Training Appropriate for Computer Certification at Two-Year Institutions

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ABSTRACT

This paper presents research results on the relevance and need for information technology certification, with a particular focus on CompTIA A+ certification. The study focused on the opinions of employers on certification, a critical review of certification provider literature, and an opinion survey of two-year institutions. The study investigated the training two-year institutions should be providing for CompTIA A+ certification to meet the needs of employers. The paper presents the historical overview, types of programs, development details and outcomes for the future information technology certification.

Keywords: Information technology, certification, IT training.

1. INTRODUCTION

The rapidly advancing technology requires evolving skills of technology staff. This evolution has created a new certification requirement for Information Technology (IT) professionals. According to Shore, "IT company professional certification is now so common that it has become an expectation for vendors. It is the rare IT company that does not provide some level of certification for its products and the technical professionals who use them" [13].

Certifications for Information Technology have become innovative and increasingly important over the past decade. They have become standard practice for health care practitioners, teachers, accountants, pilots, engineers, architects, home inspectors, therapists and other professionals with some involving intensive evaluation by examination boards. Some take weeks, months, even years to complete; others involve a simple checklist from a local agency [13]. According to the Computing Technology Industry Association (CompTIA), over 800,000 individuals have earned the A+ credential worldwide, and 20,000 member organizations exist in more than 190 countries. CompTIA celebrated its 25th anniversary in 2007.

Professional certification in the IT industry is a relatively recent phenomenon [13]. It originated in the late 1980s when Novell, Inc., a networking vendor from Provo, Utah, started building the skill levels of the IT staff members to maintain market share and manage support costs. Novell was one of the first companies to recognize the links between education/skills and product success. Novell created a process to measure and validate the required skills to effectively work with NetWare. Thus, the Certified NetWare Engineer (CNE) was created.

The growing success of Novell's program encouraged other IT vendors to follow the same path, and certification became the standard for measuring skills in the late 1990s. IT education firms and community colleges started advertising certification preparation courses, both vendor-authorized and unauthorized, for the leading certifications. Other firms offered vendors services on the creation of examination and training, program management, certification study guides, and self-assessment "readiness" exams. Instructor performance and student satisfaction were often judged by passing rates in certification examinations, rather than the actual quality of preparation for jobs.

Certification proponents in the IT fields see certifications as important. "We believe employees don't have to be certified to be proficient, but we do think that certification means the employee has gone above and beyond," [10]. On the other hand, detractors claim that a certification only proves that a worker is smart with a book work. Such critics believe that certifications do not offer the hands-on knowledge that comes with experience. Conversely, proponents argue that certifications validate skills, establish a baseline for new hires and can be very useful in corporate retention strategies [10].

Moreover, "IT certifications are neither a guaranteed money magnet nor a guaranteed waste of time. They may indicate drive as well as knowledge. But they can't measure experience or non-IT skills" [11]. Baird asserts, "IT certification programs offered at community colleges should demonstrate skills that are portable and marketable to maximize the career options for the certified professional" [1].

Most IT companies provide some level of certification for their products and the technical professional users. Most technology-related companies and IT professionals are seeking every advantage opportunity in the job market, where certification can often make the difference in the hiring process.

Organizations such as the Computing Technology Industry Association (CompTIA), jCert, and the Linux Professional Institute are consortia of IT vendors, training and certification companies. These groups produce certifications that validate entry-level and advanced IT skills in areas such as PC support, networking, security, and skills related to popular technologies such as Java and Linux. These certifications have become popular with companies staffing help desks and support centers

and are often cited as among the most valuable certifications in media and consultant research [13].

Certification is an asset to employers who are interested in verifying the skill levels of employees. Hiring companies prefer candidates with real IT experience and not just paper certifications through "book learning." However, all other factors equal, certification is often the tiebreaker because employers often pay employees to pursue relevant training and certifications.

Certification has become the standard for IT resellers and service providers. The vendors who sell or service products often require business partners to have staff certified in the vendor technologies. Customers often require a certification specific to the job as a condition of a service contract. Service providers frequently charge higher rates for certified staff members to promote and use certifications as a competitive differentiator, even those with the "paper" reputation. This expectation motivates prospective employees to aggressively pursue certification. The most commonly cited reasons by individuals who pursue certification are: to gain the respect of their employer and peers, to get a better job either within their current firm or with a new firm, and to obtain higher compensation.

The achievement of the expected outcomes of Information Technology certifications should combine teaching methods that include both theory and practice. One major criticism of IT certifications is that it is possible to read books, take an online examination and get certified. However, it is crucial that every IT professional possess a combination of not only software and hardware skills, but also soft skills for successfully satisfying job requirements. Is there an appropriate course delivery method for helping students at two-year institutions to be CompTIA A+ certified? Is CompTIA A+ certification relevant and needed for employment and professionalism?

2. PURPOSE AND ASSUMPTIONS

The research study investigated the most effective teaching methods for helping students at 2-year institutions to become CompTIA A+ certified. Technology is constantly evolving, as are the skills of individuals working with technology. This evolving technology has created a new requirement for certifications for Information Technology professionals. Becoming professionally certified as to meet needs of employers will fundamentally depend on finding an effective teaching method.

The term instructional design "refers to the process of translating principles of learning and instruction into plans for instructional materials, activities, information resources, and evaluation," [12]. Three educational philosophies with strong influences on instructional design are: constructivism, empiricism, and pragmatism [12]. Gagné divides learning outcomes into five large categories or "domains": verbal information (or declarative knowledge), intellectual skills, cognitive strategies, attitudes, and psychomotor skills [3].

Each educational philosophy and learning outcome suggests different instructional methodology. In other words, finding out the appropriate instructional design method for teaching CompTIA A+ certification was important in this research. The applicability of certification to academia stems from the fact that most students enter college to train for a career, and students in computer science typically gain a strong background in theory, as well as exposure to a variety of technologies [13]. However, many employers prefer the broad grounding in information technology that a computer science degree denotes. Most academic programs provide hands-on experience through labs and industry co-operative programs. Yet, certification might be advantageous on the résumés of graduates. A computer science program that offers students the opportunities to attain one or more valuable IT certifications during the course of study is likely to insure a successful career placement.

Ragan and Smith reiterate that "the result of the front-end analysis stage of design is a clear description of the learning environment, the learners, and the learning task," [12]. They also suggest that the learning task should clearly specify terminal objectives and instructional analysis, enabling objectives and be classified according to the types of learning outcomes required in Gagné's learning outcomes taxonomy [7].

As an integrated part of an instructional design process, the present research assumes that besides identifying the target teaching methods, it is equally important to determine the specific IT teaching characteristics favored by teachers and students. In the process of creating the research survey instrument, it was assumed that participants have some knowledge about information technology's certifications, and have had previous experience in teaching a class or taking a class related to IT at a 2-year institution.

Information Technology certifications are not new to IT professionals and businesses. However, the design of teaching methods that fit the need of potential employers is a major challenge in today's global business world. This study has impact on those working toward teaching CompTIA A+ using a method that combines theory and practice. The research results go beyond certification requirements in books or study materials on the Internet for A+ certification.

Given the interests of IT professionals and employers in certifications, this study, though limited to CompTIA A+, has potential influence on other certification teaching methods at 2-year institutions. CompTIA A+ is the most popular entry level certification [3].

3. DEFINITIONS

Attitude is a mental state that predisposes a learner to choose to behave in a certain way [8]. Gagne describes attitudes as having cognitive, affective, and behavioral components that interact. Attitudes influence the choices that learners make [12].

CCIE –Cisco Certified Internetwork Expert.

CISCO –A large supplier of networking hardware and software, including router and security products.

CompTIA–CompTIA is the organization that sponsors the A+ Certification, a non-profit organization made up of individuals from various large companies [4, 5].

CompTIA A+ Certification–This certification indicates that the individual possesses the knowledge and skills essential for becoming a successful computer service technician. The two-part exam covers hardware and software technologies and is not related to any vendor-specific products [6].

Concrete concept –responding in a single way to all members of a particular class of observable events. It is the ability to see the essential similarity among a class of objects, people, or events, in a single response. Examples include the classification of music as jazz, country western, rock, etc., and the declaration a manhole cover, a penny, and the moon as round objects [9].

Constructivism –an educational philosophy within a larger category of philosophies that are described as "rationalism." It is a rationalist philosophy that is characterized by the belief that reason is the primary source of knowledge and that reality is constructed rather than discovered [12].

Declarative knowledge –sometimes described as "knowing that" something is the case [8]. It is also comparable to Bloom's taxonomy [2] levels of recall and understanding [12].

Design –activity or process that people engage in that improves the quality of their subsequent creations [12].

Discrimination –making different responses to the different members of a particular class is seeing the essential differences between inputs and responding differently to each. Example: Distinguishing yellow finches from house finches on the basis of markings; having to tell the differences between gauges on an instrument panel [9].

Empiricism –also termed as objectivism, is a postulate that knowledge is acquired through experience.

Instruction –deliberate arrangement of learning conditions to promote the attainment of some intended goal [12].

Instructional design –systematic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources, and evaluation [12].

Intellectual skills –Intellectual skills include: 1) Discrimination, 2) Concrete concept, 3) Rule using, and 4) Problem solving. These are the four levels within the intellectual skills domain in Gagné's taxonomy [12].

Microsoft –A software company, best known for the Windows operating system.

Pragmatism –considered as a middle ground between rationalism (constructivism) and empiricism. Pragmatists, like empiricists, believe that knowledge is acquired through experience; they believe that this knowledge is interpreted through reason and is temporary and tentative [12].

Problem solving –combining lower level rules to solve problems in a situation never encountered by the person solving the problem. It may involve generating new trial and error rules until the solution to a problem is derived [9].

Psychomotor skills –coordinated muscular movements that are typified by smoothness and precise timing [7]. The psychomotor domain includes physical movement, coordination, and use of the motor-skill areas. The development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution [12].

Rule using is the application of a rule to a given situation or condition by responding to a class of inputs with a class of actions. It is the ability to relate two or more simpler concepts in specific situations. A rule states the relationship among concepts. It is helpful to think of rules or principles as "if-then" statements. Examples include: "If a task is a procedure, then use flowcharting to analyze the task;" "If you can convert a statement into an 'if-then' statement, then it is a rule or principle," [9].

4. RESEARCH METHODOLOGY

Professional IT skills and technology are constantly evolving. The progression of technology has ushered in new certification requirements for IT professionals. The integration of theory and practice into instructional course delivery methods are perhaps relevant for achieving the expected outcome of IT certifications and employment goals. The research questions investigated in this study are:

a. Is there an appropriate course delivery method for helping students at two-year institutions become CompTIA A+ certified?
- Is the combination of face-to-face and online learning adequate for CompTIA A+ training?
- Is on-site, face to face learning sufficient for CompTIA A+ training?
- Is online learning sufficient for CompTIA A+ training?
- Are CD/DVDs, books and self-learning materials adequate for CompTIA A+ training?

b. Is CompTIA A+ certification relevant and needed for employment and professionalism?
- Is there any preferred training needed for CompTIA A+ certification?
- Is CompTIA A+ a necessity for IT professionals?
- Is CompTIA A+ useful for IT professionals?
- Should CompTIA A+ certifications be a requisite for employment?
- Is CompTIA A+ certification meaningful?
- Is CompTIA A+ certification adequate?
- Is there a balance between theory and perception in reward of CompTIA A+ certification?

The research hypotheses investigated are:

H_0: There is not a significant difference between the students who are CompTIA A+ certified and those who are not certified on their perceptions of the training.

H_1: There is a significant difference between the students who are CompTIA A+ certified and those who are not certified on their perceptions of the training.

The objectives of the survey were to:

1. Determine the percentage of survey participants who (a) are aware of CompTIA A+ certification, (b) are CompTIA A+ certified, (c) would like to become CompTIA A+ certified, (d) believe that the actual training method combines theory and practice, (e) believe that the training method is more theoretical, (f) believe that CompTIA A+ is necessary for job seekers, (g) would like to see a continuous evolution of CompTIA A+ certification, and (h) believe that being CompTIA A+ certified can improve job skills.
2. Ascertain the degree of appreciation the survey participants have for the performance of CompTIA A+ certified technicians and to gather suggestions for improving CompTIA A+ (certified technicians) or certification training.

The target survey population includes students and instructors at 2-year institutions. The subgroup includes computer science students and instructors. The sample consisted of students and instructors from Minnesota School of Business Globe College, St. Cloud, Minnesota; Rasmussen College, St. Cloud, Minnesota; and St. Cloud Technical College, St. Cloud, Minnesota with a target of 80 students and 10 instructors. St. Cloud Technical College was used as the pilot test center where the surveys were administered to 10 computer science students and two computer science instructors. Both students and instructors were asked at the end to complete an opinion survey that tap suggestions for improvement.

The survey was mailed to a staff or faculty member at each of the three two-year institutions for distribution and collection in class. This method of distribution and collection helped to procure an adequate response percentage. Each survey was coded for tracking and tabulation. For *tracking*, each survey was coded in the top left corner with three digits for students' survey (ex., 001-080), and two digits for instructors' survey (ex., 01-10) coding system. To facilitate t*abulation*, all questions and response items were numbered for tabulation. Open-ended questions' responses were pre-coded by hand prior to data entry.

The Statistical Package for Social Sciences version 15.0 was used to perform all data analyses in two stages. First, descriptive statistics were generated for all variables relevant to answering the teaching and student learning research questions. Means and standard deviations were calculated on the Likert-type scale items. Frequencies and percents were computed for nominally scaled variables. The second stage of the analyses used inferential statistics to compare the survey results of students and instructors from the three locations, and to compare the survey results at individual locations.

5. RESULTS AND INTERPRETATION

The total number of instructors who participated in this research project was seven. The total number of students who participated in this research project was 71. Unfortunately, some of the instructors did not respond to all of the survey questions, thus the total response is not evenly seven on all items. The limited number of participants did not allow for an inferential statistics analysis to be performed on the survey data of the instructors. Consequently, only the descriptive statistics are reported for the instructors. The statistical level of significance for investigating all null hypotheses in this study was set to 0.10, rather than the traditional 0.05, because of the nature of self-reported, somewhat subjective opinions and the limited number of student participants.

Is there a difference of the background training on awareness of certification for instructors and students? All of the instructors surveyed and 84.5% of the students surveyed were aware of CompTIA A+ certification as indicated in Figure 1. This is not surprising because CompTIA A+ is gaining in popularity as an entry level certification for IT professionals.

Is there a difference in the perceptions of the need for CompTIA certification of students and instructor? Take a look at Figure 2. Only 33.5% of the instructors who participated in the survey are CompTIA A+ certified, which is not surprising because the CompTIA A+ certification is not necessary for teaching jobs at 2-year institutions. Only 2.8% of the students who participated in this survey are CompTIA A+ certified, which is not surprising because CompTIA A+ certification is not a requirement for the majority of IT entry level jobs.

Are the majorities of the faculty and students becoming interested in CompTIA A+ certification? The responses are illuminated in Figure 3. The majority of instructors (60%) and students (85%) expressed an interest in becoming CompTIA A+ certified. This result shows the willingness of students in obtaining CompTIA A+ certification, in compliance with the expectations of employers who require certification for IT entry level jobs.

More than half of the instructors (67%) believed that students in a computer science major at their institutions are well prepared to take the CompTIA A+ certification exam. In addition, 81% of the students expressed positive opinions on training that combines theory and practice. This result in Figure 4 contradicts the claim of IT certification detractors that certification proves only that a worker is book smart.

The percentage of instructors and students surveyed who expressed opinions that CompTIA A+ is a legitimate certification and validate both the knowledge and application of concepts and skills necessary for entry-level IT professional is 67% and 57% respectively. This finding in Figure 5, in support of IT certification proponents, indicates that the certified employee has demonstrated skills above and beyond the minimum requisite knowledge.

As illuminated in Figure 6, only half (50%) of the instructors surveyed said that CompTIA A+ certification is necessary for IT job seekers while a very small number of students surveyed (37%) expressed opinions that CompTIA A+ certification is necessary for a job.

A high percentage of instructors (83%) and 70% of students expressed opinions that CompTIA A+ certification can improve the service and support offered to end users by CompTIA A+ certified IT professionals. This finding in Figure 7 strongly supports the IT certification proponents' claim that "employees do not have to be certified to be proficient, but do think that certification means the employee has more than the required minimum IT skills and knowledge".

All instructors (100%) and a good majority of students (66%) at least agreed that certification proves that its holder has gone beyond proficiency. This finding displayed in Figure 8 supports the claim of IT certification proponents that employees do not have to be certified to be proficient, but do think that certification means the employee has more than required IT knowledge.

Less than half (33%) of instructors and 25% of students expressed opinions that certification means only being smart in book knowledge. These percentages in Figure 9 are not enough to support the claim of IT detractors that a certification proves only that a worker is book smart.

What course delivery methods are appropriate for CompTIA A+ preparation? As shown in Figure 10, among the computer science instructors and students who participated in the survey, approximately half of each group at least agreed that the blended learning methodology is appropriate for CompTIA A+ certification. As displayed in Figure 11, the majority of the participants, 83% of the instructors and 64% of the students, agreed that the face-to-face learning methodology is appropriate for CompTIA A+ training at 2-year institutions.

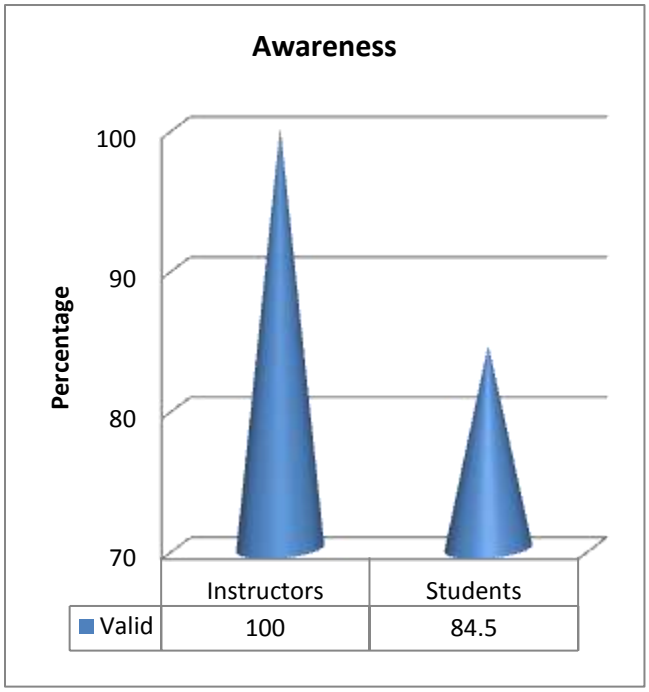

Figure 1. Awareness of CompTIA A+ Certification

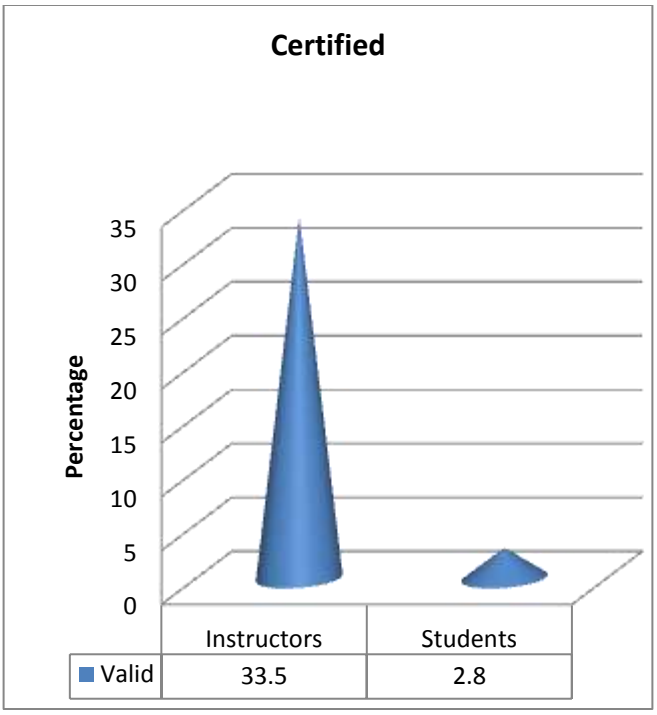

Figure 2. CompTIA A+ Certified Instructors and Students

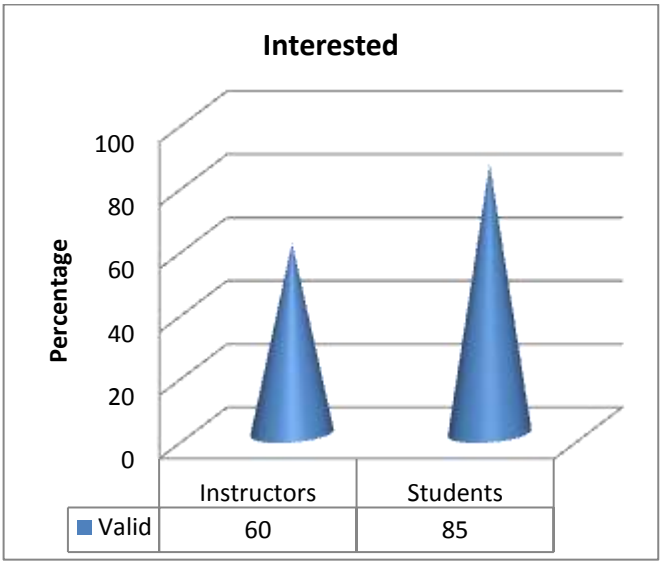

Figure 3. Interests in Certified ComTIA A+

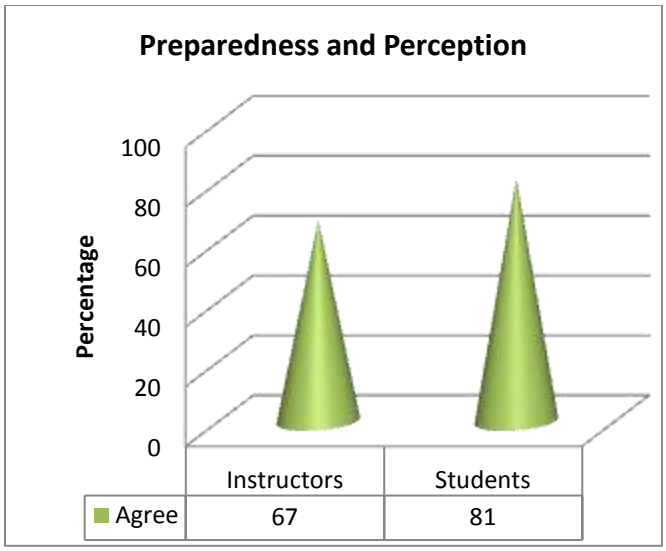

Figure 4. Perceptions of CompTIA A+ Certification Exam and Training Effectiveness Method

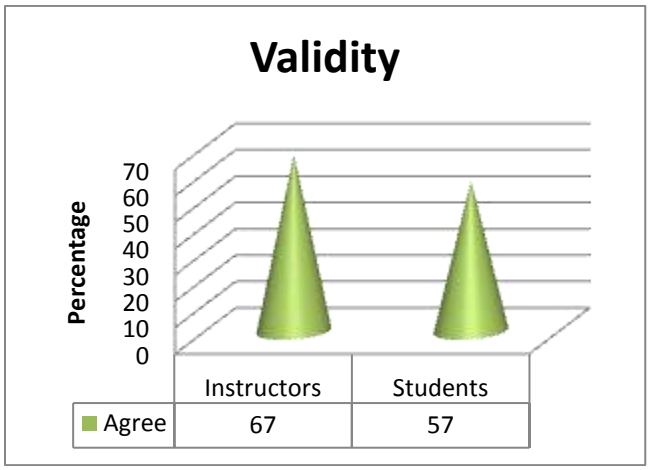

Figure 5. Validity of CompTIA A+ Exam

Among the participants, 83% of the instructors disagreed that the online learning methodology is appropriate for CompTIA A+ training at 2-year institutions (see Figure 12). However, only a small percentage (33%) of students disagreed. This could be related to the fact that instructors and students do not have the same level of teaching experience. It seems to be more difficult for students to investigate what works and what does not work in training. As illuminated in Figure 13, the majority of instructors (83%) disagreed that using CD/DVDs and books courses as a training tool for the CompTIA A+ certification exam is appropriate while only 37% of students disagreed.

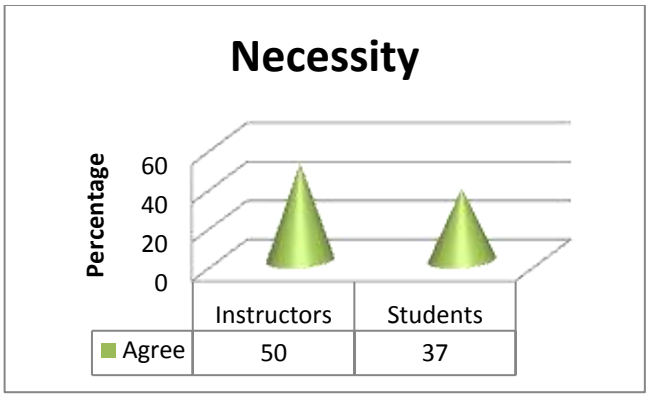

Figure 6. Necessity of CompTIA A+ Certification for Job Seekers

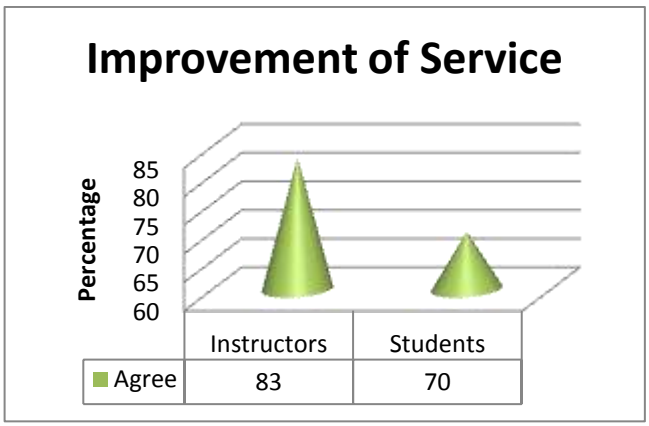

Figure 7. Improvement of Service and Support to End Users

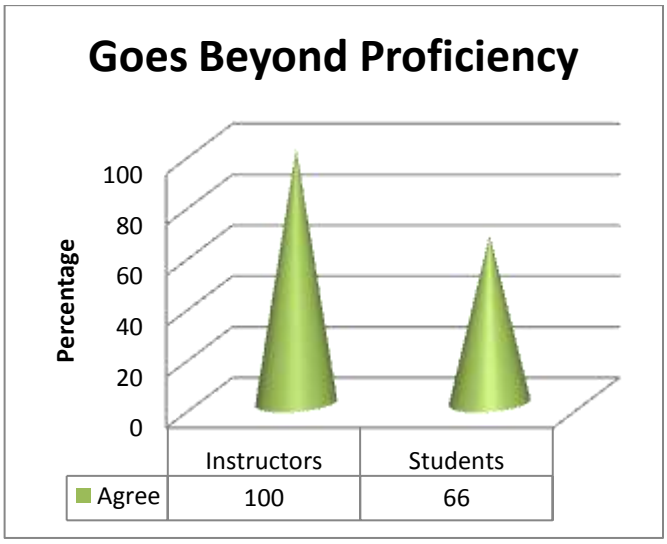

Figure 8. Certification Goes Beyond Proficiency

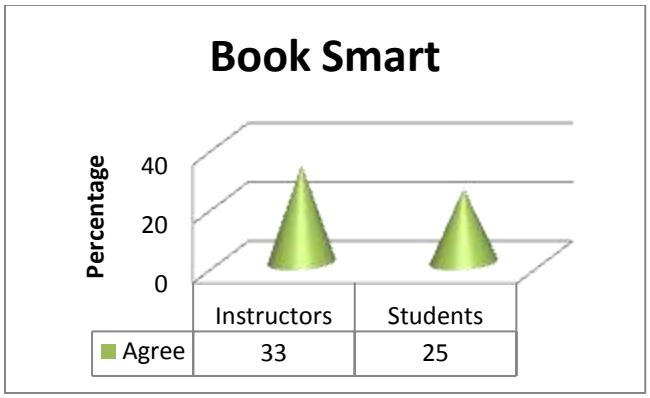

Figure 9. Certification Means Book Smart Only

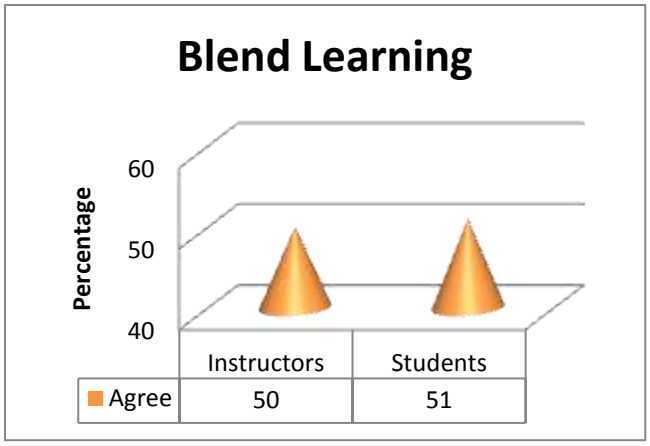

Figure 10. Appropriateness of the Blended Learning Method for CompTIA A+ Training

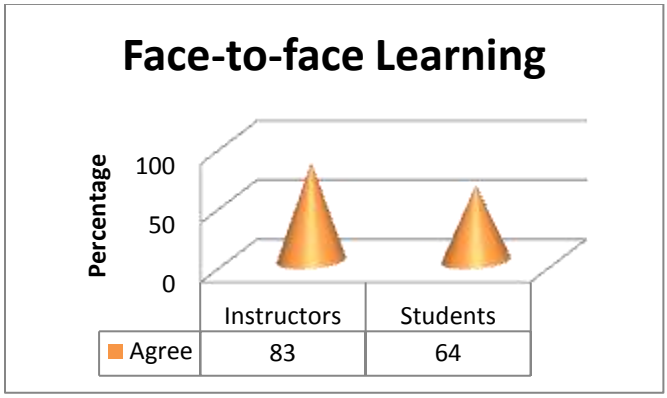

Figure 11. Appropriateness of the Face-to-face Learning Method for CompTIA A+ Training

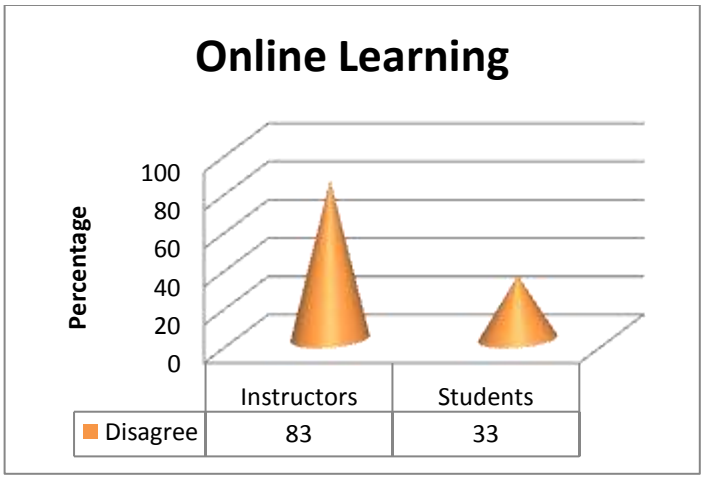

Figure 12. Appropriateness of the Online Learning Method for CompTIA A+ Training

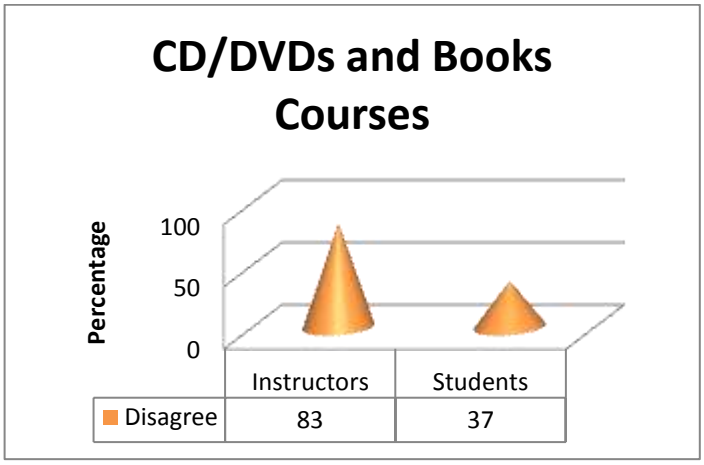

Figure 13. Appropriateness of CD/DVDs and Books Courses for CompTIA A+ Training

6. CONCLUSIONS AND DISCUSSIONS

The major limitation of this study is in the imperfect neutral party engaged in the IT certifications. The popular IT certifications have been produced by sponsors or certificate companies. Moreover, the number of CompTIA certified or certification-trained students, at two years institutions are limited. There are also a limited number of 2-year institutions in St. Cloud, Minnesota, just like many real-life academic communities who embed CompTIA A+ certification exam objectives into Computer Science and IT curriculums. The research also targeted only students and teachers with previous knowledge of IT certifications. This limits the generalization of the findings in this study to only IT professionals with knowledge of CompTIA A+ certification or topics related to IT certifications.

The survey about CompTIA A+ certification showed that the majority of instructors and students were aware of CompTIA A+ certification but only a few were certified. However, a high number of students were interested in becoming CompTIA A+ certified. In contrast, very few instructors and students perceived CompTIA A+ certification as necessary for job seekers, but felt that CompTIA A+ certification could improve the service and support offered to end users by CompTIA A+ certified IT professionals.

Figure 14 shows that the face-to-face course delivery approach is preferred by the instructors and the students. The CD/DVDs and books approaches to learning are the least popular among instructors and students, and then the online approach. This finding is not surprising due to the nature of Information Technology. Most students and instructors prefer the face-to-face delivery method that allows participants to learn the theoretical part as well as combine both hardware and operating system concepts with domains such as security, safety, environmental issues, communication, and professionalism.

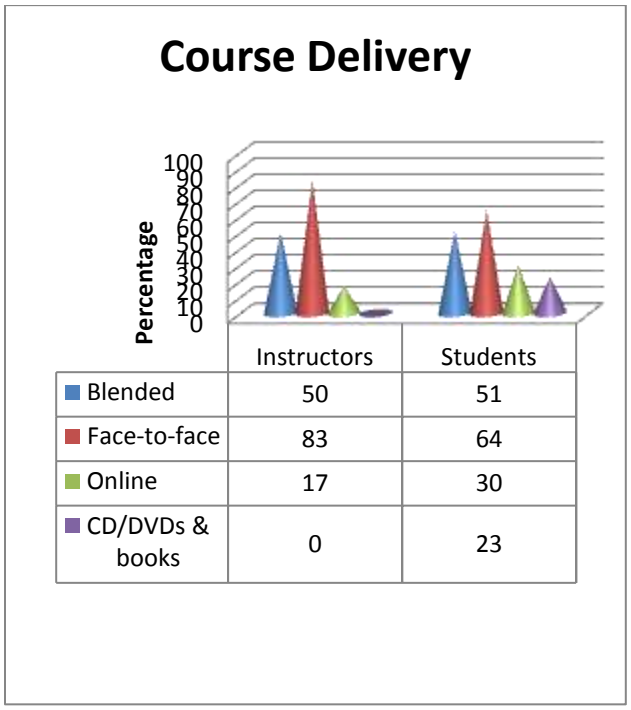

Figure 14. Appropriate Course Delivery Method

The opinions expressed by instructors and students in regard to CD/DVDs and books, and the online delivery method do not provide a clear conclusion due to the extremely small number of instructor and student respondents. We do not know how students and faculty perceive the CD/DVDs and books approach of delivery. Do they see a CD/DVD or a book as providing interactive instruction with high level simulation or simply a page of text that learners read and then answer questions? We simply do not know what content and instructional strategies they think of when they reflect on this delivery strategy.

Our second research question investigated the relevance and need of CompTIA A+ certification for employment and professionalism. Figure 15 indicates that the majority of instructors and students agreed that CompTIA A+ certification is relevant. This finding is not surprising given that certification can improve the level and support offered to end users. The result is consistent with the claim that "employees don't have to be certified to be proficient, but certification means the employee has gone above and beyond" [10] by IT certification proponents. According to Gilhooly, certifications in the Information Technology field are important [10]. On the other hand, detractors claim that certification proves only that a worker is smart with books. Such critics believe that certifications do not offer the hands-on knowledge that comes with experience. Conversely, proponents say certifications validate skills, establish a baseline for new hires and can be very useful in corporate retention strategies.

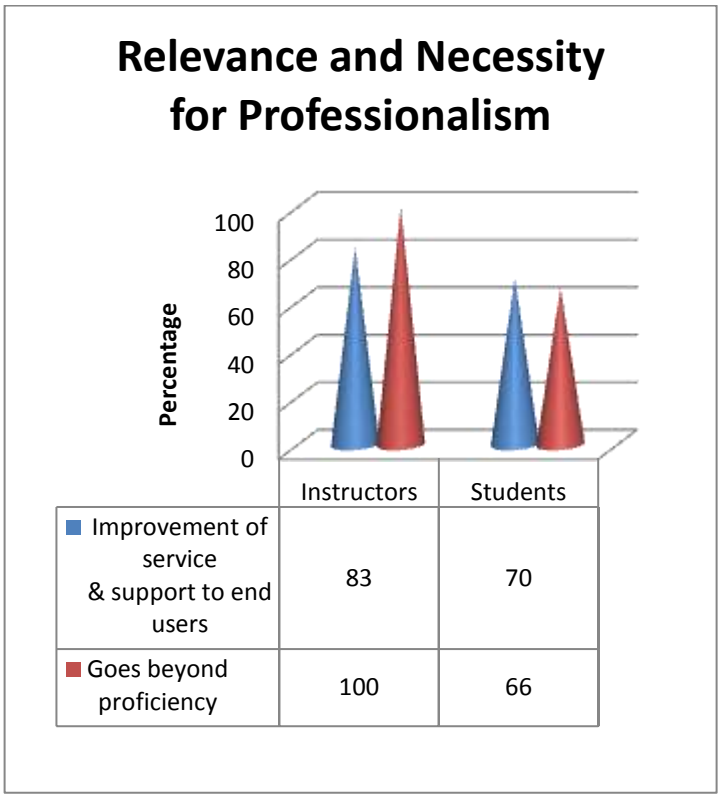

Figure 15. CompTIA A+ Relevant and Needed for Professionalism

Take a Look at Figure16. Most instructors and students believed that CompTIA A+ is valid but not necessary for employment. Only 33% of the instructors and 25% of the students agreed with IT certification detractors who claim that a certification only proves that a worker is book smart.

The results of the hypotheses testing in this research reveal that: (a) students who perceive the training method as preparing them

for CompTIA A+ certification exam tend to agree that CompTIA A+ is a valid method of measuring of knowledge and application of concepts and skills requisite for entry-level IT workers, and (b) students who are aware of CompTIA A+ certification tend to agree with detractors who claim that certification means book smart only. This finding is not surprising because most certified IT professionals prepare for the exam through reading and memorization.

Two-year intuitions should continue the practice of using face-to-face, hands-on instruction with a high level of interaction to prepare students for the workforce. High-level interactive simulation exercises for IT job skills are essential for effective certification training. CD/DVDs certification training tools should be equipped with best IT practices, job simulation exercises and performance feedbacks on individual tasks, to provide real world experiences for students.

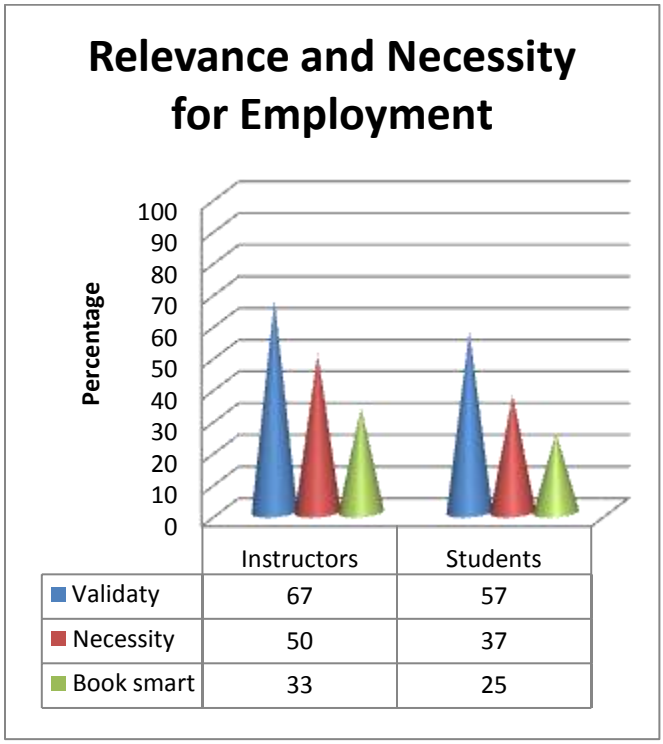

Figure 16. CompTIA A+ Relevant and Needed for Employment

The method of delivering instruction was investigated in this research. The appropriateness and preferences for blended learning, face-to-face learning, online learning, and learning using CD/DVDs and books were investigated. In future, we propose to conduct a case study to examine the best instructional delivery method for preparing students for certification tests. The scope of the future survey will include 2-year and 4-year institutions at different geographical locations. The survey will solicit the opinions of not only instructors and students but also employers such as Information Technology directors, Information Technology professionals, certification providers and testing center supervisors.

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