacher participated in two semi-structured interviews each spring at the conclusion of the writing projects. The teacher also provided the students' ITBS and Developmental Reading Assessment (DRA) scores. The second author observed classroom instruction and activities over a six-week period each spring. The class was observed 13 times in 2003 and 22 times in 2004 and each observation lasted 45-60 minutes. All students in this teacher's classes participated in the writing activities, not just the cohort of 8 students.

A Qualitative View of the Students

Alex

Alex missed a substantial amount of instruction on the writing projects because he attended a class for academically talented students. Nevertheless, he worked well independently and produced quality papers. When discussing the first two papers, the teacher commented, "Alex worked really hard … He's pretty thorough… but he couldn't find a lot." When discussing the third paper, the teacher commented:

> For him, this is wonderful! I think he did a good job writing. He did three [rain forest animals]. He was able to incorporate the three well. You know it's not all disjointed all over the place. So I thought he really did above and beyond. This is better than usual for him. He worked very hard on this and you know he worked a lot with that class [for academically gifted students] and misses my class sometimes from all his math stuff. But he's very independent with this and I thought he did a very good job, good job!

In contrast to his outstanding expository papers, "Mr. Math" as the teacher called him, had no associative links in the 2003 open-ended writing task. His paper was a reiteration of his papers' contents.

Bobby

The teacher was disappointed with Bobby's expository writing projects. On the paper that he wrote in fifth grade, she commented:

> This is a little, little boy, Bobby. Little, little boy and is going to do little, little work. And he's very smart. He likes to draw cartoons. He reads Captain Underpants. And it's about his work. He's got the intellect certainly at this [fifth] grade level but everything else is

> about third or fourth grade. . . He's really hung up with cartoons. Had we let him do this as a cartoon it would probably have been better."

Looking over the paper that Bobby wrote in sixth grade, she declared:

> This is an enigma. I don't know what. Actually, I put him on child study. He's going to junior high school. I think here's about eight, mentally, emotionally eight. I think he could do much better. I mean if you look at the ITBS and you look at his scores on those things he's pretty smart, but he is a little, little boy. So I would say, "No. This isn't very good." Given, I think, there's more out there that he could have found. And he is such a developmentally young kid. This is what he could do. And I don't know. I'm holding my breath on junior high. He will get lost over there. And he also has low self esteem. I mean he'll never give himself a hundred or think he did a really good job. He'll say didn't do a very good job.

Not only were Bobby's papers below par, his recall of the writing process was wanting. Bobby's summaries of the writing process, both 2003 and 2004, were incomplete: He mentioned note-taking but omitted drafting and revision. Most of his classmates provided more complete accounts of the writing process than Bobby.

> According to the teacher, Bobby does not pay attention and follow her instructions.
> He doesn't listen. He's gone somewhere. I don't know where he goes. You know, he's like deep six. And then you'll say and he'll go, "Huh?" And you'll say, "Bobby, where have you been? What cartoon were you drawing in your head?" Because that's what's happening, I think. I can't swear. So he's been kind of an interesting character all along. One day he'll do something and you'll just drop your jaw it's so brilliant. And the next

day it's the worst thing you've ever seen and you think, "What did he learn?" So I can't. He's a hard one to deal with.

His misunderstanding of instructions was evident during his conversations with the researcher. He appeared to be the only one in class who thought that no more than two print resources could be used for the third paper. He was also the only student to misunderstand the researcher regarding an upcoming conversation: He approached her the wrong time with the wrong materials.

As the teacher mentioned earlier, Bobby's class work was very inconsistent and unpredictable. One day he was on the mountain top performing miracles and the next day he was down in an abyss doing something that amounts to virtually nothing. Bobby was on the mountain top when he worked on his LTRT, open-ended writing task, transformation project, and oral presentation.

Of the three boys, Bobby obtained the highest score on the long-term retention test (LTRT) of content from papers in the first year. Also, he was the only one to score a point for the two synthesis questions. Additionally, his response to the 2004 open-ended writing task, in which he compared spider monkeys and Narwal whales revealed impressive retention and organization of implicitly learned information. He produced an extensive list of detailed comparisons between the two animals, a list that would be impressive for any student and is especially impressive for a student who seems to prefer drawing over writing. Bobby continued to generate comparisons between his monkey and whale long after other students quite writing. Bobby was the only student who did not finish his response to the open-ended writing project because the researcher called, "Time!"

In addition to Bobby's ability to remember many details about his animals, the ease with which Bobby generated links is impressive because he severely restricted his options for links. For him, every association was between the spider monkey and the narwhal, whereas most other students placed no restrictions on the kinds of associations they could make. Ironically, instead of generating fewer links than other students Bobby generated more links than other students.

Bobby's unconventional talents resurfaced with his transformation project. After writing the third paper, students had to do a transformation project on their sea mammal. Most students made crossword puzzles or word scrambles. Bobby wrote an adventure story about Narwhal whales and cartooned it.

Bobby's multiple talents re-emerged when he cartooned and then wrote his responses to questions on the District Reading Assessment and when he gave a talk in class on Jerry Spinelli.

> The only person who blew me away was Bobby because he cartooned his! And I tore it up and I said, "This is a test. This goes to the state. This is really serious. You did a terrible job on this! You have to take it again." Cartooned! So I made him do it again. And he did fine. And so that's why I have that kind of discrepancy between what he can do and what he does do. He was the only one I had to do over.
>
> And you know what he did? I'll never forget this. This [is] one of those that stick in your head forever. When we first did Inspiration I did a biography in it. And to culminate the biography I let them make a web of their person. And I taught them how to use the machine. And I said you can put a picture, you can put things. And then I said you are going to give an oral talk from your web. His was so brilliant! He did Jerry Spinelli. And it was like that was his karma. Jerry Spinelli wanted to be a magician when he was a little kid. And it was Bobby! This was Bobby! And it was the most brilliant thing I'd ever

> seen. I'm not kidding! I thought, "Oh, my God! This is unbelievable!" And then the next thing was like something you'd expect from somebody who was seven years old. And so there's this discrepancy in his work that I see in his work every day. You think his trying really hard but you're not sure. I just can't get it. I can't read him. But I'm really worried cause he's so young going to junior high. That's my big fear."

The teacher perceived Bobby's cartooning as an impediment to his academic progress.

> We always have a fight every time over it's not appropriate to cartoon. He is banned from cartoons because he doesn't mind. He doesn't pay attention. Oh, he's a real puzzlement for me! Sure, he's going to be a cartoonist but I said, "You know what? You got to go to college to be it. And you are not going to get there at this rate!" So, there has to be a medium.

Chris

The teacher referred to Chris as one of three "lynchpins" in her 2004 class. Often, Chris was talking or wandering around the room when he should have been working (e.g., "Why are you visiting? You need to be writing your questions." "That's your book group right over yonder there. That's where you need to be." Chris was aware of his problem. As the first and last (fourth) steps in his 2003 summary of the writing process, Chris wrote, "First, you cannot goof around when you are working. … You have to pay attention!" According to the teacher, Chris was a "borderline resource kid" and "probably ADHD." He needed extra help with his assignments. When looking over Chris's first and second papers she commented:

> It's really hard for him to focus. I think it wasn't very good and if I had more time I would have spent it with him. So he just did what he could without some support… He's one I wished I had time to work with, just sit and work with him and keep plugging,

> plugging, plugging. Now next year I'll target him… You'll see a difference just because we do a lot of papers. But I'll make sure on the whales that I'm riding him pretty hard!

Her support paid off. When looking over Chris's third paper she commented:

> This one has improved dramatically! Don't you think? I mean you remember last year we had to pull teeth to get something written. And this was pretty darn good. I didn't do too much with it. He's got the organizational focus.
>
> . . . I was reading his oral history and it was pretty good. He's still minimalist when it comes to descriptive languages but the sequence is there. It's got a story! Oh, boy! We've come along way from there! I'd say this is quite wonderful! And I think he worked hard on it. But you could compare this to last year's and you could see a large change!

Reconciling the Differences

Test Scores

Achievement tests such as the DRA and ITBS can reveal relative strengths and weaknesses in a student, chart growth from one year to the next, and facilitate objective comparisons among students. The tests can assist educators in the identification of academically talented students like Alex, who produce good work consistently, and of academically challenged students like Chris who benefit from individualized attention from the teacher. Unfortunately, achievement tests may provide little useful information about students like Bobby whose academic performance is highly erratic. For Bobby, the ITBS scores may serve as a snapshot rather than a comprehensive formative evaluation of his academic skills. Bobby's ITBS scores show that he is capable of doing average fifth/sixth grade work, even though he frequently

turns in substandard class work. Also, the ITBS was not designed to identify students like Bobby who appear to have exceptional talent and interest in the spatial domain.

When researchers and test developers study and assess large numbers of students (i.e., 1000 to 20,000) they observe correlations among achievement test scores and multiple indicators of classroom learning (Linn & Miller, 2005; Thorndike, 2005); however, when researchers explore the relationships among achievement test scores and other indicators of classroom learning for less than 10 students, the relationships among achievement test scores and grades on class work are less salient (Linn & Miller, 2005; Thorndike, 2005). The results of this study illustrate this point. In this study Alex's high ITBS scores and admirable/impressive school work were practically mirror images of each other (see Table 1 for ITBS and DRA scores). Chris's ITBS scores and school work were somewhat related in that his ITBS scores suggested that school work was challenging for him; however, his reading comprehension may not be a bad as his ITBS scores suggested. In contrast to his low scores on the ITBS reading comp., Chris obtained a high score in reading comprehension on the DRA, he and Alex receiving the same score on the DRA. Chris's reading comprehension score on the ITBS fell from the 54th percentile in 2003 to the 20thpercentile in 2004; however, the teacher does not view him as loosing ground and falling further and further behind. She views him as a 'borderline resource kid' who requires help but does not need to be identified as learning disabled. The teacher never recommended Chris for Child Study. Instead, she was most concerned about the academic progress of the student with average to above average ITBS scores, Bobby.

Table 1

Iowa Test of Basic Skills and Developmental Reading Assessment Scores for Alex, Bobby, and Chris during grade 5 and grade 6

Measure	Grade	Alex	Bobby	Chris
ITBS 2003 Vocabulary [a]	5	97	75	59
ITBS 2003 Reading Comprehension [a]	5	93	72	54
ITBS 2004 Reading Comprehension [a]	6	99	53	20
ITBS 2004 Reference Materials [a]	6	99[e]	70	41
DRA 2004 Oral Reading [b]	6	16	13	10
DRA 2004 Reading Comprehension [c]	6	20	17	20

[a] Iowa Percentile Rank

[b] Maximum score on DRA oral reading is 16.

[c] Maximum score on DRA reading comprehension is 25

The teacher commented on the District Mandated Reading Assessment (DRA) that was implemented in response to the No Child Left Behind Act.

> I won't even tell you. I'm embarrassed to tell you how many hours we gave up. I had twenty-six to do and they took me forty minutes a piece. Well, it went on for three weeks. And we spent two hours every day for three weeks getting through these.
>
> I like it [DRA] better than ITBS as another measure because this is like what we teach. Cause they write a journal. So this is indeed what they do all year. So if they can do this you say, 'Yeah! They learned it!' So it's not bad. And it is another measure, but it takes an enormous amount of time! And I'm not sure what

> I know from it because I already kind of had an idea that's how they were gonna do.

The teacher mentioned that educators in her district would be comparing the DRA scores with the ITBS scores this summer. Given her extensive knowledge of students as individuals, she expressed the following opinion regarding the tests.

> So I thought, I don't even know if there's a correlation. This summer I'm supposed to be in a group that we look at these [DRAs] and we look at ITBS and see if there's a correlation. And also what we're going to do with the data. I'm sorry! I'm sick of it! What do you need? You know, I don't know how you take kids and you, how do you take a child with this whole testing thing? On any given day I can take a genius and not. On Monday they're a genius and Tuesday they're not. And I don't know why we're thinking that we're going to change!

Learning Styles

Schools and teachers, even student-centered teachers such as the one in this study, may favor students with executive learning styles over students with legislative learning styles. In theory, all learning styles are equally valid; however, in American classrooms there is clearly a pecking order. The affordances go to the students with the executive learning styles.

A key feature of the learning styles perspective is that no one style is better than another style. The executive style is not better than the legislative and judicial styles; however the structure of American classrooms, whether traditional or learner-centered, as was this classroom, facilitates learning in students with executive styles. Also, achievement tests such as the DRA and ITBS showcase students who thrive in American classrooms, students with executive learning styles (Sternberg, 1995).

In terms of learning styles, Alex may be strong in the executive style and relatively weak in the legislative style. Bobby may be strong in the legislative style and weak in the executive style. Given our data, none of Sternberg's learner styles seemed to capture Chris's abilities. However, his primary limitations appear to be skill and attention deficits rather than mismatches between learning styles and academic environments.

As students transition from elementary school to junior and senior high, the learning environments become more and more biased toward students with executive learning styles. Thus, as the teacher noted, Alex, with an executive learning style, has a bright academic future while Bobby's academic future is tenuous/precarious. Chris will probably struggle in school but not because of an incompatible learning style, because of skill and attention issues.

In most American classrooms and on traditional tests, the weaknesses of a student with an executive learning style are often overlooked while the weaknesses of a student with a legislative learning style are salient (Sternberg, 1995). Alex, with his executive style, high ITBS scores, and impressive class work seems to have no weaknesses. On all the typical academic tests and tasks Alex does great work and it is easy for one to assume that Alex is good at everything. Yet, on the open-ended writing assessment, Alex did not generate a single ideational link in 2003, although noting some in 2004. Alex may have trouble making ideational connections among seemingly distinct domains. In other words, Alex may be much better at convergent analytical thinking than at divergent thinking. A task that was easy for Bobby and Chris was a challenge for Alex. Normally a student's weakness in divergent thinking would not surface because this creative writing measure is rarely administered in schools. Although the teacher was unaware of Alex's latent weakness in divergent thinking, the teacher was painfully aware of the weaknesses of the student with the legislative style: Bobby does not listen and

follow rules, he is socially and emotionally immature, and he turns in a lot of poorly done academic work.

Both Alex and Bobby have salient talents; however, educators are biased toward the former's talents. Achievement tests and most classroom assignments showcase Alex's strengths in the academic realm and ignore Bobby's strengths in the spatial realm. Alex's talent is nurtured (i.e., He attends a class for gifted students.) and Bobby's talent is suppressed (i.e., He is banned from drawing at school).

Although students with executive learning styles such as Alex usually do well in school, all students' learning suffers when American schools are biased toward any one particular learning style. Ideally, schools should cater to all learning styles but not all the time. Students can experience the ease by which learning comes when their individual learning styles coincide with the affordances of their learning environments, and experience the challenge of learning in the face of a mismatch between individual styles and affordances of learning environments. In this way students may learn how to adapt to a variety of environments.

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