

# Student Satisfaction and Learning Outcomes in E-Learning:

## An Introduction to Empirical Research

Sean B. Eom  
*Southeast Missouri State University, USA*

J.B. Arbaugh  
*University of Wisconsin Oshkosh, USA*

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# Chapter 11

## Measuring Success in a Synchronous Virtual Classroom

**Florence Martin**

*University of North Carolina Wilmington, USA*

**Michele A. Parker**

*University of North Carolina Wilmington, USA*

**Abdou Ndoye**

*University of North Carolina Wilmington, USA*

### ABSTRACT

*This chapter will benefit those who teach individuals using the synchronous virtual classroom (SVC). The SVC model will help instructors design online courses that incorporate the factors that students need to be successful. This model will also help virtual classroom instructors and managers develop a systematic way of identifying and addressing the external and internal factors that might impact the success of their instruction. The strategies for empirically researching the SVC, which range from qualitative inquiry to experimental design, are discussed along with practical examples. This information will benefit instructors, researchers, non-profit and profit organizations, and academia.*

### INTRODUCTION

In the recent decade technology has significantly enhanced education and online courses are increasing in popularity and credibility. In 2008, the Sloan consortium reported that 3.9 million (over 20%) students in the U.S., were taking at least one online course. In just one year, from 2006 to 2007, there was a 12.9% increase in online enrollment (Allen & Seaman, 2008); an increase of 400,000

students. The reason for this growth is that online courses offer “anytime,” “anywhere” learning which provides flexibility and convenience for students and instructors. However one of the major challenges that distance educators still face in designing effective online courses is including interactivity (Muirhead, 2004; Keefe, 2003). One of the ways this challenge has been addressed is through the use of synchronous virtual classroom technology.

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## Synchronous Virtual Classrooms

Synchronous Virtual classrooms are online environments that enable students and instructors to communicate synchronously using text chat, audio, and video. They enable faculty and students to interact as if they were face-to-face in a classroom by permitting instructors and students to share presentations on an interactive whiteboard, express emotions through emoticons, participate in group activities in break out rooms, etc. Synchronous Virtual Classrooms are software applications that bring human interaction into the virtual classroom through facial expressions, vocal intonations, hand gesticulation, and real-time discussion (Wimba, 2009a).

There are a variety of synchronous virtual classrooms (Adobe Connect, Saba Centra, Elluminate Live, Horizon Wimba, Dim Dim, Learn Linc, Microsoft Live Meeting, Webex, Wiziq, etc.). They are also referred to as synchronous learning systems or collaborative electronic meeting rooms (Table 1).

Virtual Classroom features can be grouped into three categories based on their application: (1) discussion and interaction facilitated by break-out rooms, emoticons, chats, videos, presentations,

polls, quizzes, and surveys; (2) instruction and reinforcement implemented through the electronic whiteboard, application sharing, and the content area; and (3) classroom management tools that include the ability to upload and store documents, an auto-populated participant list, usage details, and archive options. The software can be integrated into course management systems such as Blackboard. Additionally, it accommodates diverse learners (e.g. it is accessible to the hearing and visually impaired) and types of learning (e.g., auditory, visual, tactile). There is also a telephone number for participants to dial-in, which increases its reach/functionality (Wimba, 2009b).

## Advantages of Synchronous Virtual Classroom Technologies

Researchers have found that one of the major challenges in online education is including interactivity (Muirhead, 2004; Keefe, 2003). This need for interaction has resulted in developing guidelines for online courses. Adding synchronous components to online courses can enhance meaningful interactions (Repman, Zinskie & Carlson, 2005). With the introduction of virtual classroom technologies in the market, there is a cost-effective synchronous delivery in online courses which were initially made possible only with video conferencing technologies.

Student-Student interactions and Student-Instructor interactions both provide the learner with guidance and support. Students feel the need to be part of a learning community where they feel involved and have a social presence. They are motivated by receiving immediate feedback from the instructor as well as their peers. Collis (1996) lists motivation, telepresence, good feedback and pacing as the four major advantages of using synchronous systems. Park and Bonk (2007) list the following as the major benefits of using a virtual classroom: providing immediate feedback, encouraging the exchange of multiple perspectives, enhancing dynamic interactions

Table 1. Synchronous virtual classroom products

Product	Website
Adobe Connect	<a href="http://www.adobe.com/products/acrobatconnectpro/">http://www.adobe.com/products/acrobatconnectpro/</a>
Saba Centra	<a href="http://www.saba.com/products/centra/">http://www.saba.com/products/centra/</a>
Elluminate Live	<a href="http://www.illuminate.com">www.illuminate.com</a>
Horizon Wimba	<a href="http://www.horizonwimba.com">www.horizonwimba.com</a>
Dim Dim	<a href="http://www.dimdim.com/">http://www.dimdim.com/</a>
LearnLinc	<a href="http://www.ilinc.com/products/suite/learnlinc">http://www.ilinc.com/products/suite/learnlinc</a>
Microsoft Live Meeting	<a href="http://office.microsoft.com/en-us/livemeeting/">http://office.microsoft.com/en-us/livemeeting/</a>
Webex	<a href="http://www.webx.com">www.webx.com</a>
Wiziq	<a href="http://www.wiziq.com/">http://www.wiziq.com/</a>

among participants, strengthening social presence, and fostering the exchange of emotional supports and supplying verbal elements.

## **MEASURING SUCCESS IN ONLINE EDUCATION**

A number of factors contribute to the success of online courses. Phipps and Merisotis (2000) provided a comprehensive list of benchmarks for measuring success in internet based online courses. The benchmarks include Institutional support, Course development, Teaching/Learning Success, Course structure, Student support, Faculty support, Evaluation, and Assessment. Meanwhile, Lockee, Moore, and Burton (2002) presented evaluation strategies for measuring success in distance education, which consist of Program inputs, Performance outcomes, Attitude outcomes, Programmatic outcomes, and Implementation concerns. Implementation of these factors varies depending on whether or not an online course is taught asynchronously or synchronously. Consistent with the benchmarks and strategies provided above, the success of online education concerns many aspects, some related to student learning and achievement, others related to learning environment and delivery method. All of these factors aim to contribute to the ultimate outcome which is student learning and achievement. Consequently, any assessment of distance learning needs to take into account the many different aspects and how they interact to produce the ultimate outcome.

While scholars (Rovai, 2000; Moallem, 2009a) argue that assessment principles for online education should not be different than face-to-face education, there is common agreement that implementation and focus may differ. Factors such as delivery vehicle and learner technological skill, learner interaction, engagement, and identity might be key factors in an online course assessment but less in a traditional face-to-face course.

While any education program will be impacted by its environment (Moallem, 2009a), a differentiating characteristic of online education is that it involves a number of logistical, organizational, or infrastructural factors that need to work together to impact a great deal of its success. For example, while poor technical support or lack of communication between technical support and instructional staff may impact traditional course delivery, these same factors will definitely have a more devastating impact on online education. Furthermore, the flexibility to make adjustments and corrections in the middle of instruction and the visual cues available to instructors of face-to-face courses is not as readily available to online education instructors, who consequently need to carefully assess each phase of an online education program or course (from design, to development, etc.) upfront in order to guarantee success. The Quality Matters initiative is a good example of this characteristic of online education (QualityMatters, 2010). These factors make measuring the success of online education more challenging and complex than traditional education programs.

Regardless of the model or evaluation strategies used, measuring the success of online education should be based on an ongoing, integral, and continuous approach (Moallem, 2009b) in order to address the challenges raised by the lack of face-to-face interaction. Measuring the success of online education will also have to take into account learner characteristics and attitudes towards the delivery system, learning environment, and ongoing communication between instructors and students, through immediate feedback. In a study of assessment practices for online courses, Kim, Smith, and Maeng (2008) reported that immediate feedback, self assessment, and team and peer assessment are some of the main features that could be easily integrated as unique features of online education assessment. While these features can be available in a traditional course, they might be easier to implement in an online course or program. Commenting on the importance and

effectiveness of immediate feedback in online education, versus the more likely delayed feedback in traditional courses, Kim, Smith and Maeng (2008) said “Compared to the traditional instruction environment, the online learning environment made this central role of feedback achievable in terms of time and access to information”(p.18). Researchers have investigated the online education success prediction model based on the learner attitude, characteristics, and background (Hall, 2008; Roblyer & Davis). Understanding these factors will only help make our efforts to measure success of online education more valuable and integrated so that online education can be better tailored to learners’ needs. In other words, the online education effectiveness model needs to be based on a systemic approach that integrates multiple dimensions centered on a student and instructor centered approach.

## **MEASURING SUCCESS IN SYNCHRONOUS VIRTUAL CLASSROOM**

In this section, we examine measures of success in synchronous online education using the dimensions (human, design, and non-human) provided by the editors, Eom and Arbaugh. In the next section we propose a conceptual model for an effective synchronous online class and strategies for researching the SVC.

### **Human Dimension**

Human interaction is the key for success in any classroom, both face-to-face and online. In an asynchronous online setting, the human element might be missing or at times minimal, whereas in a synchronous online setting, such as the virtual classroom, the human element is significant and adds to the success of the class. Bandi-Rao, Holmes and Davis (2008) discuss ways to maintain the human element in an online college writing

class. Rodriguez and Nash (2004) conclude that the area where technology and humans intersect proves to be most critical to the success and quality of adult degree programs. Garrison, Anderson and Archer (2000) introduced a model of community inquiry that constitutes three elements essential to an educational transaction - cognitive presence, social presence, and teaching presence. They listed defining and initiating discussion topics, sharing personal meaning, and focusing discussion as the indicators for measuring teaching presence in an asynchronous text-based communication. The human elements that contribute to the success in a synchronous virtual classroom can be categorized into three groups – Instructor, Students, and Technology Support.

### **Instructor**

- Subject matter knowledge
- Setting clear goals and objectives
- Engagement and facilitation skills
- Readiness and preparedness to using technology

Being an expert in the subject matter, setting clear goals and objectives for the class, engaging the students, readiness, and preparedness to technology are some of the characteristics that are seen in effective teachers/instructors. While these are necessary skills for any instructor, the instructor’s engagement, facilitation skills, and preparedness to delivery method play a major role in an online class. Due to a shift to online education, the instructor’s role has become more of a facilitator than a traditional lecturer. The instructor in the virtual classroom setting has more opportunities to lecture and interact with students compared to an instructor in an asynchronous online setting. However, the level of interaction is different from being in a traditional face-to-face class as the students are separated by distance. Even if video conferencing with web cameras is used, it is still difficult to perceive the feelings

of the students during the entire synchronous online session. Thus, the instructors' engagement and facilitation skills are very important in a synchronous classroom. Instructors' have to be proficient to use the virtual synchronous technology. Their preparedness in using the technology plays an important role in the success of the class. Instructors who are proficient in the synchronous technology are able to overcome minor technological glitches that they might encounter during an online session. However, others who are not proficient with technology may be nervous about using synchronous technologies, or if they do try they may be discouraged if their first attempts are unsuccessful. Instructors also need to model for their students demonstrating how to communicate efficiently and effectively using synchronous communication tools.

### Students

- Motivation
- Readiness and preparedness to delivery method

Just as an instructor has to make adjustments and be ready to teach in a synchronous setting, the students also have to be prepared for the changing demands related to online learning with respect to technology, pedagogical practices, and social roles. Vonderwell and Savery (2004) examine and discuss student roles and responsibilities for learning online and strategies to promote student readiness. Students usually take an online class because of the "anytime" and "anywhere" convenience it offers. They tend to sign up for the asynchronous courses where they can work at their own pace. However, learners may not feel obligated or pressured to participate in online communications when they do not see each other (Palloff & Pratt, 1999).

Students have to be motivated to enroll in an online or blended course that requires synchronous meetings. While adult learners may

respond to external motivators such as increased pay and rewards, internal motivators such as job satisfaction and self-esteem are more important in providing them with a reason to learn (Fidishun, 2010). If these motivators can be integrated within technology-based instruction, adults will respond more positively. Enrolling in an online synchronous course makes the learner take an active role and participate in the synchronous sessions. Students who participate in the synchronous virtual setting also have to be prepared to use the synchronous technology. They have to become proficient in the use of the virtual classroom to participate completely in the synchronous virtual class. An instructor can encourage student readiness by designing experiences where the student will encounter a need for the knowledge or skill presented (Fidishun, 2010). Parasuraman (2000) proposed a Technology Readiness Index (TRI), which measures the propensity to embrace and use new technologies for accomplishing goals in home life and at work. The TRI identifies four dimensions of technology beliefs that impact an individual's level of techno-readiness. Two of the technology adoption dimensions are contributors (optimism and innovativeness), and the other two are inhibitors (discomfort and insecurity). A study conducted at Educause found that students rarely attribute technology related learning problems to their own limitations but rather to limitations on the part of the professor (ECAR, 2007).

### Technology Support

- Training Available
- Troubleshooting Support

Most of the synchronous online classrooms have technology support available on hand to troubleshoot. Technology support is also available for students and instructors before they decide to participate in the synchronous class. There is training that is available to the students ahead of time to help them be confident when they participate

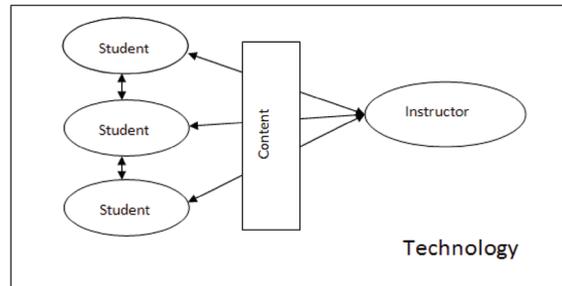
on their own. Instructors are given an opportunity to attend training sessions to prepare themselves for virtual synchronous setting. Some instructors may also have technology support available if they teach the synchronous classes online from an on campus computer. Though most of the students login to the synchronous virtual classroom from the comfort of their own homes or from a different place other than the university, they may have access to technology support through phone or chat. Instructors are also encouraged to have technical support teams present at tutorial sessions. Technology support should also be available to answer emails or respond to telephone inquiries. Before the virtual sessions, the instructor should know who is responsible to provide technical support and share this information with students (Berge, 1995).

## Interaction

- Instructor-to-student interaction
- Student-to-student interaction
- Interaction with content

Interaction is a vital component of online learning, and Northrup (2002) summarizes interaction as engagement in learning. Moore (1989) devised three different types of interaction learner-content interaction, learner-instructor interaction, and learner-learner interaction. Moore describes learner-content interaction as the defining characteristics of education as it is this process of intellectually interacting with the content that changes the learner's understand, perspectives and cognitive structures of learners mind. The learner-instructor interaction is highly desirable as the instructor seek to stimulate or at least maintain the student's interest in what is to be taught and motivate the student to learn. The learner-learner interaction, a challenging aspect in distance education is however extremely valuable resource for learning. This could include one-one interaction, group interaction with or without the presence of

*Figure 1. Interaction within synchronous virtual classrooms*



the instructor. Hillman, Willis and Gunawardena (1994) introduced the fourth type of interaction, interaction with technologies. They present the concept of learner-interface interaction and recommend instructional design strategies that will facilitate students' acquisition of the skills needed to participate effectively in the electronic classroom (Figure 1). Fullford and Zhang (2003) found that perceived level of interaction and satisfaction appears to decline with increased exposure to interactive instructional television. In the virtual classroom, students can interact with each other, with instructors, and with online resources. Both instructors and students can act as facilitators and provide support, feedback, and guidance during live interaction (Khan, 2000).

## Design Dimension

The design elements that contribute to the success of the synchronous virtual classroom are instructional design and instructional strategies.

## Instructional Design

- Course structure: Aligned objectives/content/assessment)
- Systematic instructional design models
- Pre-planned instruction

Instructional Design is a system of developing well-structured instructional materials using

objectives, related teaching strategies, systematic feedback, and evaluation (Moore & Kearsley, 1996). It can also be defined as the science of creating detailed specifications for the design, development, evaluation, and maintenance of instructional material that facilitate learning and performance. The design process is important when creating well aligned and effective instruction which in turn helps ensure having an effective virtual synchronous session. Instructional material that is aligned with the course goals and objectives, with practice activities and room for immediate feedback, have to be designed ahead of time. Unlike in a face-to-face class where spontaneous instruction can be delivered, in a virtual setting pre-planned instruction turns out to be more effective and successful. Assessment items that are aligned with the objectives have to be designed, which this helps measure student learning. There are numerous instructional design models that can be used for the design process (eg., Dick and Carey Model, Morrison, Ross and Kemp Model, ASSURE Model, Rapid Prototyping Model, etc.).

### **Instructional Strategies**

- Interactive PowerPoint's to stimulate meaningful discussion
- Collaborative activities through breakout rooms
- Web search activities through external Web Links
- Desktop sharing for student presentations
- Interaction through text and audio chats, polling, emoticons

Instructional strategies play an important role in the synchronous virtual classroom. Researchers have identified instructional strategies that work in the classroom. Marzona, Pickering and Pollock (2001) in their book "Classroom instruction that works," list eight different instructional strategies. Pitt (1996) identified ten instructional strategies for online learning (e.g., discussion, case study,

collaborative learning, etc.). Instructional strategies for online learning have to be thought through ahead of time as it is cumbersome to decide on spontaneous activities. Interactive Powerpoints have to be designed and loaded into the virtual classroom that can guide meaningful class discussion. Web links that can be shared with the students have to be readily available. Students can further explore these websites and participate in activities pertaining to them. Periodic desktop sharing gives the students an opportunity to demonstrate their own work. Breakout rooms make it possible for small group activities in the virtual classroom. Interaction can also be enhanced through private and public text, audio chats, frequent polling, and the use of emoticons.

### **Technology Dimension**

The technology elements that contribute to the success of the synchronous virtual class are technology access and features.

#### **Technology Access**

- Availability
- Uninterrupted access
- Easy set up and easy to use

Technology access is an important characteristic in order for the student and instructor to effectively participate in a synchronous virtual setting, especially in higher education. Unless the system is already available to them through the university, free of cost, instructors will not attempt to participate in it. Currently there are a few online synchronous systems such as Wiziq and DimDim that instructors can use free of cost; however, they do have limited functionality compared to the proprietary products. Students and instructors choose to use virtual classroom technology once they realize that it is a stable platform for the class to function without having to be disconnected multiple times, and this is made

possible with the advanced bandwidth available these days. A system that has easy set up without complex installation is also important. Finally, it has to be a user friendly system that any instructor or student can learn without extensive training.

## Features

- Content Frame
- Eboard
- Breakout rooms
- Text/audio chat
- Polling feature
- Emoticons
- Application sharing
- Archive feature

The features available in the synchronous virtual classroom also play an important role in the success of the class. Most of the virtual classroom technologies have a content frame to share the instructor's Powerpoints, an eboard where an instructor can write, breakout rooms for group activities, text chat for the instructor and other students in the class to interact, and audio chat to talk via a microphone or telephone with the instructor and other students. There are also features where students can share their feelings using emoticons. Instructors can administer student polls, share their desktop, or have the students share their desktops through application sharing. Websites can be displayed for students, and with the stable internet bandwidth, webcams can be used where students and instructors can see each other. The entire virtual classroom session can be archived, which the students can view later. In the latest versions, students can download the archived class sessions as an MP3 or MP4 file. Students with audio difficulties also have back up telephone numbers to dial in. Instructors have the ability to restrict or provide students with access to the eboard, share their web cam, or to talk via the microphone.

## SYNCHRONOUS VIRTUAL CLASSROOM (SVC) SYSTEMIC MODEL

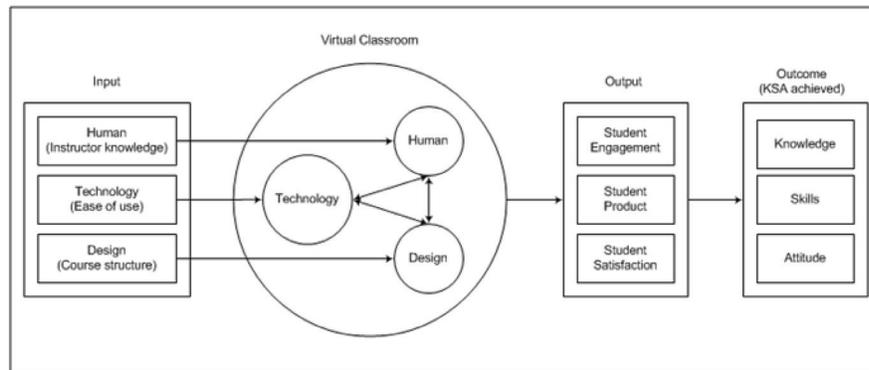
This proposed model will be based on systems theory. Each of the three dimensions of the model is depicted as a subsystem. These subsystems are interconnected (human, technology, and design). For each subsystem there are specific inputs that contribute to the learning process within the virtual classroom. The outputs (student engagement, student product, and student satisfaction) are the tangible products resulting from course activities. They serve as evidence of progress towards the learning outcomes which are the changes in new knowledge, skills, and attitude occurring as a result of taking a course, on any topic or discipline, in a virtual classroom setting.

*Student engagement* in the virtual classroom can be looked at in many different ways. Viewing chat transcripts or listening to the archive to see how interactive the student has been both in the main room and even in the breakout rooms during collaborative activities is one way it can be achieved. It can also be measured by their participation through answering or asking questions while employing the various virtual classroom features such as the raising of hands or responding using emoticons. Student engagement can also be assessed by student responses to the polling features that instructors might use periodically in the classroom to maintain interactivity. Engagement can also be measured from student presentations, which can be shared using desktop sharing functionality.

*Student Products* are direct evidence of the learning that happens in the virtual class session. These could include student artifacts such as presentations (e.g., individual and collaborative) or other group work products (e.g., writing papers, designing rubrics, developing an argument, analyzing a case).

*Student Satisfaction* is the natural consequence of student engagement and student products.

*Figure 2. Synchronous virtual classroom systemic model*



This, too, can be measured in different ways. You can periodically poll students to measure their satisfaction by asking targeted questions on course content, course progress, etc. A web link with brief surveys can be pushed out through the virtual class room to receive immediate feedback on student satisfaction. Students can also respond to questions orally or via the text chat feature. The challenge here is that most of the functionality does not allow the user to maintain anonymity.

The outputs (student engagement, student products, and student satisfaction) mentioned above, constitute evidence that the instructor might use to evaluate or assess student progress towards final course outcomes. For example, students' presentation can give an instructor feedback on how well students are moving closer or farther away from learning a new concept. These outputs could be in different types in the form of body of knowledge (e.g., theoretical concept), skill (e.g., ability to use a development tool) and attitude, (e.g., reaction to technology).

## **STRATEGIES FOR EMPIRICALLY RESEARCHING THE SVC**

Scholars use a progression of research methods to build on previous knowledge in order to advance the field (Stanovich & Stanovich, 2003). The progression from descriptive techniques to

those that allow stronger causal inferences enable researchers, policymakers, designers, and adopters to be certain of the relative value of the innovation (Bernard, et al., 2004). Following this logic, the SVC can be examined using a variety of research methods such as case studies, survey research, and correlational studies. Collectively this information can be used to design a comparative study that tests the SVC model. "It is only under these circumstances that we can push forward our understanding of the features of distance education and classroom instruction that make them similar or different" (Smith & Dillon, 1999 as cited in Bernard et al., 2004, p. 382).

Qualitative research (e.g., case studies, narratives, etc.) can be useful in the early stages of an investigation because they lay the groundwork and help researchers identify directions for future studies (Gersten, 2001). Qualitative studies can help us understand the phenomena of interest, in this case the SVC model. This may involve interviewing (individuals or groups), conducting observations within the Virtual Classroom, reviewing archived sessions, or administering open-ended surveys to instructors and students who use this media. In a recent study McBrien, Jones, and Cheng (2009) used an open-ended survey to collect qualitative data from 80 students on their experiences in the virtual classroom. This yielded six themes related to dialogue, structure, convenience, technical issues, pedagogical preferences, and learner au-

tonomy. Meanwhile, Kirkpatrick (2010) uses a case study to assess the pedagogical value of the chat-feature in a virtual class. Similarly, Hennessy, Deaney, Ruthven, and Winterbottom (2007) use a case study to understand how pedagogy is developing in response to interactive white boards. These authors demonstrate how qualitative investigations can yield thick description that help us conceptualize variables by drawing attention to unrealized aspects or sharpen our understanding of participant's perspectives (Stanovich & Stanovich, 2003) as they relate to different dimensions of the model.

The dimensions of the SVC model can also be examined by using quantitative methods that draw information from larger samples. This corresponds with Stanovich and Stanovich's (2003) recommendation to shift from qualitative methods of inquiry to other designs in order to establish a convergence of evidence. Quantitative methods include the use of attitude scales and surveys. For example, Liaw, Huang, and Chen (2007) used a survey they developed on learner attitudes toward e-learning. In comparison, some researchers combine existing scales in one questionnaire (Tung & Deng, 2007; Rovai & Wighting, 2005) for their studies or they use an existing scale and add their own questions (Cameron, Morgan, Williams, & Kostecky, 2009). Notwithstanding, any instrument albeit an existing scale, modified, or newly developed should be valid and reliable. Reliability coefficients should be at least .70 to be considered acceptable (Nunnally, 1978). While there are different forms of validity, construct validity is by far the most important (Gay, Mills, & Airasian, 2006). For instruments where validity has not been established exploratory factor analysis can be conducted to validate constructs. In subsequent uses of the instrument confirmatory factor analysis can be used. In each instance, internal-consistency reliability analysis can be used to determine the reliability of the scales. Scales that correspond with the attributes in the SVC model will need to be identified, revised, or created.

Correlational designs can be used to understand the degree to which variables in the SVC model are related and their statistical significance. Basic correlational designs involve bivariate correlations or linear regression. Correlational designs become increasingly complex with additional variables. Advanced correlational techniques such as multiple regression, path analysis, and structural equation modeling allow the researcher to examine multiple variables simultaneously and allow for the partial control of other variables. An example of a correlational study is Liaw, Huang, and Chen's (2005) research on instructor and learner attitudes toward e-learning in China. They use correlations and stepwise multiple regression. In terms of specific variables they use perceived self-efficacy, usefulness, enjoyment, and behavioral intention to use e-learning to predict instructor's attitudes. Another multiple regression is performed using other variables to predict learner attitudes. Scholars have used a variety of correlational techniques such as canonical correlations and ordinary least square regression analysis to examine technology and learners (Rovai & Whiting, 2005; DuFrene, Lehman, Kellermanns, & Pearson, 2009).

Path analysis and structural equation modeling may be especially helpful in testing the SVC model because of its many facets (human, technology, and design dimensions). Path analysis allows the researcher to examine variables that can be measured, while the latter incorporates latent variables (those that cannot be measured directly). However, in both instances diagrams are used to depict the model and software such as AMOS or LISEREL can be used to test variables in the model (Loehlin, 2004). Although Raaij and Schepers (2008) use PLS (modeling software designed for small samples) they expanded the Technology Assistance Model (TAM2) to explain individual student differences in their level of acceptance and use of virtual learning environments. The constructs in their model were computer anxiety, personal innovativeness, perceived ease of use, perceived usefulness, subjective norms, and in-

tensity of use. Among the results they found no direct effect for ease of use, which corresponded with previous findings.

Typically, correlational studies are high in external validity, but low in internal validity. In contrast, experimental designs are high in internal validity, but low in external validity because of the difficulty replicating experimental conditions in real-life, particularly in educational settings. However, because correlational designs cannot establish causality experimental designs are often used at later stages of theory testing. Experimental designs include which include true experiments, causal comparative and quasi-experimental investigations. Each design has its advantages and disadvantages. Causal comparative designs lack a control and experimental group, whereas quasi-experimental designs lack random assignment. Both of these limitations hinder the ability to establish a causal relation definitely (Stanovich & Stanovich, 2003).

In each of these experimental designs the affect of the *independent variable* (the cause) on the *dependent variable* (the outcome) is examined. In order to establish an effect, the independent variables are isolated through manipulation and everything else is held constant. This coupled with randomization, wherein participants are assigned to a control or treatment group, allows researchers to compare the results from each group to rule out alternative explanations. In doing so, researchers can confirm or disconfirm a causal theory (Stanovich & Stanovich, 2003). Lee and Kang (2005) provide an example of an experiment involving three groups (two instructional groups and a control group). In their study they examine the effectiveness of Intranet-Based instruction on perceived usefulness and achievement. In comparison, Tung and Deng (2007) use a causal comparative design to understand how students of different genders react to dynamic and static emoticons. In both instances, statistical analysis involved Analysis of Variance (ANOVA). Similar

studies can be conducted with various attributes in the SVC model.

Smith and Dillon (1999) argue that comparative studies are only useful when “there is full analysis of media attributes and their hypothesized effects on learning, and when these same attributes are present and clearly articulated in the comparison conditions” (as cited in Bernard et al., p. 382). They suggest that researchers use this level of analysis and provide a clear account of the similarities and differences between treatment and control groups. Stanovich and Stanovich (2003) aptly acknowledge that a well designed experiment may test one or two theories appropriately, but may be poorly designed to test rival theories. Subsequent research may be deemed necessary in order to eliminate some explanations in support of others.

In summary, a case study may generate a hypothesis that can be investigated in further study. To build on the case study a researcher may use a correlational design to verify the link between the variables with a larger sample. Then experimental designs can be employed to confirm or disconfirm causal relationships between variables. With comparative information researchers can eliminate alternative theories and explanations (Stanovich & Stanovich, 2003; Smith & Dillon, 1999). Qualitative research, survey research, correlational studies, and experimental designs all have their strengths and weaknesses. This does not overshadow their utility in educational research. Replication of any design is important, therefore research methodology and findings must be presented in a way that others can conduct the same study and obtain the same results. The body of converging evidence for the SVC model will strengthen the conclusions that can be drawn (Stanovich & Stanovich, 2003). Understanding the nature and extent of the impact of the SVC on important outcomes will give credibility to this instructional method (Bernard et al., 2004).

Concomitantly, in order to advance research of online and blended learning it is recommended that we review and incorporate information from

other disciplines. For example, in the last decade, a vast array of research on online learning has been conducted in business education. By integrating literature in our respective disciplines we can benefit from sharing methodological and analytical approaches, theoretical and conceptual frameworks that explain phenomena, and additional evidence to guide administrators and technicians when they are making decisions regarding the design, emphasis, and implementation of technology based tools such as the SVC (Arbaugh et al., 2009).

## CONCLUSION

This chapter will benefit those who teach using the synchronous virtual classroom. The SVC model provided will help instructors design online courses including the factors that are needed for students to be successful. This model will also help virtual classroom instructors and managers develop a systematic way of identifying and addressing the external and internal factors that might impact the success of their instruction. The strategies for testing this model empirically will benefit instructors, researchers, non-profit and profit organizations, and academia.

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## KEY TERMS AND DEFINITIONS

**Horizon Wimba:** Horizon Wimba Virtual Classroom is a live, virtual classroom with audio,

video, application sharing, and content display. MP4 capabilities provide the option for students to download the Wimba archives in either an MP3 or MP4 audio file format.

**Instructional Design:** Instructional Design is a system of developing well-structured instructional materials using objectives, related teaching strategies, systematic feedback, and evaluation.

**Interaction:** Interaction can be defined as engagement in learning. Four different types of interaction are learner-content interaction, learner-instructor interaction, and learner-learner interaction and learner–system interaction.

**Online Learning:** Learning delivered by Web-based or Internet-based technologies.

**Synchronous Technologies:** Synchronous Technologies are online environments that enable students and instructors to communicate synchronously using text chat, audio, and video.

**Virtual Classroom:** Virtual classrooms are online environments that enable students and instructors to communicate synchronously using text chat, audio, and video. They enable faculty and students to interact as if they were face-to-face in a classroom by permitting instructors and students to share presentations on an interactive whiteboard, express emotions through emoticons, participate in group activities in break out rooms, etc.