Elsevier Education

White Paper

2018 Scientific Evidence for Elsevier HESI™ Exams and Products

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2018 SCIENTIFIC EVIDENCE FOR ELSEVIER HESI™ EXAMS AND PRODUCTS

Nurse educators require educational tools that assist them in supporting students to be successful in the program and on the licensing and certification exams. Cumulative testing is well supported in the educational research literature, both as a learning tool for elementary and college students and as a tool to obtain data for remediation and program revision. Research with college students has supported the use of retrieval learning in addition to study as a method of learning (Roediger & Karpicke, 2006a, 2006b; Kang, McDermott & Roediger, 2007; Karpicke & Roediger, 2007; Swanson, Holtzman, & Butler, 2010; Karpicke & Blunt, 2011; Agarwal, Bain, & Chamberlain, 2011; Karpicke, 2012; Soderstrom, & Bjork, 2014; and Weimer, 2014). Schools preparing nurses have become aware that cumulative testing throughout the program supports success in the program and on the licensing exam (Yoho, Young, Adamson, & Britt, 2007; Murray, Merriman, & Adamson, 2008; Parrone, Sredl, Miller, Phillips, & Donaubauer, 2008; Hinderer, Dibartolo, & Walsh, 2014).

Standardized cumulative exams are available from Elsevier HESI™ for use throughout the curriculum. Elsevier/HESI provides a standardized Admission Assessment (A2), a Registered Nurse Exit (E2), Practical Nurse Exit (E2), Specialty Exams, a Custom Mid-Curriculum Exam, as well as, Concept-Based Curriculum Exams and other Custom exams. Elsevier/HESI also provides APRN End of Program exams for Family, Adult Gerontology, and Nurse Executive as well as APRN Pathophysiology, Pharmacotherapeutics, and Physical Assessment examinations that are standardized. The exit exams for the PN, RN and APRN programs are based on the blueprints for the NCLEX®-PN and NCLEX-RN licensing exams and the APRN certification exams respectively. These exams allow faculty to consistently and authoritatively evaluate their students' learning, give direction for remediation, and evaluate the strength of their curricula.

Investigators have found Elsevier HESI examinations, including the Admission Assessment, RN and PN Exit Exams, Mid-Curriculum Exam, Specialty, and APRN End of Program to be successful measures for benchmarking program outcomes, measuring student achievement, guiding remediation prior to licensure or certification candidacy, and facilitating effective hospital orientation.

Validity and Reliability

Content validity for the HESI Exit Exams (E2) and the APRN End of Program exams are achieved through use of the NCLEX-RN, NCLEX-PN, and APRN Certification Exam blueprints to determine content, types of questions, and reading level. Content validity for the Specialty Exams, Mid-Curriculum, and other custom exams is supported by basing them on the Elsevier text book content used in the classroom setting and by using masters and doctorally prepared expert nurses to write the items. Reliability is determined for each edition and version by conducting item analyses on each exam and statistically calculating reliability. Elsevier end-of-course testing and Exit Exams fall in the highest categories for estimated reliability coefficients using the Kuder Richardson Formula 20 (KR-20) ranging from 0.90 to 0.94.

Predictive Validity

Numerous studies have been conducted with the A2 entrance exam and the specialty exams to address predictive validity in relation to success in the first year and success in courses (Murray, Merriman, & Adamson, 2008; Knauss & Willson, 2013; Underwood, Williams, Lee, & Brunnert, 2013; Hinderer, Dibartolo, & Walsh, 2014; Manieri, E., De Lima, M., & Ghosal, N., 2015). Research has also been completed with the mid-curriculum exam and the need for remediation (Harding, 2010). Research with the specialty exams was incorporated into the ninth and eleventh predictive validity research with the exit exam (Zweighaft, 2011; 2016). In these studies, E2 scores were significantly higher for those schools using the specialty exams in their courses ($t=12.42$; $p=.0001$) (Zweighaft, 2011; 2016).

Regularly, research is conducted to assess the continued predictive validity of the E2 exit exam. For the twelve completed RN validity studies, the E2 was found to have 96.4% to 99.2% accuracy in predicting NCLEX-RN success for students who achieved the recommended score of 900 or greater on the E2. Table 1 outlines RN studies conducted, dates, number of participants, and study outcomes. Table 2 outlines the seven PN studies, also highly accurate at predicting NCLEX-PN success (97.9% to 100%).

Table 1: ***Predictive Accuracy of Registered Nurse (RN) HESI™ Exit Exam***

RN Study	Dates	Participants	Predictive Accuracy
One	1996-1997	2,555	97.3
Two	1997-1998	3,296	96.5
Three	1998-1999	5.588	97.6
Four	1999-2000	5,903	98.3
Five	2001-2002	9,695	97.8
Six	2004	10,147	96.4
Seven	2006-2007	4,383	99.2
Eight	2007-2008	4,134	98.3
Nine	2008-2009	3,790	96.6
Ten	2009-2010	5,038	98.3
Eleven	2010-2011	9,215	98.2
Twelve	2015-2016	4,388	96.8

Table 2: ***Predictive Accuracy of the Practical Nurse (PN) HESI Exit Exam***

Study	Dates	Participants	Predictive Accuracy
One	1996-1997	170	100.0
Two	1997-1998	456	97.9
Three	1998-1999	689	99.1
Four	1999-2000	897	99.4
Five	2006-2008	1,149	99.5
Six	2009-2011	962	98.4
Seven	2015-2016	198	98.8

Four investigations have been conducted to assess predictive accuracy of the APRN End of Program HESI exam (Binder & Nibert, 2007; Binder, Jones, & Fuentes, 2008; Willson & Goodman, 2015, Willson & Throckmorton, 2017). The investigators found that Advanced Practice Registered Nurse (APRN) students scoring 900 and higher on the Family Nurse Practitioner exam had a 100% certification pass rate on the certification exam regardless of certifying body - American Academy of Nurse Practitioners (AANP) or American Nurses Credentialing Center (ANCC). All students (207; 100%) who took the Adult Gerontology exam, regardless of their score, passed the certification exam. Table 3 outlines APRN studies conducted, dates, number of participants, and study outcomes.

Table 3

APRN Study	Dates	Participants	Predictive Accuracy for 900+
Family Nurse Practitioner	2005-2007	49	100.0
Family and Adult NP	2008-2009	170	100.0
Family and Adult NP	2011	120	100.0
Family	2017	356	100.0
Adult Gerontology	2017	207	100.0

Implementation Science

The Implementation of HESI™ Exams includes student remediation strategies, policy setting, and curriculum evaluation that is based on the evidence.

RESEARCH CONDUCTED WITH THE HESI EXAMS

HESI Admission Exam (A2)

Maniere, DeLima, and Ghosal (2015) used logistic regression to assess data collected over five years to determine which of three preadmission exams (NLN Pre-Admission Examination for Registered Nurses, the HESI Admission Exam (A2), and the ATI Test of Essential Academic Skills) best predicted success in an ADN program. Of the 339 students who took admission exams and were followed over a four-year period, 211 completed the program. Regression analysis revealed that the HESI A2 examination scores explained success in the nursing program (completion) better (15.92% of the variance) than the other tests included in this study (B= 0.101; P= .000).

Hinderer, DiBartolo, and Walsh (2014) examined the relationship of the (HESI) Admission Assessment (A2) Examination to preadmission GPA, science GPA, and nursing GPA. Using a retrospective sample of 89 students, no relationship was found between the A2 Examination and preadmission GPA or science GPA. The A2 Examination was correlated with nursing GPA ($r = .310$, $p = .007$) and NCLEX-RN success ($r = .301$, $p = .010$). No relationship was found with timely progression in the program.

House (2013) used regression analysis with 155 BSN students to determine the relationship of HESI A2 subscores including Reading Comprehension, Anatomy and Physiology, and Math with first semester GPA, second semester GPA, Pathophysiology grade and Medical/Surgical I grade. The HESI A2 exam scores accounted for 19% of the variance in the GPA from first semester nursing courses. The HESI A2 Math (beta = .27) produced the greatest amount of unique contribution, followed by the HESI A2 Anatomy and Physiology (beta = .20), and then the HESI A2 Reading Comprehension subscore (beta = .18). The A2 Math score and Anatomy and Physiology score produced statistically significant unique effects on the second semester nursing GPA. Both the Math subscore and the Anatomy and Physiology subscore showed a significant unique contribution to the Pathophysiology grade. The A2 Math subscore made a statistically significant unique contribution to the Nursing 341 grade.

Knauss and Willson (2013) completed a retrospective study with 157 associate degree nursing students. They used a composite score of 75% including basic math, reading comprehension, vocabulary/general knowledge, and grammar. The investigators found a moderate significant positive correlation between the A2 composite score and grades in Nursing I ($r=.532$; $p<.01$) and Nursing II ($r=.455$; $p<.01$). There was also a positive correlation between each of the exam components and course grades with vocabulary/general knowledge scores having the highest correlation (Nursing I: $r=.371$; $p<.01$ and Nursing II: $r=.359$; $p<.01$).

Underwood, Williams, Lee, and Brunnert (2013) evaluated correlations between A2 subscores in reading comprehension, vocabulary and general knowledge, math, and anatomy and physiology. They combined the reading comprehension and the vocabulary and general knowledge scores to form one English composite score. The investigators used A2 scores from 184 baccalaureate students and correlated them with the final grades in the first three nursing courses. The highest correlations were between the English composite and the three courses (r=.503, .581, and .414; p<.01). Correlations between A&P and the three course grades were the next highest (r= .350, .402, and .404; p<.01). The lowest, but still statistically significant, correlations were between Math scores and the three final course grades (r=.297, .239, and .253; p<.01).

Chen and Voiles (2012) assessed the success of 506 students admitted to an ADN program. The relationship of A2 composite scores and five component scores (Basic Math, Reading Comprehension, Grammar, Vocabulary & General Knowledge, and Anatomy & Physiology) with the final course grades in the three first-semester nursing courses was investigated. The composite A2 scores and all five component A2 scores were significantly correlated (P≤.01) with final course grades in Nursing Process I and Nursing Process II. All A2 scores except reading comprehension were significantly (P≤.01) related to final course grades in Pharmacology. The investigators assessed the differences in mean A2 scores of students who completed all three of the first-semester nursing courses and the mean A2 scores of students who did not complete one or more of these courses. The mean composite A2 score and the mean score for each of the five component A2 exams were significantly higher (P≤ .01) for those students who completed all 3 nursing courses than for students who did not complete one or more of the courses.

Bodman (2012) used two cohorts of 196 and 67 ADN students to assess correlations between the HESI A2 composite scores and grades in the first two nursing courses. In the two cohorts studied, the A2 composite scores were significantly positively correlated with grades in the first two nursing courses (r=0.340-0.590; p <.01). In the first cohort, the A2 biology score was significantly positively correlated with grades in the first two nursing courses (r=0.382-0.542; p< .01). This association was weaker (r= 0.390; p< .01) in the second cohort for the first nursing course and not significant for the second nursing course.

Murray, Merriman, & Adamson (2008) used a longitudinal descriptive design to evaluate the A2 in predicting student success in an ADN and a BSN program. A2 scores and grades throughout the curriculum for 68 ADN and 69 BSN students were used. The A2 was administered after admission to the program for placement and remediation. A bivariate regression analysis was used to assess the accuracy of the A2 composite in predicting course grades. In the ADN program, composite scores were significantly positively correlated with eight of the nine nursing course grades from four levels of the program (r=0.253-0.442; p= .05-.01). In the BSN program, the A2 composite score was significantly, positively correlated with 10 of the 20 nursing course grades (r=0.241-0.374; p=.05-.01). Four of the ten courses were in the sophomore year, five were in the junior year, and one was in the senior year. All 69 students in the BSN program completed the program within two years of admission. Although course grades were available for only 68 of the ADN students, 217 students took the A2 exam. Of these students, 80 did not complete the program within two years of admission. A t-test was used to assess the difference in A2 scores for those who completed the program and those who did not. Scores on the A2 were significantly higher (p<.001) for those who completed the program within two years.

Murray, Merriman, and Nibert (2006) conducted a retrospective study with 264 ADN students and 200 BSN students attending schools in Tennessee and Texas. The investigators completed correlations among HESI scores and final course grades, chi squares to determine differences in NCLEX performance according to HESI E2 scoring interval and type of program, and discriminant analysis to determine A2 predictive accuracy for program completion. Significant correlations (P<.05) were found among the HESI A2 scores and final course grades in courses across the curriculum, with the exception of one course. Predictive accuracy of the E2 was 96.43% for ADN students, 98.53% for Tennessee BSN students, and 94.87% for Texas BSN students. The investigators found no significant differences (P < .05) in the predictive accuracy of the E2 by program type. Significant differences (P<.05) were found in NCLEX-RN pass rates by E2 scoring interval. Based on the results of the discriminant function analysis, the A2 was significantly predictive (P<.000) of nursing school success.

Davidson and Miller (2013) conducted a longitudinal study with 85 baccalaureate students to assess the accuracy of the A2 in predicting student success in the first nursing courses. The students' cumulative A2 scores were significantly positively correlated with both of the first semester nursing course grades (r = 0.275-0.343; p = .05). For students who completed the program, the A2 cumulative, Reading Comprehension, and Math scores were significantly positively correlated with the first nursing theory course grade (r = 0.312-0.441; p =.05-.01). The investigators expanded the study with 79 newly admitted students. They found a positive low, but significant correlation of Reading Comprehension scores (r = 0.181; p = 0.000) and Math scores (r = 0.155; p = 0.00) with graduation from the program in two years. Finally, a low, but significant positive correlation was found between Math scores and HESI E2 scores (r = 0.128; p = 0.000).

Yoho, Young, Adamson, and Britt (2007) completed a longitudinal study with 135 students who achieved the school designated cutoff score of 70% or greater to assess the accuracy of Health Education Systems, Inc. A2 examinations in predicting the success of ADN students in the program. The A2 reading comprehension examination was correlated with scores on the mid-curriculum (MC) exam (r = .412; p = .01) and MC scores were positively correlated with Exit Exam (E2) scores (r = .617; p = .01). The E2 was 94.83% accurate in predicting the success on the NCLEX exam.

Mid-Curriculum Exam

Harding (2010) completed a longitudinal, descriptive study with 52 second year associate degree students who completed the program to assess the usefulness of the Mid-Curriculum exam in identifying at-risk students. The original sample of 68 students was reduced because 16 students did not complete the program. The MC-HESI was customized to their curriculum, included 105 items, and was administered during the final week of the second semester of a four-semester nursing sequence. The HESI E2 was administered six weeks prior to completion of the program. Program variables included grades from the two Capstone courses. There were significant correlations between the HESI MC scores and students' GPAs on admission and at the time of the test (r=0.381; p<.01 and r= 0.445; p<.01). The HESI MC scores were significantly correlated with the two Capstone course scores (r=0.522 and 0.513; p<.01). The 16 students who were not successful in the program all had scores less than 800 on the MC-HESI exam. A t-test was used to assess the difference in scores for the successful versus the unsuccessful group. There was a significant difference in scores with those who were unsuccessful scoring significantly lower ($\bar{x}$ = 823.3 and 743.4; t=2.532; p=.017).

Yoho, Young, Adamson, and Britt (2007) used a descriptive correlational design to determine the predictive accuracy of the HESI A2, Mid-Curriculum (MC) and E2 with the NCLEX-RN in a sample of 77 ADN students. Pearson correlations were used to assess relationships between the A2 Math and Reading Comprehension scores and the Mid-Curriculum exam scores. A2 Math scores were not significantly correlated with the MC scores (r=.129; p>.05). A2 Reading Comprehension scores were significantly positively correlated with MC scores (r=.412; p=.01). MC scores were positively correlated with E2 scores (r=.617; p= .01). The first version of the E2 was 94.83% accurate in predicting NCLEX-RN success.

Specialty Exams Improve NCLEX-RN Pass Rates

Zwieghaft (2011), in the ninth validity study, examined the use of specialty exams in relation to E2 scores and NCLEX success in a sample of 63 participating schools (baccalaureate, ADN, and diploma), representing a total of 3,790 students. Students had taken one or more of the HESI Specialty Exams during their course work. There was a significant difference in mean Exit Exam scores for schools (n=43) that used Specialty Exams during their programs ($\bar{x}$ =865.7) and for non-users of the exams (n=20) ($\bar{x}$ =837.3). Using odds ratios and the benchmark score of 850 and above, all eight Specialty Exams were significantly predictive (P = .0001 to .0034) of NCLEX-RN success. The three most predictive specialty exams of NCLEX-RN success were Critical Care, Pediatrics, and Medical–Surgical.

Zweighaft (2016), in the eleventh validity study, again examined the impact of specialty exams with a sample of 138 schools including 8,464 students. Ninety-nine (71.74%; 5,900 students) schools used the specialty exams and 39 (28.26%; 2,564 students) did not. There was a significant difference in E2 scores between schools that used the specialty exams

and those that did not (t=12.42; p=.0001). This difference held across types of schools: baccalaureate (t=3.53; p=.0004), ADN (t=6.14; p=.0001) except diploma (t= 1.68; p=.0943). It is possible that the result for diploma schools was affected by the sample size, 175 users of the exams and only 23 nonusers.

Repeat Testing After Remediation

Adamson and Britt (2009), in the sixth validity study, addressed the predictive accuracy of the exam for repeat testing of one to three times. On V-1, 4,715 students scored 900 and above and 4,547 (96.44%) passed the NCLEX-RN examination on their first attempt. On V-2, 822 students scored 900 and above, and 764 (92.94%) passed the NCLEX-RN examination on their first attempt. On V-3, 200 students scored 900 and above, and 165 (82.50%) passed the NCLEX-RN examination on their first attempt. A one-way ANOVA was used to determine if differences existed in the predictive accuracy of the E^2 among the three versions administered: V-1, V-2, and V-3. Findings indicated that there were no significant differences in the predictive accuracy between V-1 and V-2, but V-3 was significantly ($P < .001$) less accurate in predicting NCLEX-RN examination success than both V-1 and V-2.

Langford and Young (2010), in the ninth-validity study, asked deans and directors at 154 RN schools (66 responded; 43%) and 92 PN schools (26 responded; (28%) if they mandated retakes of the E2 exam prior to graduation. Twenty-four (36.4%) of the schools did not require repeat testing; nine schools each permitted 1-2 re-takes (versions 1, 2, and 3); 24 schools allowed 4-8 re-takes. Analysis for predictive validity indicated that the exams retained predictive accuracy over three attempts on the exam with accuracy for the RN group at 98.3%, 94.9%, and 95.9% and for the PN group 98.4%, 94.4%, and 100%.

Young and Willson (2012), in the seventh validity study, assessed the predictive validity of the E2 for students required to take the exam one to three times to achieve success. Of the 4,383-total student sample, 1,075 students scored 900 or above on V1 of the E2 and 1,066 (99.16%) passed the NCLEX-RN on the first attempt. Of the 730 (16.66%) students who were required to take V-2 of the E2, 271 scored 900 and above on the second version of the E2 and 259 (95.57%) passed the NCLEX-RN on their first attempt. Three hundred sixty-seven students were required to take V3 of the E2. Of the 148 students who scored 900 and above on V-3, 138 (93.24%) students passed the NCLEX-RN on their first attempt. Significantly more students who scored 900 and above on V-1 of the E2 successfully completed the NCLEX-RN on their first attempt than those who scored 900 and above on V-2 and V-3 of the E2 ($x^2 = 31.4156$, $P \leq .000$). Accuracy of the E2 in predicting NCLEX-RN success was 97.93%, regardless of whether the student was required to take the examination up to three times before achieving the faculty-designated E2 benchmark score.

Barton, Willson, Langford, and Schreiner (2014) assessed the predictive validity of the E2 at different required scoring levels 900 and above, 850-899, 800-849, 700-799, and 699 or less. Although HESI recommends a minimum score of 900, many schools have lower benchmarks. Predictive accuracy decreased with each descending scoring level: 900 or greater=98.26%, 850-899=95.13%, 800-849=92.43%, 700-799=86%, and 699 or less= 71.30%.

Policies Related to the HESI Exit Exam

Greene, Ford, Smith, and Throckmorton (2018) surveyed deans/directors regarding policies related to achievement of a benchmark for the standardized exit exam. One hundred forty-nine schools responded to the survey. One hundred twenty-one (81.21%) schools had a policy in place and 28 (18.79%) did not have a policy. One hundred forty-one schools responded to the question on benchmark scores. One hundred eleven (78.72%) had a benchmark score in place while 30 (21.28%) did not. Fifty-three (47.75%) had set a score of 900, 54 (48.65%) 850, one (.90%) at 875, and three (2.70%) at 750 or less. One hundred forty-seven schools responded to the question on the mandatory status of the benchmark score. Fifty Seven (38.78%) indicated yes and 90 (61.22%) no. In response to the question of whether retesting was required (N=114), 37 (32.46%) said yes, everyone retested, 71 (62.68%) only those who did not achieve the benchmark, and 6 (5.26%) that retesting was optional. A majority of schools (97; 71.32%) allowed one to three retakes of the exam. Eighteen (13.24%) allowed unlimited retakes.

Barton, Willson, Langford, and Schreiner (2014) surveyed schools about school policies related to standardized testing. Fifty-four (84.4%) schools responded representing 5,438 students with 3,084 from ADN programs and 2,354 from baccalaureate programs. Sixty eight percent (37) of the schools set a benchmark of 850 and 18.5% (10) at 900. Thirteen percent (7) set other minimum scores between 700 and 950. Forty four percent (24) required mandatory achievement of the benchmark with retesting one or more times (22; 41%) or required remediation (35; 64%). Consequences for not meeting the benchmark were set by 30 (56%) schools and included course failure (27; 50%), delayed NCLEX candidacy (13; 24%), and delayed graduation (9; 17%). The authors also assessed differences in HESI E2 scores based on the presence or absence of a policy requiring passage of the E2 benchmark set by the school. Schools with the policy had a mean score of 907.2 and those without the policy had a mean score of 855 ($t=13.365$; $p< .0001$).

Test Preparation

Barton, Willson, Langford, and Schreiner (2014) received surveys from 99 schools with 64 completing the section related to policies. Sixty one percent (39) indicated that they provided students with a preparation plan and 85% (33) of those schools mandated that the student participate in the plan. Policies included self-guided review (e.g., case studies, test items, study guide) (33; 85%), faculty guided group review (22; 56%), faculty guided individual review (18; 46%), formal review (e.g., HESI, ATI, Kaplan) (17; 44%), peer/mentor tutoring (13; 33%), and a self-guided formal review online course (1; 13%). Schools with this requirement had a mean score of 905.47 on the E2 and those without a policy had a mean score of 853.13 ($t=13.677$; $p<.0001$).

Remediation Requirements

Greene, Ford, Smith, and Throckmorton (2018) surveyed schools about policies related to remediation. One hundred forty-three schools responded to the survey. One hundred (69.93%) schools had a policy on remediation while 43 (33.07%) did not. Validation that the student remediated varied from faculty documented (45; 41.28%), to student supplied proof (42; 38.53%), a contract with proof (2; 1.84%), and an Honor System (20; 18.35%). Consequences for failing to meet the mandatory benchmark were reported by 126 schools. Thirty-nine (30.95%) indicated that students were required to retake the exam, 31 (24.60%) delayed/denied candidacy, 27 (21.43%) delayed/denied graduation, 22 (17.46%) indicated Capstone failure, and seven (5.56%) other course failure.

Barton, Willson, Langford, and Schreiner (2014) surveyed 99 schools about policies and 64 (65%) completed the survey. The authors used a t-test to determine if there was a significant difference in HESI Exit Exam scores based on whether or not remediation was required after students failed to meet the benchmark. Those with the requirement had a mean of 885.18 and those without had a mean of 849.91 ($t =9.742$ and $p<.0001$). Those schools with required remediation had significantly higher mean scores on the E2 than those without required remediation.

Langford and Young (2010) surveyed deans and directors at 154 RN schools (66 responded; 43%) and 92 PN schools (26 responded; (28%) about remediation policies. Forty-seven (71%) of the RN schools required remediation with most requiring two to six weeks. All thirteen (50%) of the responding PN schools required two to six weeks of remediation. Eighteen of the 66 RN schools required Evolve online, seven the HESI Live Review, 11 online case studies, 12 a NCLEX preparation book, 20 live tutoring, 17 computer-based tutoring, and 17 other courses. Six of the PN schools required Evolve online; none required HESI Live Review, two online case studies, three a NCLEX preparation book, four live-tutoring, five computer-based tutoring, and six required other courses.

Use of Case Studies

Greene, Ford, Smith, and Throckmorton (2018) asked deans/directors about the use of case studies. Responses were received from 146 schools. Of these, 107 (73.29%) indicated that they used case studies and 39 (26.71%) said no. Schools could indicate multiple uses. A majority of the respondents (91; 65.94%) used them as a course requirement or

ungraded within a course, 13 (9.42%) for examination preparation, 14 (10.14%) for remediation, 12 (8.70%) for missed clinical, and four for study/ticket to class/skills lab (2.89%).

Dufrene, Hodges, and Vandenberg (2016) evaluated the use of case studies and the impact on specialty exam scores. The investigators used the case studies included with the HESI specialty exam packages for Fundamentals and Health Assessment. One hundred thirty one students were divided into four groups: Group A, junior students had no case studies, but took the specialty exams, Group B, junior students had no case studies and no specialty exam, but three Fundamentals case studies and the Fundamentals specialty exam as seniors, Group C, juniors completed five case studies in Fundamentals and seven in Health Assessment plus five fundamental case studies as seniors, Group D, juniors completed ten case studies in Fundamentals and five in Health Assessment. Students in the three groups with case studies scored higher on the Fundamentals Specialty Exam than the group that did not complete case studies (B: 523-1031, C: 513-1178, D: 374-1122 compared to A: 386-849). Groups C and D scored higher on the Health Assessment exam than did group A (C: 661-1222, D: 491-1053 compared to A: 426-970). Group B did not take the Fundamentals exam. The groups were primarily Hispanic (32%, 49%, 41%, & 47%), followed by Caucasian (29%, 24%, 35%, & 11%), African American (21%, 18%, 9%, & 17%), and Asian (14%, 9%. 9%, & 25%).

Advanced Practice RN End of Program Exams

Binder, Jones, Emerson, and Fuentes (2008) correlated FNP exit exam scores for three groups of students from three campuses who had taken the exit exam and the FNP certification exam. All students (49) who scored at the recommended level of 800 or above on the APRN End of Program Exam passed either the AANP or ANCC certification exam.

Binder and Nibert (2009) evaluated the predictive validity of the HESI Exit Exam for students achieving scores ≥ 800 on the APRN End of Program exams with their ANCC or AANP certification exam outcomes. The standardized FNP and ANP exams were effective in assessing students' preparedness for the specialty accreditation exams and also provided evidenced-based measures of curricular outcomes. One hundred percent of the nurses who scored greater than 800 on the exam were successful on the certification exam.

Willson and Goodman (2015) surveyed 35 graduate nursing schools that administered the HESI APRN exam for Family and/or Adult-Gerontology about their APRN national certification exam outcomes, implementation strategies, and testing policies. Outcomes were reported for 141 APRN test takers, 96 Family APRN test takers and 45 Adult-Gerontology test takers. They found that scores of 700 or greater (113 students; 80.1%) accurately predicted certification pass rates 100% of the time. Fifty three percent of the students scored 800 or greater. Only one school had set a mandatory testing policy and few had established bench mark scores or included the test as part of a graded experience.

Willson, P. and Throckmorton, T. (2017) assessed the predictive accuracy of the Adult Gerontology Exit Exam and the Family Exit Exam in relation to the respective certification exams. Four hundred eighty-nine student certification outcomes were reported. Students' scores varied from 315 to 1,168 on the Adult Gerontology Exam with a mean score of 736. Scores on the Family Exam varied from 366 to 1,246 with a mean of 752. Scores of 900+ predicted pass rates on the Adult Gerontology and the Family Certification Exams 100% of the time.

Focused Nurse Orientations with Identified Remediation and Mentoring Topics

A HESI custom exam was evaluated as a measure of how much orientation is necessary to bring RN graduates to the level of critical thinking competence required for clinical practice. Ryan, & Tatum (2012) explored the relationship between general knowledge of pediatric nursing, critical thinking (CT) ability of newly hired nurses, as determined by a custom Health Education System Inc. (HESI E2) exam, and the length of time new graduates had to stay in orientation before meeting the required clinical competencies. A descriptive correlational study design was used. The customized exam was administered to 98 nurses who were beginning employment at a large pediatric institution. The RNs' critical

thinking ability significantly correlated (-.325; p=.004) with length of time in orientation, indicating that those with a higher critical thinking score required fewer days to meet orientation objectives. When the exam was used, orientation time was decreased by 50%. The custom examination provided an objective assessment of critical thinking ability in the nurse's specific domain of knowledge of pediatric care.

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Resources:

Ask your Elsevier Education Solutions Consultant for more information including:

- HESI Assessment RN brochure and HESI Assessment PN brochure
- HESI Assessment Testing & Remediation Research Bibliography
- State of the Science: HESI™ Remediation and NCLEX® Preparation Bibliography
- Eighth Validity RN Exit Exam Study Summary Report
- Ninth Validity RN Exit Exam Study Summary Report
- Tenth Validity RN Exit Exam Study Summary Report
- Tenth Validity PN Exit Exam Study Summary Report
- Eleventh Validity RN Exit Exam Summary Report
- Twelfth Validity RN Exit Exam Summary Report
- Twelfth Validity PN Exit Exam Summary Report

Future Research:

There are multiple research studies currently under way with Nurse Educators and Health Professionals investigating testing with HESI products and remediation, use of case studies, use of practice test questions and student outcomes. For more details, please contact Dr. Terry Throckmorton, Principal Researcher, HESI Review and Testing at 713-346-6927 or t.throckmorton@elsevier.com.