Assessing Admission Interviews at Residential STEM Schools

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Abstract:
Seventeen state-sponsored residential math and science schools have been created across the country to direct talented teens toward STEM careers. Admission is selective, based on competitive grades, standardized test scores, and references. Most of the schools also require preadmission interviews. However, selection interviews may be challenged as being both unreliable and invalid based on rater biases and unstructured protocols. A questionnaire was returned by nine of the eleven interviewing state schools. Results indicate unfamiliarity with selection research, unaddressed interviewer biases, and failure to conduct reliability or validity studies. Reasons schools continue to interview despite such omissions and recommendations for improvement are discussed.

Since 1980, 17 state sponsored residential math and science schools have been created across the country to direct talented teens ages 15 to 18 toward STEM careers. Eleven of the institutions are high schools with advanced curricula, and six are early college entry academies sharing campus facilities and faculty with traditional university students (Jones, 2009). Acceleration enables students to save considerable time and expenses as they later pursue graduate and professional degrees. The 17 specialty schools have been lauded for helping boost the supply and quality of domestic scientists and engineers (Atkinson, Hugo, Lundgren, Shapiro, & Thomas, 2007).

Admission to these state residential STEM programs is restrictive, requiring competitive SAT or ACT scores, transcripts, and teacher evaluations. Since taxpayer dollars are involved, efforts are made to enroll classes representative of the states' gender and ethnic profiles, provided grades and standardized scores meet minimum thresholds (Jones, 2009). Only one of the schools is legislatively mandated to admit equal percentages of qualified applicants from each of the state's congressional districts.

In addition to academic requirements, most of the state STEM schools require preadmission interviews. However, the reliability and predictive validity of selection interviews has been repeatedly challenged. The abundant selection literature shows that skewed judgments frequently result from a wide range of rater biases unrelated to applicant qualifications.

Background

Physical Attractiveness Bias. Bias for beauty is among the most substantiated findings in social psychology (e.g., Beehr & Gilmore, 1982; Cash, Gillen, & Burns, 1977; Dipboye, Arvey, & Terpstra, 1977; Hatfield & Sprecher, 1986; Li, Bailey, Kenrick, & Linsenmeier, 2002; and Watkins & Johnston, 2002). A prototypical field study was performed by Shahani, Dipboye, and Gehrlein (1993), who examined physical attractiveness in evaluations of over 500 applicants to a private university. Application photographs were rated for attractiveness by independent raters. Applicants were then interviewed by several judges, and results revealed significantly more favorable evaluations for the attractive applicants. Although attractiveness was unrelated to GPA, high school rank, or SAT scores, physically appealing candidates were rated as having higher qualifications than those with lower attractiveness scores.

The physical appearance bias has proven to be pervasive. In a meta-analysis of 123 attractiveness studies, Feingold (1992) reported physically attractive people were perceived as more sociable, dominant, mentally healthy, intelligent, and socially skilled than those judged unattractive. A meta-analysis involving job-related outcomes (Hosada, Stone-Romero, & Coats, 2003) reinforced the attractiveness bias for both men and women. This bias was evident whether judgments were made by professionals or college students, and whether job-relevant information about targets was low or high. The authors did note, however, the strength of the attractiveness bias was more pronounced in

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the earlier (1975-84) than later studies (1995-99), suggesting some social progress.

Selection biases also have been shown against overweight individuals (Benson *et al*., 1980; Kutcher & Bragger, 2006; and Puhl & Brownell, 2001), persons with disabilities (Miceli, Harvey, & Buckley, 2001), and those identified by ethnic name and accent cues (Purkiss, *et al*., 2006).

Similarity Bias. In a study in which interviewer-applicant similarities were compared (Frank & Hackman, 1975), three admissions officers interviewed applicants to a prestigious university. Two of the three interviewers were more favorably disposed to candidates rated as having personality characteristics similar to theirs. The third interviewer showed no similarity bias, indicating some individuals are less swayed than others by such influences. The authors concluded that, allowing for individual differences, interviewer-interviewee similarity might be a serious source of bias in selection interviews.

Although the preceding study gave no details about the age or background of the unbiased interviewer, might experience be a factor in resisting bias? A test is found in an experiment by Marlowe, Schneider and Nelson (1996) who attached male and female photographs of varying attractiveness to resume data sheets. Managers evaluated the equally outstanding resumes to which were attached photographs varying within a 2 x 2 (gender x attractiveness) design. Unmistakable evidence of both gender and attractiveness biases were revealed, although experienced managers were less prone to such expression. Even so, less attractive females were routinely disadvantaged whether managers were experienced or not.

Rater Tendencies. Kerlinger (1986) addressed four common judgment errors that threaten validity: halo, severity, leniency, and central tendency errors. The halo effect error is the tendency for one trait or characteristic of a target to influence ratings of other traits. In the studies cited earlier, halo errors occurred when attractive people were seen as more qualified and intelligent than individuals rated lower in attractiveness.

Errors of severity and leniency are reverse judgment extremes. A rater guilty of severity is universally harsh in judging applicants, while a lenient judge indiscriminately favors everyone. The error of central tendency relates to an interviewer's penchant for consistently choosing the middle of a rating scale.

Finally, Hills (1971) noted, "a poor applicant tends to make the applicant who follows him look good, and a good applicant handicaps the person who follows him" (p. 692), which describes a contrast effect error.

Medical School Interviews. A fertile area of interview research has centered on medical school applicants. Nearly all American medical schools have required candidate interviews (Edwards, Johnson, & Molidor, 1990), and given the extensive time and expense of arranging these evaluations, the process is considered essential. The same rater biases present in other contexts have been identified herein.

The similarity bias, for example, was strongly implicated in a case involving the selection of orthopedic residents (Quintero, et al., 2009). Others researchers have found gender biases. Marquart, Franco, and Carroll (1990) noted differences in the questioning of female vs. male applicants and in the way applicants felt about their interviewers. Specifically, applicants believed they could be more honest with interviewers of the same gender.

Johnson and Edwards (1991) surveyed admission officers at all 127 accredited U.S. medical schools and, with 72% responding, uncovered wide variability in the way interviews were conducted. The number of interviews required of each candidate, for instance, varied from one to four. The interview process either did (for 20% of respondents) or did not (75%) vary among applicants.

The format involved either a single questioner or a panel of up to eleven interviewers. Regardless of procedure, however, all survey respondents considered interviews necessary to assess non-cognitive traits, such as empathy, motivation, and persistence, although the schools differed on which traits should be assessed. Nevertheless, slightly more than half of the respondents failed to systematically analyze characteristics of

successful medical students to guide development of admission criteria. Such a job analysis could have been used to significantly improve interview validity (Campion, Pursell, & Brown, 1988).

Only 12 of the responding schools examined inter-rater reliabilities, i.e., correlations between interviewers' ratings for the same applicant. Few respondents (17%) indicated their schools offered training to limit rater bias, and fewer still (15%) promoted structured interviews. Only one-fifth of respondents indicated their schools evaluated the effectiveness of interviews in predicting medical student success.

In sum, the value of interviews as predictors was more often assumed than demonstrated. This is pertinent because others have assailed medical student interviews as having no predictive value (Smith, Vivier, & Bain, 1986; Taylor, 1990). Smith, et al. (1986) examined student records at Brown University School of Medicine and found after two years "there was no significant difference on any variable between the interview and no-interview cohorts" (p. 405). Taylor (1990) reported that students selected with and without interviews at the University of Iowa Medical School were not materially different, either behaviorally or academically. The attrition rate for the two groups matched and there were neither more nor fewer problem students in either class.

Can any studies be found supportive of academic interviews? A British medical school investigation warrants attention. Powis, Neame, Bristow, and Murphy (1988) compared interview records of medical students who did not complete training (n = 59) with students who graduated with honors (n = 67) over a nine-year period. Both groups were matched with controls by gender, age, and other characteristics. The authors determined students who did not graduate had been rated significantly poorer in interviews than matched controls that did graduate ($p < .005$). Further, honors graduates had considerably better interview scores than non-honors graduates ($p < .04$).

By this scheme, satisfactory discrimination had been achieved, but even here, Siu and Reiter (2009) questioned the generalizability since correlations held only for a small number of students scoring highest (honors graduates) or lowest (non-graduates) on the predictor and outcome variables, but not for the entire cohort under investigation.

Other Judgment Challenges. Authors have pointed to the difficult task of discerning whether personal characteristics assessed during medical school interviews were authentic or coached (Albanese, Snow, Skochelak, Huggett, & Farrell, 2003). Interviews may not help distinguish applicants motivated by altruism, for example, from those driven by status and power. Applicants appreciate that important decisions are based on interviews and it serves them to be perceived in an advantageous light. Pricey test preparation firms tout services in helping students maximize admission test scores, and it is likely applicants also seek help with interview preparation. In the Albanese, et al. (2003) study, first-year medical students were surveyed over three years with 41-44% reporting they had received assistance in writing personal statements.

With respect to raters, judgment errors can be minimized but interviewers first must be apprised of their susceptibility to bias (Edwards, Johnson, & Molidor, 1990; Quintero, *et al.*, 2009). Structured interviews are advocated (Conway, Goodman, & Jako, 1995; Wiesner & Cronshaw, 1988) and are characterized by four steps — an initial job analysis to devise admission criteria based on expected performance; development of sample answers for rating scales followed by tips and practice to ensure consistent evaluations; agreement on the same questions to ask all interviewees; and use of interview panels to limit personal biases (Edwards, et al., 1990). Extended discussions of other biasing factors such as posture, facial expressions, and movements are found in Kahn (1957). Economic aspects are addressed in Cascio and Ramos (1986).

Interviews at Residential Math and Science Schools

Given a litany of challenges – biased rater tendencies, unstructured protocols, unreliability, poor predictive validity and more – most education studies paint a pessimistic portrait of selection interviews (e.g., Albanese, *et al.*, 2003; Buckley, Norris, & Wiese, 1997; Feldhusen & Jarwan, 1995; Siu & Reiter, 2009; Smith, Vivier, & Bain,

1986). For such questionable gain, interviews also are quite costly, from securing faculty and staff services, to scheduling venues, tours and refreshments, to time and travel expenses for applicants.

As true decades ago as today, Hills (1971) concluded: "The low fidelity and high cost of the interview make its use irrational for most educational selection situations" (p. 693). Especially relevant here is the Feldhusen and Jarwan (1995) work which examined academic predictor variables at seven of the ten residential math and science schools created by that time. High school grades and SAT scores were found to be good predictors of residential school GPAs, but not interview scores, which had no forecasting value. In light of such negative assessments, this investigation sought to discover what roles interviews still played in student selection at these math and science schools.

Methods

Table 1 below lists the 17 residential STEM schools, the founding years, and their campus locations. Eleven are advanced high schools that hire their own faculty, while six are early college admission programs on university campuses. In almost all cases, admission is restricted to state residents.

Each school's admissions director was asked to complete a questionnaire asking whether interviews were conducted at their school and if so, to indicate (1) the purpose of the interviews; (2) the institutional roles of interviewers; (3) whether or not training sessions were held; (4) the interview format involved; (5) whether or not questions were standardized; (6) the weight given interview ratings; and (7) whether or not reliability and validation studies were conducted.

Results

Admissions officers responded from 14 of the 17 schools. Nine of the 14 officers said they interview candidates and five said they do not. The five that do not includes four that formerly conducted interviews but had stopped. Table 2 summarizes features of the five non-interviewing schools.
In one school, interviews lost favor after rural and disadvantaged students were thought to have been intimidated by faculty interviewers. But the greater reason to cancel interviews was that "Some teachers never met a student that they liked and some never met a student they did not like." This of course describes severity and leniency errors and indicates that at the very least inter-rater reliability coefficients were not initially established.

Advanced High Schools	**Campus**
North Carolina School of Science and Mathematics (1980)	Durham, North Carolina
Louisiana School for Math, Science and the Arts (1982)	Northwestern State University in Natchitoches
Illinois Methematics and Science Academy (1986)	Aurora, Illinois
Mississippi School for Mathematics and Science (1987)	Mississippi University for Women in Columbus
S. Carolina Governor's School for Science and Mathematics (1985)	Hartsville, South Carolina
Indiana Academy for Science, Mathematics and Humanities (1988)	Ball State University in Muncie
Alabama School of Mathematics and Science (1989)	Mobile, Alabama
Oklahoma School of Science and Mathematics (1990)	Oklahoma City, Oklahoma
Arkansas School for Mathematics, Science, and the Arts (1993)	Hot Springs, Arkansas
Maine School for Mathematics and Science (1993)	Limestone, Maine
Tennessee Governor's Academy of Science and Mathematics (2007)	University of Tennessee in Knoxville
Early College Entrance Academies	
TExas Academy of Mathematics and Science (1987)	University of North Texas in Denton
Advanced Academy of Georgia (1995)	University of West Georgia in Carrollton
Georgia Academy of Mathematics, Engineering, and Science (1997)	Middle Georgia College in Cochran
Missouri Academy of Science, Mathematics and Computng (2000)	Northwest Missouri State University in Marysville
Kansas Academy of Mathematics and Science (2006)	Fort Hays State University in Fort Hays
Carol Martin Hatton Academy of Mathematics and Science (2007)	Western Kentucky University in Bowling Green

Table 1 - State-Sponsored Residential Math and Science Schools

STEM School Type	Interview History	Reason Discontinued
Advanced High School	Through 2002	Reliability Questioned
Advanced High School	Through 2006	Negative Cost-Benefit
Advanced High School	First few year	Student Motives Suspect
Advanced High School	First few years	Assumed Interviewer Bias
Early College Admission	None	----------

Table 2 - Summary of Responses from Non-Interviewing Schools

At another school, interviews were discontinued when efforts seemed disproportionate to benefits and merely constituted "an additional Saturday of work," according to the admissions director. In a third school, interviewer biases were thought to have corrupt evaluations, while at the fourth school that suspended interviews, suspicion of motives rather than empirical analyses raised troubling concerns: "I have not done any analysis of the process and its success rate [but I feel] smart kids can fool the system if they want." In fact, formal validity and reliability studies had not been performed at any of the four schools, and the director at the fifth school simply never considered interviews.

Responses were received from nine of the 11 interviewing schools. Only one respondent professed any familiarity with the experimental selection research. Other respondents devised their own methods through improvisation or trial and error. Interviews were conducted by faculty members in half the cases, with staff, students, and/or community representatives serving on interview committees in the other half. Table 3 summarizes the results.

Assessment of student characteristics was the most commonly cited reason cited by admission directors as to why they conducted interviews. Respondents wanted face-to-face observations of applicants to judge their maturity, personality, and motives for applying. Officials also wanted to provide applicants the opportunity to preview the

STEM School Type	Interviewers	Format	Formal Training?	Structured?	Standard Questions?	Interview Weight	Verdict	Interview Rationale	Vaildity Studies?
Early College	Staff	Panel of two	No, but orientation	No	Yes with follow-up	Unclear	• Accept • Deny	• Ensuure personal contact with applicant • Preview hall life	No
Early College	Staff & Community	Panel of three	No	No	Yes with follow-up	Up to 30 of 100 total points	• 30% of admission decision	• Student assessment • Marketing	No
Early College	Staff & Students	Panel of two / No file access	No	No	Options provided	Varies	• Acceptable • Questionable • Not acceptable	• Student assessment • Marketing	No
Early College	Staff	Phone interview	No	No	Yes	Unclear	• Accept • Alternate • Deny	• Student assessment	No
Advanced High School	Faculty & Staff	One-on-One	No	No	Yes; other options provided	Varies	• Recoomend • Examine further • Do not recoomend	• Maturity assessment	No
Advanced High School	Faculty, Staff, Community	Panel	No, but orientation	No	Yes	Varies	• Recommend • Recommend with reservations • Do not recommend	• Student assessment • Marketing • Engage faculty & staff	No
Advanced High School	Director	One-on-One	No, but orientation	No	Yes; other options provided	Varies	• No recommendation based on interview.	• Ensure personal contact • Provide preview of college or job interview	No
Advanced High School	Faculty & Staff	One-on-One	No, but orientation	No	Yes, but optional	Varies	• Good fit • Not a good fit	• Detect red flags • Engage faculty	No
Advanced High School	Faculty & Staff	Panel of two / File access	No, but orientation	No	Options provided; others allowed	Varies	• Accept • Alternate • Deny	• Student assessment • Discern applicant motives	No

Table 3 - Summary of Questionnaire Responses from Interviewing Schools

campus and residence hall and to meet faculty and staff. One respondent viewed interviews secondarily as a service to help students prepare for future college or job interviews.

Faculty members at the advanced high schools are required to conduct interviews, whereas early college academies have no authority over university faculty, who volunteer at their own pleasure. While five schools held informal orientation sessions at the beginning of the application cycle, formal interview training did not take place. Orientations did not include practice or tips for refining interviewing skills. At best, interviewers were provided lists of questions and general guidelines based more on intuition, beliefs, and tradition than research-based facts.

The interview format included one-on-one interviews in three cases, a panel format in five, and phone interviews in one case. Seven of the respondents reported the same questions were asked all applicants, although no formats were structured. To reiterate, structured procedures have been associated with increased validity (e.g., Conway, *et al.*, 1995) and are characterized by an initial job analysis, standardized questions, coaching and practice, and panels rather than single interviewers (Edwards *et al.*, 1990). While some schools observed one or more of the steps, none adhered to all.

Interview procedural problems were prevalent. Faculty members at one school allegedly balked at interview training, considering it unnecessary, thereby stymieing efforts to standardize the process. At one of the universities, a pattern of absences or tardiness by certain faculty members ended requests for their services as interviewers. Since then, only individuals deemed reliable have been asked to conduct interviews, whether faculty, staff, students, or combinations thereof. The unfortunate consequence is that applicants are evaluated by shifting standards and conditions.

Only one academy respondent indicated concessions to the youth of the applicants. Conscious of being finalists, applicants as young as 13 or 14 sometimes succumb to nerves during interviews. Hence, candidates at the referenced academy are granted a chance on post-interview questionnaires to amend their prior responses. An item asked, "What would you like to add, emphasize, clarify, change, or otherwise remark regarding your interview?" In March 2010, over a third of 170 interviewees altered responses they felt could have been misleading or misconstrued. A few written comments conceded considerable anxiety: "It was very nerve-wracking;" "I'm shaking terribly;" "The interview thing is new to me;" "I'm shy and not outspoken when I'm in a room where I don't know anyone;" and "I kept babbling and I really wish I had spoken more loudly and clearly." The post-interview responses were included in the students' files, although the weight admission decision-makers accorded the remarks, if any, was undetermined.

In general, admission officers were nonspecific in conveying how much interviews influenced admission offers. When asked, "what weight is given to interviews in admission decision-making?" respondents answered indirectly noting interviews helped them identify "red flags," discover issues not revealed in the application, assess applicant maturity, make roommate matches, and identify students who may need help adjusting. Given such responses, one director almost certainly spoke for others by writing: "I often ask myself the same question."

The final and most important consideration is that none of the schools did any rigorous testing to assess the validity or reliability of the interviews. While some of the considerable resources devoted to conducting interviews could have been allocated to devising and testing a structured procedure, this was not done. Instead, representatives engaged in a time-consuming, expensive process that had not been proven to add predictive value over academic measures.

Discussion

With four residential STEM schools created since 2000, with another recently proposed in Colorado (Elliott, Long, Anthes, and Walker, 2010), and still others under consideration, the continued expansion of these schools has been enthusiastically endorsed (Atkinson, et al, 2007). National and even international fact-finding delegations have toured the campuses to examine operations and determine which aspects to model. One feature to consider is whether or not to institute preadmission interviews in student selection. A rigorous evaluation of interviews would help decide that question. In the present investigation,

however, no job analyses or structured procedures were even attempted at the schools prior to conducting interviews, presumably due to unfamiliarity with selection research. Moreover, in-house validation studies were never performed. Admission directors were unclear themselves how interview results should be interpreted.

So why do they interview at all? One written answer relates to institutional realities. The lone representative familiar with the research had argued against interviews but had been overruled by senior administrators. Another response noted that restrictive universities interview, so why not the STEM schools? "Selective schools are 'supposed' to interview," was the tongue-in-cheek comment approving a custom associated with exclusivity.

Interviews were recognized as marketing vehicles at several schools. Outside professionals are invited on interview panels in at least one instance in an effort to encourage community support for the academy. Similarly, other respondents favored interviews to ensure campus visits by students in hopes they form favorable impressions of the institutions. If so, noted critic Taylor (1990), then the targets of recruitment are being forced to pay the costs of being recruited.

Interviews are not optional for those seeking admission to 11 of the STEM schools. Only one school conducts phone interviews, while the others require campus visits with no provision for reimbursement. Aside from missed school time, students of limited means or from distant locales pay an especially high price to be interviewed. Parents may have to take leave from work to transport their students to the schools. In Kentucky, for example, the drive from Pikeville to the STEM academy in Bowling Green can take a family five hours. In Alabama, Mobile is six hours from the Huntsville school, and in Texas, driving from Brownsville to the Denton academy takes 10 hours — 20 hours for a round trip. Students make such sacrifices as the only route to admission.

The most common stated rationale for interviews was student assessment, and several admission officers placed undue confidence in their singular ability to judge candidates. For example, one stated, "I am the only one who interviews. With faculty and staff, I found I was getting really inconsistent information." Along these lines, representatives documented cases when their predictions proved to be accurate, but conspicuously omitted negative examples. Even though statistical predictions trump subjective measures, faith in personal judgments nevertheless held without objective corroboration, or seemingly any need for it.

Thus, despite weak or nonexistent evidence that interviews predict either academic or behavioral outcomes, the procedure remains popular. Taylor (1990) observed, "The interview is well entrenched in the admissions process, and it has the validity that comes from habit... [I]t probably will hang around for a while, though nobody can really explain why" (p. 178).

In point of fact, however, other explanations besides habit and tradition have been advanced. Arvey and Campion (1982) theorized that practical considerations make interviews popular. For example, interviews introduce applicants to expectations and realities of student life. Interacting with faculty, staff, and students exposes them to roles and responsibilities they will be expected to assume. Interviews also present opportune occasions to observe an applicant's sociability and verbal fluency.

The authors also suggest interviews accomplish other tasks unrelated to selection very well. As noted earlier, several admissions directors felt marketing was the primary value of interviews. A favorably impressed candidate is more likely to accept an admission offer or at least form a positive opinion, and perhaps influence others. A similar public relations value applies to community representatives serving on interview committees who can help marshal wider support for the school.

One more factor may account for the endurance of interviews. The phrase "illusion of validity" (Kahneman and Tversky, 1973) describes the phenomenon of having great confidence in highly fallible judgments:

> When interviewing a candidate, for example, many of us have experienced great confidence in our prediction of his future performance, despite our knowledge that interviews are notoriously fallible (p. 249).

In the present survey, such a tendency led some to trust personal decisions and discount the

assessments of others. Other interviewers tended to overly rely on case-specific information while ignoring disconfirming evidence. With no validity data and consequently only selected, biased feedback to consider, interviewers could easily inflate the accuracy of their judgments.

The question still remains as to whether or not interviews are economically defensible. Again, arranging and conducting interviews is expensive and time-consuming both for candidates and the school. If simpler, less costly means can be found to accomplish tasks admission directors listed as important, they should be explored. Suggested options include use of such technologies as online or virtual interviews or teleconferencing.

Recommendations

If, having considered all the challenges, schools decide in favor of in-person interviews, the following recommendations are proposed to maximize interview reliability.

- First, a job analysis as detailed earlier should be conducted.
- Second, an interview panel rather than single interviewers should be recruited and the panel should commit to the entire calendar.
- The interviewers should be provided instruction, coaching, and supervised practice in detecting and limiting common biases.
- Interview sessions should be structured with the same questions prepared for all applicants, and with sufficient practice to establish consistency on rating scales.
- Reliability and validity studies should then be conducted to evaluate how effectively interviews predict success. This would involve assessing students' subsequent behavioral and academic outcomes. One would then be in a better position to decide whether interviews add any predictive value over traditional academic measures.
- Finally, applicants who were not selected could be tracked and compared to admitted students. Such involved research is probably not practical for the longer-established schools that enroll but also deny hundreds of applicants. However, for the younger STEM schools with much smaller class sizes, such research could yield useful information.

References

Albanese, M.A., Snow, M.H., Skochelak, S.E., Huggett, K.N., and Farrell, P.M. (2003). Assessing personal qualities in medical school admissions. *Academic Medicine*, 78(3), 313-321.

Arvey, R.D. and Campion, J. E. (1982). The employment interview: A summary and review of recent research. Personnel Psychology, 35, 281-322.

Atkinson, R.D., Hugo, J., Lundgren, D., Shapiro, M. J., and Thomas, J. (2007). Addressing the STEM challenge by expanding specialty math and science high schools. *The Information Technology and Innovation Foundation.* Released by NCSSSMST. Retrieved August 11, 2010 from http://www.ncsssmst.org/CMFiles/Docs/STEM%20Final_03_20_07.pdf

Beehr, T.A., and Gilmore, D.C. (1982). Applicant attractiveness as a perceived job relevant variable in selection. *Academy of Management Journal*, 25(3), 607-617.

Benson, P.L., Severs, D., Tatgenhorst, J, and Loddengaard, N. (1980). The social costs of obesity: A non-reactive field study. *Social Behavior and Personality*, 8(1), 91-96.

Buckley, M.R., Norris, A.C., and Wiese, D.S. (1997). A brief history of the selection interview: May the next 100 years be more fruitful. *Journal of Management History*, 6(3), 113-126.

Cascio, W.F., and Ramos, R.A. (1986). Development and application of a new method for assessing job performance in behavioral / economic terms. *Journal of Applied Psychology*, 71(1), 20 – 28.

Campion, M.A., Pursell, E.D., and Brown, B.K. (1988). Structured interviewing: Raising the psychometric properties of the employment interview. *Personnel Psychology*, 41, 25-42.

Cash, T.F., Gillen, B., and Burns, D.S. (1977). Sexism and "beautyism" in personnel consultant decision making. *Journal of Applied Psychology*, 50(3), 301-310.

Conway, J.M., Goodman, D.F., and Jako, R.A. (1995). A meta-analysis of interrater and internal consistency reliability of selection interviews. *Journal of Applied Psychology*, 80(5),565-579.

Dipboye, R.L., Arvey, R.D., and Terpstra, D.E. (1977). Sex and physical attractiveness of raters and applicants as determinants of resume evaluations. *Journal of Applied Psychology*, 62(3), 288-294.

Edwards, J.C., Johnson, E.K., Molidor, J.B. (1990). The interview in the admission process. *Academic Medicine*: 65, 167-177.

Elliot, S.T., Long, S, Anthes, K., & Walker, C. (2010). Feasibility study on COSMIC: Colorado science, math and innovation Center. Office of the Commissioner, Colorado Department of Education, 1-112.

Feingold, A. (1992). Good looking people are not what we think. *Psychological Bulletin*, 111(2), 304-341.

Feldhusen, J.F., and Jarwan, F. (1995). Predictors of academic success at state supported residential schools for mathematics and science: A validity study. *Educational and Psychological Measurement*, 55(3), 505-512.

Frank, L.L., and Hackman, J.R. (1975). Effects of interviewer-interviewee similarity on interviewer objectivity in college admissions interviews. *Journal of Applied Psychology*, 60(3), 56-360.

Hatfield, E., and Sprecher, S. (1986). Mirror, mirror... New York: State University of New York Press.

Hills, J.R. (1971). Use of measurement in selection and placement. In Thorndike, R.L. (Ed). Educational Measurement (2nd Edition, 680-732). Washington, D.C.: American Council of Education.

Hosada, M., Stone-Romero, E.F., and Coats, G. (2003). The effects of physical attractiveness on job-related outcomes: A meta-analysis of experimental studies. *Personnel Psychology*, 56, 431-462.

Johnson, E.K., and Edwards, J.C. (1991). Current practices in admission interviews at U.S. Medical Schools. *Academic Medicine*, 66(7), 408-412.

Jones, B.M. (2009) Profiles of state-supported residential math and science schools. *Journal of Advanced Academics*, 20(3), 472-501.

Kahn, R.L. (1957). *The dynamics of interviewing*. New York: John Wiley and Sons, Inc.

Kahneman D., and Tversky A. (1973). On the psychology of prediction. *PsychologicalReview*. 80, 251-273.

Kerlinger, F. N. (1986). *Foundations of behavioral research* 3rd edition. New York: CBS College Publishing.

Kutcher, E.J. and Bragger, J.D. (2001). Selection interviews of overweight job applicants: Can structure reduce the bias? *Journal of Applied Social Psychology*, 34(10), 1993-2022.

Li, N.P., Bailey, J.M., Kenrick, D.T., Linsenmeier, J.A.W. (2002). The necessities and luxuries of mate preferences: Testing the tradeoffs. *Journal of Personality and Social Psychology*, 82(6), 947-955.

Marlowe, C.M., Schneider, S.L., and Nelson, C.E. (1996). Gender and attractiveness biases in hiring decisions: Are more experienced managers less biased? *Journal of Applied Psychology*, 81(1), 11-21.

Marquart, J.A., Franco, K.N., and Carroll, B.T. (1990). The influence of applicant's gender on medical school interviews. *Academic Medicine*, 65(6), 410-411.

Miceli, N.S., Harvey, M., and Buckley, M.R. 2001). Potential discrimination in structured employment interviews. *Employee Responsibilities and Rights Journal*, 13(1), 15-38.

Powis, D.A., Neame, R.L.B., Bristow, T., and Murphy, L. B. (1988). The objective structured interview for medical student selection. *Journal of British Medical Education*, 296, 765-768.

Puhl, R., and Brownell, K.D. (2001). Bias, discrimination, and obesity. *Obesity Research*, 9(12), 788-805.

Purkiss, S.L.S., Perrewe, P.L., Gillespie, T.L., Mayes, B..T., and Ferris, G.R. (2006). Implicit sources of bias in employment interview judgments and decisions. *Organizational Behavior and Human Decision Processes*, 101, 152-167.

Quintero, A.J., Segal, L.S., King, T.S., and Black, K.P. (2009). The personal interview: Assessing the potential for personality similarity to bias the selection of orthopaedic residents. *Academic Medicine*, 84(10), 1364-1372.

Shahani, C., Dipboye, R. L., and Gehrlein, T.M. (1993). Attractiveness bias in the interview: Exploring the boundaries of an effect. *Basic and Applied Social Psychology*, 14(3), 317-328.

Siu, E. and Reitner, H.I. (2009). Overview: what's worked and what hasn't as a guide towards predictive admissions tool development. *Advances in Health Science Education*, 14, 759-775.

Smith, S.R., Vivier, P.M., and Blain, A.L.B. (1986). A comparison of the first-year medical school performances of students admitted with and without interviews. *Journal of Medical Education*, 61(5), 404-406.

Taylor, T.C. (1990). The interview: One more life? *Academic Medicine*, 177-178.

Watkins, L.M., and Johnston, L. (2002). Screening job applicants: The impact of physical attractiveness and application quality. *International Journal of Selection and Assessment*, 8(2), 76-84.

Wiesner, W.H., and Cronshaw, S.F. (1988). A meta-analytic investigation of the impact of interview format and degree of structure on the validity of the employment interview. *Personnel Psychology*, 61(4), 275-290.

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The mission of NCSSSMST, the nation's alliance of secondary schools and programs preparing students for success and leadership in science, technology, engineering, and mathematics, is to serve our members' students and professionals, to foster collaborations, to inform STEM policy, and to advocate transformation in education.

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