Optimal Gifted and Talented Student Identification: Maximizing Efficacy, Efficiency, and Equity

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(a) Quality of the Project Design

The goal of this project is to facilitate the final development, implementation, and dissemination of Optimal Identification, a system of gifted and talented student identification that is effective (high sensitivity), efficient in its low cost and assessment requirements, and equitable in the effect it can have on mitigating historic underrepresentation of minority and low-income students. It will establish a knowledge base in the scientific literature and bring state-of-the-art identification methods to K-12 practitioners in a way that is understandable, sets a low barrier to implementation, conserves precious resources, and results in the best possible outcomes for all students. Further, the project will address the alignment between the identification process and service delivery. Identification of talent is the first step in developing it. After talents are discovered, these talents need to be nurtured through targeted services and opportunities for developing expertise at a level commensurate with a student's ability and in an area of documented performance and strength (Subotnik, Olszewski-Kubilous, & Worrell, 2011; Erwin & Worrell, 2011). Therefore, our proposal is aligned with *Competitive Preference Priority 1* (Identification of, and Provision of Services to, Gifted and Talented Students), *Competitive Priority 3* (Promoting Effective Instruction in Classrooms and Schools) and incorporates all the *Application Requirements* outlined in the Javits Program request for proposals.

In addition to providing universal access to this improved and evidence-supported method of gifted identification, this project also addresses a deficiency in knowledge of psychometrics and measurement among practitioners in the field via the creation of an extensive suite of free, modular training materials, equipping educators with the necessary technical understanding to make informed decisions regarding identification policies and procedures. This content would support more than just gifted and talented student identification. It will also help educators improve their own classroom assessments, implement informed assessment criteria for students in need of special education, and use that information to provide differentiated, targeted learning opportunities to students. These materials could also be used in gifted education endorsement courses, in professional development, or in microcredential courses. These goals are well-aligned because Optimal Identification naturally follows psychometric principles. A solid understanding of these core measurement principles will enable districts to effectively tailor Optimal Identification to suit their local conditions, constraints, and policies.

Optimal Identification represents a fusion of several recent strands of work on student identification, including the Principal Investigator's development of a mathematical framework and software tools for modeling and calculating identification system performance, the co-PI's work on alternative norm or comparison groups, including local norms and building norms, and the other co-PI's work on identification-to-service alignment as well as low income, minority, and rural gifted students. Taken together, these approaches illustrate how it is possible to fundamentally improve the gifted identification process, dramatically improving sensitivity, reducing disproportionality across race and income categories, and minimizing assessment cost, while simultaneously improving alignment between identification and services. We refer to this concept as "Optimal Identification" because it can be shown mathematically that no other two-stage identification process achieves higher performance or cost efficiency. By objective metrics, it has the highest possible psychometric performance (in terms of sensitivity) and the lowest cost-per-performance of any possible identification process. It is also simple to understand and easy to implement in schools, especially those that are already using multiple-criteria identification.

Project Design Overview

The overall goal of this project is facilitate the implementation of Optimal Identification. To accomplish this goal, we seek to 1) drastically improve the knowledge base regarding best practices in gifted and talented student identification (including matching identification to service) among researchers and K-12 practitioners; 2) disseminate that knowledge to partner school districts in a diverse group of states in an easily-understandable yet rigorous fashion; and 3) to scale up technical support and training regarding Optimal Identification, thereby resulting in the increased identification rates of qualifying students, especially those from traditionally underrepresented student groups. In direct alignment with *Competitive Preference Priority 1* and all of the *Application Requirements*, this project proposes to develop new methods and new materials to aid in high-quality procedures for gifted and talented student identification and to do so with proactive attention towards students who are commonly overlooked by traditional methods. We will develop free and open training and support materials supporting best practices in student identification (*selection criteria A5*). In Years 2 and 3, Optimal Identification will be implemented in partner school districts with intense support from the research team. Evaluation data will be collected, and feedback from participating school personnel will allow us to revise our materials such that they are maximally understandable and useful to practitioners. In alignment with *Competitive Priority 3,* the increased identification rate and more-favorable demographic representation of students that will result from the implementation will allow more qualified students to access gifted education services. At the conclusion of this project, gifted education professionals across the country (and world) will have access to a well-developed, tested, comprehensive, and modular suite of training products, supported by underlying scientific publications and software to make it easy for identification best practices to be adopted at scale.

The training materials will be created in a variety of formats, modalities, and levels of technical rigor to fill the needs of different types of stakeholders. We will create a Massively Online Course (MOOC), a comprehensive website, scientific and practitioner-focused articles, software with accompanying web apps, videos, handouts, assessments, and other supporting materials that can readily be incorporated into any training program in gifted education (*selection criteria D regarding equal access*). The goal is to bring the state-of-the-art of gifted and talented students identification methods to K-12 administrators and practitioners in a way that sets a low barrier to implementation while also ensuring optimal identification outcomes for all student subgroups. In other words, the initial stages of this project focus on *making it possible* (Years 1-3), the middle stages on *making it easy* (Years 3 and 4), and the final stage on *making it available* via wide dissemination (Year 5).

With proper implementation, Optimal Identification is expected to dramatically increase the proportion of students who are identified for gifted services without any alteration to the identification cutoffs. When combined with local norms, it is expected to dramatically reduce demographic underrepresentation of students from disadvantaged backgrounds by at least 50% and may in some cases result in complete parity[1] across groups. Furthermore, once students are identified, Optimal Identification measures allow educators to thoughtfully plan services with an eye toward cultivating student strengths and talents instead of promoting a one-size fits all approach to service delivery and talent development.

(1) Goals, Objectives and Outcomes, Clearly Specified and Measurable

Goal 1: To develop and disseminate new information to assist schools in the most effective and efficient methods and techniques for identifying of students for gifted and talented

[1] The disproportionality-reducing impact of local norms depends on the degree of school segregation that exists. Ironically, local norms have the greatest impact when segregation is high. See Peters et al. (2019) for details.

services, particularly those from traditionally underrepresented populations (i.e. children who attend high-poverty schools, students with disabilities or students who are classified as English language learners), matching services and identification methods. This is in direct response to *application requirement 4a* and aligned to *Competitive Preference Priority 1*. ***Objective 1:*** Complete the theoretical development of Optimal Identification and publish a series of articles in scientific and practitioner publications outlining the method and its mathematical basis, supported by the development and dissemination of accompanying software tools. (Year 1). Outcome 1: multiple peer-reviewed publications (see list below). Submission of the associated software (giftedCalcs R package) to the Comprehensive R Archive Network (CRAN) for dissemination and archival. Creation of web interfaces to the software (Shiny apps) for ease of use[2]. Drafts of the manuscripts related to the background and design of Optimal Identification will be completed and submitted for publication by end of Year 1.

Working titles for the scientific articles to be generated in Goal 1 are as follows. Note that we have already completed significant work towards these papers. This is why full-length drafts should be reasonable by the end of Year 1.

- *The Identification Curve: A Method for Evaluating the Performance of Selective Program Identification Systems*
- *A Psychometrically Optimal Strategy for Identifying Students for Gifted Programs*
- *A Method for Inferring the Sensitivity of Gifted Identification Systems from the Distribution of Scores Among Identified Students*
- *An Analysis of Multiple Criteria Nomination Procedures*
- *Optimal Gifted Identification with Local Normative Comparisons*

[2] For an example of such an app, see https://mmcbee.shinyapps.io/gifted_identification_explorer/

Goal 2: To implement Optimal Identification in at least ten school districts in three states (North Carolina, Washington, and Wisconsin), in partnership with local school districts, and with intensive support from the research team. During this implementation period, we will determine what types of background, technical support, and implementation guidance materials are necessary to facilitate a high-fidelity and minimally disruptive implementation of Optimal Identification. We will create initial drafts of these materials during Goal 2 (Y2-Y3) and obtain feedback on these materials from our school district partners.

Further, we will evaluate the impact of Optimal Identification in the implementing schools applying a difference-in-differences approach (Athey & Imbens, 2006), using data from comparison schools that are matched at baseline on size, demographics (i.e., socioeconomic status, ethnicity/race, level of rurality), grade levels served, rates of gifted identification, and prior achievement. We hypothesize that the Optimal Identification schools will exhibit marked increase in the proportion of students who are identified as well as increase proportionality across demographic categories. We hypothesize that this increase in proportionality will be especially pronounced in schools that incorporate local norms into their identification processes.

Objective 2: Implement Optimal Identification in partner school districts with training, support, and supervision from the research team (Years 2-3) with continuous feedback and improvement, thereby improving the identification rate and demographic representation of qualifying students in those schools. *Outcome 2: draft training and technical support materials, implementation manuals. Conduct on-site, in-person training and consulting with at least ten school districts across three or more states. These districts will include representation of urban, suburban, and rural districts in North Carolina, Washington, and Wisconsin, and will include representation of diverse student populations (race / ethnicity, home language, socioeconomic* *status). Partner districts will provide pre and post training students identification data as well as revised identification plans and policies showing how and where the content informed district identification practices and potential service-related changes based on identification data.*

Goal 3: To provide access to comprehensive, user-friendly, and evidence-based materials and professional development to enhance identification best practices. This is in direct response to *application requirement 4c and 4d and aligned to Competitive Preference Priority 3 regarding increasing the number of students who will have access to effective educators in high-poverty and rural schools.* ***Objective 3:*** Create a suite of modular, free, and open training materials supporting Optimal Identification, with anticipated topic list as outlined in Table 1. These materials will begin with basic psychometrics and measurement concepts as applied to gifted student identification, (e.g., sensitivity, specificity, ROC), identification curves, definition and detection of bias,

Table 1

Topics and anticipated sequencing of content
1. Gifted identification: the big picture
2. How many students are above grade level in the United States?
3. Bright versus gifted: a meaningless distinction
4. Scales of measurement: criterion-referenced, norm-referenced, and IRT scores
5. Local versus national norms
6. Identification for what? Aligning assessment with services
7. True scores, observed scores, and measurement error
8. Reliability and the standard error of measurement
9. Using tests for classification I: sensitivity and specificity
10. Using tests for classification II: positive and negative predictive value
11. Gifted identification I: universal testing with a single assessment
12. Gifted identification II: the tests and what they measure
13. Racial and socioeconomic disparities in the gifted population
14. Test bias: defining and detecting it
15. Non-verbal assessments
16. Opportunity to learn: the developmental perspective
17. Individual and group-administered ability tests
18. Achievement tests
19. Creativity tests
20. Gifted identification III: multiple criteria assessment and combination rules
21. Two-stage identification procedures: a focus on the nomination process
22. How the nomination process affects sensitivity and assessment cost
23. Universal screening: pros and cons
24. The use and misuse of teacher rating scales
25. Gifted identification IV: understanding the identification curve
26. Introducing Optimal Identification
27. Choosing the nomination cutoff
28. Managing multiple opportunities for identification
29. Using local, district, or building-specific norms for identification
30. Optimal Identification with local norms
31. Trial placements
32. Evaluating the performance of your identification process

implementing local norms, problems specific to multi-stage selection processes and multiple-criteria assessment, disproportionality, cut-scores versus rank-order selection, identification-to-service alignment and design, and the incorporation and use of software tools. Optimal Identification will be introduced and elaborated, connected to previous concepts, and practical implementation guidance will be provided given lessons learned in Goal 2.

<u>*Outcome 3a:*</u> *By the end of Year 3 we will post a full-length completed draft of the online suite of technical support materials. By the end of Year 4, at least 20 districts from at least six states will have a staff member complete 80% of the online learning modules with an achieved proficiency rate of 80%. These will include additional districts from the Goal 2 states (North Carolina, Wisconsin, and Washington) and include two additional states (Arizona and Minnesota). As with Goal 2, these districts will include urban, suburban, and rural districts representing diverse student bodies.* <u>*Outcome 3b:*</u> *Goal 3 partner districts will show increased identification rates overall as well as for underrepresented subgroups. Districts will submit pre-participation gifted and talented student identification data disaggregated by student subgroup. The same data will be collected in Year 5 to serve as a measure of change in both number of students identified as well as the demographics both before and after project participation.* <u>*Outcome 3c:*</u> *Goal 3 partner districts will upload their revised identification plans as well as implementation plans outlining where and how they revised district identification policies as a result of project participation. These will allow us to assess project impact as well as offer exemplars for districts that go through the process after the grant period has ended.*

Goal 4: Revise, finalize, disseminate, and promote the technical support and training materials and release them for free use by all school districts. This is in direct response to *application requirement 4c, 4d,* and aligned to *Competitive Preference Priorities 1 and 3* (Year

5). ***Objective 4:*** Too many Javits projects develop wonderful materials that remain inaccessible to the broader population of K-12 schools - especially rural and high-poverty schools. Objective 4 involves taking all of the content developed to provide background and guidance for the implementation of Optimal Identification, revising it based on both multiple rounds of district feedback and 1) publishing a final version online for universal use and 2) marketing the availability and utility of these materials in order to assure that the impact of this project far outlives the five-year funding period. <u>*Outcome 4*</u>*: Revised, final versions of training materials, based on feedback from partner school districts, published online. Materials will be marketed in Years 4 and 5 at state and national gifted education conferences and the grant team will offer three webinars during the fall and spring semesters of Year 5 with the goal of broad understanding and application of Optimal Identification and its use in providing services. We also link back to Goal 1 to provide additional information and publications related to the study findings and processes piloting Optimal Identification in schools. We will use data collected from identification plans (see Goals/Objectives/Outcomes 2 and 3), surveys, feedback, and other information to create case studies that chronicle district approaches to Optimal Identification and service delivery matched to student profiles, including final outcomes and hypothesized increases in the number of identified students. The case studies will incorporate selective sampling so that districts with diverse populations, geographic locations, and varying level of socio-economic status are included.*

(2) Appropriate Design to Successfully Address the Needs of the Target Population

Teacher training in gifted and talented education is limited in most of the country, and even when educators have received formal training via quality endorsement courses, that training rarely includes the kind of psychometric content necessary to successfully implement Optimal

Identification. Schools suffer from an abundance of data, but also from a lack of time and the necessary background in order for those data to inform instruction and best match students with appropriate interventions. Schools are also overburdened, with the result being students who are below grade-level standards often receiving the most attention from educators. All of this points to a critical need for our target population of K-12 schools: guidance and technical support on how to implement identification procedures that are not overly onerous, are free to access, and result in effective identification processes resulting in high levels of assessment sensitivity. This goal - what we refer to as Optimal Identification - is what drove this project's design.

Rural schools, high-poverty schools, and those that serve large percentages of at-risk students are most in need of support and yet are also the places where gifted identification is least likely to happen. Because of this we will develop training materials with educator support and feedback, implement intensive pilots of our support materials to assure ease of use and comprehensiveness, and then leverage the internet to post these materials to ensure universal access to the content. This project will take the best science on gifted identification and best practices in matching identification to services, translate it into terms and systems that educators can easily understand and apply, and then disseminate it freely. In this way, we seek to remove the barriers preventing implementation where it is needed most. No other form of training or resource dissemination would meet the need of the target population. As will be discussed in Section D, we will also employ a professional instructional designer and contract with a videographer in order to assure that the suite of materials and the learning modules are attractive, engaging, and represent the state-of-the-art in terms of online learning - again focusing on an exceptional approach to meeting the need of our target population.

(3) Exceptional Approach for Meeting Statutory Purposes

The purpose of this project is to conduct additional research on optimal gifted and talented student identification and then use an innovative approach (online, high-quality instructional design environments) to provide universal access to evidence-based identification methods that have been shown to increase the number of identified students and mitigate the underrepresentation of certain student populations. By co-creating and then piloting training and technical support materials with K-12 teachers and then providing them via open access online, we increase the probability of implementation as well as extend this project's potential for impact far beyond the grant period. Adding case studies from our pilot information allows districts to see first hand how similar districts to them have provided Optimal Identification, adding to the practicality, user-friendly approach, and accessibility for all. By working intensively with partner districts in Years 2, 3, and 4 and then publishing an online learning and technical support suite open to any district in Year 5, as well as additional findings on the impact through case studies and reports from pre-post district plans and surveys, this project will expand and enhance the ability of schools nationwide to meet the needs of gifted and talented students.

(4) Extent to Which the Proposed Project is Supported by Promising Evidence

Our proposed project will involve providing materials and technical support to school districts to aim them in the implementation of a number of gifted and talented student identification practices that have shown strong evidence of effectiveness in terms of missing fewer students (higher sensitivity) and identifying greater numbers of students from traditionally underrepresented populations. These practices include: 1) universal assessment of all students using a strategically designed nomination procedure, 2) implementation of a well-designed two-phase identification systems, 3) the use of multiple criteria at the confirmation stage based on a "mean" combination rule and incorporating the nominating assessment in the composite, 4) careful and strategic selection of nomination cutoff to maximize and balance sensitivity versus assessment cost, 5) (*optional*) the use of local norms instead of national norms to determine identification criteria, and 6) applying the identification findings to prescribe appropriate services based on students' areas of identification and performance within various content domains. The specific criteria to be assessed in the confirmation phase are justified on the basis of their alignment with anticipated services or interventions to be received by the identified students.

Universal consideration. A major component of the proposed project is the training of school personnel in the relative advantages and disadvantages of universal consideration (sometimes called universal screening) versus well-designed two-phase identification systems, multi-criteria identification systems, and building norms for the purposes of gifted and talented student identification. Studies published by McBee, Peters, and Miller (2016) as well as Card and Giuliano (2016) showed that universally screening all students for gifted service eligibility, rather than only considering those students who pass through a screening phase, results in fewer students missed (increased sensitivity) and mitigated racial / ethnic disproportionality. Card and Giuliano found that African American student identification rates tripled and Hispanic student rates doubled under universal screening. Identification systems whereby students are not evaluated for gifted service eligibility unless nominated by a teacher or parent, can easily miss the majority of qualified students, with the harm falling disproportionately on students from traditionally underrepresented populations.

Universal screening has amassed a promising record of evidence in the related area of college admissions. For example, following Michigan's universal administration of the ACT to all high school students, 25% more students who were eligible for a selective college were identified compared to when the test was optional (Hyman, 2017). For every 1000 low-income students who took the ACT when it was optional and scored high enough to attend a selective college, mandatory ACT testing identified another 480. Research from K-12 gifted identification and higher education shows moving to universal consideration of all students will always miss the fewest students who would benefit and will disproportionately benefit students from traditionally underrepresented populations. A major component of Optimal Identification is in helping districts to understand the costs and benefits of universal consideration as well as how the principal can be applied even when universal consideration is cost prohibitive.

Improved two-phase criteria. McBee et al. (2016) found that the relatively poor performance of traditional two-phase identification systems, compared to universal consideration, are not intrinsic but rather related to specific features of the identification process. It is possible to design an optimized two-phase identification process that performs as well as or better than a system based on universal consideration. A serious shortcoming of testing all students for program eligibility is the cost. By definition, the greatest number of tests must be administered, as all students are "considered" vie the identification process. A well-crafted nomination procedure can reduce this testing demand without harming sensitivity. As McBee et al. (2016) described, there are a few essential criteria for a high-quality screening phase. The assessment(s) forming the basis of the screening phase must be 1) highly reliable, 2) strongly correlated with performance on the confirmation phase, 3) have a substantially lower cut score than the confirmation phase, and 4) be administered to all students. Luckily, most state measures of academic achievement tests satisfy all of these criteria, especially when those tests are computer adaptive, hence possessing higher conditional test reliability in the high score range. The resources developed and technical support provided as part of this project will aid schools in implementing well-designed two-phase identification systems if universal consideration is cost or prime prohibitive. The goal of such two-phase systems are to maintain the sensitivity of universal consideration at reduced cost. For example, using Optimal Identification, it is possible to create a two-phase system that correct identifies 98% or more of the students who would be identified under universal consideration, but at only a a quarter to a third of the cost.

Combining multiple criteria. Similar to two-phase identification systems, "multiple criteria" are often cited as a best practice for gifted student identification (NAGC, 2015; Callahan, Moon, & Oh, 2013). However, how the multiple data points are combined influences both the size and relative diversity of the resulting population (Lakin, 2018; McBee, Peters, & Waterman, 2014). When additional pathways are added ("or" rules), the number of students identified goes up. When additional hurdles are added ("and" rules), the number of identified students goes down. McBee, Peters, and Waterman (2014) analyzed the effect of multiple-criteria combination rules and found that reliability of the assessments is strongly determinative of the sensitivity and specificity of the identification decisions that can be generated by those assessments. Moreover, the "mean" combination rule always results in a higher reliability than the "and" or "or" rules because some of the error variance in the assessments cancels out, thus resulting in the composite score reaching a higher reliability than any of the individual assessments could have. Further, the number of assessments to be combined does not determine the identification rate as it does under the "and" or "or" rules. For these reasons, Optimal Identification is based on the "mean" combination rule.

Local norms. Gifted and talented identification policies most often rely on national normative comparisons, whereby students are identified for services if they score higher than a certain percentage of their peers from around the country (e.g., 95th percentile). Peters, Rambo-Hernandez, Makel, Matthews, and Plucker (2019) found that moving from national norms to school building norms for the purpose of identifying students for advanced learning opportunities resulted in a 157% to 300% increase in the proportionality of African American and Latinx students in gifted education. As this was a registered report, whereby the analyses were pre-registered and peer-reviewed prior to any data analysis, this study shows promising evidence of local norms as a way to increase the number of students identified in high-poverty schools, schools with large percentages of low-achieving students, and students who, because of fewer educational opportunities, may not meet traditional criteria for identification. This project will develop resources to aid in the school-level implementation of local norms as well as provide technical assistance to that end, which are currently two serious obstacles to the implementation of local norms.

One of the reasons that typical identification methods are so problematic is that they contain multiple opportunities for assessment bias. For example, the most common time for identification to happen is following a teacher referral (NAGC, 2015). This is similar to the way in which students in New South Wales, Australia or Boston, Massachusetts are identified for placement in selective or exam high schools. Students must first apply before they are formally considered for program entry. Optimal Identification involves fewer opportunities for a subjective decision (i.e. a teacher referral) or a datapoint unrelated to program success (i.e., knowing to apply for the program) to prevent a student form being correctly identified.

Online, Open Learning. The resources and technical support materials to be developed as part of this project will follow promising evidence of best practices for MOOCs. A 2017 study by Deshpande and Chukhlomin found that to be most effective, MOOCs must offer relevant, interactive content that is a reasonable workload across the class schedule and that is not overly burdensome or complicated to navigate. It is not enough that the concepts and practices described above have been shown to be effective. The concepts and practices must be delivered in a way that is motivating and that the educators who participate have the time to complete the modules. This evidence of best practices informs both our MOOC development and how we structure the budget for sub releases for participants.

Matching Identification to Services. Identification processes should not be created in a vacuum, but instead with reference to the programming, services, or interventions to be provided. For example, the use of non-verbal ability tests to identify students for an accelerated language arts program is unlikely to result in an appropriate set of students who need or can benefit from such an intervention. One component of Optimal Identification, which will be emphasized in the training materials, is the importance of a tight connection between identification and service. Otherwise the identification process risks being arbitrary and needlessly exclusive (Peters, Matthews, McBee, & McCoach, 2014).

(5) The Extent to Which Performance Feedback and Continuous Improvement are Integral to the Design of the Proposed Project

Years 2 and 3 of the project are designed to implement Optimal Identification in at least ten participating school districts across three states with intense support from the research team, both as a proof of concept and to gain feedback on what materials are necessary in order to make implementation practical and feasible in schools when such intensive support will not be available. The experience in working with partner districts will inform and improve the content and process of the online technical support materials. The collection of district pre/post plans for identification and service delivery matched to identification methods further support continuous improvement through district self assessments and personal plans. We have also included as a Key Person one of the co-PIs (Betsy McCoach) of the National Center for Research on Gifted

Education (NRCGE) in order to assure that the lessons learned over the last few years from their work are incorporated into our project. Dr. McCoach will collaborate on Goal 1 research, but will also incorporate NRCGE findings on best-practices in gifted identification into our training and technical support materials (Goals 2 & 3). Our project is designed such that Goal 1 will inform the existing knowledge base on gifted identification, which will in turn inform Goal 2. Working on Goal 2 with district partners will inform Goal 3 - the development of the online technical support materials. Collecting further feedback from district partners on those materials will inform the final materials published online. In this fashion, feedback and continuous improvement are built into the core design details of the project.

(b) Quality of the Project Personnel

(1) Qualifications, Relevant Training and Experience of Project Directors

Matthew T. McBee, Ph.D. will serve as the project principal investigator. Dr. McBee is an Associate Professor of Quantitative Psychology and the Director of the Experimental Psychology Ph.D. program at East Tennessee State University. He received his Ph.D. from the University of Georgia in Educational Psychology with a concentration in Gifted and Creative Education. His research focuses on gifted identification, computational models of educational psychology, causal inference, and open science. Dr. McBee has over a decade of experience in R programming and has authored four R packages and several Shiny apps, including some specifically used to for exploring and understanding gifted identification. He is a recipient of the NAGC Early Scholar Award and the Outstanding Graduate Student award, and currently serves as Treasurer for the AERA Research on Giftedness, Creativity, and Talent SIG. He is the former co-editor of the *Journal of Advanced Academics*. He formerly served as a statistician on USTARS-PLUS, a prior Javits project. Dr. McBee has published over 40 scientific papers. He co-authored the book *Beyond Gifted Education: Designing and Implementing Advanced Academic Programs* with Scott Peters, Michael Matthews, and Betsy McCoach, and has presented over 80 papers at the National Association for Gifted Children and American Educational Research Association conferences. Further, he is noted for his rigorous, engaging, and understandable teaching of quantitative methods and measurement to non-technical audiences (e.g., undergraduate and graduate psychology majors), and has taught courses relevant to this project for the past eight years.

Scott J. Peters, Ph.D. will serve as co-Principal Investigator. Dr. Peters is an Associate Professor of Assessment and Research Methodology and the Richard and Veronica Telfer Endowed Faculty Fellow of Education at the University of Wisconsin – Whitewater. He received his Ph.D. from Purdue University specializing in gifted and talented education and applied research methodology. His scholarly work focuses on educational assessment, identification of student exceptionalities (particularly those from low-income or underrepresented groups) and gifted and talented programming outcomes. He is the recipient of the Feldhusen Doctoral Fellowship in Gifted Education, the NAGC Research an Evaluation Network Dissertation Award, the NAGC Doctoral Student of the Year Award, the NAGC Early Scholar Award, the NAGC Paper of the Year Award, the NAGC Book of the Year Award, and the UW-Whitewater Innovation and Outstanding Research Awards. He currently serves as the Association Editor for the National Association for Gifted Children and has served as the Program Chair of the AERA Research on Giftedness, Creativity, and Talent SIG, on the Board of the Wisconsin Association for Talented and Gifted, and as the National Association for Gifted Children Research and Evaluation Secretary. He served as co-PI on two past Javits grants - one awarded to the State of Wisconsin and the other Awarded to Purdue University.

Tamra Stambaugh, Ph.D. will serve as co-Principal Investigator. Dr. Stambaugh is an associate research professor and executive director of Vanderbilt University Programs for Talented Youth. Dr. Stambaugh's expertise is in curriculum development, programming, and identifying and serving special populations of gifted students including those from low income households and rural areas. She has directed two Javits grants ($6 million) and served as a PI, co-PI, or evaluator of a variety of grants with grant awards totaling over $2 million dollars and focused on identifying and serving students from a variety of backgrounds, languages, and ethnicities. Her most recent study and work focused on using multiple measures, local norms, and talent spotting to increase representation and reading expertise for racially diverse and low income schools.. Stambaugh is the recipient of the NAGC Doctoral Student of the Year Award, the NAGC Early Leader Award, multiple NAGC curriculum awards, the Margaret the Lady Thatcher Medallion for Service and Scholarship from the College of William and Mary School of Education, the Jo Patterson Gifted Education Award from the Tennessee Association for Gifted, and the Distinguished Faculty Award for Service to the Field from Vanderbilt University. She received the Legacy Award in the Scholar Category from the Texas Association for Gifted Children for her co-edited book, *Identifying and Serving Students from Rural Areas*. Dr. Stambaugh earned her PhD from the College of William and Mary in Educational Policy, Planning and Leadership.

Drs. Peters and McBee have collaborated for more than a decade on research on and methods to improve gifted and talented students identification with a particular focus on improving identification system accuracy or students from traditionally underrepresented populations. Both are frequent speakers at state (CO, WI, IN, IL, IA, MN) and national conferences (NAGC, AERA, Wallace Symposium) on the topics of best practices in gifted identification and methods to increase equity in gifted education. Further, Drs. Peters, McBee, and Stambaugh have published peer reviewed articles and monographs on the topics of universal screening, local norms, group specific norms, and non-traditional assessment instruments for use in increasing the identification of students from low-income families and other traditionally underrepresented student groups and providing appropriate services for them.

(2) Qualifications, Relevant Training and Experiences of the Key Project Personnel

Dr. D. Betsy McCoach will serve as a key person on this project. Betsy McCoach is a professor in the Research Methods, Measurement, and Evaluation program in the Educational Psychology department at the University of Connecticut. Dr. McCoach has co-authored over 100 peer-reviewed journal articles, book chapters, and books, including *Beyond Gifted Education* (with Peters, Matthews, and McBee), and *Instrument Design in the Affective Domain.* Dr. McCoach founded the Modern Modeling Methods conference, held annually at UCONN. Dr. McCoach is co-Principal Investigator for the National Center for Research on Gifted Education and has served as Principal Investigator, co-Principal Investigator, and/or research methodologist for several other federally-funded research projects/grants. Dr. McCoach's research interests include gifted education, instrument design, latent variable modeling, longitudinal modeling, and multilevel modeling. Her expertise in this project will be utilized in Goal 1 to develop and refine the research base on Optimal Identification and to incorporate lessons learned from the National Center work into the online technical support materials.

Other personnel. We will hire a professional instructional designer and videographer for this project in order to assure that the materials we develop are engaging, interactive, aesthetic, and of sufficient qualify and format such that educators will be motivated to use them. We will also hire a postdoc for the first four years of the project who will have a Ph.D. in gifted education as well as training in educational measurement and statistics. The postdoc will assist in the development of algorithms, the publication of scientific papers, the development of instructional materials, will travel to districts to provide instruction, guidange, technical support, and will also collect, analyze data, and report on data relevant to this project.

Importantly, a number of partner school districts will be Key Persons in this project. We have solicited the involvement of state education agency gifted and talented education coordinators and have received commitment from the following state directors of gifted education: Peter Lange in Arizona, Wendy Behrens in Minnesota, Sneha Shah-Coltrane in North Carolina, Jody Hess in Washington, and Mark Schwingle in Wisconsin.

(c) Quality of the Management Plan

We propose a four-phase project over the 60 months of the grant with each phase aligned to the four project goals. In *Phase 1* we will expand our earlier work and conduct additional research on optimal identification. *Phase 2* will involve the initial development of technical support resources and instructional materials based on the existing evidence-based research surrounding Optimal Identification. *Phase 3* will involve the guided implementation of Optimal Identification in partner districts with intensive support from the project team, during which time we will solicit feedback on the usability of the developed supporting materials and district outcomes after implementation. As part of this pilot we will further refine the resources and instructional materials over multiple iterations of refinement and improvement. The final phase (*Phase 4*) will involve the translation of all of these materials into an online platform, which will be made freely available to all schools, and will allow any school district to move through it at their own pace in order to implement these evidence-based strategies for optimal, equitable identification. Case studies will be created. Table 2 displays complete project tasks, responsibilities, and timelines, with Phases I through IV indicated in the year columns and persons responsible numbered according to their presentation in the *Key Personnel* section.

Table 2

Goal	**Activity, *primary person(s) responsible***	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**
1	Coordinate team, hire new members, communications and logistics. *Peters, McBee, Stambaugh*	X				
1	Conduct additional research on Optimal Identification. *McBee, McCoach, postdoc*	X	X	X		
2	Develop in-person technical support resources and instructional materials. *McBee, Peters, Stambaugh, Instructional designer/videographer*	X	X			
2	Identify partner school districts (10+ in three states) and schedule site visits, *Stambaugh, Peters*	X	X			
2	Conduct site visits with partner districts. *Stambaugh, Peters, McBee, postdoc*		X	X	X	
2 & 3	Implement Optimal Identification in partner districts. *Stambaugh, Peters, McBee, postdoc, district partners*		X	X	X	
2 & 3	Revise materials based on performance feedback from pilot districts. *McBee, Peters, Stambaugh, Instructional designer*		X	X		
3	Identify second group of partner districts (20+ in six states), *Stambaugh, Peters*		X	X		

3	Complete initial suite of technical support materials for use by partner districts, *McBee, Peters, Instructional designer*		X	X		
3	Second group of partner districts implement Optimal Identification, *Stambaugh, Peters, McBee, postdoc, district partners*			X	X	
3	Revise online suite based on performance feedback from pilot districts. *McBee, Peters, Stambaugh, Instructional designer*				X	
3 & 4	Finalize resources suite and technical support materials and post online *(all)*					X
4	Present at national and state conferences, hold webinars to market resources *(all)*					X
2 & 3	Collect and analyze case study data *(Stambaugh, postdoc)*			X	X	X

(d) Quality of the Project Services

Scientific Context

Research on the identification of gifted and talented students is undergoing a renaissance. Recent work on identification has largely proceeded along two parallel lines. The first might be called the *alternative norm track*, and has explored the effects and consequences of departing from traditional national normative criteria and instead utilizing group-specific or building-specific norms (e.g., Carman, Walther, & Bartsch, 2018; Peters & Engerrand, 2016; Peters & Gentry, 2012). There is considerable interest and excitement in the field about these innovations, which in some cases can have a dramatic impact on the underrepresentation of students from minority and low-income demographic groups (Peters, Rambo-Hernandez, Makel, Matthews, & Plucker, in press). Indeed, alternative norms are unquestionably the most potent of all known legally permissible interventions for reducing these disparities (Peters et al, in press; Peters & Engerrand, 2016).

The second track might be called the *identification theory track*, which has focused on articulating a formal mathematical and psychometric framework for understanding identification, and then probing that framework for insights. We wish to emphasize just how revolutionary this work is; never before has it been possible to calculate the performance of various gifted identification systems from first principles alone. Identification theory research has explored how the psychometric characteristics such as sensitivity, specificity, and the incorrect identification rate can be computed for the gifted identification process. This first metric, sensitivity is particularly crucial and is a focus of this proposal. Sensitivity is the proportion of qualifying students - students who the system should have identified - who are correctly identified. An identification process with low sensitivity misses a large proportion of students who in reality do meet the criteria. Unfortunately, research in the identification theory track has shown that the "typical" identification process, as implemented in thousands of school districts across the U.S., has sensitivity in the 30-40% range (McBee, Peters, and Miller, 2016). **This means that perhaps two-thirds of the students that qualify for and could benefit from gifted education services are not identified under current systems.** This line of research has also revealed that the "and" combination rule, which is often applied in multiple-criteria assessment processes, is particularly poor with respect to sensitivity (McBee, Peters, & Waterman, 2014). Given that a major focus of the field's efforts (including Javits grant funding priorities) over the past two decades has been devoted to the search for the "missing" students from underrepresented groups who are presumed to exist but have been overlooked by traditional identification strategies, the notion that the population of non-identified gifted students is roughly twice as large as the population of identified students is an exciting one that demands deep consideration and action.

Causes of Low Sensitivity

Research in the identification theory track has identified three predominant causes of low sensitivity: (1) measurement error (e.g., imperfect reliability) in the confirmatory assessment(s), (2) use of the “and” combination rule, and (3) poor alignment between the nomination process and the confirmatory assessment or assessments. This alignment between the nomination and later assessments is known as nomination validity, and is generally the more severe of the two problems. When nomination validity is poor, but only a relatively small proportion of students are nominated (as typical), sensitivity is dramatically compromised. Several school districts and states have responded by adopting universal screening, which in its purest form simply eliminates the identification stage altogether; every student is assessed using the full set of confirmatory giftedness assessments[3]. While universal screening does lead to major improvements in sensitivity, it also generally carries with it an exceptionally high testing cost, both in terms of money and in time. Given that every dollar spent on assessment is a dollar not available to pay for services, and that gifted education budgets are typically extremely tight, assessment cost efficiency is something that should be seriously considered. Identification alone is of no value; it is only the services that follow identification that benefit students.

[3] The term universal screening is not used consistently; some districts use the term to denote a process in which every child is assessed for nomination using a group-administered ability test such as the NNAT or CogAT. Students with qualifying scores on these assessments then have the opportunity to undergo the formal identification process. This is not universal screening as we define the term, but rather an alteration to the usual two-stage assessment system.

Defining Optimal Identification

An optimal identification process has the following characteristics:

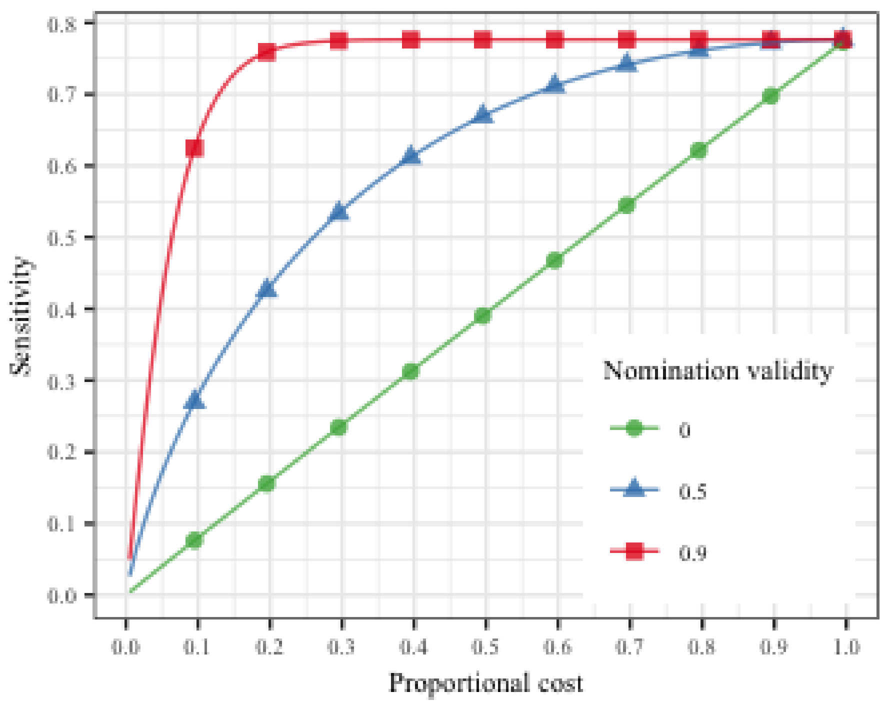
1. Considers multiple criteria at the confirmatory identification stage, allowing for a broad range of characteristics and domains of capability to be incorporated into the identification or placement decision.
2. Maximizes classification accuracy, which implies achieving the maximum possible sensitivity while simultaneously minimizing false positives.
3. Minimizes assessment cost.
4. Is free of assessment bias, including across racial, cultural, socioeconomic, and gender categories.
5. Is tightly connected to and justified by the intervention or services to be offered.

Analysis of the mathematical framework for modeling gifted identification has revealed how such a system could be created. This is particularly challenging because the maximization of classification accuracy and the minimization of cost are conflicting goals.

Non-Linearity: The Key to Optimal Identification. A nomination process has two effects. It reduces assessment costs by limiting the number of students who receive the full battery of assessments. However, it also reduces sensitivity, because some students who could pass the confirmatory assessments never get to take them by virtue of not being nominated. This is why close alignment between the nomination process and the confirmatory assessments is critical. The goals of cost reduction and sensitivity are in opposition because sensitivity is improved by nominating more students, but testing these additional students increases assessment expenses.

Figure 1[4] shows assessment cost versus sensitivity for identification systems with three different levels of nomination validity. Nomination validity is a number between zero and one measuring the degree of correspondence between the nomination process and the assessment process. It is a correlation coefficient. The x-axis ("proportional cost") is based entirely on the proportion of students that are nominated. Universal screening – testing all students with the full assessment suite – is all the way to the right, with a proportional cost of 1.0 (100%), but maximum sensitivity. Moving to the left, assessment cost is reduced by nominating smaller fractions of students, until one reaches the proportional cost of zero (0%). At this point, no students are nominated, so none are tested. There is no assessment cost, but sensitivity is now at zero because no students are identified. Every point between these extremes represents some tradeoff of sensitivity versus assessment expense[5].

Figure 1



The green line (marked by circles) depicts a system in which the nomination validity is

[4] Figure 1 and all subsequent plots were created according to calculations performed by McBee's *giftedCalcs* R package. A working paper explaining the details can be found here: https://osf.io/5ju2q/

[5] The curves in Figure 1 are essentially equivalent to ROC curves in which the x-axis is cost rather than one minus specificity. Like ROCs, the overall performance of a system can be portrayed by the area under the curve.

zero, meaning that nominations are based on uninformed random selection. In this system, the relationship between sensitivity and cost is linear and proportional. The blue line (triangle markers) shows the curve for a system with a nomination validity of 0.5, a typical value in existing identification processes. In this curve, starting at the right, can be seen that the first 40% of cost savings (e.g., 1.0 to 0.6) results in only a minor reduction in sensitivity, while the next 40% (cost of 0.6 to 0.2) has a much more severe effect on sensitivity. (Also note that if only 10% of students are nominated -- as is typical -- sensitivity is less than 30%).

The red line (square markers) shows the curve for a system with a high nomination validity of 0.9. Note the character of this curve – from right to left, it is nearly horizontal until the proportional cost reaches about 20%. From that point, further cost reduction (e.g., moving further left) greatly harms sensitivity. But there is essentially no loss in sensitivity at all for the first 80% of cost savings. This nonlinear cost versus sensitivity curve for high-validity nomination processes is one of the two pillars of Optimal Identification. But a nomination process with extremely high validity is required to achieve this type of strongly nonlinear behavior.

Achieving High Nomination Validity. A high-validity nomination process provides an escape from the usual cost versus sensitivity tradeoff by virtue of the "flat" part of the curve, representing needless cost than can be eliminated without penalty. But how does one achieve such high validity? Figure 2 depicts a multiple-criteria assessment system that has been designed according to the principles of optimal identification. In this system, identification decisions are based on confirmatory assessments 1, 2, 3, and 4. These could represent, for example, scores on an IQ test, reading achievement test, math achievement test, and a creativity assessment. In the "mean" combination rule, these scores are first standardized to a common metric. Then the mean[6] of the scores is calculated and compared to a desired cutoff score, which must be adjusted for shrinkage (McBee, Peters, & Waterman, 2014). The mean combination rule, as opposed to the “and” or “or” rules, results in the highest possible composite reliability, which increases sensitivity and reduces the false positive rate. Further, it is a compensatory combination method in which strengths in some areas can compensate to some degree for weaknesses in others. Optimal Identification is based on the “mean” rule because of these advantages. But there is another fundamental virtue to this approach.

Figure 2

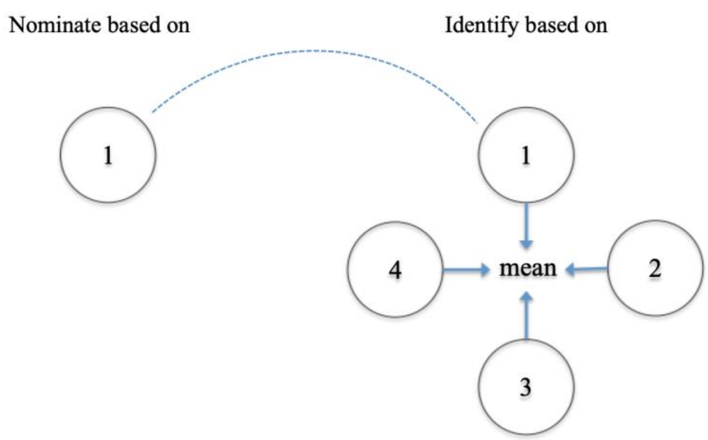


Figure 2 depicts that nominations are based on assessment 1, which is one of the four criteria assessed for identification. (Nominations could be based on any of the four assessments). Each of the four assessments will be highly correlated with the mean of all the assessments, typically on the order of r= .85 to r = .90. This is because a) the assessments tend to be moderately positively correlated anyway due to the positive manifold (van der Maas et al., 2006), and more importantly b) because each individual assessment is an *ingredient* in the mean. These correlations are the nomination validity coefficients that would be achieved if each assessment was used for nomination. If one of the four assessments is administered to all the students and used as the basis for nomination, the nomination validity coefficient will be extremely high. This is the second pillar of Optimal Identification: nominations are based on one (or more) of the

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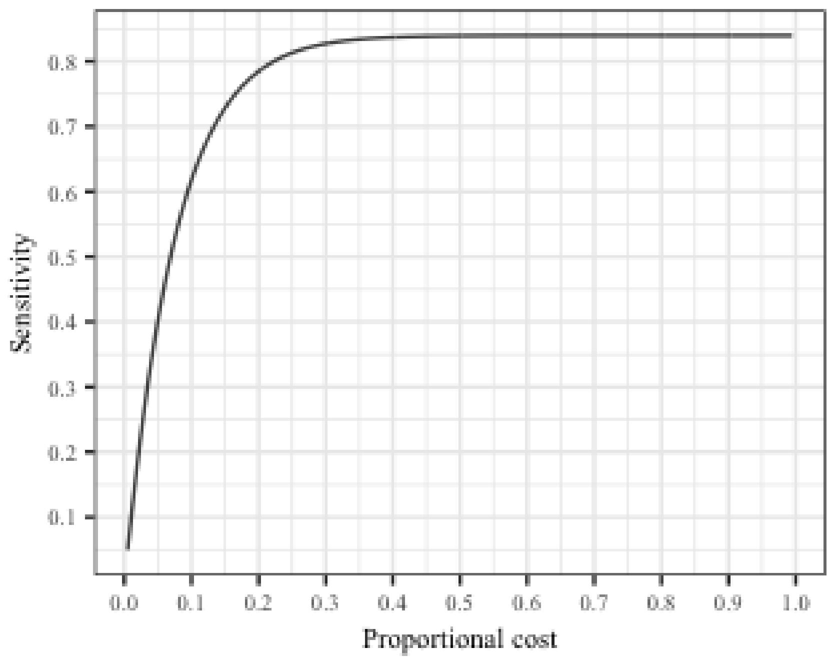
[6] This could be a weighted mean if some assessments are deemed more important than others. If not, the mean is a simple average of the standardized scores.

assessments whose scores will be combined via the mean combination rule in the confirmatory assessment. If the nomination assessment is one that is already administered to students in the course of their usual instruction then the nomination stage does not impose any additional cost or testing burden.

Example of Optimal Identification. Suppose a school district considers general intellectual ability (IQ), reading achievement and math achievement in its identification process, each of which is equally weighted. Students whose mean on these assessments exceeds the 90th percentile are identified and receive gifted services. Also suppose the correlation between IQ and math achievement is r= 0.7, the correlation between IQ and reading achievement is r= 0.75, and the correlation between reading and math achievement is r= 0.6. In that case the nomination validity coefficients that could be achieved by nominating on the basis of each assessment are as follows: IQ = 0.919, Math achievement = 0.864, and Reading achievement = 0.882. (Note: these values were calculating using the *cor_mean()* function in McBee's *giftedCalcs* R package). Since students' reading achievement is assessed on a routine basis, it makes sense to nominate students on the basis of high reading scores. Further, if the reliability coefficients for each of the assessments are 0.90 (IQ), 0.85 (Math) and 0.88 (Reading), which are typical values for such assessments, the reliability of the mean of these assessments is 0.948. This increased reliability improves the sensitivity of the nomination process above what could be achieved using any of the individual assessments alone, or in combination under the "and" or "or" rules (McBee, Peters, and Waterman, 2014). Both the achieved sensitivity and the assessment cost now depend completely on the proportion of students that are nominated. Figure 3 displays the cost versus sensitivity curve for this system. Note the desirable non-linear character of this curve.

If the school uses universal screening, 100% of its students are "nominated", meaning that it will be necessary to administer the IQ test to all of them. (This is because, in this example, the reading and math achievement tests are administered to all students in the ordinary course of instruction). In this case, the achieved sensitivity is 83.9%; quite good, but maximally expensive! Instead, if students in the top 30% of reading achievement are nominated, the achieved sensitivity is 82.7%. This massive cost reduction of 70% is paired with only a tiny loss of sensitivity. If the district wishes to conserve even more resources, they might nominate at the top 20% of reading achievement. In this case, sensitivity drops to 78.5%, which is still quite good, and *far* better than the typical 30-40% sensitivity achieved by typical identification procedures.

Figure 3

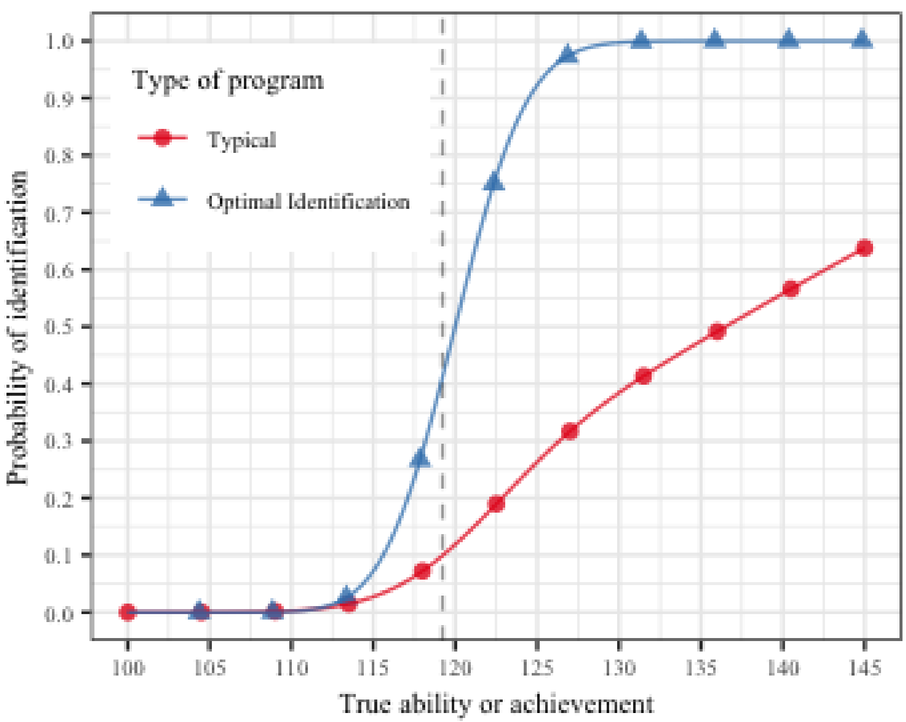


It is important that the nomination cutoff not be raised too high for reasons besides maintaining sensitivity. For example, if the district decided to nominate at the 90th percentile (e.g., top 10%) of reading achievement, sensitivity would drop to 61.7%, which perhaps is not unacceptable. But now the compensatory nature of mean combination rule has been jeopardized, because it is now impossible for high math achievement or intellectual ability to compensate for a relatively low reading score. The identification rule has now effectively become a composite of the “and” and “mean” combination rules. The point is not to nominate only the students who achieve at the "gifted standard" in reading, but to choose the students who are relatively high in reading achievement for further investigation, because these students are likely to be the ones whose mean of intellectual ability, reading achievement, and math achievement meets the identification criteria.

Identification Curves

A method for calculating the probability of identification for students with specific ability or achievement profiles has recently been developed (see McBee, Peters, and Godkin, 2019, for a working paper), allowing for the development of the identification curve, an extremely useful tool for understanding identification processes. An *identification curve* is a plot in which the student's true (latent) ability or achievement is on the *x*-axis and the corresponding probability of being identified is plotted on the *y*-axis. This allows the performance of identification processes to be described not only in terms of coarse metrics such as sensitivity and specificity, but at the level of outcomes for specific students.

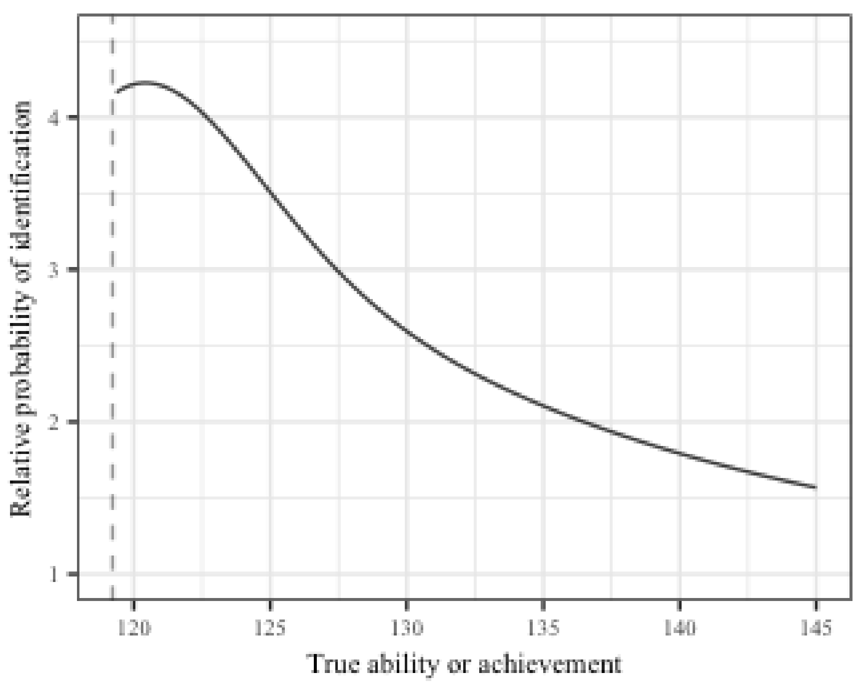
Figure 4



Example identification curves for two hypothetical identification systems are depicted by Figure 4. The red curve (circle markers) shows the identification curve for a typical process, in which teachers nominate a small proportion of students for formal testing. The blue curve (triangle markers) shows the identification curve for the optimal identification process described in the previous section. The dashed vertical reference line shows the 90th percentile identification cutoff, a score of approximately 119 on an IQ-metric. All students with true scores to the right of this cutoff should be identified; none of the students with scores to the left should be.

The "typical" identification process depicted by the lower of the lines in Figure 4 has a sensitivity of only 28%, and its identification curve shows that its poor performance disproportionally affects students with scores just above the cutoff. For example, a student with a true score of 120 – one point above the cutoff – has only a 12% chance of being identified. A student with a true score of 130 has a 38% chance of being identified, and a student with a score of 145 has a 65% chance of identification. In contrast, the optimal identification curve shows that the student with the 120 true score has a 50% chance of identification, and students with scores above 125 have a 90% or higher probability of identification. Figure 5 shows an explicit comparison of the relative performance for the Optimal Identification system versus a typical identification system. As this figure indicates, all students have a higher

Figure 5



probability of identification under the system designed according to Optimal Identification principles, but the students that experience the strongest benefits are those whose true scores are slightly above the cutoff. The probability that these “threshold students” are identified is more than four times higher in the Optimal Identification system as compared to the typical identification process. It is likely that more effectively identifying students from this group will result in reduced racial and socioeconomic disproportionality in identification, without making any other explicit equity-motivated alterations to the identification process. However, combining Optimal Identification with local norms, such as school-specific norms, will have a *dramatic* impact on reducing disproportionality in identification precisely because disadvantaged students tend to be clustered within schools (Peters et al., 2019).

(e) Conclusion

In conclusion, we believe that Optimal Identification will dramatically improve the success with which bright students from all backgrounds are identified for gifted and talented education programs. If funded, our proposal will make it possible for schools across the country to implement state-of-the-art identification systems through the development and refinement of professional, engaging, rigorous, and field-tested training materials. The result will be that thousands of students, who otherwise may have been overlooked, will receive interventions that will challenge them to develop their talents and translate their potential into performance.

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