Crucial Aspects and Objectives of a Foundations Course in Information Technology

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Abstract

A foundations course is the first exposure that most students will have to the major and profession of Information Technology (IT) causing it to be an essential stepping stone for success in this field. Both freshmen and transfer students of various backgrounds will be enrolled in the course forcing the need of handling topics that are new to some students but possibly experienced by other students.

The main goals for a foundations course in IT are to give a good academic and professional career orientation and to establish a "way of thinking" within the major. The academic orientation will allow the students to know what is expected of them within the IT major. The professional career orientation will give the students a good understanding of careers in IT. The "way of thinking" will be the foundation for a community of learning that will foster collaboration within the program.

To achieve these goals within the course there is a broad scope of learning objectives that must be covered. These range from keeping a learning community thriving with these "new arrivals" to covering the introduction of core topics of IT as-well-as the beginnings of life long learning that will be needed later in a professional career.

Introduction

Information Technology as a college major is somewhat hidden compared with majors such as Computer Science (CS) and Computer Engineering (CE). Most counselors in high school will recommend one of the latter if a student has interest in computers. Many of these students don't understand the differences between these college majors and begin taking classes to discover if they actually fit in a particular major. Because of this situation there are many students that change their major from CS or CE to IT. Many students then believe that Information Technology is the major that would better fit what they want to do with computers and use the foundations course to continue the discovery process. Of course freshmen that enter directly into the IT program will have many of the same questions regarding the major. The foundations class thus holds a crucial place in the lineup of classes for the major since it will provide the needed information for the students to decide if IT is the major for them.

Faculty and administration in the IT program have a fundamentally different interest in the foundations course than the discovery process done by the students. The faculty would like to have a clearly established "culture" within the major. This culture includes items such as how the students relate to faculty, how the standard course is conducted within the major, the social environment within the major, and other expectations of the students. Students are usually oblivious to these aspects of the educational environment until they cause a road block for the student's progression. The foundations course thus also holds a crucial place within the major to bring an understanding to the student of the culture they must work within in order to succeed in the IT major. The foundations course also has the responsibility of establishing this culture and "way of thinking" within the class in order to foster it within the major. Faculty will expect the establishment of the culture in future classes and student will feel lost if it is not assimilated within the foundations course.

Need for Authentic Foundations

The set of courses that make up a major have a particular style and culture within the program. This style is usually carried out informally between the instructors of the courses. Some programs have more formal styles as to how the courses are carried out such as a strictly laid out lab time verses the lecture time. Many times a foundations course is considered a burden to teach and thus importance is not placed on the structure of this class. Students are led astray by not having the foundations course's style and culture consistent with the remainder of the major.

Both the introductory content of the foundations course and the style and culture of the course need to be consistent with the other courses offered in the major to be considered an authentic course for the introduction to the major. It is not difficult to build a course that has subject content as an introduction to all the different area within an IT major but it is more difficult to build that same course to hold the same style and fostering of the culture that is expected to be carried out throughout the major.

Most freshmen come to college under prepared to meet the first year demands or with knowledge of how the system works. "For example, … high school assessments often stress different knowledge and skills than do college entrance and placement requirements. Similarly, the coursework between high school and college is not connected; students graduate from high school under one set of standards and, three months later, are required to meet a whole new set of standards in college."[1] Since a foundations class is usually the first course encountered by freshmen within a chosen major, there is a clear bridging responsibility taken on to introduce the student to the demands, style, and culture within the major.

The foundations course can help meet two out of the three recommendations from the Stanford Bridge Project:[2]
- Provide all students, their parents, and educators with accurate, high quality, information about, and access to, courses that will help prepare students for college-level standards.
- Create an awareness that getting into college is not the hardest part.

By conducting the foundations course in IT in this manner the students will be better prepared to succeed in the major and in college in general.

Crucial Content

The content presented in a foundations course in IT is now being defined at a national level. The tripartite content developed by the National Research Council is an excellent criterion to follow.[3]. It divides the content into skills, concepts and capabilities that should be outcomes from an introductory IT class.

The breakdown is as follows:[4]

Skills:
- Set up a personal computer
- Use basic operating system facilities.
- Use a word processor to create a document.
- Use a graphics or artwork package to manipulate an image.
- Connect a computer to the Internet.
- Use the Internet to locate Information.
- Use a computer to communicate with others.
- Use a spreadsheet to model a simple process.
- Use a database to access information.
- Use online help and instructional materials.

Concepts:
- Fundamentals of computers
- Organization of information systems.
- Fundamentals of networks.
- Digital representation of information.
- Structuring information.
- Modeling and abstraction.
- Algorithmic thinking and programming.
- Universality.
- Limitations of Information Technology.
- Social impact of computers and technology

Capabilities:
- Engage in sustained reasoning
- Manage complexity
- Test a solution
- Find problems in a faulty use of IT
- Navigate a collection and assess the quality of the information
- Collaborate using IT
- Communicate using IT about IT
- Expect the unexpected.
- Anticipate technological change.
- Think abstractly about Information Technology.

Another source is the curriculum committee of SIGITE of the ACM.[5] This committee has defined the goals and objectives of an IT program as well as topics of the core curriculum. A foundations course should effectively introduce all aspects that are described in these standards. The following is taken directly from the minutes of the committee's July 2003 meeting.

Broad Goals of IT programs:

Provide IT graduates with the skills and knowledge to take on appropriate professional positions in information technology upon graduation and grow into leadership positions or pursue research or graduate studies in the field. Specifically, within five years of graduation a student must be able to:

1. Explain and apply appropriate information technologies and employ appropriate methodologies to help an individual or organization achieve its goals and objectives;

2. Manage the information technology resources of an individual or organization;

3. Anticipate the changing direction of information technology and evaluate and communicate the likely utility of new technologies to an individual or organization;

4. Understand and for some to contribute to the scientific, mathematical and theoretical foundations on which information technologies are built;

5. Live and work as a contributing, well-rounded member of society.

Graduates of baccalaureate programs in Information Technology must have the ability to:

(a) Use and apply current technical concepts and practices in the core information technologies;

(b) Analyze, identify and define the requirements that must be satisfied to address problems or opportunities faced by organizations or individuals;

(c) Design effective and usable IT-based solutions and integrate them into the user environment;

(d) Assist in the creation of an effective project plan;

(e) Identify and evaluate current and emerging technologies and assess their applicability to address the users' needs;

(f) Analyze the impact of information technology on individuals, organizations and society, including ethical, legal and policy issues;

(g) Demonstrate an understanding of best practices and standards and their application;

(h) Demonstrate independent critical thinking and problem solving skills;

(i) Collaborate in teams to accomplish a common goal by integrating personal initiative and group cooperation;

(j) Communicate effectively and efficiently with clients, users and peers both verbally and in writing, using appropriate terminology;

(k) Recognize the need for continued learning throughout their career.

This Committee has also defined the main topic and sub topics of the core curriculum. The main topics are as follows: Security, Social & Professional Issues, Information Management (database), Human Computer Interface, Networking, Systems Administration, Programming, Software Systems, Computer Mediated Experience, System Integration, User-centric Issues, and Application Domain.

For an introductory class we must also remember that this class is setting the student up to work within the cultural environment that exists at this college. The foundations class should address these cultural aspects directly and not assume that the students will "pick them up". This includes discussion on how the major works, how the labs work, the working relationships with professors, the social environment, etc.

Crucial Learning Objectives

From the "standards" presented above specific learning objectives should be developed for the foundations class in IT. These objectives should be introductory in nature but reflect the entire scope of content for the IT major. Learning objectives are the outcome from the learning and not the methods of obtaining this outcome. The emphasis should be placed on "student-oriented, learning-based, explicit, and assessable statements of intended cognitive outcomes."[6] The following list is a good example of a set of learning objectives for the foundations class in IT.
1. Understand Information Technology as an academic discipline and a profession.
2. Commit to the IT major or find your best fit.
3. Acquire basic Teamwork and Project management skills.
4. Get to know the IT Faculty.
5. Understand the need for design and problem solving skills.
6. Understand the use of labs in the learning process and IT major.
7. Begin using Oral and Written Communications in a professional manner.
8. Understand the social environment within the IT major.
9. Obtain a basic understanding of the major topics in IT.

Effective Teaching Methods

Each activity or teaching opportunity conducted in the foundations class should be directly aimed at one of the learning objective. If the activity is not related to one of the identified learning objectives then it most likely does not belong in the class. Learning objectives thus become guidelines for the activities that will take place in the learning environment. If they are well defined the objectives may allow for a modular approach for structuring the class. A modular approach would allow student that are experienced in a particular area to test out, or move through it quickly. It is also a method that will allow for the handling of a large number of students as well as distance learning situations.

One of the overriding aspects of IT that must be clearly taught, beginning with the foundations course is the ever changing world of IT. "The professional in (IT) is faced with an ever-changing and diverse field that demands that they pay heed to constant technological advances. The student in an IT field must develop during their college years a pattern of 'life long learning' so that they can keep abreast with the changes and evolution that will inevitably take place while in their career."[7] No matter what teaching methods are used for the other content that is taught the crucial aspect is to teach life long learning as a way of thinking. This is more of a change in attitude than something that is taught directly. Students must come away with the attitude that they will always be learning something new and be prepared with self teaching methods to

accomplish this. The beginnings of this attitude change should be done in the foundations of IT class by, at the very least, making students aware of the situation. One good method is by showing a history of IT over the last 20 years emphasizing the aspects that have stayed the same and all the fast paced changes that have taken place.

Since IT is a hands on profession as are most of the future classes in IT then in keeping with the authentic requirement previously outlined, most of the learning activities within the class should be hands on. This is easily accomplished through a series of labs that will give the introductory experience to the students through a hands-on environment. This also works well with the modular approach since the labs are easily divided by the objectives in the same manner as all activities in the class. Each lab should be clearly tied to an objective just as all learning activities. A mixture of lectures emphasizing the theory aspects of IT with associated labs emphasizing the practical aspects of a particular topic has proved to be an effective teaching method in the past.

A major question arises as what teaching method will work for conveying the knowledge of the cultural environment existing within the IT major. Presenting the norms of the culture is a good starting place. This includes the normal mode of operation for relating with professors, TAs, homework, labs, etc. Since students all have different learning styles, this will only work for some of them. Other students must actually live in the environment in order to learn how to function within this culture. It is the responsibility of the foundations course to cause the students to actually live in this culture for the work being done in the class. They should begin to become part of the IT major's learning community and have a clear understanding of how to work within this community. "When a classroom becomes a learning community…the social structure transforms into one in which teacher and learners work collaboratively to achieve important goals,…"[8]

Conclusion

Success in an academic or professional field is often more attributed to an attitude or "way of thinking" than to possessing the knowledge of that field. Within IT this is especially true because of the ever changing nature of this field. A foundations class in IT has a particular responsibility to the students to establish the "way of thinking" and culture that will provide success. It should also provide an introduction to all the major topics that will be studied further in the IT major. Students should exit the course with a clear understanding of what Information Technology is in both the academic and professional sense.

Crucial aspects of a foundations course in IT are easily defined with a list of crucial learning objectives for the course. The objectives that are non IT content related such as the cultural environment or life long learning are much more difficult to define effective teaching methods and assessment scenarios for. By clearly defining the foundations course as one that will deal with the culture within the major and the professional field students will move very quickly into the IT content within the major without a cultural roadblock. Emphasis should be placed on success and the course should never be used as a weed out course for the major. Since the

students do not yet understand the culture they are working within they could have been weeded out for the wrong reason and may actually end up the best students in the program.

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