

Investigating the Low Pass-Rate of CCNA1 Students at the Central University of Technology

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Abstract - The field of Information Technology (IT) has experienced rapid change over the past few decades. Since the late 90's, many businesses in the IT industry begun to require certifications for specific technologies. Corporations begun to collaborate with traditional educational institutions so that they can control the quality and content of students that have the desire to learn their networking concepts. The Department of Information Technology (DIT) at Central University of Technology (CUT) adopted the Cisco program and teach students the Cisco curriculum. Cisco curriculum is the most widely used computer networking curriculum and the international standard by which professional competency in this field can be measured. The DIT has been experiencing a decline in student pass-rate and this has raised a lot of concern. Hence, the main aim of this research project was to investigate the low pass-rate of CCNA-1 students at CUT. Due to time constraints, this research examined the delivery method and the assessment method as they might influence student success. The quantitative research design allowed the researcher to collect both qualitative and quantitative data using an online questionnaire from 2015 and 2016 CCNA-1 students from the DIT at CUT, Bloemfontein campus. The questionnaire was administered to 188 students at the end of the second semester. The data was coded and analysed manually using Microsoft Excel. From the results it is very clear that students do not make time to study and they do not visit the library to expand on their knowledge. Some of the students indicated that the content they received was too much and coupled with little contact time they have with the lecturer, exacerbated the situation. 53% of the participants suggested that the delivery method must be improved.

Keywords - CCNA-1, student pass rate, CISCO, student success, delivery methods and assessment method.

1. Introduction

The field of Information Technology (IT) has experienced rapid change over the past few decades. Since the late 90's,

many businesses in the IT industry begun to require certifications for specific technologies [1], [2]. Prospective employers frequently stated that they are paying less attention to the results or progress reports of the graduates when hiring new employees but rather concentrate on whether the candidate has the relevant certification or not [11]. IT professional certifications are being increasingly used as indicators of professional skill. The certificate programs have high international standards approved by international institutions for example CISCO Corporation and Microsoft Corporation [18]. As a result, some of these Corporations begun to collaborate with traditional educational institutions so that they can control the quality and content of students that have the desire to learn their networking concepts. The Department of Information Technology (DIT) at Central University of Technology (CUT) also adopted this program and teach students from first, second, third to fourth year the Cisco curriculum.

Cisco Systems designed and developed a global education initiative called Cisco Networking Academy, which offers networking programs like the Cisco Certified Network Associate (CCNA), CCNA Security and Cisco Certified Network Professional (CCNP) courses. Since 2007, these programs prepare students for the certification exams of the same name, and other computer-related courses. In 2010, the programs were available in roughly 9,000 local academies, in over 165 different countries and there were over 900,000 active students. Cisco curriculum is the most widely used computer networking curriculum and the international standard by which professional competency in this field can be measured.

South Africa (SA) suffers from one of the most enduring high rates of unemployment [12]. There are a number of notions to explain this persistent high rate of unemployment. Some researchers argue that this is due to the high number of school leavers who either failed the grade or dropped out of the education system [12]. These school leavers are the exact generation we are looking for who have the potential to turn the economy around. This is exactly what the DIT has been experiencing, a decline in student pass-rate and this has raised a lot of concern. The DIT at CUT has adopted the Cisco program for a while now and teach students from first, second, third and fourth year Cisco curriculum, which is

CCNA 1-4 and CCNA Security. The student pass rate for the first semester of 2015 was 58%, meaning 42% of the students failed the CCNA-1 course and in 2014 only 63% of students passed.

Hence, the main aim of this research project was to investigate the low pass-rate of CCNA-1 students at CUT. Due to time constraints, this research examined the delivery method and the assessment method as they might influence student success. This paper is structure as follows: Section 2 discusses CCNA-1 course background, Section 3 give a detailed research methodology for the project, the findings are presented in Section 4 and Section 5 presents the discussion based of the findings. Sections 6 presents the limitations of the project and Section 7 concludes the project.

2. CCNA-1 Course Background

The Cisco CCNA curriculum consists of four components covered in four semesters each of which covers between seven and eleven topics. Each component/semester builds on the previous one and each topic progresses from simple concepts to the more complex. The four components are listed below:

1. Networking Basics (CCNA-1)
2. Routers and Routing Basics (CCNA-2)
3. Switching Basics and Intermediate Routing (CCNA-3)
4. WAN Technologies (CCNA-4)

Currently at CUT, each component is covered in two school semesters (6 months), meaning the students and the lecturer must have covered about 11 Chapters in less than 5 months, each chapter covering approximately about 30-50 slides (normally prepared by CISCO). Compared with the other three CCNA components, CCNA-1 has enormous amount of theory to be covered, with diminutive practical component.

The practical work involved in the course is designed to support the theory and vice versa. There are four key components to the Cisco Networking Academy environment: 1) a centralized curriculum distributed over the Internet; 2) standards-based testing distributed over the Internet; 3) locally customized instruction; 4) practical component, either on real equipment or on simulation and 5) an instructor support system for training, support, and certification.

2.1 Current delivery method

Porto & Aje [16] and Owen *et al.* [15] concur on what a course delivery method is. They define it as decisions about how to present the content, activities, and assessments that are designed into the course. The literature review we conducted looked at different delivery methods and currently there are mainly seven (7) delivery methods implemented and are as follows:

Table 1: Delivery methods and their definitions

Delivery method	Definition
Lecture/Demonstration	In-person lecture/demonstration on a particular topic with limited interaction and practice
Classroom Training with Instructor	Participants attend training where an instructor presents material and there is an opportunity for interaction and hands-on learning or practice.
One-on-One Tutorial	Instructor provides individual instruction to one learner.
Self-paced Learning, Non-electronic	Learner follows a course of study, setting own learning pace (e.g., with printed materials such as books or manuals, not via the Internet).
E-learning, Self-paced	Training delivered electronically (e.g., computer-based via the Internet or with CD-ROMs) in which learner sets own learning pace.
E-learning, Facilitated	Instruction delivered electronically with an instructor or facilitator who sets the pace and/or offers interaction (e.g., webcasts or scheduled Internet instruction).
Blended Learning	Combines e-learning with instructor-led classroom training or one-on-one instruction.

The current delivery method used at CUT is the typical face-to-face traditional approach, where most of the learning occurs in the physical classroom. The students attend one theory class for an hour and a half and two practical classes (for an hour and a half each) per week. Due to the sheer volume of theoretical concepts which need to be imparted to the students, there is no significant interactivity in the class between the peers and also with the lecturer. This instructive, one-way communication medium, involves the lecturer 'pushing' the information to the students and the students tend to be in a passive role and are expected to progress in a linear sequenced fashion through a pre-planned curriculum which when completed should signify that learning has occurred [4] Dyke. The students can also attend an optional SI class conducted by a senior student to reinforce some of the concepts covered in theory class. Web-based storage of course materials is utilised but no web-based learning is integrated. Unfortunately, this requires students to have internet connection to be able access the material when outside the campus. It is the same with the recommended textbooks, these books change every time the curriculum is

updated which is mostly every 2-3 years and they are relatively expensive to own.

For the practical component, the students can access the labs to complete their practical work at any time. The hands-on labs, which are provided as part of the CCNA curriculum, follow an example-based learning approach which gives the student an expert's method of how to complete the lab exercise. These labs provide opportunities for students to be actively engaged and also allow students to socially collaborate with their peers and receive guidance from the instructor when necessary.

If no lab is available, the students can also make use of simulator (Packet Tracer) activities that are available to help the students to practice and assess their practical skills. The Packet Tracer (PT) simulator is a cross-platform visual simulation program designed by Cisco Systems, it allows students to create network topologies and imitate modern computer networks. PT allows students to simulate the configuration of Cisco routers and switches using a simulated command line interface. The simulator makes use of a drag and drop user interface, allowing students to add and remove simulated network devices as needed. The software is for free, students can download it and install it on their laptops or computers at home.

2.2 Current assessment method

Assessment has a long history in education [10]. Tests have been employed in schools for a very long time and their use has amplified immensely since the turn of the last century [17]. The development and propagation of ability and intelligence testing stimulated the dramatic growth in school testing [8]. Such that, the use of tests in schools became very common in many countries throughout the years and these tests have improved over time. The literature the researcher reviewed indicated that there are three (3) types of assessments currently used. Table 2 lists these types of assessments.

Table 2: Types of Assessments

Assessment type	Description
Diagnostic	Before instruction begins, used to determine mastery of prerequisite knowledge and skills and prior knowledge of future content (e.g. reading readiness test).
Formative	Throughout a unit and lesson cycle, used to gauge progress (e.g. weekly quizzes).
Summative	At the end of a unit or end of the year, used to measure growth and achievement formally (e.g. end-of-unit test).

The assessment methods currently used include formative and summative assessments, no diagnostic assessment method is used. The assessment structure includes:

- chapter on-line tests
- assignments
- class tests
- final online test
- quizzes
- practical tests
- written exam

The students write their chapter online tests immediately after the chapter is completed in class. The Cisco online test system allows the students to get immediate feedback on their mistakes. Students are encouraged to complete these tests as they form part of their final mark for the subject, although these chapter tests count only 1% each. All the online tests are multiple choice questions which assess various levels of learning outcomes, from basic recall to application, analysis, and evaluation. The written tests and examinations make use of a combination of questions including multiple choice, fill-in the missing word, case study, true/false, sometimes computational and short answer questions. The literature argues that the ability to recall information does not constitute learning, but the ability to apply it to unforeseen problem-solving situations does and case studies assist in this area. The assignments come in different forms, it can be a case study or research. This allows students to start considering research, what research is and how to conduct research. Because of the number of students we enroll in this course, it is not possible to conduct practical tests on real equipment and hence PT tests are the most preferred tests.

Irrespective of all these delivery and assessment methods put in place, the DIT at CUT has experienced a decline in CCNA-1 student pass-rate and it has raised a lot of concern. The student pass rate for the first semester of 2015 was 58%, meaning 42% of the students failed and in 2014 63% of students passed.

3. METHODOLOGY

It was adamant that a comprehensive enquiry was needed to investigate and analyse the underlying issues/problems that caused this humongous failure rate. The research methodology used for this study was a quantitative research design, though the data was analysed both qualitatively and quantitatively. The collection of both quantitative and qualitative data allowed triangulation to be applied between the various datasets adding validity and credibility to the study.

3.1 Participants

The participants were 2015 and 2016 CCNA-1 students studying at the CUT, Bloemfontein campus. CCNA lecturers at CUT were also consulted for their views on the questionnaire and to also get some of their opinions on this issue. Approval to conduct the study was obtained from CUT and all participants that were selected gave informed consent subject to confidentiality and anonymity.

3.2 Data collection method

In order to examine student perceptions, an online survey was developed and delivered using Google forms. The questionnaire comprised of a combination of dichotomous, nominal, rating scale, bipolar, open-ended and contingency questions that gathered straightforward information relating to the participant's study behaviour and basic opinions on the delivery and assessment methods used in CCNA 1 course. The questionnaire consisted of five Sections made up of 66 items that covered such areas as Student background information, Student study behaviour, Opinions on delivery method, Opinions on assessment method and Opinions on general issues.

A pilot test was done in order to inform the survey design process. The questionnaire was evaluated by several content and methodological professionals in order to assess bias, ambiguity, or potential semantic problems. Firstly, the questionnaire was circulated to other CCNA instructors in an attempt to attain their views on their students learning experiences while studying CCNA and to reveal different approaches taken to teach this subject. Secondly, the questionnaire was given to an expert in the Education Department so to get views on the structure and appropriateness of the questionnaire. Finally, the questionnaire was pilot tested prior to implementation in order to test the efficacy of the research methodology and was modified accordingly. The questionnaire was administered at the end of the semester, just before the exams. From 248 students who were registered for the course, 188 completed the questionnaire.

3.3 Analysis

During the data analysis process descriptive statistics such as the average or median were generated to help understand the data. Frequency distribution were also generated and examined. The data was coded and analysed manually using Microsoft Excel.

4. Findings

There were 188 participants, 67% percent were males and 33% were females. In terms of age, 46.3% of respondents reported being between 22 and 24, 45.7% said that they were between 19-21. The participants were 2015 and 2016 CCNA-1 students, the 2015 cohort have passed CCNA-1 class and now doing CCNA-3. The 2016 cohort is a mix of new students from first year and student who have failed the CCNA-1 in 2015 and now repeating the course. This allowed the researcher to collect data from all three groups of students (new, passed and failed). From the 185 responses, 61.6% of the participants were in the 2016 group and 38.4% were in the 2015 group. The participants were asked for their student numbers for the follow-up focus groups, 80% of the respondents voluntarily provided their student numbers. Only 51% of the respondents prepare before class and 50% study after class. Fifty-three percent of

the respondents participate in class discussions or activities and 56% never visit the library for referencing purpose.

Sixty-four percent of the respondents think that the delivery method supports effective learning and 61% think that it helped them understand the content very well. 59% of the respondents think that the delivery method supported their learning style and 63 % think that the delivery method fostered a transfer of knowledge and skills to students. While 62% of the respondents think that the delivery method fosters creative thinking. The results indicate that the delivery method allowed collaboration, group discussion and peer learning with participants rating them as 61%, 68% and 69% respectively. Strangely, 53% of the respondents feel that the delivery method needs improvement. It was important to investigate and measure the delivery method, such that improvements can be made if necessary. The participants who strongly agreed to the statements relating to the delivery method yielded a mean score of 39.64 with 8.33 standard deviation. Whereas, the participants who strongly disagreed to the statements relating to the delivery method yielded a mean score of 14.64 and 3.56 for standard deviation. This means that if improvements are necessary to the delivery method, they will be minor. The participants were asked what improvements would they like to see with regards to the delivery method. Following are some of the responses:

Table 3: Improvements to the delivery method

Resp-1	Lecturer should spend more time on things we battle with
Resp-2	Lecturers that just don't read the slides, but that interact with the students during class
Resp-3	More questions to the students during theory class
Resp-4	More classes per week
Resp-5	The theory is too much

The participants both agreed (36%) and strongly agreed (33.5%) that the online questions were relevant and aligned to the delivery method, whereas few of the participants disagreed (19%) and strongly disagreed (11.5%) with that. Also, sixty-eight percent of the participants agreed that the written questions were relevant and aligned to the delivery method, while 32% disagreed. 65% of the participants also concurred that the practical questions were relevant and aligned to the delivery method. These results indicate that the delivery method is proper and has been accepted, probably improvements to the delivery method would be minor. Ninety-seven (52%) participants agreed that the course was difficult. When the participants were asked to rate the difficulty/easiness of the course, 2% of the participants said the course was very easy and 10% said it was very difficult. 54% of the participants think that the course should run over a year, while 39.7% think that the current six months is just fine. Some (52.5 %) of the

participants prefer to work alone, while 47.5% of the participants prefer to work in a group. 10% of the participants said they would not recommend the course because “the course is too difficult”, “more access to content is needed”, “I just don’t like networking”, “Its too basic and not that realistic”, “not enough time is given for both theory and practical”.

5. Discussions

It is quite clear as indicated by the results that students do not make time to study, whether before class (preparation) or after class (emphasis). The students also indicated that they do not visit the library to expand on their knowledge and what they have learnt in class. Unfortunately, it is the responsibility of the student to take his/her studies seriously and make efforts to study beyond what is taught in class in order to develop themselves. Lecturers can give as many exercises and assignments as they want but if the students are not ready to take their own studies seriously, then no one will. But, some of the students indicated that the content they received was too much and this coupled with little contact time they have with the lecturer, exacerbated the situation. The CCNA-1 curriculum is a rich thick content which comprises of online course material, books, animations, hands-on laboratory and Packet tracer exercises. Moreno [14], Handelsman [7] and Mayer [13] say that there it is a well-accepted axiom in education that the more information a student has, the better his learning experience will be and the more information he will retain for future recall and reuse. The students are presented with large amounts of rich thick content and the over-abundance of information can have so much negative impact such as cognitive overload, surface learning (students put minimal effort in to order complete the task) and students become reluctant to invest time in areas which are not directly assessed.

Based on the findings, 53% of the participants suggested that the delivery method must be improved. Amongst the comments the students made, two themes emerged: “lecturers should spend more time on things the student battle with” and “lecturers are currently not interacting with students during theory class, they just read the slides”. This will require that lecturers constantly adapt to meet students’ changing needs and strengths on a particular task, as suggested by [19], [20]. Also, the instruction should consist of experiences that facilitate knowledge construction, instead of simply transmitting knowledge from lecturer to students [6], [13], [21].

The second issue the students mentioned is that the lecturers are currently not interacting with them during theory class. Wessels *et al.* [20] submit that the main difficulty with the lecture mode of teaching is the lack of interactivity with the students. Kafai & Resnick [9] and Felder [5] suggests that learners are more likely to create new knowledge when they are actively engaged in making some external artefact which can be reflected upon. Cameron [22] concur with Wessels *et*

al. [20] that increasing the students’ level of interactivity in class enables deep learning and have a positive effect on their motivation, attention span and the development of cognitive structures.

The findings also indicated that students do not understand most of the work but they memorise the content in order to pass the tests. This means that students are engaging in surface learning. It quite evident that the problem is the students’ learning styles that needs interrogation and not the current assessment method as we predicted. Probably it is essential that we revisit what learning is and how students learn. Then the assessment methods can be evaluated based on that. It is indispensable that the delivery and assessment methods must be improvement, accompanied by a thorough assessment of the content itself and the relationship it has with the timeframe. This should be purely for our context and not in comparison with other universities more especially universities from abroad.

6. Future Research

This study proposed areas of improvement in CCNA-1 course and the proposed solution may be used as means of enhancing development of meaning for the students, in an effort to ameliorate their success in the course. Due to time this research project only focused on two key issues but following is a list of all or some of the issues/problems that require comprehensive investigation, review and critical analysis:

- the four components of the CISCO program mentioned in Section 2
- delivery method,
- learning materials (e.g. books, online material, practice tests, slides, etc),
- assessment methods/strategies,
- curriculum (course content),
- study period and
- the students.

7. Conclusion

Higher education is evolving and the teaching and learning methods and strategies should also evolve. For this reason and together with the low pass rate at CUT, has provided the impetus for the researcher to explore the current delivery and assessment methods used in CCNA-1 course. Improving student achievement cannot be done without understanding the critical classroom processes of Curriculum, Instruction and Assessment. This study evaluated the current delivery and assessment methods and discovered that compared to what we predicted, students engage in surface learning and also some of the students do not take their studies seriously. There is no doubt that the delivery method requires improvement and this research project proposed a multidimensional approach that has the potential to provide personalised student-centered teaching and learning. But the

proposed approach is restricted by the current environment (rich content and number of students) as well as the timeframe. A thorough research is required that will look at student learning and student learning styles, which will eventually influence the delivery method.

8. References

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