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A COMPARISON OF CERTIFIED RESPIRATORY THERAPISTS (CRT) AND REGISTERED RESPIRATORY THERAPISTS (RRT) ON SELECTED DEMOGRAPHIC AND JOB RELATED VARIABLES.

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Abstract

Background: We compared CRTs and RRTs to determine if there were significant differences in demographics, job variables, importance of AARC, attitudes, job satisfaction and intent to leave the job and field. **Methods:** A multifactor survey was mailed to a random sample of practitioners. CRTs and RRTs were compared using the t-test for interval and ratio scale variables and Chi-square for frequencies. **Results:** There were 280 usable surveys (28% response). There were no significant differences between CRTs and RRTs by gender, marital status, title, or responsibilities. There were significant differences between CRTs and RRTs by age, experience, and salary. RRTs were more aware of AARC benefits and importance and were more likely to encourage co-workers to join. CRTs were less likely to join due to cost. RRTs more strongly agreed that the RRT credential was rewarded, that all therapists should hold the RRT, rated higher on leadership and had higher levels of satisfaction with promotions, decision making and respect by nursing. There were no significant differences between CRTs and RRTs on satisfaction with work, pay, supervision or coworkers, or on intent to leave the job or field. There were also no significant differences between CRTs and RRTs in frequencies of procedures performed. **Conclusions:** RRTs were older, had more experience and better salaries than CRTs. RRTs more highly valued the RRT credential, had higher levels of satisfaction with promotions, participation in decisions and leadership and were more positive about the AARC. There were no significant differences in other aspects of job satisfaction, intent to leave the job or field.

Key Words: job satisfaction, attrition, intent to leave the job, intent to leave the field, respiratory care practitioner (RCP), certified respiratory therapist (CRT), registered respiratory therapist (RRT), American Association for Respiratory Care (AARC).

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Comparison of CRTs and RRTs on Selected Demographic and Job Related Variables

Introduction

There has been much discussion regarding the job roles, responsibilities, professionalism, leadership and other professional characteristics of certified (CRT) and registered respiratory therapists (RRT). The CRT credential is the minimum requirement for state licensure in most states.[1, 2] The RRT credential represents the advanced practice level for the respiratory care profession, and as such, should entail higher levels of professional responsibility, greater independence and a more advanced scope of practice.[1, 2] One might also expect RRTs to more often become supervisors, managers, educators and leaders in the field. [1, 2]

Job dissatisfaction is a factor that may influence respiratory therapists' intention to leave their job or profession.[3-9] There are extrinsic and intrinsic conditions that relate to job satisfaction.[3, 8] When extrinsic conditions such as salary, job security, status, and respect are less than optimal, then dissatisfaction may increase.[3, 7, 8] When provided recognition, autonomy, responsibility and advancement, respiratory therapists may experience positive intrinsic conditions and job satisfaction may increase.[3, 7, 9] It is well known that customer satisfaction is the key to retaining customers; job satisfaction is important for retaining employees. Aspects of professionalism may include such things as professional appearance, good communications, dependability, organization, safety, attention, participation, leadership and importance of life-long learning. [4, 5, 7] As an advanced practitioner, RRTs might be expected to display higher levels of leadership, participation in decision making, independence, job satisfaction and respect by other health care professionals.

We compared CRTs and RRTs to determine if there were significant differences ($p < .05$) in demographic, personal, job related and professional variables. We also examined whether there were significant differences between CRTs and RRTs in job satisfaction, intent to leave the job and field and the frequency at which both basic and advanced tasks and procedures were performed. Research questions addressed were:

1. Are there significant differences between certified and registered respiratory therapists on personal, organizational or job related variables?
2. Are there significant differences between certified and registered respiratory therapists on job stress, past turnover, absenteeism, intent to leave the job or intent to leave the field?
3. Are there significant differences between certified and registered respiratory therapists by primary job or frequency of basic and advanced procedures (scope of practice) performed?
4. Are there significant differences between certified and registered respiratory therapists on attitudes towards the American Association for Respiratory Care (AARC), the profession and other professional characteristics?

Methods

The population consisted of all (approximately 10,000) licensed respiratory care practitioners (RCPs) in Texas, as listed by the Texas Department of Health. A three part study instrument was assembled, field-tested and then mailed to a random sample of 10% of the population (n=1,000). There was one follow-up mailing to increase the return rate. Following the two mailings, a telephone survey of 10% of the non-respondents was conducted to collect demographic and job-related information about those who did not participate in the study and allow for the comparison of respondents to non-respondents to determine if there were significant differences.

The study instrument consisted of three parts: 1.) items to assess attitudes and values towards the AARC, the profession and professional characteristics, 2.) the Job Analysis Survey for Respiratory Care Practitioners (JAS-RCP) [7] with revised task list and 3.) the Job Descriptive Index (JDI).[10] The JAS-RCP collects 45 demographic, organizational, job specific, professional and personal variables including:

-Personal data (age, gender, marital status, education, credentials, salary, years in field, number of children, health, social support)
-Organizational and job related variables
-Job stress, past turnover, absenteeism
-Intent to leave the job and field
-Procedures performed (scope of practice)
-Organizational climate
-Participation in decision making
-Organizational communications
-Organizational stability
-Actual work load and perception of appropriate work load
-Job freedom, autonomy, control, independence
-Respect (physicians, nurses)
-Quality of the department
-Role clarity

The JAS-RCP has been reported to have evidence of content validity and test-retest reliability. [7]

Professional attitudes and attributes assessed included the importance of AARC membership benefits (publications, web-site, meetings, materials, services, advancing/protecting the profession, CPGs, policy statements and white papers); attitudes toward the AARC; attitudes towards the profession; and self-assessment of professional attributes (leadership, communications, dependability, organization, safety, attention, participation, importance of life-long learning). Items were developed to assess these attributes, field tested on a small group of respiratory therapists and then integrated into the survey instrument.

The Job Descriptive Index (JDI), developed by Smith, Kendall & Hulin (1969), is among the most widely used measures of job satisfaction in the world.[10] The JDI has demonstrated validity (discriminant, convergent, and predictive) and reliability (test-retest r = .70-.80). [10] The JDI generates scores for five aspects of job satisfaction: 1.) the work

(fascinating vs. boring, tiresome, satisfying vs. frustrating and endless, creative vs. routine, simple, challenging, sense of accomplishment, useful, respected); 2.) pay; 3.) promotions; 4.) co-workers and 5.) supervision.

CRT and RRT respondents were compared using the independent t-test for interval and ratio scale variables. Frequency data were compared using the Chi-square test.

Results

There were 280 usable responses for a 28% response rate. For the follow-up telephone survey of 10% of the non-respondents (n=70), there were no significant differences ($p>.05$) between respondents and non-respondents by age, gender, years in the field or credential held.

Fifty-nine percent (59%) of the participants were women (n=166) and 41% men, (n=114) with a mean age of 42 years (SD = 9.5; range of 21-68 years) and a mean of 15 years of experience in the field (SD = 9.5; range of 1-41 years). Marital status was: married (69.6%); single (15.4%); divorced (11.8%); separated (1.4%).

Respondents held the following credentials: CRT (38.6%); RRT (59.6%); NPS (8.2%); CPFT (5%); RPFT (4.6%); RN (2.5%); EMT/paramedic (2.1%); RPSGT (0.4%, n = 1); LVN (0.4%, n = 1). There were significantly more ($p=.004$) RRTs holding the NPS credential than CRTs (22 or 13% vs. 1 or 0.9%). In terms of professional association membership, 30.7% of participants belonged to the AARC and 43.6% belonged to the state society. Education in respiratory care included OJTs (2.9%, n=8); technician program (23.9%); associate's degree program (60.4%); bachelor's degree program (7.1%); master's degree in respiratory care program (0.4%; n = 1) and other respiratory care programs (3.9%). Education, other than in the field of respiratory care, included bachelor's degrees (23.6%); master's degrees (8.6%) doctoral degrees (3.2%) and medical doctorates (MD: 1.8%, n=5).

The primary location of the work place for respondents was a hospital (78.6%), home care company (6.1%), college or university (2.9%), clinic (1.8%), SNF/nursing home (0.4%), doctor's office (0.4%) or other (10%).

Table 1 compares CRTs and RRTs on selected demographic and job related variables. There were no significant differences between CRTs and RRTs by gender or marital status. RRTs were significantly older, had more years of experience and worked in departments with more employees than CRTs ($p<.05$). The mean salary for all participants was \$43,771(SD = 10,247). There was a significant difference ($p < .0001$) between mean salaries for RRTs (\$46,591) and CRTs (\$39,877).

Table 1 also compares CRTs and RRTs on the importance of AARC membership services and other professional attitudes and characteristics. RRTs were significantly ($p < .05$) more aware of AARC membership benefits, were more likely to encourage co-workers to join the AARC, and more strongly agreed that the AARC was important in protecting their future. RRTs also more strongly agreed that all respiratory therapists should hold the RRT credential and that the RRT credential was financially rewarded by their employer. With respect to other professional characteristics, RRTs rated their leadership, participation in decision making and respect by nurses significantly higher than CRTs (see Table 1). Mean RRT scores for job freedom, autonomy, control and

Table 1

A Comparison of CRTs and RRTs on Selected Demographic and Job Related Variables[1]

	CRT	RRT	p
Age	40(9.9)	43(8.9)	.02
Years of experience	13(9.3)	17(9.3)	.002
Salary	$39,877(8,565)	$46,591(10,464)	<.00001
Number of employees in the department	24(22.1)	35(33.9)	.002
AARC Membership			
CRCE transcript importance*	4.1(.9)	3.8(1.2)	.047
Aware of all AARC benefits**	3.8(2.0)	4.4(1.9)	.009
I encourage my co-workers to join AARC**	3.0(1.9)	3.9(2.0)	.002
I have not joined AARC because of the cost**	4.4(2.1)	3.8(2.3)	.03
The AARC is important in protecting my future**	4.4(2.0)	5.0(1.8)	.02
Professional Attitudes**			
All RTs should hold the RRT credential	3.9(2.4)	5.8(1.6)	<.0001
The RRT credential is financially rewarded by my employer	3.7(2.1)	4.5(2.1)	.004
Leadership**			
I am a leader in my field	5.0(1.8)	5.6(1.5)	.005
I am asked to assume a leadership role at work	5.1(1.9)	5.7(1.5)	.005
Other Professional Characteristics**			
Participation in decision making	4.6(2.0)	5.2(2.6)	.04
Respect by nurses	4.6(1.8)	5.3(2.3)	.01
Intent to leave the job	3.2 (2.1)	2.7(1.9)	.08
Intent to leave the field	3.4 (2.1)	3.4(2.0)	.97
Job Satisfaction			
Work	33(11)	37(27)	.20
Pay	12(7.7)	13(8.1)	.07
Promotions	7(6.9)	9(8.4)	.04
Supervision	36(16)	38(15)	.14
Co-workers	36(16)	38(15)	.14

* 5 = Very Important; 4 = Important; 3 = Neither Important or Unimportant; 2 = Unimportant; 1 = Very Unimportant

** 7 = Agree Very Much; 6 = Agree Pretty Much; 5 = Agree a Little; 3 = Disagree a Little; 2 = Disagree Pretty Much; 1 = Disagree Very Much

[1] Mean values were compared using the independent t test.

independence where also higher than mean CRT scores, however, these differences were not statistically significant ($p > .05$). There were also no significant differences between CRTs and RRTs on communications, dependability, organization, safety, attention, participation, or importance of life-long learning.

Job satisfaction scores and intent to leave the job and the field are also listed in Table 1 for CRTs and RRTs. RRTs were significantly more satisfied with promotions than CRTs ($p=.04$). There were no significant differences ($p > .05$) in satisfaction with the work, pay, supervision or co-workers between CRTs and RRTs. There were also no significant differences between CRTs and RRTs on job stress, past turnover, absenteeism, intent to leave the job or intent to leave the field.

Table 2

Primary Job Responsibility by Credential Held.

	CRT	RRT
Basic floor care	10% (11)	4% (6)
Critical respiratory care	9% (10)	18% (30)
Pulmonary function testing and/or blood gases	4% (4)	3% (5)
Rotate between basic floor care and critical care	33% (30)	27% (45)
Rotate between other areas	7% (8)	8% (13)
Supervisor	5% (5)	7% (12)
Department manager	4% (4)	4% (7)
Clinical educator	2% (2)	2% (3)
Teacher or professor in a RC education program	3% (3)	2% (3)
Cardiopulmonary diagnostics (cath lab, ECHO, EKG)	1% (1)	2% (3)
Sleep laboratory	7% (8)	5% (8)
Home care	7% (8)	8% (14)

The primary jobs held by all respondents included basic floor care (6.4%), critical care (14.6%), rotation between critical care and basic care (29.3%), supervisor (6.1%), department manager (3.9%), rotate across other areas (8.2%), home care (5.7%), PFT/ABGs (3.2%), sleep laboratory (1.4%), clinical educator (1.1%), teacher/professor (1.8%), cardiopulmonary diagnostics (cardiac catherization laboratory, ECHO, EKG - 1.1%) and other (7.9%). Table 2 compares CRTs and RRTs by primary job or job title. There were no significant differences ($p>.05$) between RRTs and CRTs by job title or primary job held.

Table 3 compares the frequency of basic and advanced procedures performed by CRTs and RRTs. Procedures performed, and associated percentage of all participants who routinely performed these procedures were: arterial punctures (75%); ABG analysis (75%); arterial line insertion (6.1%); simple spirometry (69.3%); complete PFTs (27.5%); stress testing (13.9%); sleep studies (7.1%); basic care procedures (82.1%); critical care/mechanical ventilation (74.6%); intubation (21.1%); extubation (69.3%); tracheotomy tube care (64.3%); tracheotomy tube changes (43.2%); and EKGs (55.4%). There were no significant differences ($p>.05$) between the frequency at which RRTs and CRTs performed these procedures – see Table 3.

For protocol based care, the following percentages of all respondents reported that they routinely performed protocol-based care for: oxygen therapy (69.6%); bronchodilator therapy (59.3%); ventilator management (50%); ventilator weaning (58.6%); and RC consults (51.4%). There were no significant differences ($p>.05$) between RRTs and CRTs in frequencies of protocol-based care performed.

In terms of advanced practice, the following percentages of all respondents said they routinely: assist with bronchoscopy (41.4%); perform air or ground transport (18.6%); assist with chest tube insertion (17.5%); perform NO administration (14.6 %); conscious sedation (7.9%); emergency thoracentesis (5%); ECMO (4.3%); and operate the aortic

Table 3

Frequency of Procedures Performed by Credential Held (CRT vs. RRT)

	CRT (n=108)	RRT (n=167)
Arterial punctures	77% (83)	73% (122)
Blood gas analysis	76% (82)	73% (122)
Arterial line insertion	4% (4)	8% (13)
Endotracheal intubation	23% (25)	20% (34)
Measurement of cardiac output and hemodynamics	3% (3)	7% (11)
Tracheotomy tube care	65% (70)	64% (106)
Tracheotomy tube changes	41% (44)	46% (77)
Simple spirometry	72% (78)	67% (112)
Complete pulmonary function testing	30% (32)	26% (44)
Critical care and mechanical ventilation	72% (78)	76% (127)
Respiratory care consults	49% (53)	53% (89)
Conscious sedation	7% (8)	8% (14)
ECMO	4% (4)	5% (8)
Smoking cessation programs	22% (24)	17% (28)
Transport (air or ground)	16% (17)	20% (34)
Basic care (aerosol therapy, O2, CPT, IPPB, etc.)	83% (90)	81% (135)
Pulmonary rehabilitation	28% (30)	20% (33)
EKG	61% (66)	50% (84)
Endotracheal tube intubation	68% (73)	70% (116)
Assist with bronchoscopy	36% (39)	44% (73)
Stress testing	19% (20)	11% (19)
Aortic balloon pumping	1% (1)	4% (6)
Perform sleep studies	7% (8)	7% (12)
Assist with chest tube insertion	22% (23)	14% (23)
Perform emergency thoracentesis	7% (7)	4% (6)
Asthma education	47% (51)	45% (75)
Asthma disease management program	20% (20)	19% (31)
Nitric oxide administration	13% (14)	16% (27)
Protocol-based oxygen therapy	76% (82)	65% (109)
Protocol-based bronchodilator therapy	64% (69)	57% (95)
Protocol-based ventilator management	50% (54)	50% (84)
Protocol-based weaning from mechanical ventilation	58% (63)	59% (98)

balloon pump (2.5%). There were no significant differences ($p>.05$) between RRTs and CRTs in the frequencies of advanced-practice procedures performed – see Table 3.

With respect to disease management, respondents reported routinely participating in asthma education (45.7%); pulmonary rehabilitation (22.9%); asthma management programs (19.3%); and smoking cessation (18.9%). There were no significant differences ($p>.05$) between RRTs and CRTs in frequencies of disease management procedures performed.

Discussion

There were significant differences ($p<.05$) between CRTs and RRTs by age, years of experience, number of employees in their departments and numbers holding the neonatal specialty credential. RRTs were older, had more experience in the field, and worked in larger departments. RRTs also made significantly more money than CRTs.

The professional community in recent years has instituted efforts to encourage eligible therapists to sit for the RRT examinations.[1, 2, 11, 12] These include official position statements supporting the registry credential and advanced practice, changes in the eligibility requirements for the examinations, and efforts to encourage employers to value and reward the RRT credential.[1, 2, 11, 12] In our study, RRTs were older and had more experience in the field than CRTs. It could be that younger therapists put less value on the RRT credential and are consequently less likely to sit for the advanced level examinations. It is also likely that some younger therapists simply have not been in the field long enough to complete the examination process and obtain the RRT credential. Employers may not include the RRT as a requirement for certain advanced job roles, and may accept RRT eligibility as an alternative for pay and promotion purposes. The profession should continue to promote a culture in which the registry credential is recognized and rewarded as the standard of excellence which all respiratory therapists are encouraged to seek and obtain. Registered therapists in our study were more likely to agree that all therapists should hold the RRT credential and that the RRT credential was rewarded by their employers. In fact, the RRTs averaged about $6,700 more per year in salary than CRTs.

We did not initially examine whether the observed difference in CRT and RRT mean salaries was due to the credential held or, as might be expected, also related to the age and years of experience of the practitioners. RRTs were on average, three years older than CRTs and had five more years of experience. Both groups had an average age in the 40s (the mean age for CRTs was 40, while the mean for RRTs was 43) – not exactly a young cohort. A post-hoc ANCOVA however, with age and years in the field as co-variants, demonstrated that a significant difference in salaries between CRTs and RRTs remained (weighted RRT mean = $46,616; weighted CRT mean = $39,877; $p < .00001$). We found similar differences when we compared practitioners with five or more years experience in the field for our sample ($n = 224$). In that case, CRTs averaged $40, 955 vs. $47,156 for RRTs ($p=.00001$). These post-hoc analyses would tend to support the argument that the differences we observed in salaries between CRT and RRT were attributable largely to differences in credential held.

RRTs were more aware of benefits of the AARC, were more likely to encourage co-workers to join the AARC and more strongly believed the AARC was important in protecting their future. CRTs were less likely to join the AARC due to cost. When we reviewed the data to compare CRTs and RRTs on actual membership in the AARC, we found that for the overall sample, AARC membership was 31% while CRT membership was 25% and RRT membership was 36%.

RRTs rated themselves significantly higher on leadership, participation in decision making and respect by nursing. For job satisfaction, RRTs had significantly higher levels of satisfaction with promotions. These findings provide additional evidence that the RRT credential is associated with advanced practice and professional leadership. It was also

interesting that RRTs were more likely to hold the neonatal specialty credential. This would be consistent with the idea that RRTs value advanced credentialing and are more likely to specialize in a specific area (*e.g.* neonatal respiratory care). There were no significant differences between CRTs and RRTs on satisfaction with work, pay, supervision or coworkers. There were also no significant differences between RRTs and CRTs on intent to leave the job or field.

In terms of primary job held, we were unable to demonstrate significant differences between CRTs and RRTs. In most cases, this is probably related to sample size rather than a lack of differences associated with the CRT or RRT credentials. For example, while 10% of CRTs and only 4% of RRTs listed their primary job as basic floor care, the total numbers in the category were only 11 CRTs and 6 RRTs – far too small a sample to detect a statistically significant difference. Nine percent of CRTs and 18% of RRTs listed critical care as their primary job, but again the numbers were too small to make this difference statistically significant. The largest category in terms of primary job was "rotate between basic floor care and critical care", which accounted for 33% of the CRTs and 27% of the RRTs. There were no significant differences in number of CRTs vs. RRTs in other primary job classifications, but a larger sample would be needed to generalize this finding.

In terms of scope of practice, CRTs more often performed basic care such as aerosol therapy, oxygen therapy, CPT and IPPB. RRTs more often performed such advanced procedures as arterial line insertion, cardiac output and hemodynamic measurements, tracheostomy tube changes, critical care and mechanical ventilation, respiratory care consults, aortic balloon pumping, and nitric oxide administration. These differences were not statistically significant. As with primary job, it would be unwise to generalize this lack of statistical significance, due to the small numbers of participants in some categories. For example, while 4% (n=4) of CRTs and 8% (n=13) of RRTs performed arterial line insertions, the total number of therapists reporting that they did this procedure was very small. In order for this observed four percent difference in frequencies to have been statistically significant, at least 75 survey participants performing arterial line insertion would have been required.

Limitations

Limitations of this study include the possibility that the study sample may not represent the population or that study respondents were not sufficiently similar to non-respondents to allow for generalization. Though care was taken to randomly sample the population, the actual sample may not represent the intended sample. The results of the follow-up telephone survey of non-respondents, however, do provide evidence that the there were no significant differences between respondents and non-respondents in terms of age, gender, years of experience, or credentials held (CRT vs. RRT).

The sample size of 280, though reasonably large, was not sufficient to detect significant differences between CRTs and RRTs on the frequency of procedures performed or primary job responsibility. The NBRC performs extensive job analysis research to ensure that the CRT and RRT examinations are job-related and reflect current practice.[13] In terms of scope of practice, the results of this paper should not be interpreted as being contrary to NBRC findings; the sample may simply have been too small to demonstrate statistical significance.

In terms of actual frequencies, our sample did show that RRTs more often performed many advanced practice procedures and a larger sample may have demonstrated statistical significance. Last, the survey used self-reported data, with all of the associated limitations.

Conclusions

RRTs were older, had more experience, worked in larger departments and had better salaries than CRTs. RRTs more highly valued the RRT credential and had higher scores for participation in decision making, leadership and respect by nurses. RRTs also were more positive about the AARC and were more likely to encourage co-workers to join. In terms of job satisfaction, RRTs were more satisfied with promotions and felt the RRT credential was rewarded by their employers. There were no significant differences between RRTs and CRTs in satisfaction with the work, pay, promotions or supervision, job stress, absenteeism or intent to leave the job or the field. Efforts to recognize and reward the role of the RRT as an advanced practitioner and encourage all respiratory therapists to seek and obtain the RRT credential should continue.

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A SURVEY OF GERONTOLOGY/GERIATRIC CURRICULAR COMPONENTS BEING OFFERED IN ASSOCIATE AND BACCALAUREATE DEGREE RESPIRATORY CARE PROGRAMS

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Abstract

Background: Respiratory therapists (RTs) are increasingly being called upon to care for older patients in a variety of settings. While some respiratory care programs offer gerontology courses, there is currently no mandate to include geriatrics in respiratory care educational programs. This study was designed to quantify the extent to which current respiratory care programs incorporate age-related issues into their curriculum. **Methods:** An email survey was distributed to all 328 accredited college-based respiratory care programs. Fifty-seven surveys were undeliverable, 271 were delivered. Follow-up phone calls were made to the non-responders. The final count was 120 returned usable questionnaires for a response rate of 44%. **Results:** Over 70% of respondents classified the following geriatric issues as being either very or somewhat important to incorporate into their curriculum: how aging affects lungs, age-related changes in vital signs, how DNR orders relate to respiratory therapists, providing palliative care to pulmonary patients, and management of co-morbid diseases with COPD. Less than 40% of the educators indicated that theories of aging or the dynamics of hope vs. hopelessness were important enough to include in their curriculum. When asked if they planned to incorporate geriatrics into their curriculum in the future, 50% said yes, 38.5% said maybe and only 11.4% responded negatively. Of the 20 geriatric educational components listed in the survey instrument, baccalaureate degree (BD) programs are currently teaching, on average, 57.8% of the listed geriatric topics and associate degree (AD) programs are teaching 50.6% of the topics listed. **Conclusions:** Programs were fairly evenly matched in terms of what geriatric related educational issues were currently being incorporated into their courses. The only areas where there was a significant difference ($p<0.05$) between the BD and AD programs in topics currently being taught were; legal issues that affect the elderly and stereotyping of elders (ageism).

Key words: gerontology, geriatrics, respiratory care, ageism, elderly patient care, curricular components, associate degree programs, baccalaureate degree programs.

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A Survey of Gerontology/Geriatric Curricular Components Being Offered in Associate and Baccalaureate Degree Respiratory Care Programs

Background

The number of older Americans who live past sixty-five years of age has dramatically increased since the early 1900s. Americans over the age of sixty-five have increased to about forty million, which makes up about 14.2 percent of today's population.[1] As the number of older people increases, their needs in regards to health care and the services of all health professionals will reach its highest point. Accordingly, professionals who work with older adult patients will need to be trained in age-specific competencies.

Today much of the healthcare that is directed towards older adults focuses on optimizing their functional capacity. Vulnerable elders however receive only about half of the recommended care, and quality of care varies widely from one condition to another.[2]

Attitudes towards older people also vary from provider to provider. Some think that the cost-benefit ratio in treating this particular age group is high because of an increased life expectancy. This attitude can result in less aggressive treatment modalities and/or sub-optimal health care.[3] Consequently, the number of older adults who seek health care essentially decreases because of these particular attitudes and practices directed towards them.

Advanced age is associated with a higher incidence of both chronic and acute disease. Nearly 90% of people age sixty-five and older have at least one chronic condition and 70% have more than one.[4] Additionally, elderly people run the risk of becoming more and more dependent on others. Although many adults can manage by themselves, a sizable percentage of adults over sixty-five require assistance with the activities of daily living. According to a 2004 Administration on Aging document, 27% of community-resident Medicare beneficiaries over age sixty-five in 1999 had difficulty in performing one or more activities of daily living (ADLs) and an additional 13% reported difficulties with instrumental activities of daily living (IADLs).[5] Dependence greatly increases from about 35 to 40 percent as the population reaches the age of eighty-five. Approximately 60% of all users of health care services are over the age of 65, which means that almost every health care professional becomes involved in caring for older adults, regardless of the type of institutional focus and patient population.[6] At the same time, older adults are living longer and are embracing healthier lifestyles. Since 1950, the decline in mortality among the elderly has been nearly 1% per year.[7]

The enormous growth in the population of older adults has significant economic consequences for the health care system. A recent report on the US health care workforce suggests that the conditions are ripe for what may be called a 'perfect storm'; the convergence of greater needs among geriatric patients and the proportional decline of available health care workers.[8] As the elderly population increases the level of chronic and acute conditions are likely to rise. In the future there will be a significant increase in the interaction between health care workers and geriatric patients whether they are in long-term or short-term care, traditional home care, or the acute care setting. One of the more important goals in health care should be to focus on the need, not only to treat, but also to educate these patients on the severity of their disease. It is also imperative to

educate health care providers in management strategies specific to the needs of older adults. The fact that the elderly often do not seek health care when it is needed contributes to disease processes taking a significant toll on their quality of life.

Many older people have spent the better part of their later years without any type of heath care, so when they arrive in the acute care setting almost everything is new to them. The acute care setting thus must be an integral component in the education of our older adult patients about their disease and disease management.

Because of age-related decremental changes in organ systems, the elderly may present to the health care facility with different clinical signs and symptoms of pathology. Often only non-specific complaints such as increased lethargy, diminished appetite, increased occurrence in falls and changes in mental status are the indicators that an underlying acute illness is present. Some medications prescribed for the older adult may actually hide or mimic the signs and symptoms of some acute disorder. The odds of elderly patients presenting with atypical manifestations are greatly increased due to the fact that malnutrition, cognitive impairment and the presence of co-morbid disease is common. It is because of these situations that health care providers should be well trained in geriatric patient assessment and knowledgeable about the diagnostic challenges.

Although many allied health care educational programs require geriatrics or a gerontology course in their programs of study, little information is available to quantify the extent to which today's respiratory care programs incorporate age-related issues into their curriculum. In an effort to determine the degree to which respiratory care programs are educating their future practitioners in the needs of older adult patients, a survey was created to gather information from RT schools.

Methods

A mailing list of all 328 accredited respiratory care programs was obtained from CoARC. An original electronic survey instrument was designed with the help of Educational Resource personnel at The University of Texas Health Science Center at San Antonio. The first portion of the survey instrument listed questions related to twenty geriatric educational components. Respondents were asked to respond YES if they were currently teaching these components in their program. The next portion of the instrument listed fifteen geriatric related issues and asked program directors to respond using a Likert scale as to their perceived importance of incorporating these issues into their curriculum. Once program directors had rated their perception of importance for inclusion of geriatric related issues, they were then asked to determine approximately how much time they would allow to cover the geriatric related issue if a paper or web-based lesson plan were available to them. At the conclusion of the survey, participants were asked to complete a few demographic questions about themselves and the programs with which they were affiliated. The instrument was tested by a select group of therapists from across the country for time of completion, ease of completion and accuracy of format. The survey instrument was then distributed electronically to all of the accredited, college-based respiratory care programs across the United States. To determine if there were any statistically significant ($p<0.05$) differences in what topics were being covered by baccalaureate and associate degree programs, the data were evaluated using Stata and doing a z-test of proportions.

Results

Three hundred and twenty eight accredited college-based respiratory care programs were sent an electronic survey instrument. A total of 57 survey instruments were returned as undeliverable. 271 electronic surveys were delivered. Phone calls were made to the non-responders to encourage completion of the survey. The final number of survey instruments used in this study was 120 for a return rate of 44%. The average age of the respondent was 48.3 years, with an average of 24.2 years of overall experience in respiratory care. 89.6% of the 120 respondents were program directors or chairs of either a baccalaureate degree or an associate degree program. Data were compiled and analyzed. Table 1.1 contains the composite percentages of programs that are currently including the designated geriatric components in their curriculum, either as an inclusion into an existing course or as a stand-alone course. Programs that were not incorporating these geriatric related components were instructed not to respond to that question in the survey instrument blank. The data in Table 1.1 reflects the programs that responded in the affirmative that they were incorporating some of these educational components.

When asked if they were planning to incorporate geriatrics/gerontology into any existing respiratory care courses in the future, 50% of the respondents said yes, 38.5% replied maybe and 11.4% of those responding to the survey said no. Another goal of this

Table 1.1

	Covered in% of BD Programs	Covered in % of AD Programs
Biological/Psychosocial Theories of Aging	57.6	49.4
Age related changes in the heart	76.9	81.3
Age related changes in the lungs	88.4	89.0
Age related changes in vital signs	88.4	91.2
Age related changes in the liver	42.3	28.0
Age related changes in sight/hearing	65.3	57.0
Age related changes in the kidney	42.3	41.7
Age related changes in the hypothalamus	26.9	12.0
Advocacy for older patients	38.4	29.6
Depression in older patients	46.1	37.0
Pharmacotherapy for older adults	69.0	64.8
Demographics of older adults	57.6	39.5
Discharge planning for older patients	38.4	41.7
Death and dying issues	92.3	84.6
Legal issues that affect the elderly	38.4	19.7
Communicating with the cognitively impaired	57.6	74.7
Issues related to caregiver stress	38.4	29.6
Modifying home environment for older adult	61.5	42.0
Stereotyping older adults (ageism)	61.5	36.2
Ethical issues in elder patient care	69.2	62.6

Table 1.2

Approximate time educators indicated would be needed to teach specific geriatric component	Time in minutes
Issues related to diseases common to older adults, including; Depression, Alzheimer's, Parkinson's, Diabetes, Arthritis	15 minutes for each module
Elder law/Medicare issues	15 minutes
Social Services for older adults	15 minutes
Vital signs and auscultation of older adult patients	30 minutes
Pharmacology for older adults	30 minutes
Normal age-related changes in the heart	30 minutes
Normal age-related changes in the lungs	30 minutes
Assessment of ADLs (activities of daily living) and IADLs (Independent activities of daily living) in older adults	30 minutes
End-of-life issues	30 minutes
Death and dying	60 minutes

survey was to determine if program directors and educators, would find pre-prepared geriatric related units of study, provided complete with lecture outlines, Microsoft PowerPoint® slides and exam questions to be helpful, and if so, how much time would they be willing to allow for presentation of each unit. Less than 2% of those surveyed (2/120) indicated a lack of interest in packaged units of study in geriatric related issues. The responses to this question are reflected in Table 1.2.

Of the 20 geriatric educational components listed in the survey instrument, baccalaureate degree programs are currently teaching, on average 57.8% of the listed geriatric topics and associate degree programs are teaching 50.6% of those listed. Two geriatric related topics were covered to a significantly greater degree in baccalaureate degree programs; legal issues that affect the elderly and stereotyping (ageism) of elders. Although a level of significance was not reached, it appears as though communicating with cognitively impaired older adults is covered in more associate degree than baccalaureate degree programs (see Table 1.3).

Table 1.3

Geriatric Topics Currently Taught	BD Program	AD Program	p value
Age-related change in liver	42.3%	28.0%	0.1487
Age-related change in hypothalamus	26.9%	12.0%	0.0542
Demographics of older adults	57.7%	39.5%	0.0872
Legal issues that affect the elderly	38.4%	19.7%	0.0407
Communicating with the cognitively impaired	57.6%	74.7%	0.0785
Modifying home environment for elders	61.5%	42.0%	0.0668
Stereotyping of elders (ageism)	61.5%	36.2%	0.0163

Conclusion

Although not listed as a standard in the 2003 CAAHEP document, "Standards and Guidelines for the Profession of Respiratory Care," geriatrics is listed as a guideline under Curriculum Resources, in the context of appropriateness of respiratory care, principles of case management and an alternate care site to include in clinical rotations.[9] Older adult patient care covers a large portion of the listed specialty areas, including; acute care, home care, skilled nursing, subacute care, hospice, physician's offices, cardiac and pulmonary rehabilitation, polysomnography, electrodiagnostics and pharmacotherapy. This study indicates that educators are currently incorporating geriatric education units of study into their curriculum and are interested in adding more. Despite the fact that there is no mandate to incorporate geriatric related educational components into the curriculum of respiratory care educational programs, many are taking the initiative to teach students about age-related changes in various body systems, age-related changes in vital signs and issues related to death and dying. Baccalaureate degree programs appear to be providing educational instruction in more of the geriatric issues than associate degree programs, in particular when it concerns more of the psychosocial issues of elder healthcare. Of interest is the fact that when asked, over 88% of educators responded that they would consider integrating components of geriatrics into their existing respiratory care courses in the future.

The decision to incorporate or infuse geriatric education into existing respiratory care classes is not difficult. Implementation may be a little more challenging. Most programs are already at the maximum credit hours allowable for their respective educational institutions. The important thing to remember is that this does not have to be an all or nothing proposition. Gradually adding geriatric related components to courses over time is a reasonable way to introduce students to their future patient population. Callahan and Counsel did an excellent job of summing up the importance of adding geriatric educational components to any health care curriculum:"The most passionate converts to the importance of geriatric [education] are therapists, nurses and physicians who have recently attempted to shepherd their own aging parents through a health care system. If we could only measure and communicate the value that influences these conversions, we might also convince the world."[10]

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Authentic Assessment of Learning Outcomes

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Abstract

Traditional testing and measurement using paper and pencil examinations has been shown to be limited in determining what students really understand about a concept or procedure. Alternative assessment strategies have recently been shown to be effective in determining what the student knows while providing a degree of knowledge building during the assessment process. One example of these new strategies is authentic assessment (AA). Authentic assessment evaluates student performance with assignments, projects, procedures, and other activities that require skills that closely mimic those that will be needed in the workplace upon completion of an educational program. Using AA can assist the student to develop desirable traits such as critical thinking, problem solving, and life-long learning. Employing various types of rubrics in the classroom and laboratory may provide the teacher with a more valid and reliable measurement of student understanding. This paper will provide a brief overview of the use of holistic and analytic scoring rubrics in the respiratory care classroom.

Key Words: authentic assessment, professional, educational measurement, holistic evaluation, performance based assessment, rating scales, scoring rubrics.

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Authentic Assessment of Learning Outcomes

Introduction

The purpose of this paper is to introduce educators to authentic assessment (AA) as a method for the measurement of learning outcomes in respiratory care. Assessment of students as they perform professional skills using scoring rubrics can bring objectivity and defensibility to grading using methods other than paper and pencil tests. Although this is not novel information, AA is not regularly used by many respiratory care instructors. The goal of this paper is to introduce AA and encourage its use in the classroom in conjunction with traditional assessment (TA) methods such as paper and pencil tests.

TA has been the mainstay of classroom instruction for decades. This form of assessment usually employs pencil and paper examinations consisting of multiple choice, true-false, or short answer items. Though test items may be written at higher levels of the cognitive domain (e.g., analysis, synthesis or evaluation) and students may select the correct answers, what does the instructor really learn about the students? Did students choose the correct answer because they understood the item or did they just get lucky and guess? Methods used for testing with TA usually follow instruction and little or no new learning takes place during testing. An alternative to TA is authentic assessment (AA) which offers more direct evidence of application and allows for the construction of knowledge during the assessment process. [1]

Authentic assessment, also known as alternative assessment or performance assessment, has become widely used at all grade levels of education.[2] These terms refer to measuring student achievement of skills that approximate the clinical work that graduates will actually perform after completion of their education. Accrediting organizations may require that programs assess measurable outcomes of student learning which may not be reflected in grades from TA such as paper and pencil tests. Under national accrediting guidelines such as those for the Southern Association of Colleges and Schools and the Committee on Accreditation for Respiratory Care Education, programs are expected to identify desired learning outcomes, determine if they are achieved, and show evidence of improvement. AA is one method of achieving this goal.

Respiratory care educators often ask employers what characteristics they want program graduates to possess. Common responses include the terms “professional, competent, self-assured, good communication skills, team worker, able to multi-task, and problem solver.” How many of these skills can be assessed on a paper and pencil exam? Perhaps very few.

According to the American Association for the Advancement of Science “Benchmarks for Scientific Literacy: Project 2061,” “...students should learn how to analyze situations and gather relevant information, define problems, generate and evaluate creative ideas, develop their ideas into tangible solutions, and assess and improve their solutions.”[3] AA is particularly important in healthcare professions where students must demonstrate skills that assure us they can perform professionally, competently, and efficiently when they graduate and become health care providers. Traits such as critical thinking, problem solving, communication, decision making, and lifelong learning are essential for success in today’s workplace.[4] AA allows instructors to assess learning outcomes that better reflect students’ achievement on assignments that are more analogous to the real world of work than paper and pencil tests.[5]

Student-centered instruction, such as problem-based, collaborative, and cooperative learning, encompasses processes and products that can be assessed. More specific examples of activities for AA include having students construct concept maps, create laboratory exercises, demonstrate specific skills, or complete "show your work" math problems.

In this paper, we will discuss the use of scoring rubrics and how these rubrics can be used to assess and grade student performance. A rubric or scoring scale typically contains specific criteria for a task with appropriate levels of performance indicated.[5] We have used such rubrics for a number of years. In our experience, students seldom question the grades received when rubrics similar to the ones we will describe have been used. We have achieved this result by soliciting feedback from instructors and providing a copy of the rubric to the students prior to their preparing for the assignment. When students know what is expected and are satisfied that grading is based on explicit criteria, fairness is seldom an issue. Moreover, instructors are confident of their scoring and have little difficulty in defending the grades assigned.

Developing and Implementing Authentic Assessment

Typically, teachers can employ both TA and AA strategies. For example, during CPR training, a pencil and paper examination is administered to assess the student's knowledge of the procedure. Pencil and paper exams, especially those that closely reflect the types of questions asked on national certification examinations, are advantageous because they help prepare students to answer such questions. Practice in taking and passing examinations similar to certification examinations is important so that students can succeed in achieving professional standing. However, practical examinations that assess student performance are also desirable for demonstrating student learning and professional competence. A scoring rubric used to grade a student's performance may better document mastery than the typical CPR checklist used in most classrooms. A scoring rubric can document if a student performed a particular step and how well.[5] Was the student hesitant or confident in their actions, professional or sloppy?

AA allows students to demonstrate skills that matter when becoming a professional.[5] Authentic assessment can also reveal the complexity and ambiguity of various treatments the respiratory therapist administers. On written tests, students learn that the correct answer is most important and memorization and cramming are common means to that end. In AA, the process and manner of thinking becomes valued by students and instructors. Content and process are blended; growth and development are documented. Using AA, we assess what is important rather than what is easy. Measuring authentic performances can hold students to higher standards and overcome grade inflation. Flexibility can be built in to accommodate individual student needs and address student disability issues and fairness concerns involving cultural, gender, and ethnic differences.[5]

Important skills expected of respiratory care students such as proper use of equipment, performing effective therapy, and patient evaluation are well suited for performance assessment. Examples of authentic assessment assignments include diagnosing patients' medical conditions, developing case studies, trouble-shooting equipment malfunctions, and modifying patient therapy. TA may have limited utility in grading these activities. TA

does not provide opportunities for students to justify their approaches or results, plan, revise, or defend their responses. AA allows students to perform tasks in a way that can demonstrate their conceptual understanding and ability to apply knowledge and skills appropriately.[6] We have found that using AA scoring rubrics better reflects students' understanding of conceptual knowledge.

Scoring Rubrics

Unlike checklists, scoring rubrics include predefined judgments of the quality of the activity being assessed.[7] There are no right or wrong answers. Instead, degrees of success and the varying levels of skill may be considered when assigning grades.[8] Scoring rubrics enable instructors to document the student's performance with various procedures while allowing the student to gain new knowledge as they are assessed.[9] Scoring rubrics define excellence so that students know what they need to do to achieve it while helping instructors and other raters remain unbiased and consistent.[8] For example, if students are required to write a technical procedure, one instructor might grade heavily on grammar and punctuation. Another instructor might weigh the order of the steps as most important. Yet another might judge the style and format as primary. If these instructors developed a scoring rubric and agreed on the relative weight of each criterion, students would know what was expected and the subjectivity would be removed. Furthermore, instructors would feel confident in their decisions, and more likely to assess actual performance rather than relying solely on paper and pencil tests.

Types of Rubrics

There are two kinds of scoring rubrics: holistic and analytical.[5] Holistic rubrics include criteria that are more general and broader in scope. This type of rubric is recommended when evaluating an overall process or product as a whole, without judging the individual steps or components.[7] Holistic rubrics are frequently used when there is overlap in criteria. An example of a holistic rubric is seen in Table 1.[5] Conversely, analytical rubrics

Table 1
Holistic Rubric Example

Criteria	Score
All requirements of the assignment were included and all standards were met	5
All requirements of the assignment were included and standards were met in four of five areas	4
Some requirements of the assignment were not included and standards were met in three areas	3
Most requirements of the assignment were not included and standards were met in two areas	2
Few requirements of the assignment were included and standards were met in one area	1
No attempt was made to complete the assignment	0

Table 2
Example of an Analytical Rubric for Group Work on a Project

Name: _____ Teacher: _____

Date : _____ Title of Work: _____

	Criteria				Points
	1	2	3	4	
Group Participation	No participation	Participates only when called upon	Participates but is not on-task	Participates enthusiastically	____
Project Process	Project not approached with correct assumptions and with little skill	Project is completed with many false starts	Project approached directly but without complete skill set	Project approached with corrrect assumptions and much skill	____
Project Product	Product is incomplete and inappropriate to project	Product is incomplete but meets some of the requirements	Product is complete but does not meet all requirements	Product is complete and meets all requirements	____
Project Presentation	Presentation is unenthusiastic and unskilled	Presentation is enthusiastic but unorganized and incomplete	Presentation is unenthusiastic but organized and complete	Presentation is enthusiastic, well organized, and complete	____
Self-evaluation of Project	Self-evaluation is incomplete and inaccurate	Self-evaluation is complete but inaccurate	Self-evaluation is incomplete but accurate	Self-evaluation is complete and accurate	____
				Total——>	____

Teacher Comments:

consider each criterion separately, and each level of each factor to be scored is described.[7] An example of an analytical rubric can be seen in Table 2.

Steps in Development of Scoring Rubrics

When designing the rubric, the following steps may be helpful. First of all, review the goals and objectives of the course or unit of instruction.[5] Second, express criteria in terms that describe the desired outcomes in the cognitive, psychomotor, and affective domains. Criteria must be readily observable in the behavior or the product of the students performance.[9] Limit the number of criteria so that meaningful distinctions can be made. Some possible rating criteria might include “not yet, almost, close, or completed;”

"emerging, developing, achieving;" "novice, apprentice, proficient, distinguished;" as percentages; "1,2, 3, 4;" or letter grades. Arrange the criteria in the order that they will be observed or evaluated.

Next, determine if a holistic or analytical rubric best describes the observable outcomes. If a holistic rubric is chosen, only one scoring scheme is devised.[8] If an analytical rubric is best, develop descriptive criteria for each scale. It is frequently helpful to describe the criteria for the highest and lowest levels of achievement, and then fill in the criteria in between. Decide whether the scoring should be qualitative or quantitative. State these criteria in as positive terms as possible. Examples of each level of performance are frequently helpful to both students and graders. It may be instructive to allow students to give feedback on the rubric or even be allowed to assist in developing the rubric. Next, determine how you will interpret and evaluate the scores. To do this, assign points to each criteria based on their relative importance. Finally, convert the scores into a grade.[9] These rubrics are most effective when used multiple times and revised based on feedback from students and instructors.

Table 3
Presentation of a Case Study Rubric

Oral Presentation of Case Study
Dr. Britton
Student:_____

CATEGORY	**Outstanding 10 points**	**Very Good 8-9 points**	**Good 7-8 points**	**Fair <7 points**
Outline/ Handout	PowerPoint handout or other complete outline and references; follows presentation completely	PowerPoint handout or other complete outline and references; follows oral presentation 90% of the time	PowerPoint handout or other complete outline and references; follows oral presentation 80% of the time	PowerPoint handout or other complete outline; lacks references; follows oral presentation <80% of the time
Visual Aids	Illustrates the points of presentation with 8 or more diagrams, tables, charts, or illustrations; follows guidelines; appropriate to content	Illustrates the points of presentation with 5-7 diagrams, tables, charts, or illustrations; follows guidelines; most are appropriate to content	Illustrates the points of presentation with 2-4 diagrams, tables, charts, or illustrations; follows some of the guidelines; some are inappropriate to content	Illustrates the points of presentation with 1-0 diagrams, tables, charts, or illustrations; do not follow guidelines; or inappropriate to content
References	8 total; 5 from refereed journals, none older than 5 years, fewer than 3 approved websites	6 or 7 total; 4 from refereed journals; none older than 5 years; fewer than 3 approved websites	3-5 total; 3 from refereed journals; none older than 7 years; <5 approved websites—1-2 unapproved websites	<2 refereed journals, none older than 10 years; >5 websites or unapproved websites used

Table 3 Continued
Presentation of a Case Study Rubric

CATEGORY	**Outstanding 10 points**	**Very Good 8-9 points**	**Good 7-8 points**	**Fair <7 points**
Content	Demonstrates full understanding of the topic.	Demonstrates good understanding of the topic.	Demonstrates some understanding of parts of the topic.	Does not seem to understand the topic very well.
Organization	Excellent flow and transition from topic to topic; persuasive	Good flow and transition from one topic to another; somewhat persuasive	Some flow and transition from topic to topic; not cohesive	Little transition and poor organization
Timing	Topic addressed completely within time limits	Topic addressed completely with +/- 2 minutes	Topic addressed incompletely in time limits; within +/- 5 minutes	Topic incompletely addressed in time limits and/or < 5 minutes
Posture and Eye Contact	Stands up straight, looks relaxed and and confident; establishes eye contact with everyone in the room during the presentation.	Stands up straight and establishes eye contact with everyone in the room during the presentation, not very relaxed or confident	Sometimes stands up straight and establishes eye contact but not confident and relaxed	Slouches and/or does not look at people during the presentation; indifferent or very nervous
Vocabulary	Uses vocabulary appropriate for the audience; extends audience vocabulary by defining words and terms that might be new to most .	Uses vocabulary appropriate for the audience; includes 1-2 words or terms that might be new to most of the audience, but does not define them.	Uses vocabulary inappropriate for the audience; does not explain 3 or 4 words or terms that might be new to the audience.	Uses several (5 or more) words or phrases that are not understood by the audience; vocabulary is inappropriate, for example, slang is used.
Volume	Volume is loud enough to be heard by all audience members throughout the presentation.	Volume is loud enough to be heard by all audience members at least 90% of the time.	Volume is loud enough to be heard by all audience members at least 80% of the time.	Volume often too soft or mumbled to be heard by all audience members.
Inappropriate habits	Does not use fillers such as “uh, um, you know”	Uses fillers such as “uh, um, you know” 3 times or fewer times	Uses fillers such as “uh, um, you know” 5 times or fewer times	Uses fillers such as “uh, um, you know” 6 or more times

Validity and Reliability Issues

With paper and pencil tests, validity and reliability can be assessed using item analysis. Developing a valid and reliable pencil-paper examination is important when using this form of assessment. Scoring rubrics are no different in that these instruments must also be valid and reliable. To be valid, the assessment must agree with what it is supposed to

measure. Validity is achieved by choosing assignments and assessments that reflect the goals and objectives of the program, accrediting agency, and licensure board as well as student's ability to use knowledge in the field. Reliability is achieved by using a detailed and specific scoring rubric that has standardized criteria, and is stable and consistent.[10] We always share the scoring rubric in advance with students so they can self-evaluate and be well prepared for the actual evaluation. When possible, we invite other instructors or professionals in the field to score the rubric when students perform. Raters must first be trained in the use and criteria of the scoring rubric to ensure interrater reliability.

To optimize the validity and reliability of a scoring rubric the following recommendations are suggested. The criteria used within the rubric should be clearly aligned with the task or procedure being assessed.[8] The criteria should be expressed in terms of observable behaviors.[5] Language used in the scoring rubric should be clear and easily understood by students. The scoring of the rubric should be logical, easily understood by the rater and student with clear separation of the scoring levels. [5, 9,10] Once the rubric has been completed, recommendations for interpreting and using the scores must be developed. Next, two independent raters must achieve similar scores using the rubric when observing the same student's performance.[10] A given rater should be able to achieve consistent scores across time using the rubric. The relationship between the score of the rubric and the student's actual grade should be immediately apparent. And finally, the score or rating should be used to improve student instruction and the assessment process.

Scoring the rubric can be either qualitative or quantitative.[9] Arriving at a final score should be logical and is often left up to the instructor who creates the rubric. Figure 1 illustrates a simple analytic rubric used in an airway laboratory exercise. This rubric uses a quantitative scale. Several examples for using qualitative scaling may include student critiques of a published paper, case study, or a role playing incident between two students acting out a therapist/patient interaction. For example, asthma patient education or home care instruction can be observed and rated.

There are a number of websites that share scoring rubrics. There sites may be helpful as you generate your own rubrics. One particular website offers a rubric generator, numerous examples, and articles on theoretical basis of AA. This website was created by Kathy Schrock: http://school.discovery.com/schrockguide/assess.html#rubrics. The site provides step by step guidance in how to create a scoring rubric. Tables 3 & 4 are additional examples of scoring rubrics we have developed and used with success.

Conclusions

The development of scoring rubrics for assessing students on higher level skills that more closely approximate the real world of a respiratory therapist at work can be used in conjunction with traditional assessment tools. Integrating traditional paper and pencil exams with AA may provide educators with a more accurate picture of what students know and how well they can apply it for problem solving and patient treatment. Best of all, scoring rubrics clarify and communicate instructors' expectations of students.

Table 4
Sample Analytic Rubric for Airway Care
Airway Lab

Objectives	Low Performance	At or Below Average	At or Above Average	Exemplary Performance	Earned Points
Gathers all the equipment necessary to effectively and safely intubate an adult manikin	**0 points** Gathers only minimal supplies	**1 point** Gathers some of the equipment, omits critical item	**2 points** Gathers necessary supplies and equipment to intubate the manikin	**3 points** Gathers all supplies and equipment to effectively and safely intubate the manikin	
Successfully intubates the adult manikin	**0 points** Fails to place head in correct position, equipment is not prepared, and/or fails to intubate the manikin	**1 point** Has the minimal equipment ready for an intubation but fails to position manikin for intubation	**2 points** Positions the head of the manikin, has the laryngoscope, endotracheal tube, and syringe ready for intubation	**3 points** Correctly positions the head of the manikin, has all equipment, suction & oxygen source, and self-inflating bag ready	
Performs appropriate tasks post intubation of the manikin	**0 points** Fails to remove the stylet in a timely manner, does not determine placement of endotracheal tube.	**1 point** Removes the stylet, manually ventilates the manikin but fails to administer oxygen therapy	**2 points** Removes stylet, attaches self-inflating bag with oxygen, ventilates the manikin and assesses endotracheal tube placement	**3 points** Removes stylet, manually ventilates manikin with oxygen, secures endo-tracheal tube, and reassesses its placement	
Continues to treat the manikin post intubation	**0 points** Continues to manually ventilate the manikin without supplemental oxygen and does not re-assess.	**1 point** Manually ventilates manikin with supplemental oxygen and does not re-assess.	**2 points** Manually ventilates manikin with oxygen, assesses breath sounds, and secures endotracheal tube.	**3 points** Manually ventilates manikin with oxygen, assesses breath sounds, secures endotracheal tube, determines the need for manual ventilation —if not needed applies appropriate oxygen therapy	
	0 points	**0 points**	**0 points**	**0 points**	
				Score:	

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IDENTIFYING THE VARIABLES OF GRADING PRACTICES THAT INFLUENCE STUDENTS' EVALUATION OF CLINICAL INSTRUCTORS

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Abstract

Procedures for evaluating and grading vary among respiratory therapy (RT) programs. Also, there is wide variation among instructors' grading practices. The purpose of this study was to identify the variables in grading practices in RT clinical education that influence students' evaluation of clinical instructors. After review of student evaluations of their instructors, Pearson correlations and multiple regression analysis were utilized to address the research questions in this study. Statistical analysis indicated that consistency and fairness had a significant impact on students' ratings of clinical instructors ($p<0.05$). Together, they accounted for 53 % of the variance in student ratings of clinical instructors.

Key Words: clinical education, grading practices, students' evaluation, respiratory therapy education and clinical instructors.

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IDENTIFYING THE VARIABLES OF GRADING PRACTICES THAT INFLUENCE STUDENTS' EVALUATION OF CLINICAL INSTRUCTORS

Introduction

Assigning grades to students in a clinical setting is a complex issue. In clinical respiratory therapy (RT) education, grading assessments should measure how well a student understands, integrates material and applies his or her learning in different clinical settings. Instructors are often required to assign grades indicating student academic achievement and it appears that there is a relationship between instructor grading practices and student achievement.[1-3] In order for instructors to know if students are achieving the desired academic knowledge and clinical competency, they must assess students' performance and summarize that assessment into a letter or numerical grade. There is individual variation among clinical instructors' grading practices. Different instructors not only perceive the meaning and purpose of grades differently but also consider achievement factors differently.[4-9] Due to the wide variability in the criteria used in grading practices from instructor to instructor, the validity of student grades is unknown.[10] Even in the same school, instructors often hold very different views about the purpose of grades and fail to communicate with their colleagues about their grading policy and practices.[11,12]

Procedures for evaluating the grading practices of clinical instructors also vary among RT programs; therefore, it is understandable that the grading practices of instructors need to be carefully monitored. Many colleges and universities use student ratings as one method of evaluation of clinical instructors. Although evaluations of RT students by clinical instructors are necessary for certifying students as clinically competent, we were unable to find any studies on the effect of grading practices on students' evaluation of their instructors in the literature. Procedures for clinical instructor evaluation vary. Many colleges and universities have used student evaluation as one measure of the effectiveness of clinical instruction. There is a need to investigate the effect of grading practices on students' evaluations of their RT instructors. By identifying factors related to grading of students' performance, clinical instructors may better understand their strengths and weaknesses, enhance their grading competence and make better decisions about grading students in clinical settings. Upon investigating the literature on the grading practices of clinical instructors, the following important questions arose:

1. What is the relationship between the grading practices of clinical instructors and the overall evaluation of instructors, as determined by students?
2. To what extent can grading practices predict the overall evaluation of instructors?

Methods

Instrumentation

A survey instrument developed internally by faculty members with a Likert Scale (1=Poor, 2=Satisfactory, 3=Good, 4=Excellent) was used by students to evaluate the clinical instruction provided in a RT Baccalaureate Program at a Southeastern University. The survey includes items which ask about the grading practices of RT clinical

instructors, specifically: (a) consistency, (b) fairness, (c) accuracy, and (d) the overall rating of the instructor (see Appendix A).

Although completion of the questionnaire is voluntary, the department requires instructors to make the questionnaires available to all students. They are distributed to students by the director of clinical education and collected by a student in the class at the end of each semester without the clinical instructor's presence. The results are given to instructors at the end of the semester after they are processed. Written comments are typed before distribution to the clinical instructors to allow for anonymity.

Sampling and Data Collection

A total of 241 questionnaires were given to students at the end of each semester from 1999 to 2003. A total of 211 questionnaires were collected from RT students during the 4-year period for a response rate of 87%.

Data Analysis

The data analysis involved two stages: First, Pearson product-moment correlation analysis was conducted in order to determine whether the variables in a clinical instructor's grading practices were significantly related to the students' overall evaluation of the clinical instructor. For variables with significant correlations, stepwise multiple regression analysis was used to determine the effect of each variable in instructors grading practices on students' overall evaluation of clinical instructors.

Results

There were positive correlations between an instructor's grading practices and students' overall evaluation of the instructor. Consistency, fairness and accuracy significantly ($p<0.001$) impacted students' evaluations of instructors. Table 1 presents these correlations. 50.8% of the variance in the students' overall rating of an instructor was predicted by the fairness of grading and 51.4% of the variance was explained by perceived consistency in grading policy ($p < 0.001$). Also, 46.0% of the variance in the overall evaluations of an instructor was explained by the accuracy of the instructor's grading practice ($p < 0.001$).

Stepwise multiple regression analysis was performed to determine the most significant predictors of students' overall evaluations of an instructor. The independent variables in the equation were students' rating of the clinical instructor's (a) consistency, (b) fairness and (c) accuracy. The dependent variable was students' overall rating of the clinical instructor. The regression equation was expressed in the formula below:

$$Y` = a + b_1 \times \text{Consistency} + b_2 \times \text{Fairness} + b_3 \times \text{Accuracy} + e$$

a = Intercept

b_1 = Slope for Consistency

b_2 = Slope for Fairness

b_3 = Slope for Accuracy

e = Error

$Y`$ = Overall Student Rating of A Clinical Instructor

The regression analysis resulted in an overall $R = 0.728$, $R^2 = 0.530$, adjusted $R^2 = 0.526$ ($p<0.05$). At the first step, consistency entered the equation and accounted for

51.4% of the variance in students' ratings of an instructor. At the second step, fairness entered the equation, adding an incremental R^2 change of 1.6% to the model. Together, these variables accounted for 53% of the total variance (R^2). Only consistency and fairness were significant in predicting students' overall evaluations. No significant additional effect was found for accuracy in predicting students' rating of a clinical instructor, after the other two variables had their predictive effect. Therefore, only consistency and fairness stayed in the regression model ($F = 117.48$, $p < 0.05$), which is summarized with the formula below:

The overall rating of an instructor = 0.533 + 0.428 x Consistency + 0.392 x Fairness + e

The multiple regression analysis revealed that, in combination, consistency, and fairness predicted 53% of the variance in overall instructor ratings; accuracy did not add significantly to the prediction. Further, every unit increase in consistency increased the overall rating of a clinical instructor by 0.428 ($p= 0.002$). Similarly, every unit increase in fairness of grading practice increased the overall rating by 0.392. The results indicate that an instructor's grading practices have significant effects on students' overall evaluation of the instructor.

Discussion

The traditional letter grade for a clinical course can be difficult to accurately derive. Assigning a letter grade to a clinical course can inflate the student's grade point average (GPA) if grades are inflated and do not properly reflect student performance. A student with average grades in didactic coursework can elevate their GPA by having exceptional marks in clinical courses. While it is possible that the student was exceptional in the clinical environment, more often it seems that clinical instructors may award inflated clinical grades. Educators are keenly aware that grades have a profound affect on students. They also know that the results of clinical evaluations affect students, sometimes dramatically.

What can programs and educators do to improve grading polices in RT clinical education? A respiratory care program should develop a clear clinical grading policy and disseminate it among those involved in grading students. Faculty, clinical instructors, and preceptors should understand that clinical grades should be accurate, consistent and fair. For this to properly work, the clinical instructor and student should have clear expectations while performing in the clinical setting. Discussions with the student should include feedback on how to improve during the next clinical day. This may be done by holding a post-clinical conference. During this time instructors can discuss the daily grade and communicate why a grade was given. This also presents an opportunity to discuss what can be done to improve grades in the future.

Another strategy would be to design a grading rubric. The rubric would outline in detail the expectations for the student and instructor, allowing a detailed step-by-step procedure for grading the student. An example of a clinical performance rubric can be found in Appendix B. Clinical instructors should review the grading rubrics with students at the beginning of the clinical rotation and inform them about grading guidelines for the clinical portion of the students' respiratory education. Thus, clinical instructors can be perceived as consistent and fair in grading students' clinical

competency. Failing to fairly and consistently grade students can lead to poor evaluations of instructors by students.

Unfortunately, students are sometimes graded on how well they are liked instead of actual clinical competency during clinical performance evaluations. One strategy to combat this tendency is to provide competency-based training for all faculty, clinical instructors, and preceptors. A competency-based preceptor training program may improve grading accuracy, fairness and consistency in the clinical setting. A problem with this strategy is the time and resources needed to train all clinical instructors and preceptors at a program's clinical affiliates. Some affiliates may not have designated instructors or preceptors to take students. One approach to address this issue is to conduct preceptor workshops for clinical affiliates. These workshops can outline the program's clinical teaching model and educate the clinical instructor on proper evaluation of the student. Other workshop topics to consider are establishing rapport, effective questioning skills, giving feedback, and dealing with difficult situations. The program can also be designed to allow participants to earn continuing education credits.

Although no RT clinical education grading policy is perfect, programs and educators should reexamine clinical grading polices to make sure fair, consistent, and accurate grades are being assigned. Implementation of changes can be difficult, but having a grading policy that is as non-subjective as possible may improve student performance, competency, and grades.

Recommendations for Future Research

The results of this study may lay a foundation for further research on the nature of grading in RT clinical education. Research questions may include:

1. What are the relationships between the instructional contexts of grading and their measurement features including reliability and validity?
2. How does varying the amount of information communicated about grades in RT clinical education affect student motivation and achievement?

Table 1

Pearson product-moment correlation coefficients for grading policy related variables to the overall grade of instructor.

Variables		Overall grade	Fairness	Consistency	Accuracy
Fairness	r	0.713*	1		
	p	0.000			
Consistency	r	0.717*	0.929*	1	
	p	0.000	0.000		
Accuracy	r	0.678*	0.951*	0.884*	1
	p	0.000*	0.000	0.000	

* Correlation is significant at the 0.05 level (2-tailed)

3. How do clinical instructors judge the amount of effort a student puts forth to learn and what is the extent of instructor variation in judging effort?
4. How reliable and valid are instructor judgments about student effort and achievement?
5. Can a valid and reliable composition of effort and achievement in clinical RT education be defined?

Conclusions

Clinical instructors' grading practices and their evaluations by students will be better connected when the role of grading in RT clinical education is more fully understood. Clinical instructors should try hard to be accurate, fair and consistent in their grading of students by informing them up front what the components of a grade will be. The results of this study may help improve the grading practices of clinical instructors and help ensure that grades assigned to students by instructors will be more accurate, fair, consistent, and educationally meaningful. This, in turn may improve the perceptions of students regarding the quality of clinical instruction they receive.

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APPENDIX A

The Students' Evaluations of Clinical Education Rating of Clinical Instructor

Grading Practices of Clinical Instructor

1. Fairness	1	2	3	4
2. Consistency	1	2	3	4
3. Accuracy	1	2	3	4

Teaching Method and Effectiveness

1. Clarified Questions	1	2	3	4
2. Provided Feedback	1	2	3	4
3. Minimized Anxiety	1	2	3	4
4. Well Organized	1	2	3	4
5. Motivated Students	1	2	3	4
6. Allowed Adequate Time for Learning	1	2	3	4
7. Demonstrated Enthusiasm	1	2	3	4
8. Integrated Theory to Practice	1	2	3	4
9. Provided Physician Input	1	2	3	4

Overall Rating

1. Quantity of Instruction	1	2	3	4
2. Quality of Instruction	1	2	3	4
3. Overall Grade of Clinical Instructor	1	2	3	4

APPENDIX B

Performance Evaluation Rubric

Scoring:
2 Points: Task performed satisfactorily without prompting.
1 Point: Task performed satisfactorily with self-initiated corrections
0 Points: Task performed incorrectly or with prompting required
N/A: Task not applicable to patient care situation.

PROCEDURE: NASAL CANNULA/SIMPLE MASK

TASK	SCORE	RATIONALE
1. Inspect medical record.	_____	To verify physician's order as to the type of administration, liter flow. A thorough inspection of the chart should be made as time permits to ascertain appropriateness of therapy. Special attention should be paid to ABGs and vital signs.
2. Gather equipment.	_____	Flowmeter, nipple adaptor or humidifier, nasal cannula or simple oxygen mask, and an "Oxygen In Use" sign.
3. Wash hands.	_____	To insure aseptic technique.
4. Identify self, department and patient.	_____	
5. Explain procedure, rationale and confirm understanding where appropriate. Explain side effects, effects, complications, and hazards to the patient and/or family.	_____	Patient understanding is important to maximize comfort and cooperation. Continuous wear of O_2 device should be stressed along with No Smoking and no self adjustment of gas flow.
6. In a non-emergency situation, make a preliminary assessment of of the patient. In an emergency situation, assessment can be done after initiating the O_2 delivery device.	_____	General patient condition. Note the following: HR, RR, and ventilatory pattern. Additional helpful information: BP, Vt, ABGs, and O_2 saturation.
7. Prior to application of nasal cannula, check patency of patient's nares.	_____	Ask patient to close mouth and breathe through nose to check for patency. An alternate delivery system should be used if obstructed.

8. Attach oxygen device to a humidifier. Set flowmeter as desired. Check humidifier popoff (if used). Check device for function prior to applying to patient.	_____	The nasal cannula can deliver approximately 24% to 44% O_2. Place prongs with the curve directed downward. Place tubing behind the ears. Take up slack under the chin to ensure more secure fit. See departmental policy for uses of humidifiers. The simple mask can deliver approximately 40% to 60% O_2 at settings of 5-8 l/m. These flowrates will prevent CO_2 build-up in the mask. The mask should fit snugly around the nose and between the bottom lip and chin. The elastic band should be placed around the back of the head to hold the mask snugly in place. This device carries the hazards of all O_2 masks.
9. Check for effectiveness of delivery system. Reassure patient if necessary.	_____	Since cannulas and simple masks are low flow oxygen systems, the student should be aware that the patient's FI_{O_2} will depend on: a) O_2 flow b) Patient's inspiratory demand c) Patients respiratory rate, tidal volume, and pattern. Check for patient comfort.
10. Reassess the patient.	_____	Auscultate the chest. Check the HR, RR, and ventilatory pattern. Evaluate for adverse reactions.
11. Return the environment to normal state. Post "Oxygen In Use" signs above the bed and at the door, if required.	_____	Dispose of any trash, reposition the patient, put tables and bedrails back in place.
12. Wash hands.	_____	To insure aseptic technique.
13. Record pertinent data on patient chart.	_____	Time of oxygen initiation, the type of delivery system, the approximate FI_{O_2} and flowrate. Patient assessment: before and after.
14. Notify appropriate personnel.	_____	Under ordinary circumstances, inform the patient's nurse that the oxygen system has been initiated. Adverse reactions should be brought to the attention of the physician and RT supervisor.
15. Complete all department records.	_____	Some records that may need to be filled out; oxygen round forms, charging forms, cardex, and patient treatment card.

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CORRELATION BETWEEN NUMBER OF HITS TO WEB-ENHANCED RESPIRATORY CARE COURSES AND STUDENT GRADES

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Abstract

Introduction: Use of web-enhanced courses represents one of the most innovative strategies to facilitate effective teaching and learning. Student participation in these courses is typically measured by the number of "hits" to the web site. Information on the use of web-enhanced courses in traditional campus-based respiratory care programs is limited. The purpose of this study was to determine if there was a relationship between student participation and course grades in two web-enhanced respiratory care courses. **Methods:** The number of hits to the web course and course grade were recorded for each student (n = 81) enrolled. Correlation coefficients were calculated to determine if there was a significant ($p<.05$) relationship between number of hits and course grade as a percentage of possible points. Stratification of subjects based on number of hits was also performed to determine if there were significant differences. **Results:** The average number of hits for both courses was 48 $\pm$ 29 and the course grade average for all groups was 86% $\pm$ 6%. Although statistically significant, there was a low correlation between number of hits and students' grades ($r=.24$, $p<.02$). There were no significant differences in course grades between students with low, moderate and high levels of participation ($p=.21$). Although the average respiratory care student accessed the web-enhanced course on a regular basis, the type and quality of the visit may correlate better with student performance. This aspect of the web instruction needs further evaluation.

Key Words: WebCT, distance learning, online course, instructional technology, respiratory care program.

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Correlation Between Number of Hits to Web-Enhanced Respiratory Care Courses and Student Grades

Introduction

Education in the U.S. is in a period of transition. Innovations in instructional technology have broadened the possibilities, potential, and availability of web-based education. According to the U.S. Department of Education, the traditional undergraduate and graduate student population represents only about 25% of campus enrollment.[1] Sixty-three percent of all undergraduates enrolled in 2003–04 received some type of financial aid that was less than needed and the average student reported working while in school.[2] The introduction of technology–based instruction and distance learning has provided a means to address and meet the needs of the changing student population.[3,4]

A large number of associate's degree respiratory therapists (RTs) who want to complete their bachelor's degree in respiratory care have positive attitudes towards and prefer programs using distance education.[5] The National Center for Education Statistics (NCES) reported in 2003 that 52% of institutions with undergraduate programs offered credit-granting distance education courses at the undergraduate level.[6] However, this move from seat–based learning to technology-based learning represents a challenge to educators. Conversion of curriculum from a traditional classroom environment to online education can be a demanding task.[7,8]

WebCT is the world's leading provider of integrated e-learning systems that allows faculty to enhance their instruction via the creation of internet-based educational environments. WebCT has over 11.2 million student accounts at nearly 3,000 institutions in more than 80 countries. WebCT allows educators to design the appearance of course pages, and provides a set of educational tools that can easily be incorporated into any course. A set of administrative tools is provided to assist the educator in the task of course administration. *Progress tracking* is an administrative WebCT tool that allows an instructor to monitor whether and how students are participating in the course. For each student, the instructor can see the first time and the last time a student accessed the course and the total number of log-ons since beginning of the course. Detailed information is available on the specific course components accessed, how much time the student spent on a particular page, and the student's activity on the course bulletin board.[9]

Georgia State University (GSU) uses WebCT as the platform for the development of web-based and web-enhanced content, offering close to 1,300 WebCT courses by about 1,000 instructors in 70 departments. WebCT reported 16,206 users at GSU as of February 2006. The College of Health and Human Sciences at GSU has listed approximately 50 WebCT courses of which, 10 were offered in the Division of Respiratory Therapy.

Even though web-based technology has served to enhance teaching, WebCT has been traditionally used to simply publish materials that supplement existing courses. Since the bulk of the materials used in these courses are created using a

Word or Word Perfect format, students are usually not able to take full advantage of all the elements that can be introduced to enhance their learning. The goal of web-enhanced courses is to encourage students to use technology in an academic environment and allow faculty to make supplemental materials available to their students such as notes, slide shows, and multimedia. Although technology may add appeal to online courses, there is a growing interest in and concern for assessing student's learning and performance with the use of this new method for delivering educational materials in the traditional campus-based student population.[4,7,10]

Student performance, satisfaction, and the number of hits from the beginning of a course have been the main outcomes measured to evaluate the effectiveness of web-enhanced courses. These outcomes measures were evaluated by Goldberg to assess first year computer science students' reactions to and use of a web-based resource at the University of British Columbia (UBC).[11] In another similar study, Goldberg measured student participation and progress for web-based courses using WebCT.[12] Sixty-six percent of the students in that study had a preference for web-based courses if given the choice.[12] These first experiments at the UBC with WebCT demonstrated that internet-based courses (with or without accompanying lectures) have the potential to be effective both in terms of student academic performance and student acceptance. Goldberg has reported better than expected academic performance in computer science courses using lecture plus web-based material.[12-14]

Disciplines such as computer science may take full advantage of the power of the web for course delivery and degree completion.[15] The American Association for Respiratory Care (AARC) currently lists only a few baccalaureate-completion programs that are offered via distance education.[16,17] Other academic institutions are offering distance education courses and programs for academic credit or continuing education in pulmonary medicine, allergy/immunology, and respiratory care.[5,18,19] Despite the utilization of online education in respiratory care, the effects of its use on student performance has not yet been well documented. The purpose of this study was to determine if there was a relationship between student participation (as number of course web page visits) and course grades in two web-enhanced respiratory care courses.

Methods

The courses evaluated in this study were Clinical Cardiopulmonary Physiology (RT 3005), a three-hour credit course offered during the first semester of the junior year, and Neonatal Respiratory Care (RT 4081), a three-hour credit course offered during the last semester of the senior year at Georgia State University. From the beginning of each course, all students had access to the course materials on WebCT. The same instructor taught both courses and provided Power Point® presentations for every lecture. After being converted to HTML format, the presentations were uploaded to WebCT as the main

component of the course content. Students also could access various web resources by selecting links embedded in the slide presentations.

A total of 81 students who accessed the course material on WebCT were included in the study. At the completion of each course, the number of hits to the Web site was recorded for each student and correlated with the final course grade. Stratification of subjects was performed based on the number of hits. Students with ≤ 50 hits (low participation); with 51-100 hits (medium participation); and > 100 hits (high participation) to the Web course were further compared and analyzed. Data were printed directly from WebCT, so an instrument was not developed. The university's internal review board approved the study.

Statistics were calculated using SPSS version 14.0, Chicago, IL. The independent t test was used to compare the two courses. Pearson product-moment correlation coefficients (*r*) were calculated between the number of hits and students' course grades as a percentage of possible points. Course grades for the low, medium and high participation groups were compared using ANOVA. Significant differences were determined using a (*p)* value ≤ .05.

Results

Eighty-one students accessed the course material through WebCT and lecture, 37 students for RT 3005 and 44 students for RT 4081. While there was not a significant difference between courses in the number of hits (44 vs.51, p = .13), there was a significant difference between mean class course grades (84.4% vs. 86.6%, p = .05). Table 1 shows characteristics of the study group. The average number of hits per student for both courses combined was 48 (SD =29) and the course grade average for (all groups) was 86% (SD=6.2%; See Figure 1). There was a low, but statistically significant correlation between number of hits and overall course grade (r= .24, p= .024).

Table 1

Characteristics of the study group

	RT 3005	RT 4081	TOTAL
# students	37	44	81
Mean # hits (SD)	44 (31)	51 (27)	48 (29)
Mean % grade (SD)	84 (7)*	87 (5)*	86 (6)
Pearson r	.19	.26	.24
Correlation p value	.05	.03	.02

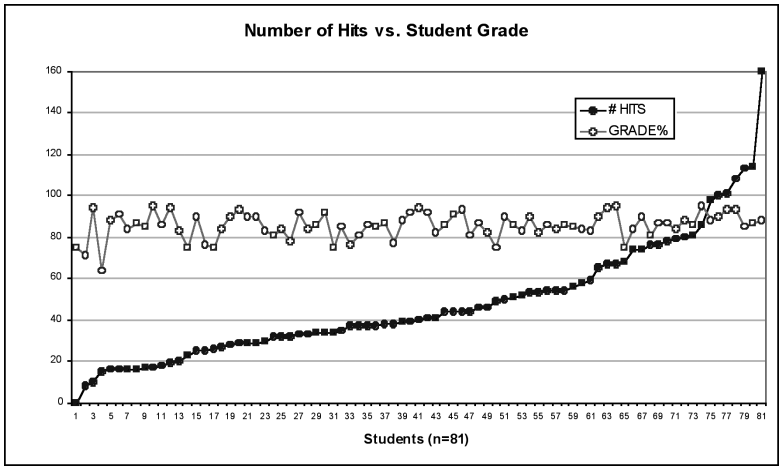
There was a statistically significant difference between students of both RT courses when compared by mean course grades. There were statistically significant correlations between number of course web page hits and students' grades for RT 3005, RT 4081 and both courses, combined.

(SD): Standard deviation, RT 3005: Clinical Cardiopulmonary Physiology; RT 4081: Neonatal Respiratory Care.

* p= ≤ 0.05

Figure 1

Number of Hits vs. Student Grade

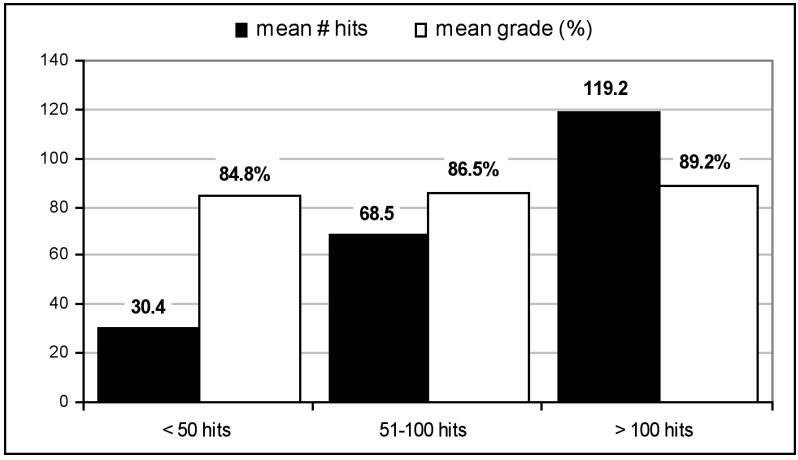


Eighty-one students accessed the course material through Web CT and lecture, 37 students for RT 3005 and 44 students for RT 4081. The average number of hits for both courses was 48 (SD=29) and the course grade average for all groups was 86% (SD = 6%). Although statistically significant, there was a low association between number of hits and course grade (r= .24, p= 0.02).

While students with high participation had better mean course grades (89.2%) than those with medium (86.5%) and low (84.8%) participation, there was not a statistically significant difference between groups (p= .21) (Figure 2).

Figure 2

Comparison of mean student grades according to participation in the web course.



Discussion

In web-based course environments, student participation has been typically measured by the number of visits or "hits" to the web site and its different content areas.[20,21] It is widely accepted that students must actively participate or access course materials to gain knowledge using web-based instruction. Kendall found that students who more frequently accessed course information and made postings on the discussion page in an online communication course had higher grades.[20] In our study, students accessed WebCT material at least three times a week. Grades were highest in the group of students who reported more than 100 visits, however, this difference was not statistically significant. This may have been because of an insufficient sample size. Although our study found a statistically significant relationship between number of hits and course grades, the correlation indicated that only about 6% of the variance in course grades could be explained by participation rate. Our findings are consistent with the study by Stith who reported a low correlation between number of "hits" and course grade for students taking an online biology course.[21] However, Stith's study showed that students with an "A" for the final course grade read twice as many articles on the web-bulletin board as the students with a "C." Student postings on discussion pages or bulletin boards and responses to assignments may dramatically improve the quality of a visit or "hit" to the web course. This type of interactive access has been shown to strongly correlate with student performance.[20,21] In our study, the "hit" did not reflect the level of active participation of the student or how hard they worked, which may explain why other studies found stronger correlations between student participation and course grades.

Factors such as education background, computer proficiency, familiarity with WebCT, speed of internet connection, and motivation were not evaluated and may have affected student acceptance, interaction, and performance.[22] According to Moore et al, one of the best predictors of success in distance education is the educational background of the student.[23] Instructors need time to acquire or improve instructional technology skills needed to implement web-based teaching, since it is the instructor who is primarily responsible for creating effective interactions with the student.[24-26] Distance education instructors often need to adopt different instructional philosophies and roles and learn new teaching skills and strategies. The effectiveness of technology-enhanced teaching is related to how well instructors use the technology and their understanding of its limitations.[23]

Although a small number of respiratory care educational programs have indicated that they are using online education, the use of distance and computer learning in respiratory care is increasing.[27] Web-based technology can be an effective tool to enhance traditional lecture-based courses and create effective student interaction.[28-30] While it is sometimes difficult for educators to pinpoint the methods that contribute to better student performance, it is widely accepted that creative teaching and the use of the latest computer technology can positively impact teaching at all levels of education.[8]

Conclusions

Our study found a small, but statistically significant association between the number of course web page hits and students' course grades. A larger sample or more direct

measurement of the quality of students' interactions may have resulted in a stronger relationship between participation and course grades. As respiratory care programs introduce more web-based courses to meet both basic and advanced educational needs, student engagement and participation will become important determinants of student performance. This aspect of the web instruction needs further evaluation.

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USE OF DIGITAL VIDEO CLIPS TO SUPPLEMENT ARTIFICIAL AIRWAYS INSTRUCTION

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Abstract

This study examined how supplemental digital video clips enhanced artificial airway written exam scores and the first-time pass rates for skill tests. Experimental and control groups were compared using first semester GPA, the written exam scores, and the first-time skill test pass rates. During audiotaped interviews, experimental group students described how they used the video clips in their studies and rated the ease of learning from lecture, laboratory, written materials, and video clips. No differences were found between first semester GPA and first-time skill test pass rates, however, the experimental group members had higher written exam scores. Students found learning through video clips easier than the other methods. They could more easily visualize procedures with video and valued replaying content. Instructors should employ methods to increase hands-on practice for skill mastery and consider using video supplements for students who encounter many new terms requiring application in unfamiliar contexts.

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Use of Digital Video Clips to Supplement Artificial Airways Instruction

Introduction

Respiratory care students need to demonstrate assembly and application skills with a wide range of medical equipment in preparation for their clinical experiences. Textbook pictures and written procedures provide static instructions for assembling and using equipment. Video, however, displays motion and allows for auditory descriptions. The auditory descriptions can help students learn equipment terminology and highlight key points for each procedural step. Furthermore, video resources can be consulted at times when faculty are not available and reviewed as often as desired.

Video resources have been successfully used in cardiopulmonary resuscitation (CPR) instruction. Relaying content through video cassettes took less time and had equal or greater effectiveness than instructor-led training with adults in the community and specific populations such as older African-American laypersons and new medical students.[1-3] Citizen participants who reviewed a CPR refresher video had better compression rate, hand placement, and increased frequency of carotid pulse checks than peers who used a written refresher.[4] Video can be edited to provide information that is concise and consistent which helps students focus on relevant procedural content.[1] The emergence of digital video allows educators to break video into discreet segments, making it easier to locate desired topics. Digital video is being utilized to teach a variety of medical topics[5-7] as it can be inexpensively distributed through CD ROMs and viewed on computers.[5] The proliferation of campus computer resources and the increase in computer ownership to > 62% of households makes digital video accessible to most students.[8]

The goal of this research was to test whether supplementing classroom and laboratory teaching with digital video clips would improve the first-time pass rates on laboratory skill tests related to artificial airway care. The hypothesis was that first-time pass rates would be enhanced if each student had access to and used supplemental video clips.

Methods

Subjects and Setting

Respiratory care students enrolled in a bachelor's degree granting program at an urban university with a highly diverse student body participated in this study. Students in the experimental group ($\underline{n}$ = 15) were enrolled during a separate academic year than students in the control group ($\underline{n}$ = 19). Both groups of students took a five credit course that included four hours each of lecture and laboratory practice every week during the second semester of their junior year. One module within this course addressed artificial airways. Separate pass/fail skill tests were conducted on four skills within this module; manual resuscitator bag use, suctioning, intubation, and extubation. Students received feedback from their skill tests prior to taking the module's written exam.

Students in the experimental group received CD ROMs containing a total of 35 digital videos ranging 1-5 minutes in duration. The videos were produced by the course instructor with the help of the university's media center and showed the course instructor demonstrating procedures in the respiratory care laboratory. Consistent with

constructivist learning theory, the content was taught in the context that it would be used.[9] The videos were compressed into Windows Media format and distributed both on CD ROMs and through hyperlinks within WebCT (WebCT, Inc.; Lynnfield, MA). The number of videos on resuscitator bags, suctioning, intubation, and extubation were 10, 10, 13, and 2, respectively.

The control group was selected retrospectively by finding a class who took a similar written exam as the experimental group. Control group students took the course three years earlier than the experimental group with the same instructor. There were no curricular or faculty changes in the respiratory program during the three year time interval. Lecture and laboratory sessions for the artificial airway module were conducted similarly. At the start of the semester each group received a coursebook that included a syllabus, lecture notes for the entire semester, and supplementary readings. Each group also participated in weekly online discussions. All laboratory procedures were similar, but the experimental group's lecture notes differed slightly to reflect updated content.

Data Collection

Comparisons between experimental and control groups were made by comparing the cumulative grade point average (GPA) from respiratory care courses in the students' first semester of their junior year to control for differing academic abilities. The GPA score was based on a 4-point scale and was collected from departmental records. Student test scores were taken from the course instructor's records. The total first-time pass rates on the four artificial airway laboratory skill tests for experimental and control groups were tallied. The written exams for both groups differed slightly so only the 32 identically-worded items were used which yielded a maximum score of 49. The number of questions eliminated from the experimental and control group's written tests were 8 and 5, respectively.

Table 1
Student Ratings for Ease of Learning through Lecture, Laboratory Work, Written Materials, and Video Clips

Lecture	Laboratory Work	Written Materials	Video Clips
4	3	4	5
4	5	3	5
3	4	3	4
4	4	4	5
4	4	3	5
3.5	3.5	3	5
5	5	3.5	5
5	3	3	5
3	5	3	5

Note: Student volunteers from the experimental group (n = 15) rated their ease of learning respiratory care content on a scale with endpoints of 1 = very difficult to 5 = very easy.

Table 2
Comparison of Ease of Learning through Video Clips with Lecture, Laboratory Work, and Written Materials

Comparison		Sign Test Significance Values
Video Clips	Lecture	<.001*
Video Clips	Laboratory Work	<.001*
Video Clips	Written Materials	<.001*

*Significant at p = .0167.

Demographic information for gender and race was taken from departmental records. Additionally, a graduate assistant conducted audiotaped interviews with volunteers from the experimental group and identified students' ease of learning through lecture, laboratory work, written materials, and video clips. Students rated their ease of learning on a 5-point Likert scale with scale anchors of 1 = very difficult and 5 = very easy. In addition to identifying their first language, students also answered opened-ended questions that addressed how they used the video clips in their studying and how the video impacted their written exam score. The graduate assistant produced a written transcript of the audiotaped interviews.

Data Analysis

Fisher's Exact test was used to compare the experimental and control groups on the dependent variables of first-semester GPA, first-time pass rate for the four laboratory skill tests, and written exam scores. Categories for each dependent variable were created by aggregating the data for the experimental and control groups and finding the median value. Frequencies of scores above and below the aggregate median value were used in Fisher's Exact test. The Chi Square test of homogeneity was used to compare group differences with regard to race and gender. The Latino and White racial categories were combined because they were too small to permit analysis if kept separate. All tests were conducted at $\alpha = 0.05$. The Sign Test was used to compare the ease of learning through video with lecture, laboratory, and written materials for the experimental group. All three comparisons were tested at $\alpha = 0.0168$ to maintain a familywise $\alpha = 0.05$. All analyses were run using SPSS v.11.0 for Microsoft Windows (SPSS Inc.; Chicago, IL).

The interview transcript was reviewed to identify the most frequently cited remarks about using the supplemental video. A frequency count was conducted for the questions related to the number of points video viewing added to the written exam, video viewing locations, viewing frequency, whether students studied alone or in groups, if used primarily for the written exam or skill tests, and number of native English speakers.

Results

The numbers of students in the experimental and control groups were 15 and 19, respectively. The median first-semester GPA of the aggregate sample was 3.29. The number of students below the median GPA in the experimental and control groups were

6 and 10, respectively and both groups had 9 students above the median GPA. Fisher's Exact test showed no significant difference in first semester GPA scores, $p = .510$. Similarly, Fisher's Exact test showed no difference in the numbers of students passing their laboratory skills on the first-attempt, $p = .219$. First-attempt pass rates for the experimental and control groups were 34 and 51, respectively. Two or more attempts were required for students in the experimental group on 26 tests, compared to 25 for the control group. The written exam scores between experimental and control groups differed significantly, $p = .005$. The median written exam score for the aggregate sample was 40.5. Twelve experimental group students scored above the median level compared with five control group students. Three experimental group students and 14 control group students had scores below the median GPA.

Only 9 of the 15 students in the experimental group volunteered for interviews. Student ratings of their ease of learning through the varied media are listed in Table 1. The Sign Test comparisons between video clips and lecture, laboratory, and written materials were all significant, $p < .001$, and are listed in Table 2. Common themes from open-ended interview questions were that students used the video clips mainly for review prior to both tests, valued the ability to replay content, found concepts clearer after viewing, and visualized procedures more easily. The frequencies for the following findings appear in parentheses. Student either viewed their videos at home (2), on campus (4), or in both locations (3). They viewed the videos alone (2), in a group (1) or through both strategies (6). The videos were either used to prepare for the skill tests (2) or both exams (7). Five students felt that the videos added 5-10 points to their written exam score whereas one student felt 3 points were added. Students reported viewing all of the video clips 2-3 times. Some students did not answer all questions.

Regarding demographic variables, there were no differences in gender, $\chi^2 = 1.145$, df = 1, $p = .285$; or racial categories, $\chi^2 = .875$, df = 2, $p = .646$. The experimental and control groups both had 12 female students, whereas the number of male students in the experimental and control groups were 3 and 7, respectively. Both the experimental and control groups had 6 Black, 5 Asian, and 2 Latino students. The number of White students in the experimental and control groups were 2 and 6, respectively. Of the 9 experimental group interviewees, 6 had English as their second language.

Discussion

This study explored how supplementing classroom and laboratory teaching with digital video clips would impact first-time pass rates on artificial airways skill tests. Contrary to expected findings, students in the experimental group did not have greater first-time pass rates on their skill tests. The experimental group did, however, have higher written test scores. Given the similarity between experimental and control groups as evidenced by their first-semester GPA scores, gender and racial mix, potential reasons for the lack of skill test improvement were explored.

Performing a procedure requires students to have mastery of both procedural knowledge and procedural performance. Students must know "how" to perform the procedure[10] before they "can" perform the procedure.[11] Research in motor control suggests that people use imagery as a tool to piece together individual steps when they

describe a procedure.[10] Thus, the ability to construct images plays an important role in learning procedural knowledge. Experimental group students remarked on how the videos made the information clearer and made visualizing procedures easier. The videos appeared to help students form clearer and more accurate images of how to perform artificial airway procedures, thus enhancing their procedural knowledge. Thus, it is not surprising that the experimental group had higher written test scores and perceived that viewing the videos enhanced their scores.

The videos did not, however, help students master procedural performance as evidenced by no change in first-time pass rates on skill tests. Among the features of the video-based CPR instruction presented earlier was that the video provided information more efficiently which allowed more time for hands-on practice.[1-3] The experimental group in this study was not directed to increase their hands-on practice time. The lack of hands-on practice is the likely reason for no performance improvement.

Experimental group students indicated that they found it easier to learn through video in comparison to lecture, laboratory, or written works. The literature on listening and reading comprehension lends some insights to this finding. In lecture and laboratory settings, listening skills are critical to learning. Comprehension through listening is affected by intelligence, language facility, background knowledge and schema, variation in speech registers, metacognitive strategies, kinesics, and motivation.[12] The ability to replay video offers advantages in several of these areas. Take vocabulary, a variable within language facility, for example. Words have many different meanings, thus students need to determine the context before concluding the meaning.[12] Also, students new to respiratory care need to add medical and technical terms to their vocabulary and lack the clinical context. Thus, new respiratory care students will struggle with both the additional vocabulary and how equipment and procedures fit into broader health care practices. The presence of a visual image along with the audio may help students learn the new vocabulary and establish the context. It is critical to recognize spoken words and segment them into appropriate units for comprehension. Students less familiar with the vocabulary spend more time decoding individual words, leaving less time to segment words into meaningful phrases, and process the remaining steps required for comprehension.[12] Visual elements such as kinesics, or non-verbal gestures such as facial expressions, eye contact, direction of gaze, hand gestures, and other body motions, also add important cues for comprehension.[12] The ability to replay the video also helps students who struggle with listening comprehension as they lack control over the rate of the instructor's speech in lecture and laboratory settings.[13]

Experimental group students rated the ease of learning through written works the same or less than learning through video. Like video, written works can be reviewed. Factors affecting learning through reading are intelligence, understanding terms related to language construction, decoding ability, background knowledge and schema, text structure, anaphoric terms, metacognitive strategies, language facility, graphic literacy, and motivation and attention.[12] Several of these variables are the same as those involved in listening comprehension, however, reading comprehension requires additional skills such as knowledge of how quotation marks, exclamation marks, commas, colons, and others

convey meaning.[12] In contrast, spoken word has pauses that occur naturally every six words or roughly two seconds,[14] and vocal intonation which may be easier to decode than punctuation marks. Text structure also affects reading comprehension. Students need to understand how the layout of text material conveys relationships between various content elements.[13] Further, written works contain greater information density and abstract information.[15] Writers spend more time constructing their text than a speaker can dedicate to spoken works. Thus, written works have a greater variety of vocabulary, more ideas condensed into individual sentences, and more complex sentence structures.[16] The combination of decoding new words, punctuation, static images, and denser sentence structures may be a few reasons why new respiratory care students found learning through written works more difficult than video.

Many students in both groups had English as a second language (ESL). A strong vocabulary base is required to negotiate the large reading volume assigned in academic settings. It is not surprising that a broad vocabulary had the greatest impact on academic learning in ESL schoolchildren.[17] Academic reading is more difficult because it has fewer contextual cues as most content is delivered through plain text.[18] Reading is also more time-consuming for ESL students and thus requires more motivation.[19] Even if bilingual, reading in a second language takes more time[20] and there is less recall.[21, 22] Reading comprehension can be improved for ESL students by providing background information through demonstration and visual media.[23] In a group of nursing ESL students, video was helpful in enhancing their vocabulary[19] and was perceived as more beneficial by new ESL nursing students than native speakers.[24] New health professions' ESL students will likely reap the most benefit from video because the amount of new vocabulary is highest and clinical context is lowest during the first year of professional studies. Thus resources should be targeted to this group.

Experimental group students valued the videos beyond the novelty of having the media. There were no course requirements to view the videos, yet most students viewed the videos both alone and with others, often multiple times, and in preparation for both written and skill tests. It is noteworthy that students used the videos primarily for review. Given the video's strength in setting the context for students with limited clinical experience, students might benefit more if encouraged to view the videos earlier in their study process. Perhaps the decision to defer use of the videos until closer to the exams results from inexperience with this learning resource. In future uses, students should be encouraged to consult their videos earlier in the study process.

Several limitations of this study relate to potential measurement errors. Scoring skill tests involved subjective judgments and the two written tests were not identical in length. Not all experimental group students completed the online surveys and even fewer volunteered for the interview which may also impact the findings. Further, the three year time lapse between comparison groups might have allowed other program variables or the quality of the instructor's teaching to impact the results. Other limitations relate to the topic studied, student population, and instructor variables. This study focused on only one clinical topic. Different findings might result by studying other content areas. Students with higher academic abilities and native English speakers might not benefit as

much from the supplemental video clips. Finally, the impact of video resources may vary when used by different instructors.

Conclusions

The supplemental use of video clips in the artificial airways module did not improve the first time pass-rates on laboratory skill tests. However, an improved performance on the artificial airways written exam was noted. More hands-on practice is required for students to master procedural skills. Viewing the video clips benefited the students' procedural knowledge. Students found learning from video easier than other methods as they could replay the content and better visualize the procedures. Therefore, instructors should consider using video clips as a learning supplement especially when presenting content containing many new terms that have applications in unfamiliar contexts.

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