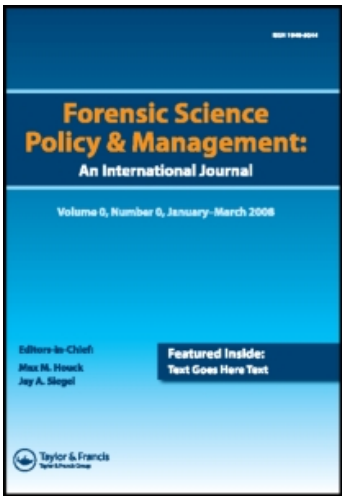

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The Forensic Science Assessment Test (FSAT): A Potential Tool for the Academic Assessment of Forensic Science Programs

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Abstract *Forensic science college and university education, like college education in general, needs assessment tools to ensure the accountability and continued improvement of academic programs. Both forensic science educators and practitioners have vested interests in the successful student outcomes of forensic science programs and the need for rigorous high quality academic programs. The Forensic Science Assessment Test (FSAT) may provide a viable and robust component of assessing the relative academic strengths and weaknesses of forensic science graduate and undergraduate programs and student outcomes. The FSAT potentially meets a specific component of the Forensic Science Education Programs Accreditation Commission (FEPAC) Standard 3.2 Planning and Evaluation. The FSAT if used appropriately will help to gauge and improve academic collegiate curricula in the forensic sciences.*

Keywords Education, FEPAC, forensic science, FSAT

Introduction

Forensic science operates within the domains of the criminal and civil justice systems, and provides a unique contribution to issues where the law and science come together in the determination of justice. Regarding expert testimony in the United States, Rule 702 of the Federal Rules of Evidence requires that expert witnesses are "qualified as an expert by knowledge, skill, experience, training, or education. . . " (Federal Rules of Evidence, 2006). Both the knowledge and education components of this qualification are direct effects of undergraduate and graduate education for most practicing forensic scientists, and consequently, the need for comprehensive and relevant academic training is essential to the profession. Since forensic science continues to play a significant role in the justice system, competent forensic science practice is the expected standard. The education of forensic science professionals has become a highly relevant issue, and the accountability for the knowledge component of forensic professionals falls largely on colleges and universities.

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Historically, forensic science academic programs have experienced an uneven and belated development with regard to established standards of academic accountability. At an international level, high quality forensic science education appears to an evolving process. A 2004 survey of Mediterranean countries stated that the Mediterranean Academy of Forensic Sciences is still a "young association" and one of their main challenges is to obtain ". . . self-development through education training. . . " (Chadly, 2004, pp. S5-S6), and forensic education should include "stated objectives and demonstrations of competency". In an attempt to provide accountable standards for competence, the European Network of Forensic Science Institutes (ENFSI) created forensic practitioner standards which can be delivered by "forensic science institutions or academic environments" (ENFSI, 2004). In the United Kingdom (UK), as in the United States, there has been a recent upsurge in forensic science programs. A British study reflects the most recent trend and points out the lack of focus and accountability. The study states,

> The number of forensic science courses available at UK universities has increased dramatically over the last five or ten years. A search of the Universities and Colleges Admission Service website for "forensic" undergraduate courses produces a list of 401 degree courses at 57 universities. These range from "Forensic Science" through

> to "Forensic Science and Human Resource Management" (Keele University), "Citizenship Studies and Forensic Science" (London South Bank University) and "Football Technology and Forensic Computing" (Staffordshire University). Various witnesses told us that the expansion in provision of forensic science degrees "does not reflect the limited employment prospects in forensic science nor is it in response to employers in the sector". Rather, we heard that the growth was a result of student interest in forensic science, which was, at least in part, stimulated by television dramas featuring forensic scientists and high profile coverage of forensic science in books and by the media. (House of Commons, 2005, p. 43)

Forensic science educators and practitioners have had strong and vested interests in forensic science education, and this interest remains in the forefront of the profession. Although historically forensic science education has been viewed with skepticism (see Jonakait, 1991), the growth of forensic science academic programs and increased legal scrutiny of forensic science must eventually lead to accountability and the implementation of quality standards in forensic science education.

Accountability in Education

Accountability in education is a substantial goal of the 21st Century. In 2006, the United States Department of Education issued a report entitled *A Test of Leadership: Charting the Future of U.S. Higher Education* that focused on accountability and transparency in higher education. The report states that "... improved accountability is vital to ensuring... success..." (U.S. Department of Education, 2006, p.4). In 1985, the American Association for the Advancement of Science (AAAS) founded Project 2061 regarding science literacy. One of the outcomes from the AAAS Project 2061 is the 2008 book *Designing Coherent Science Education*. When discussing assessments, DeBoer et al note "... that there is a "current lack of high-quality assessment instruments in science", and there needs to be "... increased funding... for facilitating the development and implementation of more cognitively sensitive and meaningful assessments..."(p.182). The uncoordinated lack of a meaningful academic integration of forensic science education programs is aptly expressed by a UK House of Commons report which states,

> It is disappointing that, in view of the concerns expressed to us by the police and the wider forensic science community over standards in forensic science education, the Home Office has taken no action to communicate the existence of these problems to colleagues at [Department of Education and Skills] (DfES). We regret this lack of coordination between the Home Office and DfES (House of Commons, 2005, p. 45).

Some form of answerability must be available to ensure high quality student outcomes, and standardized testing is one established form of accountability. Kuncel and Hezlett (2007) conducted a meta-analysis of standardized tests including the Graduate Record Examination (GRE) and Medical College Admissions Test (MCAT) and concluded that "... standardized tests are useful predictors of subsequent performance in graduate school, predict more accurately than college GPA, do not demonstrate bias, and are not damaged by test coaching" (p.1081). There may also be other dimensions of student performance such as motivation, research projects, internships, leadership, or professional contributions that could also be important to student outcomes, but these dimensions would require considerably more research as they apply to and augment forensic science educational programs. Although there are numerous measures that might be used to assess forensic science academic performance outcomes, a standardized test does offer a recognized, objective and valuable metric. The Forensic Science Assessment Test (FSAT) is one available measure that is well designed to meet one of the much needed evaluations of program accountability.

Moving toward Forensic Science Education Accountability

In response to the recognition of shortfalls in forensic science education, the National Institute of Justice assembled a panel of 47 experts in 2001 to serve as a Technical Working Group for Education and Training in the Forensic Sciences (TWGED). In 2004, TWGED published a report titled *Education and Training In Forensic Science: A Guide for Forensic Science Laboratories, Educational Institutions, and Students* which provided several recommendations including sample curricula guidelines for undergraduate and graduate forensic science programs (U.S. Department of Justice, 2004). The *Guide* was designed to provide "... a framework for achieving and maintaining professional competency in forensic sciences," (p. 29) and stated that high quality academic programs are essential in achieving professional competency. The *Guide* indicated that a forensic science academic program "... is expected to provide documented, measurable objectives, including expected outcomes for graduates. The program is expected to regularly assess its progress against its objectives and use the results to identify areas for program improvement and to modify the program objectives" (p. 15).

The need to establish high quality forensic science education programs has been expanding internationally. In 2004, a UK panel studied British academic programs "... to examine the quality of forensic science education and training..." (House of Commons, 2004, p. 5), while the Forensic Science Society had already established standards for academic course accreditation. These national

activities confirm the current trend toward increased accountability in forensic science education.

Forensic Science Educational Program Accreditations

The United Kingdom (UK) began their accreditation of forensic science programs in 2001. The Forensic Science Society began an accreditation program for UK forensic education programs in an effort to standardize forensic courses. Their stated goal was that

> The service was developed to help establish and maintain standards of education in forensic science and involves major employers and professional interests. (Forensic Science Society, 2008, p. 1)

In the United States, as a consequence of the TWGED recommendations, the American Academy of Forensic Sciences (AAFS) in 2002 established an ad hoc committee called the Forensic Science Educational Program Accreditation Committee to develop an accreditation system for forensic science academic programs based on the curricular recommendations outlined by TWGED. In 2004, the committee became an official standing committee of the AAFS at which time its name was changed to Forensic Science Educational Program Accreditation Commission (FEPAC). In 2004, FEPAC began accrediting colleges and universities with forensic science programs. FEPAC's stated mission is

> . . . to maintain and to enhance the quality of forensic science education through a formal evaluation and accreditation system for college-level academic programs that lead to a baccalaureate or graduate degree. (FEPAC, 2009, p. 3)

One of the purposes of FEPAC is "to develop and to implement a set of well-defined procedures for evaluating forensic science programs against [the] standards" (FEPAC, 2008, p. 3). A standardized test will assist in meeting FEPAC Standard 3.2 Planning and Evaluation, wherein it states, "The program evaluation system shall consist of .... An analysis of the results of the students' performance in a capstone experience [*e.g.*, an evaluation of forensic science standardized test results, publications, and/or reports]" (p. 5). These objectives are consistent with and supportive of formal evaluation tools that can measure successful academic outcomes. This is also consistent with TWGED and *Education and Training in Forensic Science* of "a high level of competency for graduates" (National Institute of Justice, 2004, p. 23). The goal of an accountable metric addressing the academic competency of forensic science programs is a crucial objective of forensic science educators. Accordingly, the FSAT was developed.

FSAT Development

The Forensic Science Assessment Test (FSAT) arose from a series of meetings during 2006 intended to devise an assessment tool for forensic science academic programs. NIJ sponsored FSAT development meetings of forensic science practitioners and educators from several professional organizations including the American Society of Crime Laboratory Directors (ASCLD), American Board of Criminalistics [ABC], Council of Forensic Science Educators (COFSE), and FEPAC. Both ASCLD and the ABC represent international members and certificate holders. The content knowledge and administration for the FSAT were patterned on the ABC General Knowledge Examination test and process. The ABC (http://www.criminalistics.com), one of the largest forensic scientist certifying bodies in the world, has a vested interest in individual competence and professional certification. TWGED and *Education and Training in Forensic Science* also noted that an undergraduate education should include the "provision of a foundation for professional certification" (National Institute of Justice, 2004, p. 11).

The FSAT Elements

The FSAT is a standardized test that consists of 220 multiple-choice questions of which 200 are scored, 20 are pilot questions. Three hours are allowed to finish the test. Questions cover analyses typically provided by a forensic laboratory and questions from eight discipline areas and are scored independently as well as a part of the total score. This is not a pass/fail test. A relative ranking numerical score out of a possible 1200 points is provided to the student. The 'relative effectiveness' of students to students and programs to programs is also generated from FSAT analyses. Relevant texts used to assist in the initial development of the FSAT are included in Appendix A.

Knowledge, Skills and Abilities

Knowledge, skills and abilities (KSAs) provide the necessary elements of a competent and comprehensive assessment tool. One of the objectives of the TWGED and *Education and Training in Forensic Science* was to provide a "structure for the continuing education of practicing forensic scientists and training to enhance a current employee's knowledge, skills, and abilities [KSAs]" (National Institute of Justice, 2004, p. 1). KSAs are commonly a part of job descriptions, and would logically be aligned with any educational tool intended to enhance job competence. The KSAs for the FSAT were developed at the FSAT

development meetings. The final outline for the initial KSAs is outlined in Appendix B.

FSAT Job Description

The typical FSAT student test taker must be enrolled in a forensic science educational program. This test is designed for graduating seniors and graduate students.

A qualified student candidate must be able to:

- Understand the major scientific principles behind forensic science analysis.
- Understand how to recognize, collect, secure, and preserve physical evidence.
- Understand how to perform physical, chemical, and/or biological analyses to locate and identify items having evidential value.
- Understand how to interpret and compare analytical data generated from the analyses of physical/chemical evidence and known exemplars.
- Understand how to recognize the potential for forensic examinations in areas outside an area of specialization, prioritize the sequence of examinations, and handle evidence accordingly.
- Evaluate the appropriateness and/or the appropriate method of securing samples.
- Understand the use of laboratory instrumentation.
- Observe safe practices to ensure the safety of analysts.
- Understand legal processes including courtroom testimony, relevant legal decisions and concepts.
- Recognize and employ quality assurance measures to ensure the integrity of the analyses.
- Understand the importance of impartial and ethical work practices.

Test Administration

The FSAT is available to any forensic science undergraduate or graduate program through the ABC registrar (ABC Registrar, P.O. Box 1123, Wausau, WI 54402-1123, Fax: (715) 845-4156, phone 715-845-3684, abcreg@dwave.net). A program director or designee can administer the FSAT provided that appropriate test protocols are followed and a confidentiality agreement is signed.

Test Cost

The cost of the test for 2008 was $50.00 per test taker.

Test Score Report Waiver

Students taking the test are asked to sign a test report waiver form which allows program directors to receive copies of scores from individual test takers. This will allow program directors to determine if success on the FSAT is correlated with a student's academic success and may serve as a more thorough and external means of assessment of the curriculum.

Test Maintenance

The ABC Examination Committee will be responsible for updating and maintaining the FSAT. Other subject matter experts' assistance is anticipated.

Test Questions and Scores

Questions represent the breadth and depth of eight discipline areas: forensic molecular biology, trace evidence, drug analysis, toxicology, fire debris, fingerprints, questioned documents and firearms/toolmarks. For example, a representative test question from trace evidence is

> Which of the following is the most common type of external plasticizer found in the paint industry?
> a. phosphates, b. butyl acrylate, c. phthalates, d. adipates.

The correct answer is phthalates. This answer is found in the *Forensic Science Handbook* (Saferstein ,2002), pages 446-448. This answer would generally not be found in introductory forensic science texts, but in more advanced texts which address more specific forensic science knowledge. This question would generally be scored as more difficult, and relatively few students would likely know the correct answer. An example of a less difficult question from Forensic Biology is

> Human genomic DNA is not found in:
> a. white blood cells b. red blood cells c. spermatozoa d. epithelial cells

The correct answer is red blood cells. This answer could be found in numerous introductory texts in forensic science and in numerous texts for other biology courses. It is likely that most forensic science students would correctly answer this question.

Similar to the Graduate Record Examination (GRE), scores are based on the difficulty of the questions. Difficulty is based on the number of test takers who answer the specific question correctly. For example, if only 10% of the test takers obtain the correct answer, then the correct answer is worth 10 points; however, if 90% of the test

takers obtain the correct answer, then the answer is worth only 2 points. Therefore, test takers are ranked relative to one another in relation to correct answers and the extent of the difficulty of the question.

Test Score Benefits

The ABC has offered to waive certification application fees for future ABC examinations for students who achieve a 75th percentile ranking or better.

FSAT Pilot Spring 2007

A pilot paper version of the FSAT was offered in the spring of 2007 to FEPAC accredited programs. The FSAT was piloted with 147 test takers from eight FEPAC institutions with accredited forensic science programs: Arcadia University, Cedar Crest College, Eastern Kentucky University, Metropolitan State University at Denver, Marshall University, Ohio University, Virginia Commonwealth University, and West Virginia University (WVU). The WVU Forensic Science Initiative covered the cost of the pilot test, and participation was voluntary.

During the fall of 2007, the FSAT underwent a series of psychometric, content, and bias tests, and in February of 2008, the final subject matter review was conducted. A review of all the test elements of the FSAT indicated that the test was valid for testing purposes. The validated FSAT became available in the spring of 2008.

Preliminary statistical evaluations of the FSAT suggested that the test is robust and appropriate for the targeted test takers. Table 1 shows the descriptive statistical analysis of the pilot test.

Table 1. FSAT Statistics

FSAT score		
N	Valid	147
	Missing	0
Mean		574.04
Median		571.00
Mode		507[a]
Standard Deviation		90.783
Variance		8241.546
Skewness		.078
Std. Error of Skewness		.200
Kurosis		.020
Std. Error of Kurtosis		.397
Range		501
Minimum		310
Maximum		811

[a] Multiple modes exist. The smallest value is shown.

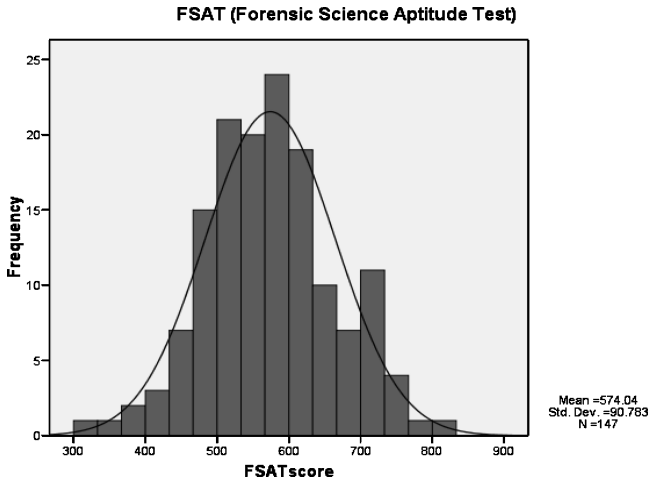

Figure 1. FSAT Test Takers

The shape of the histogram in Figure 1 indicates that the overall scores on the pilot test are normally distributed.

A subsequent analysis of 2007 and 2008 test takers combined showed a similar normal distribution (Figure 2). for overall scores.

The Shapiro-Wilk W (StatsDirect, 2008) test for non-normality (W = .991762, p = .2831) showed no evidence of non-normality. The statistical analyses suggest the normality of the FSAT test scores, and it supports the intent of the test developers to provide a robust and fair assessment. The post-test expert panel that reviewed the 2007 FSAT expected the following: 1. the test question degrees of difficulty were predictable and performed as expected, and 2. the question performance appeared to be normally distributed across the schools and participants taking the

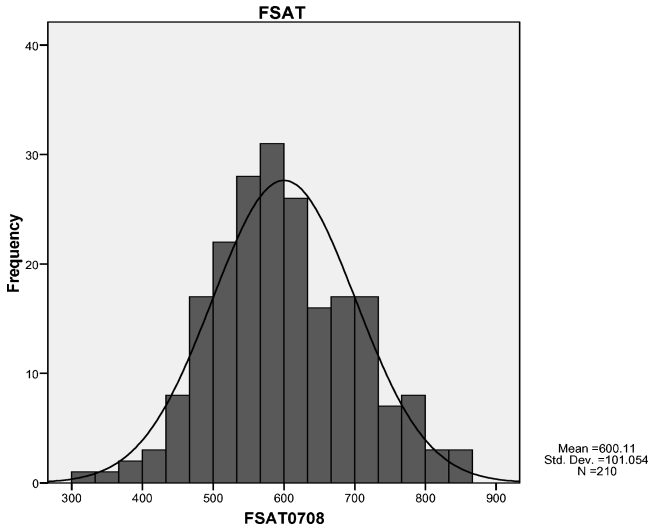

Figure 2. 2007 and 2008 FSAT Test Takers Combined

Table 2. GRE Quantitative Data (2005–06) and FSAT Score Report Format

GRE General Test Quantitative Scores by Intended Graduate Major Field: 2005–06 (U.S. Citizens Only) [Source: http://www.ets.org/Media/Tests/GRE/pdf/05-06_factors_final.%20pdf.pdf]				
Intended Major	N	Mean Score	75th Percentile	25th Percentile
Life Science	78,366	550	650	460
Physical Science	19,215	665	760	600

GRE General Test Verbal Scores by Intended Graduate Major Field: 2005–06 (U.S. Citizens Only) [Source: http://www.ets.org/Media/Tests/GRE/pdf/05-06_factors_final.%20pdf.pdf]				
Intended Major	N	Mean Score	75th Percentile	25th Percentile
Life Science	78,366	460	530	390
Physical Science	19,215	517	590	440

FSAT (2007)				
Forensic Science	N	Mean Score	75th Percentile	25th Percentile
	147	574	629	510

		Percentiles						
		Percentiles						
		5	10	25	50	75	90	95
Weighted Average(Definition 1)	FSATscore	425.40	468.00	510.00	571.00	629.00	704.60	727.20
Tukey's Hinges	FSATscore			510.00	571.00	629.00		

FSAT. The post-test expert panel concluded that the FSAT met the expectations.

FSAT Sample Test Reports

The FSAT may be used to evaluate student academic knowledge gained from participation in a forensic science program. For comparison purposes, the FSAT Score Report Format and GRE quantitative data from 2005-06 are presented in Table 2. This presentation format could be part of an annual FSAT report.

Scores may also be presented in comparative and relative formats ranking schools against schools (Tables 3a-b). Relative scores likely reflect whether the schools emphasize or de-emphasize specific discipline areas. For example, some forensic science programs specialize in the area of forensic biology, and would likely not score well overall in toxicology or latent prints. Also, the depth of survey forensic science courses might vary by using introductory forensic science texts and/or more advanced texts such as the *Forensic Science Handbook*. Ultimately, the forensic science program curriculum development should determine the depth of the various disciplines that are covered. The program director and faculty should determine the desirability of narrowly or broadly focused programs. The FSAT does offer a measure of the outcome of changing a curriculum to emphasize or de-emphasize specific discipline knowledge. Individual score reports for the students may also be generated (Tables 4a-b).

The Use of the FSAT

Since the FSAT is new, how it will be used by forensic science academic programs is still largely to be determined.

Table 3a. School A Rankings

School Name		
Rank 7 out of 8		
Average student score	521	
Category Scores	% Correct	Rank
Forensic Biology	39	8
Controlled Substances	56	2
Trace Analysis	47	3
Toxicology	39	8
Latent Prints	72	5
Questioned Documents	51	5
Fire Debris	59	6
Firearms/Toolmarks	62	5

Table 3b. School B Rankings

School Name		
Rank 1 out of 8		
Average student score	705	
Category Scores	% Correct	Rank
Forensic Biology	69	1
Controlled Substances	60	1
Trace Analysis	51	2
Toxicology	70	3
Latent Prints	97	1
Questioned Documents	69	2
Fire Debris	81	1
Firearms/Toolmarks	70	2

Table 4a. Student A Rankings

Student's Name		
Ranks 145/147		
Score	385/1200	
Category	% Correct	Rank
Forensic Biology	38	114
Controlled Substances	31	136
Trace Analysis	20	144
Toxicology	50	75
Latent Prints	38	140
Questioned Documents	20	133
Fire Debris	40	120
Firearms/Toolmarks	50	104

Some guidance may be derived from similar tests like the American Chemical Society (ACS) chemistry tests or GRE scores.

The ACS Example

The ACS tests are generally used by chemistry instructors to determine how their students' outcomes compare to other student outcomes in a specific area of chemistry. ACS exams are voluntary, and began as an ACS Division of Chemical Education project in September 1930. ACS exams continue to be used for end-of-course use and placement examinations, as well as conceptual and laboratory safety exams (American Chemical Society, 2008). Typical composite scores are represented in Table 5.

ACS composite scores are typically used for placement, or to make changes in the course designed to improve students' outcomes, or to gauge the individual course outcomes against the national averages and scores. Courses may be appropriately adjusted to be more in line with ACS general or organic comprehensive student study guides, or provide more depth of current courses. For example, one semester courses may be expanded to more credits or two semesters to cover more material in greater detail. The ACS exams may also be useful as end of course assessments, or overall chemistry program evaluations.

Table 4b. Student B Rankings

Student's Name		
Ranks 3/147		
Score	764/1200	
Category	% Correct	Rank
Forensic Biology	88	1
Controlled Substances	65	9
Trace Analysis	64	5
Toxicology	50	75
Latent Prints	88	45
Questioned Documents	80	10
Fire Debris	100	1
Firearms/Toolmarks	60	75

Table 5. ACS Composite Norms, Analytical Chemistry Exam 2001

American Chemical Society Division of Chemical Education Composite Norms Analytical Chemistry Exam 2001					
Score	*Percentile*	*Score*	*Percentile*	*Score*	*Percentile*
50	100	33	68	16	6
49	100	32	64	15	5
48	100	31	61	14	5
47	100	30	57	13	4
46	100	29	52	12	3
45	100	28	47	11	2
44	99	27	41	10	1
43	99	26	35	9	1
42	98	25	30	8	0
41	96	24	26	7	0
40	94	23	22	6	0
39	93	22	19	5	0
38	90	21	16	4	0
37	87	20	13	3	0
36	83	19	10	2	0
35	80	18	9	1	0
34	74	17	7		
Mean		28.48			
Std deviation		7.58			
Median		29			
KR-21 rel		0.8			
Std error/meas		3.37			

From: http://www4.uwm.edu/chemexams/stats/norms/an01.cfm

The GRE Example

The GRE exam use policy suggests that the GRE might be used for admissions decisions, fellowship awards, teaching assistantships, or counseling. For example, superior GRE scores may be useful for scholarship disbursements based on the relative potential of the student, or adjusting curriculum or specific course requirements for the relative strengths or weaknesses of student candidates. The correlation of student program outcomes with incoming GRE scores, if appropriately correlated, may be useful for predicting final student outcomes. The GRE use policy suggests that the test is not appropriately used for the final conferral of a degree, employment decisions, or for using any test measure without conducting and documenting a validity study to establish an appropriate weight for the measure (Educational Testing Service, 2008).

The FSAT Example

The FSAT may be used in similar ways to the ACS or GRE, or the FSAT may be used in more novel or different ways that are better suited to the needs of the forensic science academic and professional communities. One of the main advantages of the FSAT is as a program evaluation metric, particularly with regard to curriculum. For example, the FSAT could function as an annual gauge for the improvement of a program. Improved scores in relevant knowledge categories would reflect intentional program developments aimed at improving specific knowledge. For instance, program enhancements in forensic biology (e.g., an additional course or course module in forensic serology, or biotechnology) would likely improve scores in forensic biology. Conversely, decreased or absent course elements in a specific knowledge area (e.g., firearms and tool mark analyses) would be reflected in low scores in that specific area. It should be kept in mind that low scores in a specific area do not necessarily reflect a 'poor' quality program, but rather a de-emphasis in a specific area of knowledge. The FSAT is not intended to be an ultimate measure of the overall quality of a forensic program, but rather is well suited to be a single measure of a program's discipline emphases. Research, internships, other course work, graduate or teaching assistantships, publications and professional presentations, and a host of other academic activities would be much more reflective of the overall quality of a forensic science program.

Since some programs offer survey or introductory forensic science courses, the depth and breadth of these courses could be reflected in the overall scores for some or all eight categories of the FSAT. Higher scores overall might also be correlated with aptitude as indicated by GRE scores or overall GPA for an individual student.

Students moving from undergraduate to graduate programs may demonstrate sufficient knowledge from the FSAT to place out of a survey or broad forensic seminar course requirement. The FSAT might also be used in conjunction with other program requirements as part of a capstone event. Minimum FSAT scores in a specific discipline area may be used as part of an overall program outcomes evaluation, and may be used to compare different student cohorts over time. Overall and discipline scores on the FSAT may also serve as a gross predictor and relevant preparation for later similar written examinations provided by certification bodies such as the American Board of Criminalistics.

Conclusion

Accreditation requirements provide an overarching aura of accountability, and individual and organizational accountability are indispensible forensic science outcomes. The National Research Council recommended that "laboratories should adhere to high quality standards. . . and make every effort to be accredited for DNA work (by such organizations as ASCLD-LAB)" (National Research Council, 1996, p.88). One of the goals of accreditation is to ensure a minimum compliance with accreditation criteria, and hence a minimal level of quality. Just as forensic laboratory accreditation schemes use external proficiency tests as measure of professional competence, forensic science educational programs should use an external standardized test as a measure of academic competence.

The FSAT was designed to be an external standardized test which meets the needs of forensic science academic programs in providing a viable and valuable metric. Ultimately the FSAT should aid in designing and meeting the knowledge requirements of the forensic science community. At a minimum, the FSAT, if used appropriately and effectively, will help to gauge and improve academic collegiate curricula in the forensic sciences. The FSAT's timing and content provide an opportune measure of academic outcomes for the forensic science educational community, and consequently, the FSAT may assist in meeting the forensic science communities' expectations of hiring competently educated practitioners.

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Appendix A

Texts Used in Development of FSAT

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Appendix B

Definitions:

Knowledge (K): The theoretical, historical, and intrinsic information that provides the background/basis of a specialized job class. Knowledge questions should be designed to measure comprehension (knowing the facts).

Skills (S): The techniques used in the application of knowledge (applying the facts or knowledge).

Ability (A): Inherent expertise needed to apply knowledge and skills to achieve results and form conclusions (interpreting the facts/skills, knowledge).

KSA Elements:

Each main and first sublevel in the KSA element will be scored by the Subject Matter Expert (SME) Committees of the ABC in terms of frequency and importance for determining the weight of each question on the test. Additional levels provide guidance and examples for breadth of scope in preparing questions and studying within the heading and first subheading.

I. History (K)
   A. Evolution of practice (past practices)
   B. Significant historical figures (e.g., Locard, Gross, Orfila, Kirk)
II. Crime Scene Preservation (K)
   A. Securing
   B. Documentation
   C. Searching
   D. Recognition of evidentiary value
   E. Safety
III. Crime Laboratory Operations—Overview (K)
   A. Laboratory Functions
      1. Forensic biology
      2. Controlled substances
      3. Trace analysis
      4. Toxicology
      5. Latent fingerprints
      6. Questioned documents
      7. Fire debris
      8. Firearms/toolmarks
      9. Pattern evidence
IV. QA/QC (K,S)
   A. Accreditation, Certification, Standardization (K)
      1. Laboratory accreditation
      2. Personnel certification (K)
      3. Standardization (K)
   B. Quality Assurance/Quality Control Application (S, A)
      1. Definitions
      2. Validation and verification
      3. Controls and standard reference materials
      4. Proficiency testing
   C. Document/Data Management
      1. Databases
      2. Case document preservation/integrity
V. Safety (K,S)
   A. Chemical Hygiene
      1. Safety labeling (MSDS)
   B. Universal Precautions
      1. Blood born pathogens
      2. Personal protective equipment
   C Hazardous Waste/Biohazardous Waste Handling
      1. Spill control
VI. Legal (K)
   A Decisions/Laws
      1. Frye
      2. Daubert and related decisions
   B. Legal Terminology
      1. Subpoena, deposition
   C. Court Testimony
      1. Voir dire/qualification
      2. Expert witness
   D. Procedural Law
      1. Search and seizure (4th Amendment)
      2. Discovery
VII. Ethics (K)
   A. Professional Ethics
      1. Conflict of interest
      2. Professional integrity
      3. Objectivity
      4. Professional obligations
VIII. Evidence Handling (K, S, A)
   A. Evidence Recognition and Collection
      1. Prioritization based on circumstance
      2. Sampling

B. Evidence Characteristics (Class/Individual)
   1. Identification
   2. Primary, secondary transfers
   3. Visible vs. latent evidence
C. Evidence Preservation and Integrity
   1. Chain of custody
   2. Alteration/degradation
D. Evidence Packaging
   1. Proper sealing
   2. Types of packaging

IX. General Science Terms and Principles (K, S, A)
A. Definitions and Applications
   1. Scientific method
   2. Microscopy
   3. Instrumentation
B. General Chemistry Concepts
   1. Nomenclature (IUPAC)
   2. Type of molecule/compound (e.g., aromatics, isoalkanes)
   3. Atomic, molecular weights
   4. Acids/bases
   5. Periodic table
   6. Elemental composition
   7. Bonding
C. General Biology Concepts
   1. Cell structure
   2. Genetics
   3. Characteristics of body fluids
D. General Physics Concepts
   1. Energy
   2. Electromagnetic spectrum
   3. Force
E. General Statistics (S)
   1. Central tendency
   2. Variation
   3. Population characteristics
F. Stoichiometry
G. Metric System
   1. Metric to metric conversion
   2. Metric to English conversion