

Development of an Independent Learning Environment for Operating Systems in Information Technology

Aron N. Barabas, Stephen R. Renshaw, C. Richard G. Helps
Information Technology, Brigham Young University

Abstract

There is a great need for students to keep abreast with the constant evolution of technology in Information Technology (IT). In order to succeed, students need to develop learning strategies to master new technology. In order to ensure that students are well-grounded for life-long technical careers, schools must teach technical foundation courses. Since time-to-graduate is always a concern, this means they cannot always teach as many technical depth courses as they wish to. Students have to become independent learners so they can master all the up-to-date technical understanding they desire.

Brigham Young University is developing an 'independent learning environment' focused on teaching the Linux operating system. Through this learning platform students are able to learn essential technological skills on their own time, thus giving them the opportunity to expand their knowledge independently. This kind of 'self-motivated' learning tool can instill in the student a spirit of self-learning. The learning environment is a structured series of learning experiences to enable students to master operating system concepts.

This paper presents the learning environment, its associated assessment mechanisms and analysis of formative evaluation results.

Introduction

The professional in Information Technology (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.

The practice of life long learning is essential for a successful career in IT; without it the professional would inevitably become obsolete and become an unprofitable employee for their company. "Lifelong learning has become a necessity, [and] training at the beginning of a job is often not sufficient to prepare the worker for changing conditions in the job due to new technologies or new roles."¹

Technological companies spend millions of dollars each year upgrading their computer systems and training their workers to stay current with the latest technological advances. In light of this, students entering industry with a solid ability to expand their expertise in accordance with the technological advances will be ready to participate and lead in their chosen field.

*Proceedings of the 2003 American Society for Engineering Education Annual Conference & Exposition
Copyright © 2003, American Society for Engineering Education*

Students who enter the Information Technology (IT) field are usually proficient at the widely used Microsoft Windows operating system (OS). Despite the fact that this is a very popular OS in industry, students need to expand the scope of their OS understanding in order to be competitive and versatile in industry. Since the Linux OS is an operating system widely used in industry but usually unfamiliar to the new IT student, an independent learning environment was developed in order to teach students the fundamentals of the Linux OS on their own time. Our goal in developing this learning environment is to give the student a foundation upon which they can build a greater structure of knowledge about operating systems and how in general to discover mechanisms and methods of new operating systems.

The Independent Learning Environment

The independent learning environment that has been developed is a series of structured lessons. The student can choose how and when to complete each lesson. The typical time to complete a particular lesson is one hour, making this system both practical and concise.

One of the main objectives of this environment is to train students to teach themselves through independent learning and consequently develop life-long learning skills and habits. “When students learn on their own, they develop the ability to focus and reflect. Working on their own also gives them the opportunity to take personal responsibility for their learning.”²

Each lesson has a specific learning objective at the beginning and a short assessment at the end based on the objective gives immediate feedback to the student. The assessment is essential to the student's learning as it is through the completion of the assessment that the student can gauge where their particular strengths and weaknesses are within the module and improve accordingly. This also provides feedback for the authors of the learning materials for measuring if the learning outcomes are being met.

Progressive checks are placed throughout the lesson that the student should successfully pass in order to proceed to the next portion of the lesson. These checks ensure that the student actually understands the concepts as they are presented rather than assuming that they will just pick up these concepts along the way.

Developing the independent learning environment was challenging as it was a new way of approaching the old problem of trying to maximize the student's learning potential. The initial development of the lessons were formed around a “skeleton” which consisted of such things as a clearly laid out objective for each lesson as well as a defined overview of the lesson. The progress checks at first were quite unpolished as it was not determined yet how well the student would learn the material and at what rate. So refining the assessments through peer review was a very important step in refining the progress check assessments to a point where it was felt that they challenged the student enough to make them think but not so far as to frustrate them to discourage them from wanting to carry on with the lessons.

The lessons were focused on providing the most conducive atmosphere possible for the student to

learn Linux outside of a classroom setting and still provide meaningful results for the student in a minimal amount of time. Providing assessment checks and defined objectives for each lesson helped focus the lessons to a particular scope and narrow down the teaching frame to smaller well defined teaching objectives. This was done in the hope that the student could build upon principles and develop a powerful base for learning other Linux principles.

Learning an Operating System in an Independent Learning Environment

Every computing device these days whether it be a computer or a personal digital assistant (PDA) needs a user interface or operating system in order to interact with the hardware and software for the device. A myriad of operating systems have flooded the tech-world over the past decade, each with different features, advantages, and disadvantages. For instance usability, predictability, uptime, etc, are all important selection features for an operating system.

The popular Windows operating system is the most familiar to the average consumer, while other operating systems are not as well known to the majority of ‘everyday’ computer users. This is true for students entering the IT field too. They tend to be limited in their understanding of other important operating systems like Linux. In industry IT professionals will need to know a wide range of operating systems to be able to utilize all of the benefits each has to offer. Becoming fluent in more than the Windows operating system will allow the IT professional greater flexibility in their problem solving strategies, and will allow them a larger arsenal of tools to work with.³

Linux is similar to Windows in that most of the same tasks can be performed on either operating system, yet the main difference is how a user would actually interface with the operating systems to get that task done. People who are familiar with Windows already have a basic understanding of what an operating system is supposed to do, so learning a new operating system like Linux should be reminiscent of their Windows use and therefore provide some common ground to build upon. The learning environment takes this into account so that the naïve Linux user can easily adapt to Linux comfortably and quickly feel confident in its use.

Development of the Independent Learning Environment from a Student’s Perspective

Being a naïve Linux user myself made this task all the more challenging as I had to learn the Linux platform along with developing the lessons. This unique approach was done intentionally as when I developed a new lesson it would have been from the perspective of user who has just learned the material himself which would hopefully ensure that the lesson would contain pertinent information for new users. By pertinent it is meant that the information is presented in such a way as to allow the new user to gain a greater understanding of the topic rather than be strewn across a web of overly complicated explanations by experts who know the basics so well that they tend to skip the vital basics upon a new user needs to build upon. The lessons fore to mentioned refer to the systematic organization of the introductory steps needed for a new user which makes these

lessons quite versatile as they can be used by anyone who has a basic understanding of any computer platform (ie: Microsoft Windows).

The development of a Linux independent learning environment has been a very tedious and lengthy process. To adequately cover all the necessary concepts and topics of Linux is a daunting task as it is hard to ever really say that we have included all the student will need to know about Linux. Work was therefore undertaken to not only structure the lessons in such a way as to cover the foundational concepts of Linux but to more importantly teach students how to ‘think in Linux’.

‘Thinking in Linux’ is more than just knowing how to use the Linux operating system; rather it is a structured approach to teaching students how to teach themselves. Once a student increases their interest and subsequently their willingness to explore new realms of the technological world, they will ultimately become an indispensable asset in their IT field.

Developing the lessons from ‘scratch’ has proven to be fairly difficult as we wanted to make them to-the-point but also fairly concise as to convey important foundational concepts. For instance we had to ask ourselves if our progressive assessment questions were too hard or possibly too easy in light of what the student has learned so far in their lessons. Questions also arose as to what concept to structure each lesson around so as to adequately include all the major concepts of the Linux platform in a minimal number of lessons.

The lessons start off with a list of objectives that the student should achieve by the end of the lesson. The lesson is then broke up into sections that each focus on a particular concept in greater detail.

The lessons were structured in such a way as to allow the student to go through the lessons in more of an experiential fashion instead having us walk them through the lesson. “Focusing on learner experience rather than content as the fundamental reflection of curriculum places a greater emphasis on instructional strategy from the outset of curriculum design”⁴

There are many websites that include Linux tutorials, yet the degree of quality among them varies. For instance www.linux.org/lessons presents a good example of a solid Linux tutorial.

Further Research and Development

This independent learning environment is anticipated to be the first of possibly many learning environments. Other topics of study may include the Windows operating system, Pearl, or Cisco.

Regardless of the learning topic which we use in the learning environments, the emphasis will always be on the development of life-long learning habits in the student so that they will feel comfortable in learning all types of technological tools. It is anticipated that students who diligently immerse themselves in these learning environments will gain an advantage when it

comes to job placement after graduation as they will have developed the necessary drive to stay 'on-top' of the never-ending technological advancements.

Refinement of existing learning environments will be an on-going process so as to keep them up-to-date as well as to keep them as viable as possible.

The independent learning environments that were developed have been reviewed and analyzed by various IT students and professors in the Information Technology school at BYU and the goal is to try to implement these lessons into IT class curriculum which will be provided concurrently to the students along with their other homework in their respective class.

This research into developing meaningful and worth-while independent learning environments is a recent emphasis in the Information Technology department at BYU as it reaffirms the university's goal "to assist individuals in their quest for perfection and eternal life." The goal is to develop life-long learning habits that will give students an innate drive for success in their careers and in their life.

Conclusion

Through an independent learning environment, students and professionals alike can learn important skills and techniques for their careers that will keep them abreast of the latest technological trends which ultimately spells job security. Through such a learning environment, a spirit of 'life-long learning' will be developed and if such an attitude is coupled with such things as on-the-job training and company seminars, a professional in an IT field will remain to be a valuable asset for her company.⁵

The independent learning environment has the potential to become an important tool for students and professionals to use to hone their technological skills and stay current in the evolving tech-world.

Bibliography

1. Schott, F., & Driscoll, M.P. *On the architectonics of instructional theory*, instructional design: International perspectives (Vol 1). 1997 Hillsdale, NJ:Erlbaum p.136
2. Silberman, Mel, *Active Learning; 101 Strategies to teach any subject*, 1996 Allyn & Bacon p.121
3. Helps, Richard & Renshaw, Stephen *Introducing IT students to New Operating Systems*, Proceeding of the 2002 conference for Information Technology Curriculum, Rochester NewYork, 2002 Society for Information Technology Education, session 262
4. Smith, Patricia, L. & Ragen, Tillman, J. *Instructional Design (2nd ed)* 1999 John Wiley & Sons p.309
5. Helps, Richard & Renshaw, Stephen *Life-Long learning of Operating Systems in IT*, Conference for Industry and Education Collaboration Conference, Jan 2003 session 343

ARON N. BARABAS

Aron Barabas is an Information Technology undergraduate at Brigham Young University in Provo, UT. He used to be a research assistant in a biomedical research facility at the University of Calgary, Canada and was in charge of all computer administration as well as assisting in medical experiments. Currently working as an audio-visual technician in Provo, UT.

STEPHEN R. RENSHAW

Stephen R. Renshaw is an Instructor of Information Technology at Brigham Young University in Provo, UT. He received a B.S. and an M.S. in Computer Science from Brigham Young University in 1985 and 1987. Prior to instructing full time he experienced 13 years within industry in various Information Technology areas including: telephony, process control, system integration, networking, and health care computing.

C. RICHARD G. HELPS

Richard Helps is the Program Chair of the Information Technology program at BYU. He is also a TAC-ABET program evaluator and vice-president for Western USA for SITE. He spent ten years in industry as a control systems design engineer. He completed BS and MS degrees at the U of the Witwatersrand, South Africa and a further graduate degree at the University of Utah in Electrical Engineering.