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Simulation for Network Education: Transferring Networking Skills Between Simulated to Physical Environments

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Abstract

Simulated environments can provide a convenient, effective way to teach skills. Simulations have been used for decades to teach skills such as piloting aircraft. As technology has improved, it has become feasible to simulate many other tasks. Recent advances in virtual and augmented reality provide new avenues for expanding training using simulations. Going forward, it is imperative that we understand how skills are transferred from simulated environments to physical environments. The current research investigated network simulation training in an introductory computer networking course. Students completed networking exercises in a simulated network environment using Cisco Packet Tracer then subsequently completed exercises using physical Cisco routers and switches. Data from the study indicates that simulations are effective tools to teach computer networking principles but may not necessarily eliminate the need for students to learn using physical networking equipment. Student perceptions of simulation realism explained a large portion of the variance in skill transference between the simulated and physical environments. Practical advice for instructors teaching networking using simulated and physical environments is given.

Keywords: Simulation, Computer networking, Pedagogy, Training

1. INTRODUCTION

The demand for computer networks continues to grow. High speed internet, Wi-Fi, and mobile network deployments continue to extend internet access globally. Businesses use networks to improve operations, increase employee productivity, and create novel applications. For example, Amazon required a high-speed, stable wireless network to enable its Kiva autonomous robots to automate warehouse operations (Li & Liu, 2016). Ironically, cloud computing increases the importance of networking rather than reducing it, as the network provides critical access to the leased infrastructure in the cloud. Educators must teach computer networking skills effectively so that students can enter the workforce ready to deliver networking solutions that businesses expect and to develop innovative systems, even in a cloud-first environment.

Networks are complex systems with many elements that are difficult to directly observe. While professionals can use signal strength bars, blinking lights on a switch, and other status indicators as gross indicators of network functionality, much of the network operation goes unseen. Simulations may be a way to increase understanding of what occurs in a computer network.

Simulations enhance learning environments. Virtual representations of the complex world allow educators to give learners experience that should transfer directly to the physical world. Many organizations are exploring how simulations can improve training delivery for continuing education in the workforce (Bell & Kozlowski, 2008). Results of simulation training are encouraging. Training with game simulations has demonstrated improved declarative knowledge, procedural knowledge, retention and self-efficacy (Sitzmann, 2011). But are simulations a silver bullet? Careful consideration of pedagogical factors and simulation design must be given to ensure that simulation training is effective.

Many fields have used simulations effectively for education. Pilots have used sophisticated simulations for decades. Doctors have used simulations to learn skills used in surgeries. In the computer world, software simulations allow information technology students to learn hardware and software platforms in an isolated learning environment.

Cisco Systems developed Packet Tracer, a visual network simulation tool that helps networking students and professionals learn networking fundamentals, design networks, and troubleshoot network configurations. Using Packet Tracer, students can interact with simulated network hardware without the need for physical routers and switches (Frezzo, Behrens, Mislevy, West, & DiCerbo, 2009).

Many elements of Packet Tracer's simulation match the physical world counterparts. Packet Tracer has models of switches and routers sold by Cisco Systems. Nearly all functionality supported by the physical equipment works in Packet Tracer. However, there are a few key differences. Experience teaching students in Packet Tracer then having them apply their skills using physical equipment proved to be more challenging than expected. This led us to investigate the differences between the physical and simulated environments to determine how the simulated training might be improved.

In the following sections we will address the theoretical background of training in simulations, describe our research methodology, and present our results. We conclude with a discussion of our results as they apply to future research and guidance for educators who use simulations.

2. HISTORY OF SIMULATIONS

At a high level, simulation is the imitation of a real-world process over time (Banks, 2001). Simulations "evoke or replicate substantial aspects of the real world in a fully interactive manner" (Gaba, 2004, p. i2). Researchers have investigated overall effectiveness of simulations for training purposes and found them useful in many contexts. This section discusses some of the key contexts that have driven research in simulations.

Simulated Training Environments

Flight simulators are among the most common simulators in the cultural zeitgeist. One of the first was Edwin Links "Blue Box"—an electric and mechanical replica of an aircraft that could be used to assess pilot proficiency (R. Smith, 2014). Simulation proved to be so helpful that the Federal Aviation Administration would later require commercial pilots to train using simulation to achieve licensure (Rosen, 2008).

Simulations allow medical professionals to practice in an environment that minimizes the cost of mistakes. Patient safety is a key driver of simulations in medical training (Akaike et al., 2012; Datta, Upadhyay, & Jaideep, 2012). Some of the earliest examples of medical simulations include human patients built in clay (Jones, Passos-Neto, & Braghiroli, 2015). Surgical simulation training results in more proficient medical professionals (Dawe et al., 2014). Today, digital simulations using virtual reality augment physical simulations such as mannequins.

Simulations have proven useful in other contexts. The military uses simulations for combat training (R. Smith, 2010). Golfers can improve their game with indoor simulations (Libkuman, Otani, & Steger, 2002). Mine operators use simulations to improve safety outcomes(Van Wyk & De Villiers, 2009). Games, such as the *Oregon Trail* (developed by MECC in 1974), simulate American frontier life for educational purposes. Increasingly, simulation games are being used for training in business environments (Sitzmann, 2011). Clearly, simulations can aid training in a variety of fields. In the following section, simulations in a computer networking context are discussed.

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Computer Network Simulations
Several classes of network simulations exist. A small distinction exists between simulation and emulation. In a simulation, the user interface is designed to respond in the same way that the physical devices would respond, though the underlying programs and routines might vary. Packet Tracer is a popular network simulator that has been used to teach networking principles and practical skills (Zhang, Liang, & Ma, 2012).

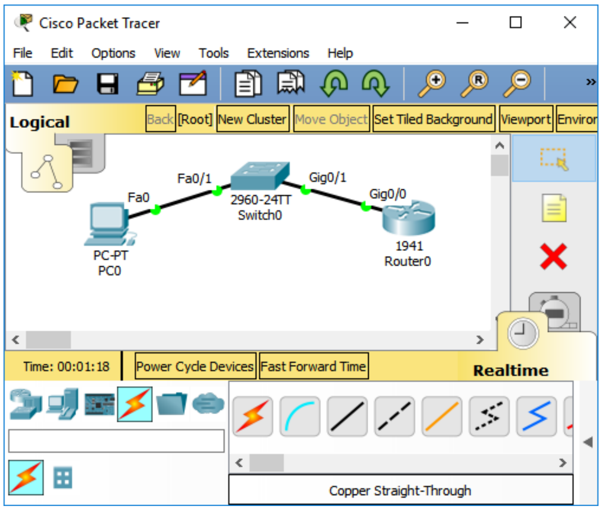

Figure 1: Small Network in Packet Tracer

In an emulated environment, the software runs the actual firmware and code that runs in the physical environment. GNS3 is a network emulation tool that works similarly to simulations (Gil et al., 2014). From an end user perspective, emulation and simulation can appear to be identical (aside from increased resource utilization typically required by emulation). Network simulations may enable distributed groups to collaborate in a semi-synchronous manner (A. Smith & Bluck, 2010).

Network simulations can vary widely in their graphical representation. Whereas Packet Tracer and GNS3 largely target educators and learners they feature graphical user interfaces that lower the learning curve. In contrast, products like DeterLab enable the creation of complex network topologies using the Network Simulator language syntax (Mirkovic & Benzel, 2012). In Packet Tracer, a network switch is a graphical icon on a visual workspace. In DeterLab, a network switch is a line of text in a configuration file.

Teaching with Simulations
A primary benefit of training with simulation is that simulations typically use an active learning model. Active learning activities require students to do things and think about what they are doing (Bonwell & Eison, 1991). Frequently, simulation exercises are goal oriented, such that the learner must take active action and progress through a series of steps to attain the goal. Active learning is more effective than noninteractive approaches because it requires the learner to be more cognitively engaged (Sitzmann, Kraiger, Stewart, & Wisher, 2006).

A meta-analysis of simulation training shows that the interactive nature of simulations leads to improved cognitive gains compared to traditional instructional techniques (Vogel et al., 2006). It should be noted that interactivity is a feature that must be built into simulation training. For example, in one training simulation, participants navigated a virtual world and interacted with different characters and items in the world, but all learning was passive through reading text such as digital books or transcripts (DeRouin-Jessen, 2008). Examples of active learning through simulation include an exercise in which learners used simulators to interactively build electronic circuits (Zacharia, 2007).

Pazil et al. (2007) identified four key elements of simulation exercises: exposure, sequence, feedback, and repetition. In the exposure phase, learners are introduced to the scenario and given learning objectives. In the sequence phase, learners are walked through the exercise, typically with increasing difficulty as the exercise progresses. In the feedback phase, the instructor and learner work together to assess performance. Debriefing at the conclusion of the simulation exercises is critical to give learners time to reflect on learning objectives (Cho, 2015). This reflection should help learners understand how the exercise will apply in future work (Kaufman, 2003). Repetition allows learners to solidify skills and correct mistakes.

It is critical that skills learned in simulations are retained when applied to real-world scenarios. One way in which this transfer occurs is when new knowledge and skills can be applied to work in daily life (Simons, 1999). One barrier to transference is the difficulty in recognizing situations where the knowledge and skills can be applied (Bereiter, 1995). Cold Stone Creamery provided a game to its employees that aimed to increase productivity and reduce waste (Jana, 2006). Though employees had fun playing the game and shared it with friends, it is not clear if behavior serving ice cream changed. If the differences between simulation and work in daily life are great, it is likely that learners will struggle with skill transfer. This is likely truer with novices

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rather than experts. Experts are more likely to understand the principles that simulations are teaching and more easily understand how the principles can be applied in new contexts.

Outcome Variables
Measuring simulation training effectiveness is an important consideration because too often simulation developers focus on technology rather than learning (Salas, Bowers, & Rhodenizer, 1998). Commonly measured outcome variables include self-efficacy, declarative knowledge, procedural knowledge, and retention. By improving these outcomes, other important outcome variables can be improved. For example, error rates are a primary concern in medical practice (Leape, 1994). While computer networking professionals rarely deal with life or death scenarios, mistakes can lead to substantial losses in the confidentiality, integrity, and availability of systems. By improving self-efficacy, declarative knowledge, procedural knowledge, and retention, educators can improve many secondary outcome variables.

Self-efficacy is the confidence in which learners feel that they have gained knowledge and can apply their skills (Bandura, 1997). Because simulations provide opportunities to accomplish tasks defined in learning exercises, they can contribute to self-efficacy (Bandura, 1977). Self-efficacy is important, but it should be noted that it is a self-assessment and therefore educators should augment its measurement with other variables.

Declarative knowledge is they retention of facts, principles, and the interrelationship between them (Kraiger, Ford, & Salas, 1993). Procedural knowledge is the knowledge required to successfully carry out a task and is typically learned by doing (Koedinger & Corbett, 2006). In computer networking, the differences between declarative knowledge and procedural knowledge can be stark. Students who learn about networking solely through books and classroom discussions may find themselves unable to apply practical networking skills, such as configuring a router. Retention is the degree to which declarative knowledge is retained after training has been completed, typically measured at least several weeks after the learning exercises.

3. TEACHING COMPUTER NETWORKING WITH SIMULATIONS

Simulations that provide constant feedback help students learn by continually allowing students to assess their performance (Abela, 2009). Network simulation software can provide feedback indicating if configuration changes were made successfully through methods such as error messages, indicator lights on hardware, or successful connectivity between devices.

Simulation-based training differs on its fidelity. Fidelity is composed of many dimensions, such as accuracy, believability, verisimilitude, and realism (Feinstein & Cannon, 2002). High fidelity training closely mimics the real-world physical environment, but these simulations can be costly to produce. There has been a push for creating simulations that emphasize psychological fidelity by evoking the critical learning components that apply to real-world scenarios (Kozlowski & DeShon, 2004). Fidelity can be objectively measured in part by comparing features of a simulation to its real-world counterparts. In the current study, we focus on perceived fidelity. Perceived fidelity can be high if the simulation experience is similar to the real-world experience despite differences between the two environments (Lee, 2017). Of the dimensions that compose fidelity, we focus on realism. Realism is concerned with how closely a simulation represents the real-world environment (Norris, 1986). The nature of training with simulated and physical network devices controls for many other facets of fidelity. Realism is the primary dimension that would differ between environments.

Hypotheses
Based on the review of the literature, we set forth the following hypotheses.

H1: Students participating in a simulated learning environment will increase their computer networking self-efficacy.

We believe that following learning in a simulated environment, students will continue to improve their computer networking skills when subsequently completing exercises in a physical environment. In essence, simulation is only one step in the learning process. We therefore hypothesize:

H2: Students participating in a physical learning environment after using a simulated environment will further adjust their computer networking self-efficacy.

We posit that the most effective learning will have occurred once students complete exercises in both the simulated and physical network environments. Therefore:

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H3: The combined effect of simulated and physical training on computer networking self-efficacy will be greater than either method alone.

A key consideration for determining how effectively skills transfer should be the perceived realism of the simulation. If the simulated environment does not match the physical world, it is likely that skills transference will be low. We therefore hypothesize:

H4: Students that perceive simulated environments to be realistic will be more able to transfer their knowledge between the simulation and a physical environment.

4. METHODOLOGY

A mix of qualitative and quantitative methods were used. There has been a call for carrying out mixed methods information systems research (Venkatesh, Brown, & Bala, 2013). Specific to simulation-based training, qualitative methods "are best suited for building an understanding of the processes that drive effective performance in the real world" (Salas, Rosen, Held, & Weissmuller, 2009, p. 353). Quantitative measures were used to analyze specific variables relevant to learning outcomes, attitudes, abilities and other related constructs.

Data was gathered in an introductory networking course in a Midwestern university. The data was gathered during a normally scheduled classroom activity. In total, 17 participants (3 female, 15 male) completed the study.

The networking course was offered in a computer lab equipped with Cisco 1960 switches and Cisco 1941 routers. This equipment matches models available in Packet Tracer. Using the same models in the simulated and physical environment enabled a direct comparison.

Prior to the study, students had been introduced to Cisco Packet Tracer and physical networking switches and routers. All students had completed exercises in both environments. In the qualitative part of the study, students were asked to answer open-ended questions. Validated items were used where possible for the quantitative survey. A complete list of survey items can be found in Appendix A.

The quantitative analysis was a within-subjects quasi-experiment. Because the students completed the exercises simultaneously, it was not possible to observe each error they made or time their results.

In the study, students first reported their computer networking self-efficacy (CNSE). Next, they completed an exercise using Packet Tracer. The exercised included the creation of VLANs on a Cisco 1960 switch, assigning IP addresses to clients and Cisco 1941 router interfaces, setting up OSPF on the router, and other configurations needed for a small network in a single building. After completing the exercise in Packet Tracer, students again assessed their CNSE. Then, students completed the same exercise using physical networking equipment. After completing the exercise, students again assessed their CNSE and completed other survey items as listed in the appendix.

5. RESULTS

This section reports the results from the student surveys. The quantitative data was analyzed using R 3.4.1 (R Core Team, 2013) and SmartPLS 3 (Ringle, Wende, & Becker, 2015). The results of the qualitative surveys were analyzed for trends in response patterns.

Quantitative Data Analysis

Computer networking self-efficacy is important to this study, as it shows students' perceptions of their abilities. Since this study occurs at the end of a semester-long course of study, students are expected to be proficient and to have a realistic understanding of their own abilities and shortcomings. Self-efficacy is measured at three times: before the exercise (Time 1), after completing the exercise in a simulated environment (Time 2), and finally after completing the exercise in a physical environment (Time 3). Students are asked three questions at each time (please see the measure items in the appendix); the scale combines these scores through simple averaging. Descriptive statistics are provided in Table 1.

Time	N	Min	Max	Mean	Standard Deviation
1	17	2.00	7.00	4.79	1.21
2	17	3.33	7.00	5.21	0.91
3	17	3.33	7.00	5.44	0.97

Table 1: Descriptive Statistics for Computer Networking Self-efficacy

These observations will be highly related because students have inherent characteristics that will impact their appraisal of their CNSE, ranging from optimism, actual ability, and personality traits. Thus, high levels of correlation are expected, and seen. As can be seen in the paired samples

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correlation table (Table 2) below, all three of the correlations are significant at the p = .001 level.

	N	Corr.	Sig.
CNSE Time 1 & CNSE Time 2	17	.893	<.000
CNSE Time 2 & CNSE Time 3	17	.819	<.000
CNSE Time 1 & CNSE Time 3	17	.728	.001

Table 2: Paired Samples Correlations

Hypothesis 1 predicts that students participating in a simulated learning environment will adjust their computer networking self-efficacy from the anchor they set for themselves during the period before completing the exercises. Visual inspection of Table 2 shows that the means are changing; however, to ensure the mean differences are statistically significant, a paired samples T-test is used because the observations are not independent. The paired samples T-test results are provided in Table 3 below.

	M	St.D	t	df	Sig. 2-tailed
CNSE Time 1 - CNSE Time 2	-1.86	2.18	-3.00	16	.008
CNSE Time 2 - CNSE Time 3	-0.53	1.77	-1.23	16	.236
CNSE Time 1 - CNSE Time 3	-2.12	2.55	-3.43	16	.003

Table 3: Paired Samples Test

Support for Hypothesis 1 would require a statistically significant difference between Time 1 and Time 2, which is indeed the case (t=3.00, p=.008). Thus, Hypothesis 1 is supported.

Hypothesis 2 predicts that students will once again adjust their computer networking self-efficacy between times 2 and 3. Using a similar paired samples T-test, this hypothesis does not receive support (t=-1.23, p=.236).

Hypothesis 3 predicts that the combined effect on computer networking self-efficacy will be greater than either of the other adjustments. Said another way, students will change their self-efficacy in only one way. Visual inspection of the means shows that students increased in their self-efficacy over time, even though this was a review activity. For each step, the mean did increase, without any retreating effect.

Hypothesis 4 predicts that students that perceive simulated environments to be realistic will be more able to transfer their knowledge to the physical world. To help us measure the effect and remove measurement error simultaneously, this hypothesis is tested using Partial Least Squares Structural Equations Modeling (PLS-SEM). Because of the small sample size, a simple model must be used to provide enough power to detect any effects. With realism predicting transferability, 44.8% of the variance in transferability was explained by students' perceptions of realism. The standardized path coefficient is 0.669 (t=5.25, p<.001). Thus, Hypothesis 4 is supported.

We further explored the data to discover attitudes about Packet Tracer and the physical equipment. Students reported whether they strongly disagreed (1) or strongly agreed (7) that they were easy to use on a 7-point Likert scale. Packet Tracer was rated as easy to use (M=6.00, SD=0.80). The physical equipment was rated slightly less easy to use (M=5.67, SD=1.00). A paired T-test found no significant difference between the ease of use of Packet Tracer and the physical equipment (t=1.04, p=.31).

The usefulness of Packet Tracer to improve computer networking abilities was likewise measured. There was strong agreement that Packet Tracer was useful (M=6.25, SD=0.67).

Qualitative Data Analysis

Student responses to open ended questions were analyzed for trends in the responses. First, students were asked what differences they found between using Packet Tracer and the physical networking equipment. Several students noted that cabling the equipment differed substantially in the two environments. Students generally found that it was more difficult to make configuration changes to physical equipment than the equipment in Packet Tracer. Several students noted that it was faster to work in Packet Tracer because there was no need to reset the hardware configuration prior to use. Resetting the configuration for physical equipment is necessary to ensure that previous lab exercises did cause configuration conflicts. Differences in cabling were frequently mentioned. With physical equipment, students needed to ensure that power cables were attached—a step not needed when using Packet Tracer. Though the results generally conveyed the idea that exercises were easier in Packet Tracer, one student said, "Packet Tracer sometimes gives you too many options and makes it easy to slip up." Another student remarked, "The most obvious thing I noticed was you are not handling physical equipment. There is something a lot different handling physical equipment than packet tracer. You don't have to

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physically cable anything in packet tracer like you do with physical equipment."

Students were asked to describe things that make it difficult to apply the skills learned in Packet Tracer to physical networking equipment. Several students mentioned that cabling is easier in Packet Tracer. In Packet Tracer, it is impossible to plug a cable into a port without specifically choosing the port. With physical equipment, some students tended to plug a cable into open ports that did not necessarily match the exercise instructions. Differences in cabling was by far the most common response. It was also more difficult to access the configurations using physical equipment.

Students were asked which parts of Packet Tracer they found most confusing that were unique to Packet Tracer. Few themes were consistent across multiple responses. Finding objects, lack of clear labels on icons, difficulty cabling, and finding ports were all mentioned but not consistently. One surprising comment was that Packet Tracer is "not hands on and makes it more confusing." Several students reported that nothing was confusing about Packet Tracer specifically.

Students were asked, "What parts of the physical Cisco networking equipment do you find most confusing?" The most common response by far were cabling followed by accessing the equipment configuration and command syntax. Having to switch the console cable from the configuring laptop to the network device causes confusion, especially when working with multiple devices.

6. DISCUSSION

In trying to make sense of the results, the non-support of Hypothesis 2 presents a conundrum. From qualitative data, students could tell the difference between the simulated and physical environments. The self-efficacy increases, but there is not enough power to determine that the difference is greater than chance. One possible explanation is that students' confidence increases with each interaction with networking. Simulation is good enough to create a statistically significant difference in students' self-efficacy in this study. While there was another increase in students' computer networking self-efficacy with physical hardware, we could not ensure it was not due to chance. This could be an artifact of the small sample size for this study.

The results support the use of simulations and physical networking equipment to teach computer networking. However, the results cannot be used to unambiguously determine whether computer networking can be taught using either method alone. Our experience teaching networking classes in years prior to the outfitting of a lab with physical networking equipment tells us that physical equipment is important. Network simulations were adopted at our university after the physical equipment. Together, the technologies complement each other very well. Many institutions do not have physical lab spaces, or perhaps teach classes online where physical colocation is not possible. In such cases, network simulation software is likely the primary vehicle for teaching computer networking. Based on our history of teaching with no technology support (physical or simulated), physical, and simulated, we feel that all are necessary. The data in the current study supports the notion that the physical computer networking equipment augments network simulation training. Though the simulated and physical environments may be perceived as similar by an experienced practitioner, novices are likely to be more sensitive to interface differences. We believe that for students to be well prepared to work with computer network equipment, some hands-on experience with physical equipment is invaluable.

7. LIMITATIONS

Time to complete the exercise was not measured because of key differences between the simulated and physical environments. For example, accessing a switch's configuration in Packet Tracer only requires that a learner click on the switch icon in the workspace, and open the command line interface tab. Accessing the same configuration with the physical equipment requires that learners connect a USB adapter, determine the COM port of the USB adapter in the Windows Device Manager, launch PuTTY, enter the connection information in PuTTY and open the connection. Future studies could control for those differences to measure time to completion.

Due to sample size limitation, a within-subjects quasi-experiment was used. In the future, it would be helpful to randomly assign students to SBT or no-SBT conditions prior to the physical exercise to more direct assess the impact of SBT.

8. CONCLUSIONS

Simulations can be a powerful tool for effective computer network training. In the current study, we demonstrated how Packet Tracer can augment physical networking exercises to teach computer

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networking skills. Data from the study shows that while Packet Tracer does help student perform better when using physical hardware, instructors must work with learners to bridge several key gaps. Learn perceptions of simulation realism were highly correlated with perceived skill transference.

In a report on instructional games, Hays (2005) suggests that games must be part of a larger instructional program. Learners should be aware of simulation exercise learning objectives, otherwise knowledge gained in the exercises can stay there (Tobias & Fletcher, 2007). In the context of computer networking, we believe that network simulations should exist to augment, not replace working with physical networking equipment. Unique benefits to each method exist to support learning.

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Appendices and Annexures

Appendix A – Survey Measures

Qualitative Survey Items

- What differences do you find between the using Packet Tracer and the physical Cisco networking equipment?
- Describe things that make it difficult to apply the skills you learn in Packet Tracer to physical networking equipment.
- What parts of Packet Tracer do you find most confusing that are unique to Packet Tracer (not physical networking equipment)?
- What parts of the physical Cisco networking equipment do you find most confusing?

Quantitative Survey Items

All items were measured on seven-point Liker scales unless otherwise noted, with 1 = strongly disagree and 7 = strongly agree.

Computer Networking Self-efficacy (Adapted from Taylor & Todd, 1995)	In this context, building a network for a small building includes the configuration of client devices, a switch and a router. Switch configuration includes basic security, VLAN creation, and spanning-tree protocol selection. Configuration of the router includes basic security, interface configuration, and OSPF configuration.	
	CNSE1	I feel comfortable creating a network for a small building on my own.
	CNSE2	If I wanted to, I could easily create a network for a small building on my own.
	CNSE3	I can create a computer network for a small building even if no one is around to help me.
Perceive Ease of Use – Packet Tracer (Adapted from Venkatesh & Davis, 1996)	EUPT1	My interaction with Packet Tracer is clear and understandable.
	EUPT2	I find Packet Tracer to be easy to use.
	EUPT3	I find it easy to get Packet Tracer to do what I want it to do.
Perceived Ease of Use – Physical Equipment (Adapted from Venkatesh & Davis, 1996)	EUPE1	My interaction with physical network equipment is clear and understandable.
	EUPE2	I find physical network equipment to be easy to use.
	EUPE3	I find it easy to get physical network equipment to do what I want it to do.
Simulation Realism (Adapted from Feingold, Calaluce, & Kallen, 2004)	SR1	Packet Tracer resembled a real physical network environment.
	SR2	Packet Tracer provided a realistic networking environment.
Perceived Usefulness of SBT (Adapted from Venkatesh & Davis, 1996)	PU1	Using Packet Tracer would improve my performance in learning computer networking.
	PU2	Using Packet Tracer in computer networking would increase my computer networking abilities.

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	PU3	Using Packet Tracer would enhance my effectiveness in learning computer networking.
	PU4	I find Packet Tracer would be useful to learn computer networking.
Transferability (Adapted from Feingold et al., 2004)	T	Packet Tracer prepared me for real a real physical networking environment.

