

Updating the Intelligence and Ability Testing Platform: Improved Prediction and Reflection of Learning Through Computer-based Testing Using Examinees' Learning Styles

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Abstract

The problem of putting multiple intelligences and varied learning styles into testing is profound. Intelligence and ability testing are predominately lexical and mathematical. To exclude other intelligences from testing is both unbalanced and unfair. Testing has retained a bias against other cognitions of many contributors to society. This may have once been an acceptable bias as classrooms were limited to the three Rs. This is no longer true. Classrooms increasingly embrace students' unique and varied ways of learning. Testing has lacked an effective mechanism to allow for testing in the multivariate manner required of accurate representation of capability before learning and ability after. Now, though, computers offer the range of hardware, software and connectivity to make testing legitimately multiple intelligences friendly. So, test results become more valid representations of examinees' potential to learn and expression of prior learning. This article details how.

1. Description of Problem

The beginning and conclusion of education is in testing. Intelligence tests are used up front to foresee the potential for examinees' success in a learning environment, be it a school or workplace. At the end, ability testing is meant to foresee examinees' capacity to exhibit or express previously learned skills and behaviours. But, testing mechanisms themselves are out of date. The schism between testing mechanism and practiced pedagogy undermines the validity of education's tested results. Bad results suggest that the tests themselves are faulty.

Where learning theory and practice have evolved, testing remains relatively fixed. This is particularly true for intelligence tests of learners' potential classroom success. With pedagogies having evolved to incorporate students' learning styles and the variety of intelligences they innately exhibit, the inaccuracy of test results can only and increasingly be at variance with learners' real potentials and abilities. A new test mechanism is needed to realign education's pedagogies and tests.

2. Background

Again, testing brackets learning with intelligence tests before and ability tests after. Accurate prediction of successful learning or use of the learned skills is the mantle of a test's reliability¹. It must reliably predict future performance or the test is valueless. But, the mechanism by which these tests are principally provided, through recognition and expression of written text-mathematical and lexical-are obsolescent. Testing is out of step with current research on and classroom practice in multiple intelligences and learning styles². Therefore, testing must be brought up to date or become increasingly irrelevant.

Multiple Intelligences identify discrete capacities wherefrom people excel. Lexical and mathematical are merely two among many possibilities. The actual number of discrete intelligences remains a topic of debate, but where more than a single intelligence presents itself in a person, they overlap and influence one another³. Learning styles reflect multiple intelligences. The make-up of a person's intelligences and the range of ways that are learned and practiced in employing them sets the terms by

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which that person learns any and all acquired skills⁴. Meta-cognition, ubiquitous in education today, presupposes exactly this learned and practiced character of multiple intelligences as related to learning style.

Instructional design has increasingly acknowledged the role of multiple intelligences and diverse learning styles within the classroom. Testing, though, has remained largely an either-or proposition whereby test questions exhibit almost exclusively single-intelligence formatting⁵. To do otherwise has been time consuming and required pluralistic skills in intelligences and learning styles on the part of test writers. Indeed, until notions of multiple intelligences and varied learning styles came to light there was no reason to consider altering the test paradigm to reflect them. But, now multiple intelligences and varied learning styles are expressing themselves in classroom instruction⁶. Students are increasingly encouraged to learn by whatever learning means they have at their disposal. This, too then, is the most fair and balanced way to address and assess their learning-potential and actual. It is also a generally recognized maxim in education that testing form and function that mirrors learning environment forms and functions produces the most accurately predictive and expressive results⁷. Given this, the present reliance of testing formats on lexical and mathematical intelligences and learning styles alone amounts to educational malpractice conducted on an industry-wide scale.

3. Alternative

Education industry-wide malpractice is a strong claim. To be a fair claim, there must be a feasible alternative available capable of rectifying the disparity between instructional design and testing practice and this alternative must be being ignored. Such a rectifying mechanism is presently commonplace and most of the pieces are readily available. The basic answer to employing multiple intelligences and varied learning styles in a manner synonymous with instructional design is to employ computers in the testing task. Today's computers are an interactive technology⁸. They offer many varied routes to access, analyse and express

information⁹. They are, thus, highly credible platforms for providing multiple intelligence formats for answering identical test questions.

Employing computers with software that presents multivariate routes to solve tests allows the most consistent testing methodology in the face of a diverse examinee population. Test questions for weighting and for skills, with the former weighting the latter, results in a most accurate reproduction of examinees' present potential to learn or express what has been learned. In this manner, multiple intelligences and varied learning styles cease to be factors for variation for results. So, using computers appropriately in this testing context is a key ingredient in improving prediction of examinees' ability and determining the optimal environment of learning.

4. Testing Multiple Intelligences and Diverse Learning Styles

By way of explanation, the relationship between multiple intelligences and learning styles is direct. The two are manifestations of the same root concept. Multiple intelligences denote intelligence as a repertoire of discrete thinking skills, each of which is varyingly pronounced among individuals¹⁰. Learning styles denotes the employment of those discrete thinking skills in learning¹¹. Multiple Intelligences "are" and Learning Styles "do."

Multiple Intelligences theory grew from the assertions of a Dr. Howard Gardner upon publication of his book "Frames of Mind" in 1983. The theory therein stated that the I.Q. test fixed the nature of intelligence too narrowly upon skill in math and language¹². Indeed, from near its inception by Binet for Parisienne education authorities before WWI, the IQ test was entirely meant to aid in separating special needs students from normal students¹³. Classifying their ability for classroom studies emphasized the three "R"s of reading, writing, and arithmetic as prevailed in classrooms at that time. This undervalued the abilities that contribute to achievement in non-academic professions such as:

- Music and the Arts
- Dance and Sport

- Architecture and Design
- Naturalists and Discoverers
- Therapists, Nurturers and Entrepreneurs.

Indeed, to the extent that those non-academic professions were represented in school, even they were institutionalised as 3R studies.

Gardner suggested that success in these and other non-academic professions did not adequately correlate with success in classroom studies of those subjects. A dancer is not proven expert on a written test. Thus, he outlined a broader range of intelligences intended to be more exhaustive than the IQ test and better illustrate from where the intelligence that makes for performing excellence is derived¹⁴. These intelligences include:

- Linguistics: skill with words
- Logic-Mathematics: skill manipulating sums
- Natural: skill operating from experience
- Kinaesthetic: skill in manipulating the body
- Spatiality: skill assessing images
- Musical: skill with song and sound
- Meta-cognitive: aware of internal mental-emotional processes
- Interpersonal: aware of social environment and processes

As a result of his Multiple Intelligences theory, various Learning Styles theories arose as Gardner and others such as Kolb¹⁵ and Briggs & Myers-Briggs¹⁶ applied the theory directly or integrated it into their standing theories. An increasingly sophisticated and contradictory topography of intelligence and ability testing has been the result. Nonetheless, the practice of testing and teaching in an environment accountable to tests has been made richer by increased value being given to other intelligences and abilities.

Though intelligence and ability tests for reputable organizations, such as government, schools and large businesses, suffer from fewer statistical compromises and so tend to show less variability in results, rival tests do offer notable variation¹⁷. This unpredictability is due to many factors, some of which are outside of the capacity of any test to accommodate, such as how much sleep the examinee received before the test, but most of which are accounted for by the statistical probabilities¹⁸ of “accurate to within X%, Y times out

of Z.” Unfortunately, those statistical probabilities of normal range also vary across tests based simply upon different questions asked and the way that questions are conveyed¹⁹. Statistical anomalies expand the range in unpredictable ways but often geometrically as successively layered anomalies compound the affects. Scepticism about IQ results seems well founded.

From Gardner's first criticism of the IQ testing targets as too narrow, the point was that other forms of intelligence are valuable and, yet, not directly represented in the results of tests of scholastic aptitude²⁰. This did not halt the concept of multiple intelligences from trickling down into educational paradigms. Teachers' pedagogies and teacher education are being modified to support a widening variety of other intelligences in the learning environment to build greater student success²¹. And, the IQ test system should have accommodated this change according to “test as you teach” expectations. This has not been the case²². Tests of scholastic aptitude have accommodated sex, race and culture differences²³ to some degree, but have not freed themselves from reliance upon language and mathematical/spatial augers of ability²⁴. This constraint of the IQ test remains firmly intact and penalizes students even more heavily now that their learning environments allow students to more readily learn in their own learning style. The grand effect is to ever more fully concentrate the power afforded by test-success in a narrower polis²⁵.

Overcoming this deficit is not easy. Indeed, in past, it could be argued that making testing to include all learning styles and intelligences would not only be unfeasible, but impossible. Today, though, with the ready availability of personal computing, an excellent platform has become available. And, thus, now, multiple intelligences/learning style theory and testing practice have a medium for synergy. To see the possibilities inherent in adopting computers for the classroom and testing, consider the following appraisal:

- Computers and the Internet represent real possibilities of enhancing teaching and learning through dynamic, interactive and engaging content. Unlike radio or television,

through the use of computers, the learner can interact with the learning materials and with the instructor.

Another important element for the proliferation of personal computers as effective tools of educational technology is the fact that personal computers can have real application in offering individualized instruction. An instructor in a class of many students can, through the use of a personal computer and software give individual students an opportunity to work on problem areas or work on new content by themselves in an a way that supports individual learning style or learning pace²⁶.

Computers with hardware and software to support the various intelligences and learning styles:

- Interpersonal (social communicative via headsets & blog/e-mail/web functions)
- Meta-cognitive (introspective via access to own prior files & links)
- Musical (rhythm & interrelationships via shared media functions)
- Spatial (imagery via screen & icons)
- Kinaesthetic (touch & move via mouse & interlaced hyperlinks)
- Natural (experience via personal & public multi-media resources online)

As well as the standard Linguistic and Mathematical formats opens testing to all its varied learning styles and intelligences.

So, computers, with the microphone, headset, mouse and all of hyperlink, internet, e-mail and touch-and-click ready operations that are ubiquitous today, redefine the fabric of the education environment and, so too, the testing environment.

The question of feasibility remains, but, in all first-world countries, sufficient numbers of computers with sufficient hardware and power are available to handle the fairly simple requirements of multiple intelligences and varied learning style testing needs²⁷. At this point, the bigger issue is whether the education industry, and particularly the state-controlled education industry, can catch up with the advanced technology to get multiple intelligences/learning style friendly testing

software developed and used in schools.

Presently, revision of testing software to provide for effective multiple intelligences testing is the weakest link regarding implementation. That is unlikely to change until greater demand accrues from educational institutions eager to enhance students' scoring. "Grade inflation" would result since mathematically- and lexically minded examinees would do as well but others scores would go up. This is a structural limit that resists adopting a broader range of intelligences into testing as examinees can be expected do better in their preferred learning style. Thus, the results of testing in multiple intelligences would be higher scores. Of course, higher scores, if also more accurate, is the objective of revising testing. National or regional state-sanctioned educational systems must implement in an all-or-nothing manner for test results to remain legitimately "apples-to-apples" consistent.

As for the technology, though, software is already available for modification to fit a multiple intelligences testing paradigm. The nearest approximation of multiple intelligences and varied learning styles software, curiously, comes from the gaming industry²⁸. Many online games are presently available. Even sophisticated off-line games use multi-sensory output and feedback to broaden the market base and so profitability of games. Owing to the profit motive, game developers are, counter-intuitively, more motivated to adopt a multiple intelligences/varied learning styles approach than is an education industry beholden to institutional factors. Nevertheless, some such games are already dedicated teaching tools for students to interactively develop targeted skill sets. Still others use the internet as a medium for multiplayer games. The fundamental software supporting critical thinking in an all-inclusive environment is already on hand. Seven major distributors²⁹ include:

- [Academic-Distributing](#)
- [Crimson Multimedia Distribution](#)
- [Douglas Stewart](#)
- [The Knowledge Tree](#)
- [LibraryVideo.com](#)
- [NAS Software](#)

- **Tangent Scientific Supply**

To get larger producers more involved requires adequate incentives to develop those same constituencies into readily adaptable platforms for testing. To be broadly useful, those testing platforms need to be available to and able to be manipulated by classroom teachers themselves. Larger producers serve their shareholders, so to get them involved requires incentives that are financial or legal, and significant.

Adopting a multiple intelligences/learning style component to testing adds a mechanism for balancing testing results against real potential and against the limitations of being taught in a learning style environment that does not fit with the examinee's preferences and predilections. By using a multiple intelligences component to the test to set a verifiable and individualized weighting system for the remainder of the test, examinees' inherent ability and optimal learning potential can be simulated³⁰. This not only allows educators to modify the results of ability tests arising from material taught in class, but also to alter the learning environment in the future to meet examinees' learning styles requirements in a professional way. Furthermore, multiple intelligence testing is a meta-learning medium for the student to better understand how one's learning and test-taking skills might be changed to result in higher scores³¹. That is, better learning for better results.

Better learning for better results brings the discussion back to meta-cognition. Evaluation of learning style preferences is a valuable end in itself. It aids learners to be more self-aware of his or her innate learning skill sets³². It also aids professional instructors in aligning their classroom pedagogy to support students' learning in the best way that they have available to them³³. Meta-cognitive testing has one more sizeable benefit in education. Through meta-cognitive learning styles and multiple intelligences testing, the differential between students' achieved and potential learning can be determined³⁴. That is to say that it becomes possible to test what a student's success would have been if that student had been taught in his or her own learning style schemata. This makes it possible to eliminate the effects of the teacher's

quality, vis-a-vis deficiencies in a teacher's multiple intelligences teaching style, from students' assessments.

In every way, assessment using computers with interactive hardware and appropriately multiple intelligence dedicated software for testing provides assessment with results that take account of learning styles attributes of the examinee and learning styles deficiencies of the learning environment.

5. Assessment

So, as noted above, intelligence and ability test results vary across rival tests. These differing results do not accurately reflect examinees' intelligence or ability targeted by the test itself, but differing capacities relevant to each examinee's multiple intelligences preferences. This deficiency in the testing medium is easily overcome by employing a testing medium that utilizes the broadest range of intelligences' performance environments. The least cumbersome mechanism for providing a comprehensive access to the various multiple intelligence platforms is through computers employing interactive software, multiple intelligence dedicated test material, and free access across the multiple intelligence testing media so that the examinee's will (choices) adjusts the test to that examinee's ability. The assumption need not be that the examinee will automatically self-select the medium in which the optimal test result is most easily achieved, but the addition of a further layer of testing which limits the examinee's options to an exclusive number of analysis and performance media should provide both an additional mode of assessment that may be used to further show the examinee and examiner where the examinee's actual abilities lie and that said actualities can be entered into the intelligence and ability testing as weights to better describe the examinee's real potential for performance in the intelligence and ability targets of the test. The result is a radical improvement in the quality of latent and practiced ability testing and also the potential for examinees' learning capability in each of the multiple intelligence learning environments tested. Using computers appropriately in this

testing is a key to improved prediction of examinees' ability and environment of learning.

Endnotes

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