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1. Title:

A Critical Evaluation of Learners and Learning in the Cisco Networking Academy Programme.

2. Introduction

This evaluation will review the Managed Online Learning Environment created by Cisco as the core of their Networking Academy Programme. The programme is aimed at students in the post 16 phase of education and comprises an online curriculum in association with assessment and community resources to simulate an entire learning community.

The key questions to answer are:

1. What is the ideology behind the academy programme?
2. How do students respond to online learning?
3. Can the programme be related to learning theory?

3. Literature Review

Online learning has only been considered by researchers and practitioners for a few years, although it has continued, perhaps where the original distance learning concepts of Open Learning left off. As a result there is a limited amount of prior research and literature to draw on.

It is useful to consider the dawn of online learning. Computer based tuition actually precedes the internet, web and the term “Online”. Early systems were locally based and usually in classroom environments. However, some of the issues we discuss today (Vail, K. (2002:1)) were causing concern even then. Jim Ridgway makes the point:

> “ICAI (Intelligent Computer Aided Instruction) might be seditious too, if it acts to de-skill teacher’s jobs and pupils tasks..”

(Ridgway, J. 1991:124)

Even at the time I would have considered this to be a fairly paranoid, self absorbed and narrow minded view, but it does accurate reflect the concern that teachers held at the conception of online learning systems. However, Ridgway goes on to makes some useful points and poses important questions:

> "How is knowledge represented? How should learning experiences be arranged? What misconceptions do learners have?"

(Ridgway, J. 1991:124)

The reflection in the article suggested that knowledge was "delivered" in a traditional manner – i.e. as a teacher would. Learning theory has moved on since then and many computer aided learning systems now facilitate student progress through challenges and discovery based exercises.

A useful text was "Web Based Learning and Teaching Technologies: Opportunities and Challenges" by Anil Aggarwal. Although there is too much useful content to comment on here, the focus was very much on the issues that I am considering (use of online learning in the sixth form) and a mixture of discussion and practical advice is used. The text refers mainly to the American education system, but as my particular study is of a system primarily developed in and for that sector I see no difficulty with this. In one section particularly focusing on K-12 (sixth form) web based learning several important points are made:

> "The benefits that students gain from Web-based teaching depend on content and instructional strategy. Students can improve their critical thinking skills through the sustained use of Web-based technology."

(Tetiwat & Igbaria in Aggarwal 2000:28)

This is a highly valid issue when considering the effectiveness of the medium. Just putting content on the web does not immediately mean

students will learn. Whether or not the claim about critical thinking skills – put very forcefully – is supported by evidence is not clear.

The problems that students can encounter when faced by an entirely new learning environment are explored by Ko and Rossen:

> "Suddenly thrust into a world into which independent or collaborative learning is heavily stressed, students accustomed to traditional classroom procedures…….must make unexpected and even jolting adjustments to their study habits."

(Ko & Rossen 2001: 194)

This is to my mind a fundamental issue with the online learning experience for any student – sixth form or otherwise. Ko and Rossen go onto make some good points about the isolation of online learning and the difficulties of being disciplined enough when there is no instructor shouting at you (196)– both very accurate comments from my experience.

Looking at the issue of learner motivation, one of my key questions, a useful link to course structure is made by Miller and Miller, as they quote:

> "…the most important determinant of learning is probably "awareness, acceptance and understanding of the required task or learning outcome"."

(Jonassen & Wang (1993) in Miller & Miller (2000) in Abbey (2000:168))

This highlights the fundamental importance of ensuring that online learning resources are explicit in their description of the aims of the tasks and what is to be achieved. They also make a useful reference to Grabowski and Curtis's (1991) adaptation of Keller's model of motivational design. Motivation is subdivided into four factors:

> "(1) interest in or attention to the information and the technology. (2) perceived relevance of the information. (3) self-confidence in the

> ability to access and use the information. (4) resulting satisfaction from the successful access to and usefulness fo the information."
>
> (Grabowski and Curtis (1991) in Miller & Miller (2000) in Abbey (2000: 168))

Again, this is borne out by my experience and the issue of perceived relevance to importance is highly telling in students who are not good independent learners and who seem unable to determine what is important or not while there is no teacher to tell them. This in turn has an impact on performance.

The role of learning theory is examined in many texts. Leflore examines the importance of theory on the design of web based materials:

> "..learning can be enhanced if attention is given to how the material to be learned is presented and how the students are required to interact with and interpret the material."
>
> (Leflore (2000) in Abbey (2000: 102))

Although self-explanatory this is then linked to cognitive learning theory as Leflore states:

> "Cognitive mapping or webbing, concept attainment activities, and use of motivational graphics, animation and sounds are ways that cognitive theory can substantially contribute to the instruction."
>
> (Leflore (2000) in Abbey (2000: 102))

She also goes on to discuss how Gestalt theory can be used to ensure accurate perceptions of visual learning materials and how constructivist theories can be applied to develop learning activities. As an insight to applying learning theory to online learning this is a very useful text and offers commonsense and practical thoughts as well as guidance on the theories themselves. Simpson takes this further by examining how the students will develop cognitive skills through teacher interaction (Simpson 2002: 140). Crook discusses the relationship between

Papert's Microworlds and Piagetian constructivist principles (Crook 1994: 61) providing a useful thinking frame, but as the discussion is not specific to online learning it may prove to be of limited value.

4. Research Method and Methodology

4.1 Method

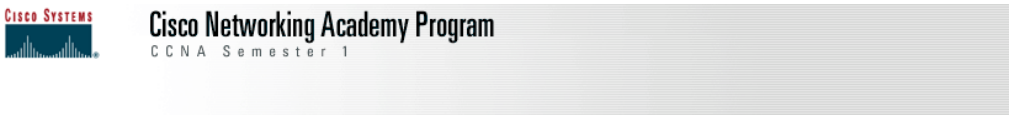
Because of the extremely limited time available for the study I have determined a case study to be the most effective way of analysing the research questions. However, this alone will not give a wide enough focus on the issues and may be subject to my own conscious and unconscious bias. As a result I will also employ simple informal questioning of both students and instructors to gain insight into their views and experiences. A Questionnaire approach will be too inflexible and with only a small sample would be of questionable validity. Empirical studies with a statistical focus would perhaps offer some data for comparative analysis.

4.2 Methodology

The chosen research method is predicated on naturalistic philosophy. This is appropriate as the data to be collected will be personal interpretation and observation from a range of sources. Positivist based approaches would not be appropriate at this stage as the sample size available is too small to have any real meaning or validity in scientific terms.

5. The Cisco Networking Academy Programme – Case Study

5.1 The Cisco Networking Academy Programme



The Cisco Networking Academy Programme was originally developed to help focus on meeting a predicted shortfall of skilled IT staff by providing prepared training materials and testing facilities to help students to meet the demands of the Cisco Certified Network Associate exams. Initially developed in the US the Academy was designed to target the K-12 sector of education, equivalent to Sixth form here.

Although the Programme has been struggling to get anywhere near enough graduates to fill the skills shortage, the impact across the globe has been phenomenal and there are now Academies operating the programme in all parts of the world. In addition the experience of the Cisco education team has encouraged other manufacturers to join forces with them to develop other learning units – such as Sun Microsystems “Java” and Adobe “Web design”. Again, these target industry exams as an eventual outcome.

All Materials in the programme are provided online from a web server, but may also be locally served by the Academy.

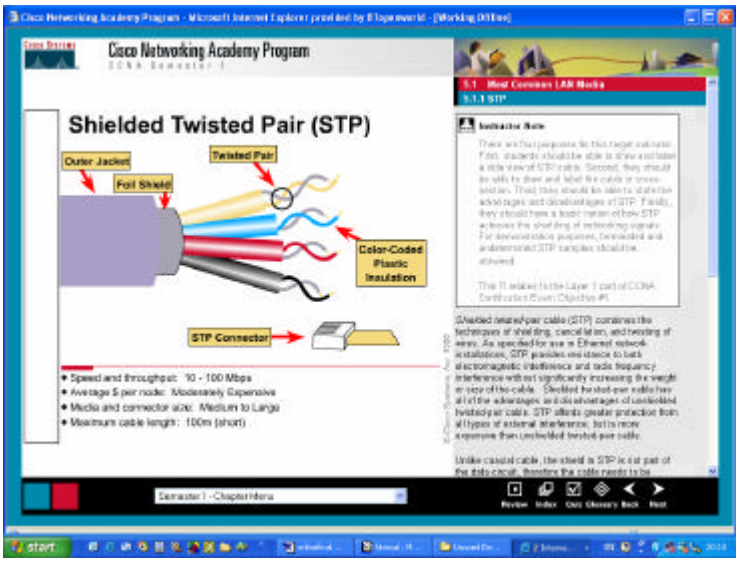


Fig 1. An example of the Academy Curriculum Resources

The resources incorporate multimedia as well as text based activities – but essentially represent an e-textbook. Paper books and other software are available to support learning in alternative ways and the Instructor community has generated a huge number of presentations and additional teaching and learning resources which are shared online. Students log in to the system to work through the curriculum materials and then are allowed to take specific tests and exams by the Instructor.

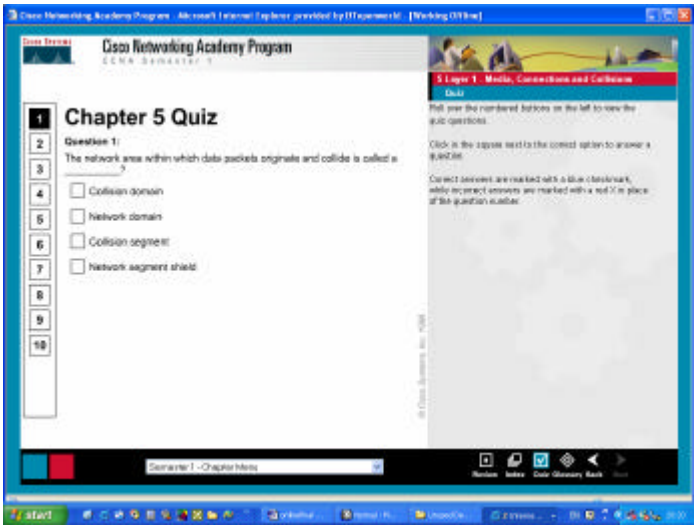


Fig 2: A quiz within the Curriculum Materials.

In addition, practical labs are undertaken combining practical construction and networking skills with programming and troubleshooting / fault finding. These are also examined.

Other tasks that Instructor use include oral presentations, group presentations, design work, case studies and enhancement activities – such as networking a small school or learning skills outside of the set objectives.

Fig 3: The Saffron Walden County High School Cisco Students after Wireless Networking the whole school.

5.2 The Students' Views

Students currently studying the Academy course expressed several views which link to my original questions.

- The course materials are good but get very boring after so long (the course is 280 hours long)
- It is hard to concentrate on screens for long periods.
- The course objectives are clear and easy to follow – but there are so many of them!
- The materials retain the American spellings and references and this reduces the immediate relevance.

- It is easier to motivate yourself to learn when in the class with the teacher.
- It seems better when the teacher does a presentation to help explain the course material.
- The exam system is great because you get instant results and feedback from your instructor.
- The practical work is more fun.

Certainly, from my observations students do find self discipline and motivation hard to begin with. After a period of adjustment they usually learn to cope – even though many still don't like the online nature of the course and would rather have face to face teaching.

5.3 The Instructors' Views

The school has three qualified instructors and one in training. All have been through the entire curriculum in the same way that the students do – but at a greatly accelerated speed (2 years into 4 weeks). In addition they have to demonstrate their ability to teach the materials through presentations.

The Instructors noted that the new students year on year seem to demonstrate less ability to work independently and require a longer acclimatisation period. The Instructor has to be extremely firm to ensure that assignment and test deadlines are met – much of the work is done as homework. Many students excel at the practical side but loathe the online curriculum study. The brightest students (academically speaking) seem to have the least tolerance of the self-guided learning style and demand the most teacher interaction – conversely, some of the less able are far happier to progress independently. The curriculum objectives are exactly mapped to the exam requirements and there is little room for flexibility in exploring beyond those. However, they are clear and

well defined and link clearly to learning materials. It has been observed that a student can memorise the material well for short term retrieval and tests, but may lose that retention after a while – making the effectiveness of the learning questionable.

6. Analysis and Discussion

6.1 What is the ideology behind the programme?

Initially the ideology that lies behind the Cisco Academy programme appears to be reconstructionist in that they promote the system as an assault on traditional educational models, opening up the digital divide (www.cisco.com 22/12/02) and that a resultant change in learning will take place on a global social level.

Skillbeck points out that one of the distinctions of reconstructivist ideology is:

> "A conception of learning and the acquisition of knowledge as active, social processes involving projects, problem-solving strategies guided by but not dominated by teachers."
>
> (Skillbeck, M. (1976))

Skillbeck also points out that this approach to learning is held in common with the progressivist ideology. It is also possible to see some progressivist thinking behind the conception of the Academy. It would appear that the act of developing an online course aimed at opening up skills and training to a wider group and taking away the hard work from school teachers is a very different approach.

Although the generous of nature might see this as a hugely philanthropic approach to social reform - a major international company in the social reformist light – I admit to being more sceptical. Examine the facts:

- Cisco were (are) the largest manufacturer of networking equipment and systems in the World.
- Cisco develop and run one of the most important international certification schemes for this field (the Cisco Certification pathways – similar to the Microsoft certifications)
- A massive shortfall in skilled technicians was predicted whilst growth in networking and technologies was set to rise.

Is it possible that the Academy was developed because it was assumed that a lack of trained technical staff would effectively reduce the rate of growth of Cisco's key business? Also, is it possible that Cisco perceived an easy way to ensure a common standard of training to meet their own certification requirements, worldwide?

It is true that Cisco have invested a large amount of money into developing and maintaining the system and now expanding it to include other products and certification programmes. However, Academies are required to buy new (albeit slightly discounted) Laboratory kits and to pay an annual license fee to Cisco. So the process isn't free to schools and Academies.

I believe that the argument is strongest for an Instrumentalist ideology. This is a response to a specific adult-oriented need which results in meeting social and economic ends if successful (Elsey, C (2002):1). Other points are:

> "(a) A belief that Social and economic ends can be achieved through educational means…..
>
> (b) An emphasis on the relevance and utility aspects of knowledge.
>
> (c) The dominant model of learning underlying educational arrangements is a simple mechanistic input-output model."

(The Open University E204 3.4 p14)

I would argue that each of these points can be seen within the Cisco programme. Point (a) has already been discussed above, the Cisco learning materials demonstrate an absolute emphasis on the certification requirements – the utility aspect of networking, with no room for exploration or development of new ideas. It is also true to say that the simple “text book” approach with read, exam, read, exam could be called a simple input – output model and as such I feel that the ideology behind the programme is definitely Instrumentalist.

6.2 How do students respond to online learning?

The vast majority of students do enjoy the course (personal observation) but there are some real difficulties with the online experience. Many students on starting the course have only been used to the increasingly didactic world of exam or test led education (SAT and GCSE). Their experiences of independent learning are extremely limited. In most cases the students have actually been deskilled by the lower years in secondary school.

Some students like the chance to take responsibility for their own progress and learning and apply themselves wholeheartedly, only seeking advice or guidance when needed. The nature of the course is that all students will receive some traditional teacher led learning anyway, but to these students the independent online approach is actually motivating.

Most students struggle with the concept initially, demanding some additional input until they have developed the necessary coping strategies for the online approach. These students generally begin to develop good thinking skills and a higher level of self-discipline within a few weeks of beginning the course.

The final group are those who despite the fact that the course is advertised as online, try to reject the whole process. The instructors believe that this group tend to be those who are academically strong and have excelled in lower level study simply by being able to learn facts and regurgitate. They are generally more science oriented and mathematically advanced – but often immature in their approach to learning in general. These students prefer to absolve themselves of responsibility for their learning by requiring the teacher to guide them at each stage – and if possible to explain. As an experiment one instructor taught a topic face to face – but word for word as it was laid out in the online curriculum. This particular group of students claimed that the teachers' explanation was far better!

In all cases – students respond better to the course if they have an opportunity to have an induction to the curriculum and learning systems, combined with learning skills input from the instructors – What Simpson refers to as Induction and preparation (Simpson (2002:172)).

6.3 Can the programme be related to learning theory?

Student learning styles, as defined by Honey and Mumford identify 4 learner types – Activist, pragmatist, theorist and reflector.

From my experience their description of the Theorist best fits the model behind the resources that Cisco provide – although the Reflector learner will also benefit from this style.

> "The theorist prefers to have a conceptual framework to make sense of new information.
>
> The reflector likes to absorb information and think about it"

(Honey & Mumford cited in James Cook University 2002)

> "Theorists will appreciate a structure that maps out where the different concepts are and allows access to the theory from the main page."

(James Cook University 2002)

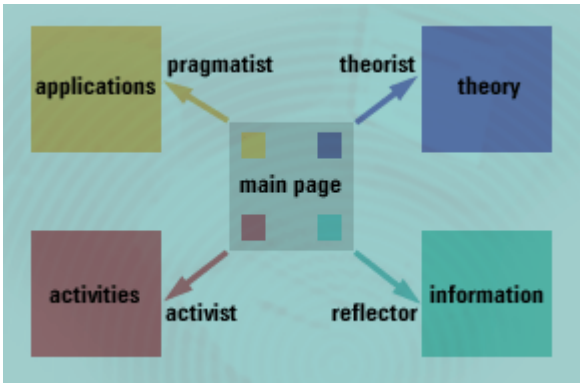


Fig 4: Honey and Mumford cited in James Cook University

Other learning styles can be catered for with Instructor led practical activities (Activist).

It is also important to consider what learning philosophy might underlie the programme resources. There does appear to be a constructivist element to the course. Jonassen (1994) proposed several characteristics of constructivist learning. I will cite two here:

> "Constructivist environments emphasise authentic tasks in a meaningful context rather than abstract instruction out of context
>
> Constructivist learning environments provide learning environments such as real world settings or case based learning"

(Jonassen (1994))

Although these comments appear to be relevant to the instructor led elements of the course, they don't really apply to the online curriculum, likewise the online material doesn't encourage a

> particularly cognitive approach as defined by Piaget – the instructional role doesn't encourage or enforce a reflective or critical approach to experiences (On Purpose Associates 2002). It is simply fact absorption. The Behaviourist model seems to fit, better although there isn't a specific reward based impetus to learning. The Instructional paradigm seems to be prevalent in the course materials and this seems to fit the behaviourist model best. (Pachler and Leask (1999:7))

I would argue that the materials are well designed and it is possible that Gestalt theory requiring a good visual layout to aid perception is present (Leflore (2000:103)), but I have no firm evidence to support this view.

The course does allow for an application of various learning theories, but the course material as prepared by Cisco does not demonstrate, to me, any specific intended foundation.

7. Conclusions and Proposals

The CNAP is a course founded on an Instrumentalist ideology that provides a generally behaviourist range of teaching and learning materials for students to access. The Instructors can bring a more cognitive approach to learning through their own activities and tasks, but in general the only purpose of the curriculum is to act as an online textbook and testing system to help students learn the core certification criteria to help them pass the CCNA (Cisco Certified Network Associate) certification, the aim being to generate an increased number of skilled "Networkers" to meet the needs of the market.

Most students value the course and are able to progress, however for a small number of students the online requirement is in excess of their abilities for self discipline and independent learning. Most students would gain from a formal induction and preparation period at the start of the course.

The course would prove to be a more rounded learning experience if some aspects of cognitive learning approaches could be formally employed allowing room for learning through discovery.

I believe I have demonstrated Mastery of this topic by applying my understanding of the course content to a specific application and by analysing both educational theory and practice in this respect. Although I have not perhaps developed any new theories, the proposals made above will be utilised in our Academy to help develop our own systems to aid effective learning.

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APPENDIX A

1. *Student Competencies.*

   A key question to consider not covered within my original remit is on what basis are student competencies measured. Are they cognitive or behavioural measurements of understanding, practical skill, etc. In fact the certification 'Objectives' measured in several ways – but generally they are behavioural. Knowledge is tested via multiple choice questions. This only requires simple recall and does not need any long term depth of understanding. The practical skills are demonstrated and copied. There is some cognitive testing later in the course where the instructor deliberately 'faults' the system so that students have to find the faults. This requires thinking about, but as the students are limited to knowing what is in the curriculum – all faults used have to be within that sphere of experience.

2. *Instructor views of the learner.*

   I did not specifically ask my colleagues about how they view the learners in their groups – but generally, from previous discussions, I feel safe in saying that learners are viewed mainly as passive receivers of knowledge. There are a few instances where they may be freed enough to actively discover information for themselves in a more cognitive or constructivist way – but generally, the instructional paradigm being foremost with extremely tight objectives and time scales – they are passive.

3. *Collecting the data.*

   It is worth adding that the naturalistic data gathered from students and instructors was done in a non-formal discussion based way, with

questions being, mostly, fitted into specific one-to-one discussions with students and some being directed to the whole class for group discussion.

As there are only two other instructors – gathering views was easy particularly with the aid of a cup of coffee and a mince pie!

Questions were informal – although I had a list of points I wanted to cover and took the form of a chat. Colleagues were aware that the discussion would be used for this purpose and that they would be treated anonymously in accordance with APU ethical requirements.