Association Supporting Computer Users in Education
"Our Third Quarter Century of Resource Sharing"

Proceedings of the 2022 ASCUE Summer Conference
54th Annual Conference
June 12 – 16, 2022
The 2022 hybrid conference will include online and onsite components.
Web: http://www.ascue.org

ABOUT ASCUE

ASCUE, the Association Supporting Computer Users in Education, is a group of people interested in small college computing issues. It is a blend of people from all over the country who use computers in their teaching, academic support, and administrative support functions. Begun in 1968 as CUETUG, the College and University Eleven-Thirty Users' Group, with an initial membership requirement of sharing at least one piece of software each year with other members, ASCUE has a strong tradition of bringing its members together to pool their resources to help each other. It no longer requires its members to share homegrown software, nor does it have ties to a particular hardware platform. However, ASCUE continues the tradition of sharing through its national conference held every year in June, its conference proceedings, and its newsletter. ASCUE proudly affirms this tradition in its motto: "Our Third Quarter Century of Resource Sharing"

ASCUE's LISTSERVE

Subscribe by visiting the site http://groups.google.com/a/ascue.org/group/members and follow the directions. To send an e-mail message to the Listserve, contact: members@ascue.org Please note that you must be a subscriber/member in order to send messages to the listserve.

NEED MORE INFORMATION

Direct questions about the contents of the 2022 Conference to the chair: Elif Gokbel, Thomas Jefferson University,901 Walnut St, Philadelphia, PA 19107, 215-955-1533, conference@ascue.org, Web: http://www.ascue.org

Association Supporting Computer Users in Education

ASCUE 2021-2022 Board Members

(years remaining in office including current year)

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We're excited to announce that our 2022 Keynote Speaker will be Dr. M.J. Bishop!

ABOUT M.J.

Dr. M.J. Bishop joined the University of Maryland Global Campus as vice president of Integrative Learning Design in April 2022. In that role, she leads the Digital Teaching and Learning team. **Dr. Bishop** was Associate Vice Chancellor and inaugural director of the University System of Maryland's William E. Kirwan Center for Academic Innovation, which was established in 2013 to create a collaborative culture of academic innovation that catalyzes new ways of thinking about student success, translates ideas into action, and scales and sustains promising practices. The Kirwan Center leverages the power of multi-institutional collaboration to increase access, affordability, and achievement of high-quality credentials for Maryland students. As Director, Dr. Bishop was leading statewide initiatives in open educational resources, analytics, digital badging, adaptive learning, high-impact practices, academic integrity, and online education. Since coming to the USM in 2013, the Kirwan Center has been awarded grants totaling over $5.6M in support of a variety of initiatives aimed at exploring the role that state-level consortia can play in advancing institutional efforts to improve student success.

Prior to USM, Dr. Bishop was an Associate Professor and Director of the Lehigh University College of Education's Teaching, Learning, and Technology Program where she led the institution's graduate programs in instructional design and technology, taught graduate level courses, and mentored master's and doctoral students. While at Lehigh, Dr. Bishop received several awards for her research and teaching including the 2013 Stabler Award for Excellence in Teaching for leading students to "excellence in their chosen field" as well as "excellence as human beings and as leaders of society." MJ's research interests include understanding the fundamental components and the psychology behind instructional media and delivery systems in order to discover their pedagogical capabilities and limitations and to devise more effective ways to design instructional technologies to enhance learning.

KEYNOTE ADDRESS: ***The New Shape of Learning: Moving Academic Innovation from Peripheral Activity to Mission Critical for Success***

Organizations that do not grow and innovate are doomed to fail due to changes in the surrounding environment including: technology advances, changing demographics, resource restrictions, and the like. Most industries understand this need to be "forever agile" in the face of external challenges and they address it by investing substantial portions of their revenues back into developing and rigorously researching new models of doing business. In this way, research and development (R&D) plays a vital role in the success and sustainability of most major industries, with sectors like healthcare and technology investing more than 10% of their revenues exploring innovations that promise to help them adapt to future external market pressures. But while universities contribute almost 42% of their own resources toward "funded" research for other sectors (like healthcare and technology), higher education is among the only major global industries that does not significantly invest in R&D on its own, core business model. In fact, the very teaching and learning centers engaged in these R&D efforts are among the first to lose funding when budgets are cut.

In this talk, Dr. Bishop will explore what we know about the financial impacts of academic innovation, how academic leaders can enable a culture of experimentation on their campuses, and the critical importance of moving academic innovation from being a peripheral activity to mission critical for success.

ORGANIZATION FOR THE PROCEEDINGS

ASCUE initiated a refereed track for paper submissions to the conference in 2008. In fact, at the 2008 business meeting, the membership approved three different presentation tracks: refereed with 3 blind reviews for each paper, session with paper where the author submits a paper but it is not reviewed, and session without paper where no paper is submitted and only the abstract is included in the proceedings. To reflect this division, we will divide the proceedings into three sections. The first section, up to page 98, will contain the approved refereed papers, the second section, from 99 to 128, will hold the papers from the sessions with paper, and the last section will list the abstracts for the other sessions.

ASCUE BOARD OF DIRECTORS FROM 1967 to 2022

At this conference we celebrate the 53rd anniversary of the founding of ASCUE at a meeting in July, 1968, at Tarkio College in Missouri of representatives from schools which had received IBM 1130 computers to help them automate their business functions and teach students how to use computers. They decided to form a continuing organization and name it CUETUG, which stood for "College and University Eleven-Thirty Users Group." By 1975, many of the member schools were no longer using the IBM 1130, and were requesting to be dropped from the membership lists. At the same time, other small schools were looking for an organization that could allow them to share knowledge and expertise with others in similar situations. At the 1975 business meeting the name was changed from CUETUG to ASCUE which stood for "Association of Small Computer Users in Education," and we opened membership to all institutions that agreed with our statement of purpose. In 2015, we decided that the word "Small" was misleading and changed our name to "Association Supporting Computer Users in Education" with the same acronym.

Our historian, Jack Cundiff, has collected the names and schools of the officers for ASCUE and its predecessor CUETUG for the last fifty years and we have printed these names on the following pages.

ASCUE BOARD OF DIRECTORS FROM 1967 to 1972

	1967-68	1969-70	1970-71	1971-72
President	Ken Zawodny St. Joseph's College	Howard Buer Principia College	Jack Cundiff Muskingum College	Wally Roth Taylor University.
Program Chair	Wally Roth Taylor University	Jack Cundiff Muskingum College	Wally Roth Taylor University	James McDonald Morningside College
Past President	Al Malveaux Xavier, New Orleans	Ken Zawodny St. Joseph's College	Howard Buer Principia College	Jack Cundiff Muskingum College
Treasurer	Howard Buer Principia College	Al Malveaux Xavier University	Al Malveaux Xavier University	Al Malveaux Xavier University
Secretary	John Robinson	Dorothy Brown South Carolina State	Dorothy Brown South Carolina State	Dick Wood Gettysburg College
Board Members	James Folt Dennison University	James Folt Dennison University	James Foit Dennison University	John Orahood U. of Arkansas, LR
At Large	Don Glaser Christian Brothers C.	Don Glaser Christian Brothers	Don Glaser Christian Brothers	N. Vosburg Principia College
Public Relations				Dan Kinnard Arizona Western
Librarian				Jack Cundiff Muskingum College
Equip. Coordinator				
Web Coordinator				
Sponsor Relations Coordinator				
Location:	Tarkio College	Principia College	Muskingum College	Christian Brothers

ASCUE BOARD OF DIRECTORS FROM 1972 to 1976

	1972-73	1973-74	1974-75	1975-76
President	James McDonald Morningside College	Dan Kinnard Arizona Western	T. Ray Nanney Furman University	Larry Henson Berea College
Program Chair	Dan Kinnard Arizona Western	T. Ray Nanney Furman University	Larry Henson Berea College	Jack McElroy Oklahoma Christian
Past President	Wally Roth Taylor University	James McDonald Morningside College	Dan Kinnard Arizona Western	T. Ray Nanney Furman University
Treasurer	J. Westmoreland U. Tenn Martin	J. Westmoreland U. Tenn Martin	Jim Brandl Central College	Jim Brandl Central College
Secretary	Ron Anton Swathmore College	Ron Anton Swathmore College	Harry Humphries Albright College	Harry Humphries Albright College
Board Members	John Orahood U. of Arkansas, LR	Al Malveaux Xavier, New Orleans	Sister Keller Clarke College	Sister Keller Clarke College
At Large	N. Vosburg Principia College	Wally Roth Taylor University	Wally Roth Taylor University	Mike O'Heeron
Public Relations	Dan Kinnard Arizona Western	Dan Kinnard Arizona Western	Dan Kinnard Arizona Western	Dan Kinnard Arizona Western
Librarian	Jack Cundiff Muskingum College	Jack Cundiff Muskingum College	Jack Cundiff Muskingum College	Jack Cundiff Muskingum College
Equip. Coordinator				
Web Coordinator				
Sponsor Relations Coordinator				
Location:	Georgia Tech	Morningside	Furman	Berea

ASCUE BOARD OF DIRECTORS FROM 1976 to 1980

	1976-77	1977-78	1978-79	1979-80
President	Jack McElroy Oklahoma Christian	Harry Humphries Albright College	Fred Wenn Caspar College	Doug Hughes Dennison University
Program Chair	Harry Humphries Albright College	Fred Wenn Caspar College	Doug Hughes Dennison University	J. Westmoreland U. Tenn Martin
Past President	Larry Henson Berea College	Jack McElroy Oklahoma Christian	Harry Humphries Albright College	Fred Wenn Caspar College
Treasurer	William Roeske Houghton College	William Roeske Houghton College	James Foit Central Ohio Tech	James Foit Central Ohio Tech
Secretary	Doug Hughes Dennison University	Doug Hughes Dennison University	Dave Dayton Grove City College	John Jackobs Coe College
Board Members	Dave Dayton Grove City College	Dave Dayton Grove City College	Jan C. King Chatham College	Wally Roth Taylor University
At Large	Fred Wenn Casper College	John Jackobs Coe College	John Jackobs Coe College	Jan C. King Chatham College
Public Relations	Dan Kinnard Arizona Western	Sister Keller Clarke College	Sister Keller Clarke College	Sister Keller Clarke College
Librarian	Jack Cundiff Muskingum College	Jack Cundiff Muskingum College	Jack Cundiff Muskingum College	Jack Cundiff Muskingum College
Equip. Coordinator				
Web Coordinator				
Sponsor Relations Coordinator				
Location:	OK Christian	Albright College	Casper College	Dennison Universit

ASCUE BOARD OF DIRECTORS FROM 1980 to 1984

	1980-81	1981-82	1982-83	1983-84
President	J. Westmoreland U. Tenn Martin	John Jackobs Coe College	Jan Carver Chatham College	Wally Roth Taylor University
Program Chair	John Jackobs Coe College	Jan Carver Chatham College	Wally Roth Taylor University	Dudley Bryant Western Kentucky
Past President	Doug Hughes Dennison University	J. Westmoreland U. Tenn Martin	John Jackobs Coe College	Jan Carver Chatham College
Treasurer	Ron Klausewitz W. Virginia Weslyan	Ron Klausewitz W. Virginia Weslyan	Harry Lykens Mary Institute, St L.	Harry Lykens Mary Institute, St. L.
Secretary	Jan Carver Chatham College	Ken Mendenhall Hutchinson CC, KS	Ken Mendenhall Hutchinson CC, KS	John Jackobs Coe College
Board Members	Dudley Bryant Western Kentucky	Dudley Bryant Western Kentucky	William Roeske Houghton University	William Roeske Houghton University
At Large	Wally Roth Taylor University	Chuck Mcintyre Berea College	Chuck Mcintyre Berea College	Bob Renners Kenyon College
Public Relations	Sister Keller Clarke College	Sister Keller Clarke College	Sister Keller Clarke College	Sister Keller Clarke College
Librarian	Jack Cundiff Muskingum College	Jack Cundiff Muskingum College	Jack Cundiff Muskingum College	Jack Cundiff Muskingum College
Equip. Coordinator				
Web Coordinator				
Sponsor Relations Coordinator				
Location:	U. Tenn Martin	Coe College	Chatham College	Taylor University

ASCUE BOARD OF DIRECTORS FROM 1984 to 1988

	1984-85	1985-86	1986-87	1987-88
President	Dudley Bryant Western Kentucky	Paul Pascoe Vincennes University	Jack Cundiff Horry-Georgetown	Keith Pothoven Central College
Program Chair	Paul Pascoe Vincennes University	Jack Cundiff Horry-Georgetown	Keith Pothoven Central College	David Cossey Union College
Past President	Wally Roth Taylor University	Dudley Bryant Western Kentucky	Paul Pascoe Vincennes University	Jack Cundiff Horry-Georgetown
Treasurer	Harry Lykens Mary Institute, St. L	Harry Lykens Mary Institute, St. L	Maureen Eddins Hadley School Blind	Maureen Eddins Hadley School Blind
Secretary	John Jackobs Coe College	John Jackobs Coe College	John Jackobs Coe College	Dudley Bryant Western Kentucky
Board Members	Keith Pothoven Central College	Keith Pothoven Central College	Robert Hodge Taylor University	Robert Hodge Taylor University
At Large	Bob Renners Kenyon College	Carol Paris Goshen College	Carol Paris Goshen College	Ann Roskow Ister CC
Public Relations	Dough Hughes Dennison University	Wally Roth Taylor University	Wally Roth Taylor University	Wally Roth Taylor University
Librarian	Jack Cundiff Muskingum College	Jack Cundiff Muskingum College	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
Equip. Coordinator				
Web Coordinator				
Location:	W. Kentucky	Vincennet	Myrtle Beach	Myrtle Beach

ASCUE BOARD OF DIRECTORS FROM 1988 to 1992

	1988-89	1989-90	1990-91	1991-92
President	David Cossey Union College	Tom Warger Bryn Mawr College	David Redlawsk Rudgers University	Bill Wilson Gettysburg College
Program Chair	Tom Warger Bryn Mawr College	David Redlawsk Rudgers University	Bill Wilson Gettysburg College	Carl Singer DePauw University
Past President	Keith Pothoven Central College	David Cossey Union College	Tom Warger Bryn Mawr College	David Redlawsk Rudgers University
Treasurer	Maureen Eddins Hadley School Blind	Maureen Eddins Hadley School Blind	Tom Pollack Duquesne University	Tom Pollack Duquesne University
Secretary	Dudley Bryant Western Kentucky	Kathy Decker Clarke College	Kathy Decker Clarke College	Dagrun Bennett Franklin College
Board Members	Kathy Decker Clarke College	Dagrun Bennett Franklin College	Dagrun Bennett Franklin College	Mary Connolly Saint Mary's College
At Large	Ann Roskow Ister CC	Rick Huston South Caolina/Aiken	Rick Huston South Carolina/Aiken	Rick Huston South Carolina/Aiken
Public Relations	Wally Roth Taylor University	Wally Roth Taylor University	Wally Roth Taylor University	Wally Roth Taylor University
Librarian	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
Equip. Coordinator				
Web Coordinator				
Sponsor Relations Coordinator				
Location:	Myrtle Beach	Myrtle Beach	Myrtle Beach	Myrtle Beach

ASCUE BOARD OF DIRECTORS FROM 1992 to 1996

	1992-93	1993-94	1994-95	1995-96
President	Carl Singer DePauw University	Rick Huston South Carolina/Aiken	Mary Connolly Saint Mary's College	Paul Tabor Clarke College
Program Chair	Rick Huston South Carolina/Aiken	Mary Connolly Saint Mary's College	Paul Tabor Clarke College	Carl Singer DePauw University
Past President	Bill Wilson Gettysburg College	Carl Singer DePauw University	Rick Huston South Carolina/Aiken	Mary Connolly Saint Mary's College
Treasurer	Tom Pollack Duquesne University	Tom Pollack Duquesne University	Tom Pollack Duquesne University	Tom Pollack Duquesne University
Secretary	Dagrun Bennett Franklin College	Dagrun Bennett Franklin College	Dagrun Bennett Franklin College	Dagrun Bennett Franklin College
Board Members	Mary Connolly Saint Mary's College	Gerald Ball Mars Hill College	Gerald Ball Mars Hill College	Rick Huston South Carolina/Aiken
At Large	Tom Gusler Clarion University	Tom Gusler Clarion University	Tom Gusler Clarion University	Tom Gusler Clarion University
Public Relations	Don Armel Eastern Illinois U.	Don Armel Eastern Illinois U.	Don Armel Eastern Illinois U.	Peter Smith Saint Mary's College
Librarian	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
Equip. Coordinator				
Web Coordinator				
Sponsor Relations Coordinator				
Location:	Myrtle Beach	Myrtle Beach	Myrtle Beach	Myrtle Beach

ASCUE BOARD OF DIRECTORS FROM 1996 to 2000

	1996-97	1997-98	1998-99	1999-2000
President	Carl Singer DePauw University	Carl Singer(acting) DePauw University	Bill Wilson Gettysburg College	Dagrun Bennett Franklin College
Program Chair	Chris Schwartz Ursuline College	Bill Wilson Gettysburg College	Dagrun Bennett Franklin College	Carol Smith DePauw University
Past President	Mary Connolly Saint Mary's College	Mary Connolly Saint Mary's College	Carl Singer DePauw University	Bill Wilson Gettysburg College
Treasurer	Tom Pollack Duquesne University	Tom Pollack Duquesne University	Tom Pollack Duquesne University	Tom Pollack Duquesne University
Secretary	Dagrun Bennett Franklin College	Dagrun Bennett Franklin college	Tom Gusler Clarion University	Nancy Thibeault Sinclair CC
Board Members	Richard Stewart Lutheran Theological	Richard Stewart Lutheran Theological	Nancy Thibeault Sinclair CC	Fred Jenny Grove City College
At Large	Rick Huston South Carolina/Aiken	Rick Rodger Horry-Georgetown	Rick Rodger Horry-Georgetown	George Pyo Saint Francis College
Public Relations	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College
Librarian	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
Equip. Coordinator				Rick Huston South Carolina/Aiken
Web Coordinator				
Sponsor Relations Coordinator				
Location:	Myrtle Beach	Myrtle Beach	Myrtle Beach	Myrtle Beach

ASCUE BOARD OF DIRECTORS FROM 2000 to 2004

	2000-01	2001-02	2002-03	2003-04
President	Carol Smith DePauw University	Fred Jenny Grove City College	Nancy Thibeault Sinclair CC	Barry Smith Baptist Bible College
Program Chair	Fred Jenny Grove City College	Nancy Thibeault Sinclair CC	Barry Smith Baptist Bible College	George Pyo Saint Francis College
Past President	Dagrun Bennett Franklin College	Carol Smith DePauw University	Fred Jenny Grove City College	Nancy Thibeault Sinclair CC
Treasurer	Tom Pollack Duquesne University	Tom Pollack Duquesne University	Tom Pollack Duquesne University	Tom Pollack Duquesne University
Secretary	Nancy Thibeault Sinclair CC	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College
Board Members	Barry Smith Baptist Bible College	Barry Smith Baptist Bible College	David Frace CC Baltimore County	David Frace CC Baltimore County
At Large	George Pyo Saint Francis College	George Pyo Saint Francis College	George Pyo Saint Francis College	Jim Workman Pikeville College
Public Relations	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College
Librarian	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
Equip. Coordinator	Rick Huston South Carolina/Aiken	Hollis Townsend Young Harris College	Hollis Townsend Young Harris College	Hollis Townsend Young Harris College
Web Coordinator			Carol Smith DePauw University	Carol Smith DePauw University
Sponsor Relations Coordinator				
Location:	Myrtle Beach	Myrtle Beach	Myrtle Beach	Myrtle Beach

ASCUE BOARD OF DIRECTORS FROM 2004 to 2008

	2004-05	2005-06	2006-07	2007-08
President	George Pyo Saint Francis College	Jim Workman Pikeville College	Lisa Fears Franklin College	George Pyo Saint Francis College
Program Chair	Jim Workman Pikeville College	Lisa Fears Franklin College	George Pyo Saint Francis College	Fred Jenny Grove City College
Past President	Barry Smith Baptist Bible College	George Pyo Saint Francis College	Jim Workman Pikeville College	Lisa Fears Franklin College
Treasurer	Tom Pollack Duquesne University	Tom Pollack Duquesne University	Tom Pollack Duquesne University	Tom Pollack Duquesne University
Secretary	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College
Board Members	Lisa Fears Franklin College	Blair Benjamin Philadelphia Bible	Blair Benjamin Philadelphia Bible	Janet Hurn Miami U. Middleton
At Large	David Frace CC Baltimore County	David Frace CC Baltimore County	David Fusco Juniata College	David Fusco Juniata College
Public Relations	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College
Librarian	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
Equip. Coordinator	Hollis Townsend Young Harris	Hollis Townsend Young Harris	Hollis Townsend Young Harris	Hollis Townsend Young Harris
Web Coordinator	Carol Smith DePauw University	David Diedreich DePauw University	David Diedriech DePauw University	Blair Benjamin Philadelphia Bible
Sponsor Relations Coordinator				
Location: Myrtle Beach		Myrtle Beach	Myrtle Beach	Myrtle Beach

ASCUE BOARD OF DIRECTORS FROM 2008 to 2012

	2008-09	2009-10	2010-2011	2011-2012
President	Fred Jenny Grove City College	Janet Hurn Miami U Middleton	Janet Hurn Miami U Middleton	Andrea Han U of British Columbia
Program Chair	Janet Hurn Miami U Middleton	Dave Fusco Juniata College	Andrea Han U of British Columbia	Tom Marcais Sweet Briar College
Past President	George Pyo Saint Francis College	Fred Jenny Grove City College	Fred Jenny Grove City College	Janet Hurn Miami U Middleton
Treasurer	Tom Pollack Duquesne University	Tom Pollack Duquesne University	Dave Fusco Juniata College	Dave Fusco Juniata College
Secretary	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College
Board Members	Dave Fusco Juniata College	Thomas Marcais Lee University	Thomas Marcais Lee University	Jeffery LeBlanc U of NW Ohio
At Large	Andrea Han Miami U Middleton	Andrea Han Miami U Middleton	Mark Poore Roanoke College	Mark Poore Roanoke College
Public Relations	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College
Librarian	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
Equip. Coordinator	Hollis Townsend Young Harris	Hollis Townsend Young Harris	Hollis Townsend Young Harris	Hollis Townsend Young Harris
Web Coordinator	Steve Weir	Steve Weir	Steve Weir	Steve Weir
Sponsor Relations Coordinator				
Location: Myrtle Beach		Myrtle Beach	Myrtle Beach	Myrtle Beach

ASCUE BOARD OF DIRECTORS FROM 2012 to 2016

	2012-13	2013-14	2014-2015	2015-2016
President	Tom Marcais Sweet Briar College	George Pyo Saint Francis College	Jeffery LeBlanc U of NW Ohio	Jeffery LeBlanc U of NW Ohio
Program Chair	George Pyo Saint Francis College	Jeffrey LeBlanc U of NW Ohio	Terri Austin Roanoke College	Terri Austin Roanoke College
Past President	Andea Han U of British Columbia	Tom Marcais Sweet Briar College	George Pyo Saint Francis College	George Pyo Saint Francis College
Treasurer	Dave Fusco Juniata College	Dave Fusco University of Colorado	Mark Poore Roanoke College	Mark Poore Roanoke College
Secretary	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College	Kim Breighner Gettysburg College	Jean Bennett Coastal Carolina Univ
Board Members	Jeffery LeBlanc U of NW Ohio	Luke VanWingerden USC Upstate	Bruce White The Apprentice School	Bruce White The Apprentice School
At Large	Mike Lehrfeld E. Tenn. State Univ.	Mike Lehrfeld E. Tenn. State Univ.	Mike Lehrfeld E. Tenn. State Univ.	Anthony Basham Berea College
Public Relations	Peter Smith Saint Mary's College	Peter Smith Saint Mary's College	Tom Marcais Sweet Briar College	Tom Marcais Sweet Briar College
Librarian	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown	Jack Cundiff Horry-Georgetown
Equip. Coordinator	Hollis Townsend Young Harris	Hollis Townsend Young Harris	Hollis Townsend Young Harris	Hollis Townsend Young Harris
Web Coordinator	Steve Weir	Steve Weir	Steve Weir	Blair Benjamin Cairn University
Sponsor Relations Coordinator	Mark Poore Roanoke College	Mark Poore Roanoke College	Berte Thompson Messiah College	Jeffery LeBlanc U of NW Ohio
Location: Myrtle Beach	Myrtle Beach	Myrtle Beach	Myrtle Beach	Myrtle Beach

ASCUE BOARD OF DIRECTORS FROM 2017 to 2020

	2016-17	2017-18	2018-2019	2019-2020
President	Terri Austin Roanoke College	Jean Bennett Coastal Carolina Univ	M.J. Clark Lynchburg College	Jacqueline Stephen Mercer University
Program Chair	Anthony Basham Berea College	M.J. Clark Lynchburg College	Jacqueline Stephen Mercer University	Nicole Lipscomb-King Mercer University Elif Gokbel, Coastal Carolina
Past President	Jeffery LeBlanc U of NW Ohio	Terri Austin Roanoke College	Jean Bennett Coastal Carolina	M.J. Clark Lynchburg College
Treasurer	Mark Poore Roanoke College	Mark Poore Roanoke College	Brad Weaver Wabash College	Brad Weaver Wabash College
Secretary	Jean Bennett Coastal Carolina Univ	Carmen Morrison NC State College	Carmen Morrison NC State College	Carmen Morison NC State College
Board Members	MJ Clark Sweet Briar College	Matthew Tyler Coastal Carolina Univ	Matthew Tyler Coastal Carolina	Dmitri Gusev Purdue Polytechnic
At Large	Carmen Morrison North Central State	Jacqueline Stephen Mercer University	Terrie Bethea-Hampton Campbell University	Terrie Bethea-Hampton Campbell University
Public Relations	Tom Marcais Sweet Briar College	Tom Marcais Washington & Lee	Tom Marcais Washington & Lee	Tom Marcais Washington & Lee
Librarian	Jack Cundiff	Jack Cundiff	Jack Cundiff	Jack Cundiff
Equipment Coordinator	Hollis Townsend Young Harris College	Hollis Townsend Young Harris College	Hollis Townsend	George Warriner III Coastal Carolina
Web Coordinator	Blair Benjamin Cairn University	Blair Benjamin Cairn University	Blair Benjamin Cairn University	Blair Benjamin Cairn University
Sponsor Relations Coordinator	Jeffery LeBlanc U of NW Ohio	Tina Stuchell U of Mount Union	Tina Stuchell U of Mount Union	
Location:	Myrtle Beach	Myrtle Beach	Myrtle Beach	Online

ASCUE BOARD OF DIRECTORS FROM 2021 to 2024

	2020-21	2021-22	2022-2023	2023-2024
President	Jacqueline Steven Mercer University	Nicole Lipscomb-King Emory University		
Program Chair	Nicole Lipscomb-King Emory University	Elif Gokbel Thomas Jefferson U		
Past President	M. J. Clark Lynchburg College	Jacqueline Stephen Mercer University		
Treasurer	Brad Weaver Wabash College	Brad Weaver Wabash College		
Secretary	Carmen Morrison NC State College	Dmitri Gusev Purdue Polytechnic		
Board Members	Irene Knokh University of Michigan	Irene Knokh University of Michigan		
At Large	Dmitri Gusev Purdue Polytechnic	Chelsie Dubay East Tennessee State		
Public Relations	Tom Marcais Washington & Lee	Tom Marcais Washington & Lee		
Librarian	Jack Cundiff	Jack Cundiff		
Equipment Coordinator	George Warriner III Coastal Carolina	George Warriner III Coastal Carolina		
Web Coordinator	Blair Benjamin Cairn University	Blair Benjamin Cairn University		
Sponsor Relations Coordinator		Keith Fowlkes E&I Cooperative Services		
Location:	Online	Myrtle Beach		

Undergraduate Student Perceptions of the Qualities of Effective Online Software Instructional Video

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Abstract

Undergraduate university students experience a knowledge gap when required to use unfamiliar software applications without the benefit of direct instruction. As a solution, students often turn to online support, particularly video, but little is known about students' perceptions of the effectiveness of support videos. As libraries are a principle resource on campus where students can seek additional academic help, library staff can benefit from a study of student perceptions of the effective qualities of online instructional support video for software knowledge development. Understanding student perceptions can increase the effectiveness of library staff instructional video and improve the knowledge gap of undergraduate students. This study employed the theoretical framework of Mayer's Cognitive Theory of Multimedia Learning (2001) to explore the perceptions of undergraduate students of the effectiveness of instructional videos. This basic qualitative study sought to gather information on undergraduate students' perceptions of the qualities of effective online software instructional videos through descriptive survey and semi-structured interviews with thematic analysis. Themes discovered revealed positive perceptions of video with a natural class setting and personalization as well as desires for previous experience with software, more interactivity and segmenting, and the development of skills perceived as useful for the future.

INTRODUCTION

Undergraduate university students are expected to use software for course assignments but are not taught how to use the software (Dahlstrom & Bischel, 2014; Klomsri & Tedre, 2016). Lack of software knowledge can result in poorly developed assignments that result in poor grades, and grades can be more reflective of software knowledge rather than content knowledge (Alexander et al., 2016; Tang & Chaw, 2016). University students need assistance in developing software knowledge to be effective learners (Tang & Chaw, 2016).

As university libraries are primarily responsible on most campuses for assistance with information literacy skills, including software knowledge (Alexander et al., 2016), campus libraries are a principal resource where students can receive this assistance. Libraries assist with the implementation of information literacy across disciplines, including software knowledge (Alexander et al., 2016). Yuen et al. (2018, p. 95) define software knowledge as "the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others."

With the rise in student use of smartphones and tablets, libraries are developing library support materials for information research support using video sharing platforms (Bomhold, 2014) but little is known about the qualities of the videos that students find to be effective. Additionaly, the focus of these videos is on student research skills rather than software skills (Bomhold, 2014). Little research investigates library-staff created instructional video on software topics and student perceptions of its effectiveness in helping students learn software, despite a digital skills knowledge gap present on many campuses (Alexander et al., 2016) and a need to include digital skills in literacy practices at the university level (Guzmán-Simón et al., 2017).

Effective video tutorials can empower students to incorporate software use into their assignments. Incorporating Cognitive Theory of Multimedia Learning (CTML; Mayer, 2001) when designing videos can help library staff develop more effective videos. Researching student perceptions of the qualities of instructional video that students find effective can increase the likelihood that students will use library staff created supplemental online instructional videos, as student perceptions of technology affect usage (Sligar et al., 2017). Understanding student perceptions of instructional video is important, as it impacts the delivery of library staff instruction. Increased usage of online instructional support due to positive student perceptions of effective qualities of online instructional software videos can address knowledge gaps of students.

Statement of the Problem

Undergraduate university students often experience a software knowledge gap in applying computer-based, online, and mobile software to their coursework (Dahlstrom & Bischel, 2014). The knowledge gap is a common occurrence on campuses, affecting large numbers of students (Klomsri & Tedre, 2016). Only 17% of adults report being confident in their ability to use digital tools in their learning (Alexander at al., 2016). As noted, this gap results in lower achievement and is a barrier to student success (Buzzetto-Hollywood et al., 2018). When large numbers of students need to be supported in technology learning, academic support staff need ways to approach the support of campus-wide software implementation.

Some libraries have offered support via instructional video crowdsourcing (Whitehill & Seltzer, 2016) but do not focus on software skills support, as it takes staff time to review and collect videos. Other universities offer subscription video tutorial services such as LinkedIn Learning to their students, but this is at a cost to the university (LinkedIn Corporation, 2020). Student perceptions of library space usage (Cowgill et al., 2001; Khoo et al., 2016), library patron perceptions of library mobile web presence (Bomhold, 2014), and best practices in information literacy tutorial videos (Primary Research Group, Inc., 2016) have been studied, but there is little research on university students' perceptions of library staff created instructional video design to support the development of their software knowledge. This may be due to the lack of software and technology support from libraries in general, as libraries focus on information research support (Khoo et al., 2018). Students' perceptions of instruction delivery affects their performance as learners, so perceptions are an important factor in implementation of instructional video to inform practice (Miner & Stefaniak, 2018). Students' perceptions of online video influences student engagement with instructional content, affecting students' academic success (Hajhashmi et al., 2016). As students' perceptions of instructional technology solutions influences their level of engagement with the content (Staples et al., 2018), it is important to understand and apply this knowledge in the library setting to improve student success.

University students place an importance on instructional video for learning software (Galanek et al., 2018). As students often turn to online video, and video is a form of multimedia, including a multimedia learning theory when studying student perceptions of instructional support video qualities may illuminate additional areas of

student perceptions, providing richer descriptions. A main idea of Cognitive Theory of Multimedia Learning is that, "people learn better from graphics with spoken words than from graphics with redundant spoken and printed words" (Dousay, 2016, p. 1257). Studies involving Cognitive Theory of Multimedia Learning have been applied to specific courses and adult learner training scenarios, but more research is needed on the integration of the theory to online learning support needs of a larger, more diverse group (Tang & Chaw, 2016; Yuen et al., 2018). Additionally, research is limited on the implications for design using CTML principles for educational video when combining principles (Chen & Wu, 2015; Ibrahim, 2018) especially in the area of student perceptions of online software video instruction. Libraries and other academic entities supporting large numbers of students can use the findings of this study to more effectively meet the mobile, personalized needs of learners via online instructional video by being informed of student perceptions to improve the practical software knowledge of undergraduate students, addressing a software skills knowledge gap.

Research Purpose

The purpose of this basic qualitative study is to explore university undergraduate students' perceptions of library staff instructional video qualities to support the development of their software knowledge at a southeastern university in the United States. Perception is defined as the ways of experiencing reality through senses, allowing for discernment; perception affects opinion and judgement (Given, 2008). Studying perceptions are key to understanding experiences as a phenomenon (Merriam & Tidsell, 2016). Undergraduate students in this study will be undergraduate students currently enrolled in the southeastern university in the United States. Instructional video will be a researcher-created online instructional video on a software topic. Understanding students' experiences in the process of viewing online instructional video by studying their perceptions may inform library support video design, may improve the likelihood of students using online support videos (Miner & Stefaniak, 2018), and may increase student success (Mayer et al., 2020).

In this qualitative study, I sought to gather information on undergraduate students' perceptions of the qualities of instructional videos through a survey and semi-structured interviews. A recruitment letter and information letter (Appendix A, Appendix B) was included in the call for participants. The survey (Appendix C) consisted of an information letter (Appendix B) followed by modified survey questions based on validated instruments used in similar studies as a Likert-type survey (Andrade et al., 2014; Chen & Wu, 2015), modified to include updated terminology in the field of multimedia learning and CTML principles, demographic questions, and open-ended survey questions. The use of a survey allowed me to view data through a lens of CTML by collecting responses on a validated scale and open-ended responses on a shared cognitive experience with a goal to uncover themes of instructional video perceptions. Leppink et al. (2013) developed and validated a Likert-type instrument based on an updated version of a combination of four commonly instruments in cognitive load research and CTML research. A main intent of the Leppink et al. (2013) ten-item questionnaire (Appendix C, Part 1) is to include the measurement of all types of cognitive load within one instrument to assess working memory self-reporting (Leppink et al., 2013), which fits the purpose of this study to gain rich descriptions of perceptions students have of software instructional video. The ten-item questionnaire has been used in research with students in the knowledge domain of statistics, but is not limited to any knowledge domain, just as the original instruments are not limited (Leppink at al., 2013). The ten items were slightly modified to inquire on online video software learning instead of statistics learning, which is an appropriate use of the instrument (Leppink at al., 2013). The same 11-point scale was used.

Open-ended survey questions requested that students reflect on the design of the instructional video, and questions related to multimedia design were developed considering CTML principles (Appendix C, Part 3; Mayer, 2014, Chapter 12). Utilizing open-ended questions gather richer descriptions from students through the lens of

CTML and were expanded upon for the interview questions in semi-structured interviews. Semi-structured individual interviews with undergraduate students allowed for deeper exploration of student perceptions of online instructional video for software learning support by identifying themes in students' experiences. Interview questions (Appendix D) were expanded upon from the open-ended questions from the survey and additional interview questions were developed from the research questions. By understanding students' perceptions of instructional video qualities, library staff and other educators can evaluate and design more effective instructional videos on learning software applications, addressing unversity students' knowledge gap. Non-identifiable demographic information (Appendix C, Part 2) was collected including gender, experience, software knowledge, and more to enhance understanding of the population sample's perceptions.

Theoretical Framework

The Cognitive Theory of Multimedia Learning is developed upon cognitive knowledge that humans process information through dual channels; visual/pictorial and auditory/verbal. These channels each have processing limits, and when humans learn actively, the brain is coordinating a series of cognitive processes (Mayer, 2001). Cognitive Load Theory states that when new information is introduced to working memory, the capacity of working memory is limited, and the duration of memory is very limited (Sweller et al., 2011). Cognitive Theory of Multimedia Learning expands upon the idea of Cognitive Load Theory as the amount of cognitive processing needed when viewing or engaging with multimedia. Cognitive load can occur when too much information is presented, reducing the ability to learn. When students view instructional videos on cognitive-heavy topics such as software skills development, cognitive load can occur. The effective qualities of a video created for instructional purposes is often based on the employment and consideration of Cognitive Theory of Multimedia Learning, "people learn better from graphics with spoken words than from graphics with redundant spoken and printed words" (Dousay, 2016, p. 1257). When instructors or designers implement multimedia principles of CTML into the design of instruction, cognitive load is reduced, and the effectiveness of the instruction increases (Chen & Wu, 2014; Mayer & Moreno, 2003).

Explorations of perceived effectiveness and perceived mental effort incorporating Cognitive Load Theory and CTML have been used in studies of instruction and video to further understand perceptions and cognitive experiences (Andrade et al., 2014; Chen & Wu, 2015; Valenti, 2019). However, limited research implementing CTML exists for the study of student perceptions of instructional videos on software topics to support large numbers of students (Alexander et al., 2016; Ibrahim, 2012), and qualitative study is needed to understand how learners interpret cognitive items (Leppink et al., 2013). As such, this project will explore undergraduate students' perceptions of effective software instructional video qualities by including cognitive load questionnaire items in a survey and multimedia principle open-ended questions from CTML in survey and interview questions. Multimedia principles of CTML (Mayer, 2014, Chapter 12) will be included in open-ended descriptive survey questions and in some of the semi-structured interview questions. Incorporating multimedia principles from CTML in the study of undergraduate students' perceptions of instructional video will help to illuminate richer themes discovered in descriptive survey results and semi-structured interviews to inform practice and will meet the need for qualitative study in this area.

Research Questions

This study is centered around one primary research question and one sub question. The research questions were developed from the problem of practice experienced by the researcher in the setting and include the incorporation of the theoretical framework into the phenomenon of study.

Research Question 1. How do undergraduate university students describe the cognitive qualities of library staff created online instructional video for software knowledge development in a kinesiology research course?

Research Question 2. Considering Mayer's (2014, Chapter 12) multimedia principles of Cognitive Theory of Multimedia Learning, what qualities of the library staff created video do undergraduate students perceive as most effective for their software knowledge development?

Significance

The problem of a software knowledge gap for undergraduate students is widespread; university undergraduate students are often expected to use software to help them complete course assignments but often are not directly taught the software (Buzzetto-Hollywood et al., 2018; Dahlstrom & Bichel, 2014). University students' development in software skills is key to their future success (Gorghiu et al., 2018). When students are not provided with formal training opportunities, students learn through informal and less reliable methods such as accessing the internet. This dynamic results in students being unable to address to gaps in knowledge and leads to difficulties in the development of students' academic literacy and digital competence (Guzmán-Simón et al., 2017). As studies on student perspectives show that student beliefs and perspectives are a significant influence on students' capabilities to learn digital skills (Guzmán-Simón et al., 2017; Sligar et al., 2017), this study adds to the body of knowledge on student perspectives by focusing on student perspectives of online instructional video on software topics. While studies have been completed on student perspectives of online learning (Cundell & Sheepy, 2018; Miner & Stefaniak, 2018; Razzak et al., 2020), little research exists on the student perspectives of online instructional video specifically for software knowledge, especially in the area of supporting large numbers of students.

The local setting of the problem of practice benefits from a study of student perceptions on qualities of effective online software instructional video by having a better understanding of what students perceive as effective instructional video. As we learn about what students believe are effective instructional videos for learning software skills, we can better guide informal learning for students, and we can create more formal learning strategies that align with student perspectives, thus increasing their likelihood of usage. Additional learning opportunities, formal and informal, are needed to support students in this area of knowledge gap. As university libraries are a main source of students' additional academic support (Khoo et al., 2016), university libraries can benefit from this study to implement formal and informal learning opportunities for students via online instructional video on software topics, aligned with student perspectives. Instructional video promotes student engagement and provides a way for students to connect to the content and apply their knowledge (Powers, 2020). As students are the largest population university libraries serve, many students can benefit. Additionally, other entities such as public libraries assisting large numbers of patrons in software knowledge development can benefit from this study, as its focus on undergraduate student perspectives can extend to adult learners.

Definitions of Terms

Cognitive Theory of Multimedia Learning. A theory based on assumptions that there are two separate channels (auditory and visual) for processing information; there is limited capacity of each channel; and learning is an active process of filtering, selecting, organizing, and integrating information (Mayer, 2001).

Cognitive Load. The used amount of working memory resources (Sweller et al., 2011).
Cognitive Load Theory. A theory suggesting that learning happens best when conditions are aligned with human cognitive architecture involving schemas (combinations of elements) as the cognitive structures that constitute the knowledge base of the individual (Sweller et al., 2011)

Extraneous Cognitive Load. The way information is presented to the learner, such as including uneccessary additional information or making the topic more complex than necessary (Sweller et al., 2011)

Information Processing Theory. A cognitive psychology theory stating that humans process information presented to them that they perceive or attend to in short-term memory, adding to schema for long-term storage when relevant or attended to (Atkinson & Shiffrin, 1968)

Intrinsic Cognitive Load. The effort associated with a certain topic; the level of difficulty in learning due to the nature of the topic being learned (Sweller et al., 2011)

Germane Cognitive Load. The effort the learner puts in to creating permanent knowledge or a schema, a conceptualization of an idea (Sweller et al., 2011)

Online Instructional Video. Multimedia instruction in the form of online video presenting words and pictures to foster learning (Mayer & Moreno, 2003).

Mobile Learners. Learners who have anytime, anywhere acsess to learning, enabled by device proliferation (Dahlstrom & Bichsel, 2014).

Multimedia Principle. Part of Cognitive Theory of Multimedia Learning; the idea that people learn better from words and images than from words alone (Mayer, 2001).

Multimedia Principles. Part of Cognitive Theory of Multimedia Learning; 12 principles to follow when designing multimedia qualities to reduce cognitive load (Mayer, 2014, Chapter 12).

Perceived Mental Effort. A measurement of cognitive load; perceived amount of effort in learning (Paas, 1992).

Perception. The ways of experiencing reality through senses, allowing for discernment; perception affects opinion and judgement (Given, 2008).

Software Knowledge Development. The acquisition of computer software skills in order to apply them (Alexander et al., 2016; Tang & Chaw, 2016,).

Working Memory. A cognitive system that has a limited capacity to hold information temporarily; short-term memory is a part of working memory (Sweller et al., 2011).

REVIEW OF THE LITERATURE

Introduction

University students need information literacy skills to succeed in their academic studies (Whitehill & Seltzer, 2016). Software skills are part of information literacy skills (Alexander et al., 2016). In many universities, undergraduate students are expected to use software to complete course assignments but are not directly taught how to use the software (Dahlstrom & Bischel, 2014; Klomsri & Tedre, 2016; Whitehill & Seltzer, 2016). Lack of software knowledge to complete assignments can result in lower academic performance (Alexander et al., 2016). In order to effectively complete course assignments, university students need assistance in developing knowledge of software (Tang & Chaw, 2016). University libraries are a main source of additional assistance on most campuses, especially in the area of information literacy. Information literacy can include software knowledge, but the assistance libraries provide in the area of software knowledge is inconsistent (Alexander et al., 2016). There is a need to provide additional software development skills in library literacy practices at the university level (Guzmán-Simón et al., 2017).

Libraries have supported university students with information literacy by creating and using online tutorial videos, but these often do not include software skills as specific topics, and thus need more ways to provide students with assistance in the area of software skills (Primary Research Group, Inc., 2016). Whitehill and Seltzer (2016) state some libraries have provided support using instructional video crowdsourcing, but they do not focus on support for software skills development. Students often rely on video for software learning (Galanek et al., 2018) but little is known about student perceptions of online instructional video for software skills development when large numbers of students need to be supported. Some higher education institutions provide access to third party video training solutions such as LinkedIn Learning (LinkedIn Corporation, 2020), but as this is as a cost to the institution, student access to this type of solution varies as it is dependent on the institution's resources. Students' perceptions of online video affects their level of engagement with the instructional content, which affects their level of academic success (Hajhashmi et al., 2016). Knowledge of students' perceptions of instructional technology solutions in the form of online instructional video can assist library staff in implementing more effective online video to improve students' digital skills across campus.

As students often use online video for software learning, including a multimedia learning theory may reveal more detailed descriptions of student perceptions. In this review, the implications of known research of student perceptions and the qualities of effective video are examined. The theoretical framework of Cognitive Theory of Multimedia Learning is presented, defined, and discussed. Additional research is presented through the lens of Cognitive Theory of Multimedia Learning and Cognitive Load Theory to review what is known about the application of the theory. Studies involving instructional video and student perceptions of online learning are included as well as how the theory informs the topic of study. Review of the literature includes university students' use of video, their perceptions of online instructional video, and studies of how student perceptions affect usage and student success. A summary of the limitations of current research and support of the need for research in this area is also presented.

Theoretical Context

As Cognitive Theory of Multimedia Learning (Mayer, 2014) draws from Cognitive Load Theory (Sweller et al., 2011), history and key assumptions of each theory are presented as well as how the theories relate, how advancements in the theories were achieved, followed by how the theories inform the topic of study.

Cognitive Load Theory

Cognitive Load Theory (CLT) began in the 1980's as a theory for instructional design based on known facts of human cognitive architecture. CLT received a major progression forward with the publication of an article by Sweller, van Merrienboer and Paas in 1998, after there had been sufficient time to collect data to conduct a thorough analysis of the role of CLT in the field of instructional design.

Information Processing Theory (Atkinson & Shiffrin, 1968) is a foundation for Cognitive Load Theory. Information Processing Theory (IPT) describes how humans process information. Our ability to attend to information is limited. When we attend to the information, it goes to short-term memory for processing. Also known as working memory, this too, is limited. As information is processed, it is determined to be irrelevant and discarded or relevant and assimilated. When assimilated it is stored in long-term memory via schema for retrieval at a later time (Atkinson & Shiffrin, 1968).

Building upon IPT, Cognitive Load Theory includes the idea that as new information is presented to working memory, the working memory's capacity is limited and in turn limits the duration of memory, affecting the learning process (Sweller et al., 2011). According to Cognitive Load Theory, there are three sources of cognitive load (the used amount of working memory resources): *intrinsic cognitive load*, which refers to the nature of the material, its difficulty level, and *extraneous cognitive load*, which refers to the way the instruction is designed, and *germane load*, which refers to the amount of work the learner puts into creating permanent knowledge, or schema (Sweller et al., 2011). When unnecessary demands are made of cognition, cognitive load increases and impairs learning (Sweller et al., 2019). Cognitive load can increase when one or more of the three types of cognitive load increases. For example, when the topic of learning is complex by its nature such as learning how to calculate statistics, intrinsic load increases, resulting in increased demands on cognition. This can lead to reduced learning, as working memory is at a higher capacity. If the instruction delivery of the content adds extraneous load by being unclear or difficult to navigate, extraneous load increases and can lead to reduced learning, as working memory resources are being used to make sense of the new information rather than only focusing on understanding (intrinsic load) and relating the new information (germane load). When learning tasks are designed, the designers work to reduce extraneous load in order to allow resources for intrinsic and germane load (Sweller et al., 1998), as well as to optimize germane load when possible by relating new information presented to currently known information, as an example.

Cognitive Theory of Multimedia Learning

After Cognitive Load Theory (CLT) began in the 1980's, Richard Mayer (2001) developed the Cognitive Theory of Multimedia Learning (CTML), derived from CLT. Cognitive Theory of Multimedia Learning draws upon Cognitive Load Theory to include how much cognitive processing is involved when viewing or learning from multimedia. When working memory begins to be limited due to increases in cognitive processing, cognitive load can occur, resulting in a lower ability to create permanent knowledge, affecting learning. The Cognitive Theory of Multimedia Learning makes the assumption that humans process information through dual channels: visual/pictorial and auditory/verbal. These channels each have processing limits, and when humans are in the process of learning, the brain is coordinating a series of cognitive processes that affects the capacity of working memory (Mayer, 2001; Mayer, 2014).

Multimedia is presented to the learner through words and/ or pictures. Words could be read or heard, and channeled through the ears, eyes, or both, if words are written and spoken. Pictures, however, are viewed and are channeled only through the eyes. The learner's brain then processes the data from these sources, organizes the

information, and makes sense of it. The learner's brain can also integrate prior knowledge from long-term memory when organizing words and pictures into either a verbal or pictorial model. For example, if someone says the word "lightning", the learner may recall an image of a lightning strike from a storm they have seen before (Mayer, 2001).

Cognitive Theory of Multimedia Learning includes three assumptions: the dual-channel assumption, limited-capacity assumption, and active-processing assumption (Mayer, 2001; Mayer, 2014). The first assumption is the dual-channel assumption, which states that humans have two separate channels for processing information. Information presented to the eyes begins to be processed in the visual channel, while information presented to the ears begins to be processed in the auditory channel. After information begins to be processed, it can travel between channels, as in the case of printed words being converted to sounds by a learner.

The second assumption is the limited-capacity assumption, the idea that there is a limit to the amount of information that humans can process through each channel at a given time. A learner's working memory can only hold a few images at one time and is only a partial amount of what was presented (Mayer, 2001; Mayer, 2014). Cognitive Theory of Multimedia Learning (CTML) is built upon Cognitive Load Theory. Cognitive Load Theory is related to the assumptions of CTML as it states that when new information is introduced to working memory, the capacity of working memory is limited, and the duration of memory is very limited (Sweller et al., 2011).

The third assumption is the active-processing assumption. This is the idea that humans process information to create a mental representation of their interactions, such as organizing incoming information, relating it to prior knowledge, and focusing (Mayer, 2001; Mayer, 2014). Active processing involves the production or attachment of new knowledge to schema (elements or chunks of information), which can result in increased cognitive processing, leading to cognitive load (Schilling, 2016).

Suggestions for Practitioners

Using design principles that take the assumptions of Cognitive Theory of Multimedia Learning and Cognitive Load Theory into consideration when creating instructional materials can reduce cognitive load and improve learning (Dousay, 2016; Mayer & Moreno, 2003). Designers and practioners can use multimedia principles and strategies to reduce cognitive load and increase learning. Selecting which principles to use may depend on the designer’s access to create materials and the learning content (Mayer, 2014).

In a study conducted by Mayer and Moreno (2003), the authors presented ways to reduce cognitive load in multimedia learning that consider multimedia principles. These include off-loading (moving essential information from the visual channel to the auditory channel), segmenting (dividing content into smaller sections), pretraining (providing names and information of upcoming topics), weeding (removing extraneous material), signaling (providing cues for how to process information), aligning (placing printed text with corresponding graphics), removing redundancy (avoiding presenting same printed text as audio), synchronizing (presenting narration and corresponding graphics), and individualizing (checking that learners can retain mental representations). Implementing these methods resulted in better transfer, retention, and cognitive load in multiple studies conducted over a span of 12 years as well as contributed to the study of cognitive science (Mayer & Moreno, 2003).

As found in a study by Xie et al. (2017), reducing cognitive load by cueing (non-content information such as arrows and highlighting added in learning materials to direct learner’s attention and to assist in their organiza-

tion; also known as signaling) in multimedia learning resulted in retention and transfer of knowledge. The meta-analysis they conducted found that cueing had a positive effect on the reduction of total cognitive load and increased learning, as reported by participants via measurements of subjective cognitive load and retention and transfer tests. Practitioners can use these findings when designing learning and add cueing in multimedia materials to reduce cognitive load and increase learning.

Implementing design with Mayer's (2001) multimedia principles in mind when preparing power-point presentations can make presentations more engaging and effective (Mahajan et al., 2020). Recommendations include implementing multimedia principles when creating instructional materials in order to apply them in a practical way during the design of the materials rather than after the materials have already been created. Specific principles recommended include: the coherence principle (people learn better when extraneous words, pictures, and sounds are excluded), the signaling principle (people learn better when cues that highlight the organization of the essential material are included), the spatial contiguity principle (people learn better when corresponding words and images are close together), the temporal contiguity principle (people learn better when corresponding words and images are presented at the same time), the segmenting principle (people learn better when media is presented in user-paced segments) and the redundancy principle (people learn better from graphics and narration rather than graphics, narration, and on-screen text) (Mayer, 2001). Using these principles while developing instructional materials increases retention (Mahajan et al., 2020).

Ibrahim (2012) found that incorporating the design principles of signaling, segmenting, and weeding in educational video affected student's cognitive load and learning outcomes. Students who used the educational video designed with the principles of signaling, segmenting, and weeding as compared to the students who used the education video not designed with these principles reported lower difficulty and scored higher on retention and knowledge measures (Ibrahim, 2012). The design principle of signaling helped novice learners focus their attention on important sections of the topic. Segmenting, breaking the longer video into smaller units, helped students process the information by dividing the focus time. Weeding, reducing extraneous (unnecessary) information, helped students to focus on processing only the essential information needed for the learning topic.

Practitioners can implement design adhering to multimedia principles in a variety of multimedia types. Increasing familiarity of multimedia principles for designers results in better usage of the principles in practice and improved instructional materials and environments (Sentz et al., 2019). Multimedia learning materials take many different forms, such as pictures, text, diagrams, charts, maps, and so on. With the increase of the use of multimedia in education over the past two decades, educational video has come to the forefront as a dynamic content delivery medium with the ability to present in multiple ways including still and moving images, animations, text, and audio (Cundell & Sheepy, 2018; Ibrahim, 2012).

Advancements in Theory

Since CLT began in the 1980's, additional theoretical work and empirical studies have added to the body of knowledge. Contributions to cognitive knowledge offered new concepts such as working memory resource depletion (decreased performance following extensive mental effort) which was incorporated into CLT (Sweller at al., 2019). Cognitive load effects, building upon the original 3 types of cognitive load, were developed over the years as studies were carried out and completed to provide more precise descriptions of cognitive load (Sweller et al., 2019). Examples include the worked example effect, which provides an entire problem and solution for learners to study as a complete example within the topic to ease intrinsic and germane cognitive load (Sweller et al., 2019). Studies on the worked example effect led to additional effects such as the split-attention effect (relat-

ing to the spatial and temporal organization of information sources, which should be placed together to ease intrinsic load) and the modality effect (the assumption that working memory can be divided into two separate processes, auditory and visual) states Sweller et al. (2019). Following the development of these and additional effects studied in the early 1990's, Mayer identified 12 principles for designing multimedia to reduce cognitive load and increase learning which have been used as guidelines for designers of multimedia for many years (Mayer, 2001).

Other advancements include developing new subjective and objective measurements of cognitive load to help differentiate between the types of load. As CLT advanced, CTML reflected these advancements, employing many of the newer cognitive load effects such as the collective working memory effect which recommends replacing individual tasks with collaborative ones so more cognitive resources are available (Mayer, 2014) and including the development of the four-component instructional design (van Merrienboer & Kirschner, 2018) which considers compound effects (effects that change the characteristics of other, more simple cognitive load effects). An example of a compound effect is the compound self-management effect, which includes explicitly teaching the learner how to recognize when split-attention is present and manage one's own cognitive load (Sweller et al., 2019). CLT has many strengths which add to its viability, including being based in scientific knowledge of human cognitive architecture, continually being developed as our knowledge increases, and having a significant amount of empirical data to support it (Sweller et al., 2019). This in turn strengthens CTML as advancements are reflected from the related CLT theory. Suggestions for future research include the exploration of self-management of cognitive load and cognitive load effects on self-regulated learning; cognitive studies are often experimental studies with randomized, controlled trials and include qualitative studies much less often (Sweller et al., 2019). Implementing qualitative studies in this area would provide thick descriptions of cognitive load effects. Including open-ended questions and semi-structured interviews allows for more richer data collection as themes can be uncovered, expanded upon, interrelated and used to form larger meaning to gain deeper understanding of experience.

CTML and Video

Implementing Cognitive Theory of Multimedia Learning when designing video improves the learning effectiveness, "People learn better from graphics with spoken words than from graphics with redundant spoken and printed words" (Dousay, 2016, p. 1257). In the study by Dousay (2016), results of a pretest and posttest found that learners reported higher interest in the information when the design principles of redundancy (using graphics with spoken words instead of with both spoken and written words) and modality (words are spoken instead of printed) were implemented in training modules, resulting in increased learning. A study conducted by Chen and Wu (2015) tested the perceived mental effort and learning performance of university class learners in online video lecture via three styles of video lecture: lecture capture, voice-over presentation, and Khan-style video lecture. Results indicated that while all three styles significantly promoted learning performance, the lecture capture and picture-in-picture types led to higher learner performance than the voice-over type, consistent with multimedia principles, in particular the spatial and temporal contiguity principles (Chen & Wu, 2015). Also consistent with CTML, the preferred video styles contained elements to increase the ease of active processing by including the instructor's moving image while speaking. Including the instructor's moving image while speaking provides viewers with a view of the source of the audio rather than only audio with no corresponding image, which eases active processing (Mayer, 2014).

In a study conducted by Andrade et al. (2014), university students in the same course were presented three types of different multimedia content in three different groups; audio text and graphics, text and graphics, and video, audio, text, and graphics. Mixed results ensued, indicating the text and graphics group had lower perceived

mental effort and lower cognitive load, but the multimedia format of the other two groups resulted in learners' positive attitude towards the course and towards learning more material in that multimedia format. The study concluded that when designing course materials, instructors should consider the various effects of different types of multimedia to include and employ Cognitive Theory of Multimedia Learning in course material design, depending on desired outcomes (Andrade et al., 2014). The results of positive attitudes within the mixed results suggest additional exploration of student perceptions of multimedia is needed. Study results such as these show the progression of Cognitive Theory of Multimedia Learning and indicate that the theory can be applied to newer forms of multimedia, including complex forms of video, to positively affect learning.

Cognitive Theory of Multimedia Learning Informs the Topic

Learning software skills is a cognitive-heavy topic, as it involves students understanding concepts pertinent to the software program such as the purpose of using the software, when to use specific software programs for certain tasks, and how to apply usage skills in their coursework. As students view instructional videos, cognitive load can occur, as the information is presented in a multimedia format (Mayer, 2014). Additionally, the topic of software skills development requires higher cognitive processing as it is a complex learning topic. The degree of complexity can depend on the learner's previous experiences and specific software being learned. When multimedia principles of Cognitive Theory of Multimedia Learning are employed in the creation and design of instructional video, cognitive load decreases, and the learning effectiveness increases. Even when learners found the multimedia principle of segmentation annoying, the transfer of material improved (Doolittle et al., 2015). A study of instructional video in a self-directed asynchronous multimedia learning environment involved the use of segmenting: presenting the content in smaller sections, dividing the content among several shorter videos. Results indicated a positive outcome on recall and application of knowledge, regardless of the learner's attitude toward segmentation. Using multimedia effectively is crucial to student learning, particularly for introductory lecture courses, as designing courses using CTML improves learning (Andrade et al., 2014). In a mixed-method study to determine the effect of supporting course materials of varying multimedia formats in a food science course, multimedia course materials were designed using the Cognitive Theory of Multimedia Learning. Students' cognitive load was measured using perceived mental effort (PME) scores along with students' perceptions. Results indicate multimedia course materials designed using CTML resulted in better transfer of knowledge (Andrade et al., 2014). Study results such as these indicate that Mayer's theory (2014) applies to current forms of instructional video.

Limitations of the theory include that the majority of studies in the area of CTML include quantitative studies (Sweller et al., 2019). Qualitative studies in this area of study are needed for deeper understanding of cognitive processes (Leppink et al., 2013; Sweller et al., 2019). Self-reporting is often used for measures of perceived effectiveness, implementation of which can vary in consistency depending on the participant (Mayer, 2014). CTML's inclusion of graphics can assume the learner has previous familiarity with iconic representative images when this is not always the case (Westelinck at al., 2004). CTML focuses on cognitive processes, which is one aspect of learning. Learning is also dependent upon affective processes such as motivation and interest (Dousay, 2016).

Incorporating multimedia principles and cognitive load considerations in the exploration of student perceptions of online instructional video for software skills development will inform the study of what students perceive as qualities of effective video. Cognitive load questionnaire items will be included in a Likert-type survey and open-ended questions and semi-structured interview questions incorporating multimedia principles (Mayer, 2014, Chapter 12) will be used to gather rich themes of student perceptions to inform practice.

Review of Multimedia Instruction Studies

Online instructional video is defined as multimedia instruction in the form of online video presenting words (via print or audio) and pictures to foster learning (Mayer & Moreno, 2003). Online instructional video is often used as a primary method of instruction delivery in formal and informal settings, but many questions remain regarding student perceptions and instructional video effectiveness. Specifically, questions include how best to design and develop video lessons that students perceive as effective for their learning, and how to better align learning materials and learning outcome measures (Ou et al., 2019). To address questions regarding student perceptions of online instructional video to determine the effectiveness of the video, evaluating library usage and student perceptions of library resources should be an ongoing effort on the part of library staff (Khoo et al., 2016). Reviewing previous studies can help inform the current need for research in the area of student perceptions of effective online instructional video for software skills development.

Students Need Software Knowledge

A lack of information literacy skills, which include software skills, can be barriers to academic performance. In a mixed-methods study by Klomsi and Tedre (2016), information literacy skills of university students were measured via questionnaire. In this study, it was noted that while students and staff have internet access, the integration of software skills is limited, and more advanced topics are not covered in information literacy. As a result, students with lower information literacy skill scores were not as readily able to meet their academic needs. As stated in an NMC Horizon Project Strategic Brief (Alexander et al., 2016, p. 15), "Higher education institutions must play a crucial role in providing the tools and opportunities that ensure students know how to successfully deliver visual and digital communications that help them attain their goals." University students are expected to use software to meet course assignment requirements, but they are not taught the software skills necessary for academic success.

In a study by Dahlstrom and Bichel (2014), undergraduates who completed a questionnaire on technology inclination and preparation stated that older undergraduate students felt more confident using software than younger undergraduate students, dispelling the myth that younger students who may use technology more will know more about implementing software more than older students. The study states 34% of undergraduates wish they had been better prepared to use software programs and applications (Dahlstrom & Bichel, 2014). Tang and Chaw (2016) found that students need help on how to use technology and software effectively for learning. University students were issued a questionnaire to determine the effectiveness of learning resources for student success. Results included the need for students to be digital and information literate in order for online learning to be successful, and that when given resources for using educational technology tools, students were more successful in an online learning environment. Through self-reporting questionnaires, undergraduate students in a study by Guzmán-Simón et al. (2017) indicate a gap between their software skills knowledge and literacy learning opportunities offered by the library and the university, which can lead to difficulties in academic development. Additional development of software skills in library literacy practices at the university level is needed.

Resources Are Limited

The information literacy assistance that university libraries provide can include software knowledge, but assistance in this area is inconsistent. The Primary Research Group, Inc. (2016) found that many libraries have created and implemented online tutorial videos for information literacy, but they often do not include software skills

as topics. Libraries need to develop more ways to provide students with academic assistance in the student development of software skills.

Whitehill and Seltzer (2016) implemented a crowdsourcing approach as a way to meet the needs of large numbers of learners but did not focus on software topics.

Finding helpful instructional support videos can be a challenge for students. The need for descriptive titles and linking instructional videos to the point of need is necessary as videos are difficult to locate (Bowles-Terry et al., 2010). The Americans with Disabilities Act (ADA) compliance law requires the subtitling of video, so the creation of accessible instructional video content takes time and requires specialized technical resources (Louder et al., 2016). With a lack of library resources, students often turn to other sources such as YouTube for assistance. Alexander et al. (2016) report when undergraduate students need additional technology assistance, 71% most frequently search online resources such as Google or YouTube. The commonly used video sharing platform YouTube reaches more individuals than any broadcast or cable TV network. With over 400 hours of video uploaded every minute, the average viewing session for 18-49 year-olds is more than 40 minutes (Brandwatch, 2018). Library staff can mitigate this less effective video assistance by creating or curating effective online instructional video according to student perceptions.

Limitations of Video

There are limitations and challenges of learning from video. Understanding student perceptions of video will help library staff address these limitations and challenges when developing and curating online instructional video for software skills development. Multimedia demands high cognitive processing of students, requiring learners to use their processing capacity to attend to and process material (Ibrahim, 2012). Video instruction also requires the learner to deal directly with essential content. The content in the video can be difficult and demanding of learners but necessary to include (Bhatti et al., 2017). Instructional videos can have a short shelf-life. Keeping instructional videos up to date as software updates occur, maintaining current cultural references to maintain learner's perceptions of the currency of the video, and meeting the ADA compliance requirements can be difficult, as video production is time-consuming and requires use of technical resources (Bowles-Terry et al., 2010).

Benefits of Online Instructional Video

There are benefits to online video and multimedia as a potential learning solution for library staff to employ with large numbers of students for software skills development. As video used for instructional purposes as an instructional process when students and instructor are not in the same place (Li & Liu, 2012), online multimedia offers freedom and control to the learner as they can pause and rewatch the instruction or learn at a distance. Video can include additional communication such as body language and verbal tone to the learner as the instructor conveys a message. Learners can watch a video and acquire visual information quickly, making learning more convenient and efficient by accessing online video including graphics and words that learners can receive at the same time. Video can include other mediums of communication such as images, animations, audio, and printed text, allowing for a way for instructors to address multiple learning preferences (Valenti et al., 2019). Online video allows for anytime and personalized instruction; learners are more engaged when they have the ability to choose their learning topic of need and access it quickly, and online video is an accessible production tool for instructors (Yuen et al., 2018). Video can compress expertise into a condensed period of time and convey many points of view (Valenti at al., 2019). Many schools use a Learning Management System (LMS) to

deliver content. Instructional video is often posted in the LMS online. Additionally, students often use video informally to learn additional skills and content (Dahlstrom & Bischel, 2014). College students place importance on video for learning software skills for completion of assignments (Galanek et al., 2018). Research on the learning effectiveness of video indicates that video can be a viable teaching resource to communicate content for university courses and identify supplementary videos and problem-solving videos depicting worked examples as effective when they allow for autonomous learning (Miner & Stefaniak, 2018).

Student Perceptions of Online Learning

Learners' perceptions of video can play a large part in the usefulness of the video, and learners' perceptions may vary. Students prefer blended learning environments to traditional classrooms and the ability to view and rewatch instruction may be one reason for this trend (Dahlstrom & Bischel, 2014). Students prefer video as a mode of online instruction, perceiving instructional videos and other video formats such as presentation with narration and video recording of live classes are among the most helpful and preferred instructional activities (Bowles-Terry at al., 2010, Jayaratne & Moore, 2017). Students expect the online availability of instruction, and the technology infrastructure needed to support online instruction (Galanek et al., 2018; Tanner et al., 2009).

The learning effectiveness of video can increase when it matches the students' learning style and perceived comfort level as well, and when it can be replayed (Aniroh et al., 2018). In the study by Aniroh et al. (2018), teachers of an English elective course used YouTube live to stream teaching content, and undergraduates taking the course completed questionnaires on communication effectiveness and learning effectiveness. Study results indicate the perceived communication effectiveness of YouTube live was positive (Aniroh et al., 2018). In a study by Staples et al. (2018), students' perceptions of technology and online learning had a significant effect on their academic success. A study of learners utilizing asynchronous video for language acquisition found the effectiveness of the learning relied more on the learners' perception of their language gain rather than scored recordings of the learners' speech (Young & West, 2016).

Student Perceptions Affect Student Success

When students perceive that they have online access and support, they rate their overall satisfaction in online learning as more positive (Cundell & Sheepy, 2018; Lee et al., 2011). When students take on responsibility for learning and are allowed choice in learning topics, their participation increases (Weiser et al., 2018). Providing video instruction may help individuals select learning segments and take more control of their learning trajectories. An implication of a study by Klomsi and Tedre (2016) was that students made low use of library resources due to perceived inconvenience and inaccessibility.

Positive student perceptions align with the implementation of multimedia principles. A study conducted by Chen and Wu (2015) tested the perceived mental effort and learning performance of university class learners in online video lecture via three styles of video lecture: lecture capture, voice-over presentation, and Khan-style video lecture. Results indicated that while all three styles significantly promoted learning performance, the lecture capture and picture-in-picture types led to higher learner performance than the voice-over type, consistent with multimedia principles (Chen & Wu, 2015) and aligned with positive student perceptions.
Another study included several principles of multimedia learning while studying student perceptions (Stanković et al., 2018). Findings from this theoretical study state that studies of implementation of multimedia in teaching led to increased participation and increased student success, likely due to positive student perceptions. Student perceptions relate to instructional video designed using multimedia principles in a positive alignment.

As seen in a study conducted by Andrade et al. (2014), student perceptions contribute to student engagement with instructional content. In this study, university students in the same course were presented three different types of multimedia material course content distributed in three different groups; audio text and graphics, text and graphics, and video, audio, text, and graphics. Mixed results ensued, indicating the text and graphics group had lower perceived mental effort and lower cognitive load, but the multimedia format of the other two groups resulted in learners' expressed positive attitude towards the course and towards learning more material in that multimedia format. The study concluded that when designing course materials, instructors should consider the various effects of different types of multimedia to include and employ Cognitive Theory of Multimedia Learning in course material design (Andrade et al., 2014). As increased student engagement can lead to higher student success, understanding student perceptions of online instructional video can lead to increased student success.

Additionally, there is reason to believe when students have positive experiences with video, their motivation and interest in the content increases. A study by Hajhashemi at al. (2016) involved student perceptions of the value of online videos in their blended learning coursework at a rural and remote university. They conducted semi-structured interviews to gather data and developed questions from the literature on online videos. Their findings stated that students preferred the integration of video into their coursework as it provides them with flexibility in when and where they access the videos and through multiple types of devices and locations. Students reported when having a positive experience with the video, their motivation to learn and interest in the topic increased. Students who report positive experiences with video also report increased knowledge satisfaction. Powers (2020), studied nursing students' perceptions of video instruction through a pre- and post-questionnaire on a high-fidelity video unfolding nurse-patient simulation. Student participants reported more favorable perceptions of the high-fidelity video than for prior nursing videos. This may have been due to the improved video providing additional embedded opportunities for the learner to engage with the content. Students reporting more favorable perceptions of the enhanced video also reported higher levels of satisfaction and self-confidence in the knowledge content contained in the video (Powers, 2020). In a study by Grossman and Simon (2020), university students in biology classes perceived video-based open education resources as positive learning experiences, increasing the likelihood that they pursue science disciplines of study. As student perceptions of online learning and video have an effect on student engagement with academic content, it is important to understand student perceptions of online software video tutorials.

Student usage of library resources affect student success, as seen in a study by Mayer et al. (2020) involving thematic analysis of semi-structured interviews of students using university library services. The results included a positive correlation between the use of library resources and student persistence. In the qualitative component of the study, students reported perceiving the library as contributing to their success through facilitating their scholarly work and the importance of the library providing resources for students to help them progress in their knowledge (Mayer et al., 2020). Because student perceptions impact the delivery of video instruction and student usage of library resources, it is important to understand university student perceptions of library staff online instructional video for software skills development.

Understanding Student Perceptions to Increase Student Success

Student perceptions of the value of video as external-to-class learning material also needs further exploration as a tool of effectiveness to increase student success (Long et al., 2016). A mixed-methods study on student perceptions of library services confirmed that library services are impactful to students but indicated that further study is needed to help identify ways to address more specific resources and learning services needs of students (Mayer et al., 2020). Student perceptions of online learning and video in specific coursework have been studied

(Cundell & Sheepy, 2018; Grossman & Simon, 2020), but needs to be expanded to include the support of a large number of students in a variety of academic study areas across campus.

Previous Studies Are Limited

A dissertation written by Turso (2017) includes the study of modality as found within cognitive load theory with regards to narration rather than on-screen text as best supporting learners. The study is limited to engineering students who are already familiar with technical terms (Turso, 2017). A mixed-method study conducted determined the positive learning transfer effect and attititudes of supporting course materials of varying multimedia formats in a food science course but was limited to that course (Andrade et al., 2014). Students currently majoring in digital animation were invited to participate in a study of how and why students use online video. These students were already very technically skilled due to their area of study (Yuen et al., 2018). Focus groups of participants' shared experiences discovered that digital animation students use online videos for ideas and inspiration and for mastery of skills, relying heavily on the Internet for instruction (Yuen et al., 2018). Previous studies have addressed specific online courses and online learning within the framework of university courses rather than addressing supplemental online learning for all university students in various areas of study across campus. Results of many studies include the study of student perceptions and the application of Cognitive Theory of Multimedia Learning; however, they are limited to specific types of student groups or adult learners with previous skills and do not address large numbers of undergraduate university students in various areas of study with no previous technical skills.

Study Design and Tools Need Further Expansion

Most studies conducted involving CTML and/or CLT are quantitative (Sweller et al., 2019) Further examination in the area of tools and measurements and the effectiveness of video will help advance the field, as implementation and study design limitations are present. Newer tools for measuring student perceptions of the effectiveness of video such as the ten-item measurement of IL, EL, and GL (Leppink et al., 2013) need to be explored. This tool, though validated, has not yet been implemented in a variety of learning topics. Additionally, there is a need for more qualitative study in this area, as the majority of studies completed to-date are quantitative. Leppink et al. (2013, p. 1069), state, "New studies should examine qualitatively how exactly learners *interpret* these items across a range of tasks." Expanding upon the use of tools and measurements and implementing more qualitative studies will further our knowledge on how effective instructional support videos are, and will advance the field through additional data gathering and validity via implementation.

Additional Research to Add to Library Staff Knowledge

Currently, there is little research on how students perceive the effectiveness of video tutorials as library instructional support for software skills development. Tutorials are focused on library-related information-seeking assistance for patrons, and the focus of current video tutorials is on getting the information out as quickly as possible (Bowles-Terry et al., 2010; Whitehill & Seltzer, 2016). Using video as a primary instructional mode improves the digital skills of students by using a mode of communication they are already familiar with and currently use. Placing instructional videos where students expect to find them in an online environment viewed as a campus center for additional student academic support, will improve student access.

Summary/Solution

Studies involving student perceptions and Cognitive Theory of Multimedia Learning have been applied to specific courses and adult learner training scenarios, but little research is available on the application of the theory to online learning support needs of larger, more diverse groups. Advancements in theory have led to newer research tools, but the use of those tools needs to be expanded upon. Understanding student perceptions of online instructional video on software topics will add to the body of knowledge for library staff to support large numbers of students across campus.

Other studies have approached library space usage and student perceptions of library resources (Khoo et al., 2016), but have focused on information and research support rather than software skills development; further studies are needed to continue to meet student learning needs (Mayer et al., 2020). While student perceptions of online learning in specific coursework have been examined, studies need to be expanded to support larger numbers of students in various academic settings across campus. As most studies involving CTML and CLT are quantitative, qualitative studies are needed to provide more in-depth perspectives of participants. The use of newer instruments should be expanded to advance knowledge in the field. Libraries and other academic support entities supporting large numbers of students can use the findings of this study to more effectively meet the mobile, personalized, digital skills development needs of learners.

Improving the digital skills of university students can help sustain their lifelong learning and help them to be academically successful (Anthonysamy et al., 2020). The findings detailed in this study may lead to additional research on the student perceptions of video. These results can then be applied to anyone creating support videos on a variety of software topics, or even applied to videos that were not intended to be support videos but have been found to have cognitive value.

METHODOLOGY

Introduction

Undergraduate university students are expected to use software in course assignments but often are not directly taught how to use the software (Dahlstrom & Bischel, 2014; Klomsri & Tedre, 2016). University students need assistance in this area, and campus libraries are a principal resource where students can receive extra academic help. As libraries are a principle resource on campus where students can seek additional assistance (Alexander et al., 2016), and usage of library assistance and student success is affected by student perceptions (Mayer et al., 2020; Miner & Stefaniak, 2018), library staff can benefit from understanding students' perceptions of the qualities of online instructional videos to provide improved software learning support.

The research questions are restated, followed by the method and design, limitations, participants, and setting descriptions. The research intervention, instrument, procedures, and data collection methods are articulated, followed by the analysis.

Research Question 1. How do undergraduate university students describe the cognitive qualities of library staff created online instructional video for software knowledge development in a kinesiology research course?

Research Question 2. Considering Mayer's (2014, Chapter 12) multimedia principles of Cognitive Theory of Multimedia Learning, what qualities of the library staff created video do undergraduate students perceive as most effective for their software knowledge development?

The Investigation Plan

I conducted a basic qualitative study to explore undergraduate students' perceptions of the qualities of library staff instructional video to support the development of their software knowlege. I gathered information on undergraduate students' perceptions of the qualities of online software instructional video to explore their experience in the learning process through a descriptive survey and semi-structured interviews. A Likert-type survey item scale on cognitive load which is a validated survey instrument by Leppink et al. (2013), modified survey questions based on the instrument and open-ended survey questions based on the research questions were used. Interview questions were expanded upon from the open-ended survey questions to go more into depth, gaining richer description through additional questions developed from the research questions. Using purposeful sampling, the criteria for participants is currently enrolled undergraduate students at a southeastern university. A convenience sample of undergraduate students who are enrolled in two kinesiology classes at a southeastern university was used as they are part of the population of undergraduate students at the university level and due to the researcher's access. The online instructional video was created by library staff on the software topic of Adobe Acrobat DC (Document Cloud), a software program used to create and edit portable document format files (PDF) that the students will be using in their courses. The video, which was already part of their coursework, was provided to all participants for viewing and enabled a shared experience for study of student perceptions.

Basic qualitative research is important in many fields, particularly professional fields such as education and medicine, as it uses practical and sensible methods in order to inform best practices in response to a research question (Merriam, 2009; Savin-Baden & Howell, 2013). It is a research approach that involves understanding a phenomenon or process or perspectives (Savin-Baden & Howell, 2013). This type of research often involves sampling to gain numerous perspectives, and data collection often involves interviews, observations, documents, and similar ways of gathering descriptions of perspectives and processes from the participants (Savin-

Baden & Howell, 2013). Basic qualitative studies are a common type of study used in educational practice as the researcher seeks to understand the meaning of a phenomenon experienced by the participants and the meaning they have constructed (Merriam, 2009; Merriam & Tisdell, 2016).

As a basic qualitative approach is used for understanding a phenomenon, process, or perspective (Merriam & Tisdell, 2016; Savin-Baden & Howell, 2013), it is an appropriate fit to conduct research on the topic of undergraduate students' perceptions of library staff instructional video qualities to support the development of their software knowledge. Basic qualitative is the preferred method for this study as it facilitates understanding perspectives of a process. Understanding the student perspective, the phenomemon of students' perceptions of video qualities, can be discovered through implementing a basic qualitative research approach since basic qualitative helps researchers understand people's experiences (Merriam & Tisdell, 2016).

Many features of basic qualitative research were addressed in this study. One feature of qualitative research includes the researcher as the primary collector of data, enabling multiple perceptions to be collected and analyzed (Merriam & Tisdell, 2016). As the researcher is also an instrument and is in contact with the participants, the researcher must employ ethical practices (Merriam & Tisdell, 2016). Another feature of qualitative studies is that the researcher should aim to study the process or phenomenon in a natural setting (Merriam & Tisdell, 2016). As undergraduate students in the setting are accustomed to online video, online response systems, and the use of videoconferencing in their courses, this study employed online tools they are already using in their LMS. Demographic information was collected to confirm this experience. Qualitative research often employs a theoretical framework and also requires researchers to choose a methodology, research approach and instrument(s) of measurement (Creswell & Guetterman, 2019). The study of people's experiences is the most commonly studied topic of qualitative research and interviews are a common form of data collection (Merriam, 2009). Basic qualitative research findings are interpreted via recurring patterns discovered which show the data's characteristics (Merriam & Tisdell, 2016) so implementing thematic analysis will help me discover students' perspectives to show how their meaning is constructed. This research approach also provides efficient methods for determining best practices, enabling change to be affected more quickly to benefit students in multimedia learning, as basic qualitative uncovers and interprets meanings (Merriam & Tisdell, 2016).

Participants/ Learner Characteristics

Non-probability convenience sampling was used for the initial participants for the survey which is often implemented in basic qualitative research as it allows for selecting participants who have the experience that is the focus of the study and that the researcher has access to (Merriam, 2009). The goal in selecting initial participants was to include the main body of students that libraries support, which is undergraduate students. The criteria was currently enrolled undergraduate university students at a southeastern university in the United States. A convenience sample of undergraduate students enrolled in two kinesiology classes was used as this sample represents the population of undergraduate students at the university in the setting (Creswell & Creswell, 2018).

The kinesiology classes were designated as distance courses and used an online learning management system with synchronous and asynchronous content and learning activities. Students enrolled in the kinesiology classes tend to be traditional undergraduate students in their fourth year of college, in a fairly even number of males and females. As students in their fourth year of college, they are likely to have many previous experiences with instructional video to draw upon when describing their shared experience of the Adobe Acrobat DC video. As undergraduate students, they are not exposed as often to online instructional video on this type of software as Adobe Acrobat DC is an advanced productivity software tool. As they are students enrolled in a kinesiology

research course, they can also benefit from having an opportunity to participate in research. To ensure the gathering of pertinent participant data, demographic questions collected information about participants' familiarity of the software topic of the instructional video (Creswell & Creswell, 2018). The researcher selected a software topic for the video that the participants were not likely to be familiar with, given their status as undergraduate student, but that would be pertinent and applicable to their area of study. As seniors, these students are often preparing files for submission to internships, job positions, graduate school applications and other program applications in their field of study. Knowledge of how to create Adobe PDF files for LinkedIn and other online profiles and applications is required. Knowledge of how to use Adobe Acrobat DC to convert various file types to PDF, edit, organize, and digitally sign will help them in their academic and professional careers. The students use the information in the video to complete assignments in their course, including using Adobe Acrobat DC to combine research article PDF files and to convert and combine additional word processing document files. The instructor included an assignment within the course for all students following the course requirement to view the video on Adobe Acrobat DC. The course assignment developed by the instructor required students to find research articles on their topic of study within kinesiology in PDF format. These assignments, including the video and the PDF research files assignments, were already part of the course materials prior to this semester.

Additionally, knowledge of Adobe Acrobat DC helps students in their current kinesiology courses as they manage various PDF research files. This software knowledge will also benefit them in their future career as they gain knowledge of an advanced productivity tool for sharing across platforms as they begin to work with other researchers and colleagues. The sample was also selected due to the researcher's access to the classes and enables interview participants to volunteer from the same sample, providing continuity of participants. Within the convenience sample, non-probability purposeful sampling was planned to be used to select interview participants, which is often implemented in basic qualitative research as it allows for selecting participants who have the experience that is the focus of the study (Merriam, 2009). Planned criteria for interview participants included utilizing the demographic data already collected to select an even male to female ratio as possible as this best represents the class and the population, followed by criteria of widest variety of additional demographic data as possible, including software and computer experience, relationship status, and more. However, due to low participation, all interview volunteers were selected as participants, which resulted in a lack of representation of males. This still follows purposeful sampling as participants who have the experience that is the focus of the study (Merriam, 2009), which is being a student in a kinesiology course who viewed the instructional video as part of their coursework.

Learner characteristics are described in Table 1. Undergraduate students are mobile learners; they are accustomed to having access to learning anytime and anywhere and have access to devices (Dahlstrom & Bichsel, 2014). In this setting, students have access to on-campus computers and Internet access. If students need to be off campus, laptops and Internet hotspots are available for borrowing and on-campus computers are also available for use off-campus through remote lab access via the library web site. On-campus computers and laptop computers available for use and borrowing have Adobe Acrobat DC already installed. Students have access to license and install Adobe Acrobat DC onto their own computer at no cost via their university login. Finally, Adobe Acrobat DC is available through web-based Adobe Document Cloud (DC) if students' computers are not powerful enough to download the software.

Video is an instructional mode of communication undergraduate students are already familiar with and currently use (Tang & Chaw, 2016). Students often use online video sharing platforms such as YouTube for informal learning on topics not directly taught in their university courses (Yuen et al., 2018). This study took the learner characteristics of online learning expectations into consideration by using familiar delivery methods of the LMS and online video platforms.

Table 1
Learner Characteristics

Information Categories	Data Sources	Learner Characteristics
Entry skills	Enrollment status as undergraduate students	Basic computer skills (navigate a software program, access videos on the Internet, use email)
Prior knowledge of software	Demographic survey questions	Very low or no prior knowledge of software topic (Adobe Acrobat DC)
Educational and ability levels	Enrollment status as undergraduate students	Currently enrolled undergraduate students in distance kinesiology courses
General learning preferences	Literature review and Learning Management System (LMS) usage	Students are mobile learners and as they are enrolled, are users of video instruction through the LMS

As there are many different ways to employ qualitative research, there are differing recommended sample sizes. Recommended participant numbers can range from two to a few hundred (Savin-Baden & Howell, 2013). Including a reasonable minimum number of participants given the type of data to be gathered is typical practice in basic qualitative studies (Merriam, 2009). A goal of sample size in qualitative studies is to have a sufficient number of participants to reach saturation of data collection, which occurs when the researcher has gathered enough data to reach the point of not collecting any more new information (Merriam, 2009; Savin-Baden & Howell, 2013). Approximately 30 students are enrolled in each kinesiology course. Similar studies have used sample sizes of most of the students in a class (Andrade et al., 2014; Miner & Stefaniak, 2018; Yuen at al, 2018), so a goal was to obtain 30 survey participants. For interview participants, a goal was to obtain a sufficient sample size of 5 to 8 participants as recommended by Merriam (2009) and as implemented in similar studies given the research questions, population and sample, and demographics (Hajhashemi et al., 2016; Mayer et al., 2020). A goal was to reach a sufficient sample size to explore the phenomenon of student perceptions of library staff online software instructional video via a descriptive survey and interviews, given the shared experience of viewing the same instructional video provided by the researcher and number of question items. A goal of the sample size is to enable the researcher to gather sufficient data to reach saturation, which is an indicator of sufficient sample size (Merriam, 2009). Saturation of data in this study occurs when no additional new responses are collected that create new themes arising from the data. Following basic qualitative guidelines, I employed convenience sampling to select undergraduate student participants who experience online instructional video on software knowledge development and perceive its effectiveness, followed by purposeful sampling for ease of access to students in specific classes.

Setting/Context

The setting is a state-accredited large public university (approximately 22,000 undergraduates enrolled) in the southeastern United States. The university began in the mid-1800's as a state land grant agricultural and polytechnic university and has grown to become a division I SEC university with undergraduate and graduate programs. A main library on campus serves the various colleges and departments at the university in information literacy, research, and course assignment assistance. Library staff assist with the implementation of information literacy across disciplines, including software application use (Alexander et al., 2016). The researcher is based in the library of the university. The setting for the procedures of this study is online. The viewing of the instructional video, survey and interviews took place online via the university's Learning Management System, Canvas (LMS), university-vetted survey software (Qualtrics), videoconferencing software (Zoom), and university email. In the setting, students are already accustomed to online instructional video as a LMS is used for most or all courses, and they have access to several software packages. Demographic questions are included in the survey to confirm this experience. Additionally, online administration can add to the fidelity of the study as it emulates current instruction at the university. This setting was chosen due to the researcher's access based on place of employment, the large number of the undergraduate student population, and the intent of the study to improve practice.

In the setting, the convenience sample consisted of students enrolled in two kinesiology classes. The classes are very similar as they are both designated as semester-long fourth year level undergraduate distance courses of the same number of credit hours on the topic of kinesiology research, providing sample equivalance. Students in this course are typically traditional fourth year undergraduate students. As university students in this setting, they use computers and the Internet to access the LMS (Canvas) to view and submit their assignments, Zoom to connect with their classes with an online component, and Microsoft Office applications for completion of assignments. They may use their own personal computers or computers on campus. They have access to additional software through their university login and through on-campus computers available on campus and remotely. Adobe Acrobat DC aligns with their current knowledge of productivity software such as Microsoft Office and extends their productivity skills to PDF files. Students enrolled in the courses are learning additional research skills in the area of kinesiology as many of them will continue in their studies to become occupational or physical therapists. In their future careers, being able to conduct research and share information in their area of study is an important aspect of their scholarship to develop. Learning Adobe Acrobat DC provides the students with skills in downloading and combining PDF research article files for review and sharing as well as combining and converting Microsoft Office files for sharing with others in their field of study, submitting grant applications, digitally signing documents, password-protecting documents, and more.

Instructional Intervention

An instructional intervention, already part of the coursework, in the form of a library staff created instructional video on a software topic was used to provide a shared experience to the participants to address the research questions. The instructional goal of the study is to provide learners with an online instructional video on the use of a software program to provide a shared experience to gather their perceptions of of library staff instructional video qualities to support the development of their software knowledge. The instructional video used was first designed using the general multimedia principle (the idea that people learn better from words and pictures than from words alone), (Mayer, 2014, Chapter 12) by incorporating words via audio and images via screencast video. Additional multimedia principles that matched the instructional goals of the video were also included in the video design. These principles included: the personalization principle (people learn better from multimedia lessons when words are in conversational style rather than formal style), the image principle (people do not necessarily learn better from a multimedia lesson when the speaker's image is added to the screen), the voice principle (people learn better when the narration in multimedia lesson is spoken in a friendly human voice rather than

a machine voice), the pre-training principle (people learn better from a multimedia lesson when they know the names and characteristics of the main concepts), the coherence principle (people learn better when extraneous words, pictures, and sounds are excluded rather than include), the spatial contiguity principle (people learn better when corresponding words are pictures are presented near rather than far from each other), and the temporal contiguity principle (people learn better then corresponding works and pictures are presented simultaneously rather than successively) as outlined by Mayer (2014, Chapter 12).

Incorporating multimedia principles in the design of the video allowed for exploration of the student perceptions of the video's cognitive qualities. The instructional video, which was already part of the course materials, was a recorded 1-hour workshop session presented by the researcher on the topic of Adobe Acrobat DC, a software program that all students in the setting have access to. The video was captioned and included a view of the researcher's desktop screen while actively demonstrating and verbalizing the steps to using the software and also included a view of the researcher speaking. The length of 1 hour is required to include the main features of the software pertinent to undergraduate students. First, the video explains how to request an Adobe Creative Cloud license and install or access the software and introduces a web link for the viewer to access the relevant links and resources for the workshop (approximately 20 minutes, Figure 1; Figure 2). The video includes directions using the web link where they can download practice files to follow along with the demonstration in the video. Then, the video demonstrates tools and features of the program that students can use to create portable document format files (PDF). The video demonstrates how to open the software, reviews the interface and an overview of the tools and file location options and how to create a PDF from a file using the software (approximately 10 minutes, Figure 2). Next, a demonstration of the Combine Files tool is included using the practice files from the web link, showing importing and converting word processing files and image files and combining the files into one PDF. This demonstration includes the Organize tool to remove or add PDF pages within the combined PDF and the Edit PDF tool to edit the PDF pages after they are combined (approximately 20 minutes, Figure 3). The remaining time (approximately 10 minutes) demonstrates additional tools including how to Export pages (convert from PDF back to word processing), Protect files using the password-protect feature, Comment on files when working with others on projects, Fill and Sign to digitally sign files, use the Accessibility tool to prepare files for accessibility needs, and how to get assistance with the software if needed via the library. The video was created using Zoom screen recording software and was posted within the university's video storage system, Panopto, which integrates with the university's LMS, Canvas. The video opens up in the Panopto viewer, enabling the student to pause and rewatch the video as needed.

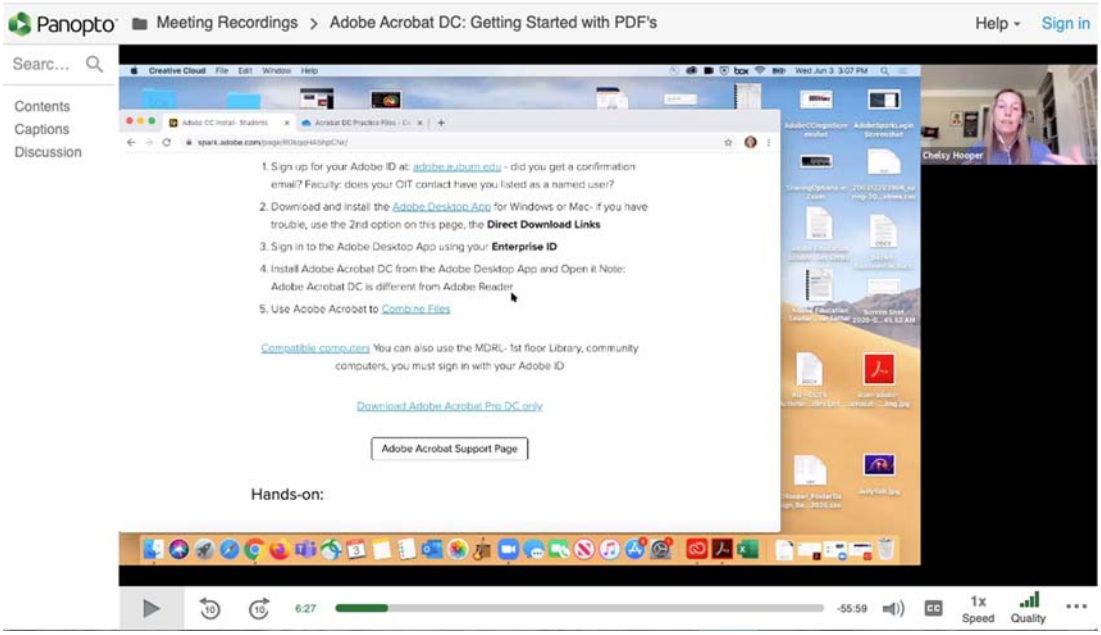

Figure 1
Screenshot of Instructional Video with Software Installation Directions

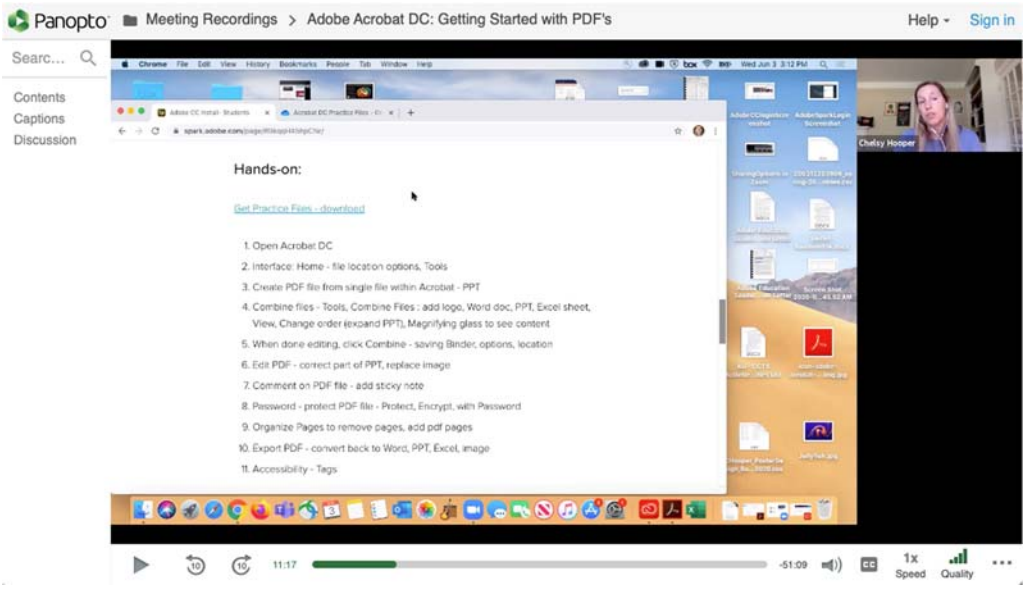

Figure 2
Instructional Video with Demonstration Outline

As part of the video, a main concept of using the Combine tool within Adobe Acrobat DC to create one combined PDF file was explained and demonstrated (Figure 3).

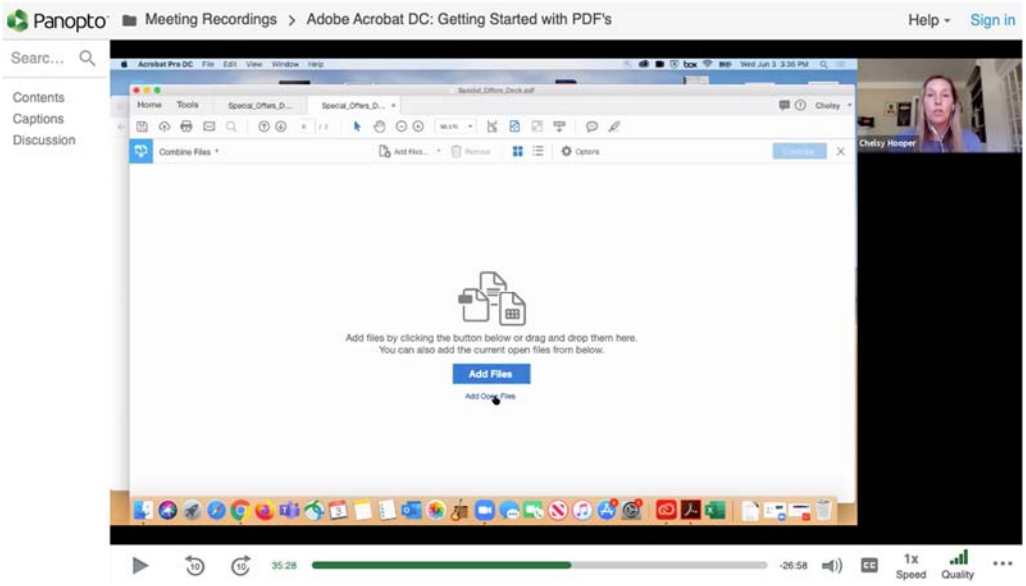

Figure 3
Screenshot of Instructional Video with Demonstration of Combine Files

Students use the features of Adobe Acrobat DC shown in the video to create and edit PDFs in their class assignments and in their future academic and professional careers, so the information in the video is pertinent to their area of study. In the kinesiology courses, students were presented with assignments that required the use of Adobe Acrobat DC, particularly for combining research article files in PDF file format and organizing them.

One specific assignment required students to find research articles relevant to their topic of study, download the PDF of the articles, make copies of the PDFs, bring the copies of the PDFs into Adobe Acrobat DC, and delete the pages of the PDF article files except for the first page of each article. Students read the articles, summarized them in a word processing document and cited them using APA format. Then, students used Adobe Acrobat DC to convert the word processing files to PDF containing their summaries and citations. Finally, the students used the Combine Files tool and the Organize tool to arrange the files in order of the article and its summary and citation and submit the comined PDF as one file to the LMS. The instructor was then able to review the combined PDF and see the types of research articles the student found and selected. The files included the abstracts and citation information for quicker review by the instructor for relevance to the topic, sources used, types of studies found as well as demonstrating new skills developed by the student in the use of Adobe Acrobat DC. Additionally, students can use the skills gained in creating, combining, editing, and signing PDF's to support them as they apply for online job, internship and graduate school applications as well as for grants and shared research in their future career activities. The video was stored in the researcher's Panopto folder and the link to to the video was shared with the instructor of the course who posted the video link as an assignment to the course LMS. Table 2 outlines the alignment of the research questions and the instructional intervention.

Table 2
Research Questions and Instructional Intervention Alignment

Research Questions	Instruction	Activities	Assessments
Research Question 1. How do undergraduate university students describe the cognitive qualities of library staff created online instructional video for software knowledge development in a kinesiology research course?	Instructional video on software use with multimedia principles applied	View instructional video on software use with multimedia principles applied	1. Likert-type survey (Leppink et al., 2013) (questions 1-10) and open-ended questions modified from CLT and CTML (questions 39-44) 2. Semi-structured interviews (questions 1-5, 9-12)
Research Question 2. Considering Mayer's (2014, Chapter 12) multimedia principles of Cognitive Theory of Multimedia Learning, what qualities of the library staff created video do undergraduate students perceive as most effective for their software knowledge development?	Instructional video on software use with multimedia principles applied	View instructional video on software use with multimedia principles applied	1. Likert-type survey (Leppink et al., 2013) (questions 1-10) and open-ended questions modified from CLT and CTML (questions 39-44) 2. Semi-structured interviews (questions 4-12)

Instrumentation/Data Collection Methods

The instruments used in this study, along with the researcher, include a descriptive survey and semi-structured interviews. All instrument collection methods and systems were password-protected.

Descriptive Survey

The survey instrument used in this study utilized the ten-item cognitive load perceptions Likert-type instrument developed by Leppink et al. (2013), which was also used in empirical research on student perceptions of statistics learning: a ten-item questionnaire for the measurement of intrinsic load (IL), extraneous load (EL), and germane load (GL). This instrument employs a scale that was developed and updated by Leppink et al. (2013). It combines four commonly used instruments in cognitive load and CTML research (Appendix C). The four base instruments include the Paas scale (1992) which is a 9-point Likert-type scale measurement of PME that measures overall cognitive load; Ayres' (2006) subjective measure of instrinsic cognitive load; the measure of extraneous load by Cierniak et al., (2009); and Salomon's (1984) measure of germane load. The intent of Leppink et al. (2013) when developing this updated instrument was to reflect new advances in scientific knowledge and to provide an instrument to measure all types of cognitive load within one scale to assess a participants' self-report of their working memory. This more comprehensive assessment of participants' perceptions of cog-

nitive effort fits the purpose of this study to gather thick descriptions of perceptions students have on the qualities of effective instructional video on software topics. While this instrument has been used in research with students in the area of statistics learning, it is not limited to that topic, just as the original base instruments it was developed from are not limited in use to any specific knowledge domain (Leppink et al., 2013). The instrument utilizes an 11-point Likert-type scale and has good reliability and validity based on the findings from the three confirmatory factor analyses conducted, which showed that the three-factorial structure of the instrument is well-supported (Leppink el al., 2013). Multiple experiments conducted (4 studies conducted by the authors described in the development of the instrument) suggest that the ten-item questionnaire measures the various types of cognitive load more effectively than the previous four instruments on which it is based (Leppink et al., 2013).

The items in the ten-item questionnaire were kept the same, with the exception of three of the ten items. The researcher modified the wording of three items in the Leppink et al. scale (2013) for the topic of software learning rather than statistics learning, maintaining the structure of each of the items but slightly adjusting the item wording to include a similarly complex topic of software skills learning, as allowed by the creators of the scale (Leppink et al., 2013). As a similarly complex topic, the scale can be applied to the researcher's topic of software skills development and the wording can be modified (Leppink et al., 2013). The authors state, "…the intended applicability of Items 1–10 is not restricted to a particular knowledge domain. With minor adjustments (e.g., "statistics" in some items), these items could be used in research in other complex knowledge domains" (Leppink et al., 2013, p. 1070).

Validity is maintained by using the same number of scale points (11) as the Leppink et al. scale (2013) and by subject matter expert peer review of the modified survey items. Two instructional technology specialists and one technical writer reviewed the modified survey items and the Leppink et al. (2013) scale. All three subject matter experts found consistency with the use of the scale according to the authors of the scale and the researcher's implementation of the scale in this context. Likert-type scales measuring cognitive load and perceived mental effort have been used in wide array of research in learning and instruction and in conjunction with CTML (Sweller et al., 2019). Results of several studies state that the more subjective cognitive load as measured by perceived mental effort was reduced, retention and transfer increased (Xie et al., 2017). As part of the Leppink et al. scale (2013), the Paas scale (1992) has been used as a base and comparative instrument and expanded upon in other studies (Szulewski at al., 2016, Young et al., 2016).

In the descriptive survey, six open-ended survey questions were also included based on Cognitive Load Theory (CLT) and the research questions. Previous similar studies have employed these types of open-ended survey questions based on CLT (Chen, 2016; Miner, 2018; Valenti, 2019). Table 3 outlines the modified question, original question, and the instrument or source of the questions.

Table 3

Descriptive Survey Questions

Question #	Modified question	Original question	Survey tool
1		The topic/topics covered in the activity was/were very complex. (11 point scale)	Ten-item questionnaire for the measurement of IL, EL, and GL (Leppink et al. 2013), 11 point scale
2	The activity covered software that I perceived as very complex. (11 point scale)	The activity covered formulas that I perceived as very complex. (11 point scale)	Ten-item questionnaire for the measurement of IL, EL, and GL (Leppink et al. 2013), 11 point scale
3		The activity covered concepts and definitions that I perceived as very complex. (11 point scale)	Ten-item questionnaire for the measurement of IL, EL, and GL (Leppink et al. 2013), 11 point scale
4		The instructions and/or explanations during the activity were very unclear. (11 point scale)	Ten-item questionnaire for the measurement of IL, EL, and GL (Leppink et al. 2013), 11 point scale
5		The instructions and/or explanations were, in terms of learning, very ineffective. (11 point scale)	Ten-item questionnaire for the measurement of IL, EL, and GL (Leppink et al. 2013), 11 point scale
6		The instructions and/or explanations were full of unclear language. (11 point scale)	Ten-item questionnaire for the measurement of IL, EL, and GL (Leppink et al. 2013), 11 point scale
7		The activity really enhanced my understanding of the topic(s) covered. (11 point scale)	Ten-item questionnaire for the measurement of IL, EL, and GL (Leppink et al. 2013), 11 point scale
8	The activity really enhanced my knowledge and understanding of the software. (11 point scale)	The activity really enhanced my knowledge and understanding of statistics. (11 point scale)	Ten-item questionnaire for the measurement of IL, EL, and GL (Leppink et al. 2013), 11 point scale

Table 3 (Continued)

Question #	Modified question	Original question	Survey tool
9	The activity really enhanced my understanding of the software covered. (11 point scale)	The activity really enhanced my understanding of the formulas covered. (11 point scale)	Ten-item questionnaire for the measurement of IL, EL, and GL (Leppink et al. 2013), 11 point scale
10		The activity really enhanced my understanding of concepts and definitions. (11 point scale)	Ten-item questionnaire for the measurement of IL, EL, and GL (Leppink et al. 2013), 11 point scale
	Open-ended survey questions		
	Modified question	Original question	Source
39	What qualities of the online instructional video you viewed are MOST helpful for your learning?	What components of online video are MOST helpful for your learning?	Modified online learning open-ended survey question based on CLT principles (Chen, 2016) and the research questions
40	What qualities of the online instructional video you viewed are LEAST helpful for your learning?	What components of online video are LEAST helpful for your learning?	Modified online learning open-ended survey question based on CLT principles (Chen, 2016) and the research questions
41	How could the online instructional video you viewed be used more effectively to promote student learning?	How could online instructional video be used more effectively to promote student learning?	Modified online learning open-ended survey question based on CLT principles (Chen, 2016) and the research questions
42	Imagine that you could add features or technology to fundamentally change the learning experience of the video you viewed. What would you do, add, or modify to the video to enhance the learning experience?	Imagine that you could add features or technology to fundamentally change the teaching and learning experience in the online classroom. What would you do, add, or modify to enhance the teaching and learning experience?	Modified online learning open-ended survey question, (Valenti, 2019) and the research questions

Table 3 (Continued)

Question #	Modified question	Original question	Source
44	Considering all your pre-		The research questions

	vious experiences with online instructional video, what are your perceptions of online instructional video for software knowledge?	

To ethically use the survey, I obtained IRB permission (Appendix H) for the participants from the proper boards associated with myself and the sample of participants used in this study. Qualtrics (university-vetted, password-protected survey software) was used to deploy the survey to participants as part of their university course. The descriptive survey includes students rating their perceptions using the Likert-type survey items and includes open-ended survey questions regarding student perceptions as outlined above. The survey provided a way for students to share reactions to their experience in viewing the online instructional video and to share their perceptions of the effectiveness of that video. Using a descriptive survey provides a way for the researcher to discover student perceptions, since the researcher cannot directly observe the student perceptions (Creswell & Creswell, 2018).

Semi-Structured Interviews

The interview questions are developed from the research questions (Appendix D). Zoom (university-vetted, password-protected videoconferencing software) was used to conduct the interviews. The data collection for the semi-structured interviews included password-protected written notes, audio and video recordings of the interviews, and transcriptions of the interviews. Interviewing is one of the most common ways to collect data for a qualitative study in education and is a good data collection technique to use when the researcher cannot observe the phenomenon or experience (Merriam, 2009). As the researcher cannot observe the perceptions of students towards online instructional video, interviewing students to gather their thoughts and perceptions is a good fit for this study and is necessary to capture the interpretations and feelings of the participants (Merriam, 2009). A semi-structured interview format was used to allow for some flexibility on using open-ended questions to encourage participant sharing of their experiences (Merriam, 2009). During the interviews, I used member checking, which involves repeating or stating a summary of the responses to verify the accuracy. Following the interviews and analysis, member checking was used again to present the themes and transcribed interviews by holding a Zoom meeting with interview participants, reviewing themes discovered and checking for agreement. Using member checking increases the trustworthiness of the data collected (Savin-Baden & Howell, 2013).

Research Question Alignment

Table 4 outlines the research questions and the survey items and interview questions that correspond to each research question, demonstrating alignment of research questions and information gathering. These types of data collection align with basic qualitative research, as the procedures involve descriptive survey and semi-structured interviews with individuals (Merriam, 2009; Savin-Baden & Howell, 2013).

Table 4
Research Questions and Instrument Alignment

Research questions	Data collection
Research Question 1. How do undergraduate university students describe the cognitive qualities of library staff created online instructional video for software knowledge development in a kinesiology research course?	1. Descriptive survey including ten-item questionnaire for measuring II, EL, and GL Likert-type descriptive survey including modified items for the topic (questions 1-10) and open-ended questions modified from CLT and from research questions (questions 39-44) 2. Semi-structured interviews (questions 1-5, 9-12)
Research Question 2. Considering Mayer's (2014, Chapter 12) multimedia principles of Cognitive Theory of Multimedia Learning, what qualities of the library staff created video do undergraduate students perceive as most effective for their software knowledge development?	1. Descriptive survey including ten-item questionnaire for measuring II, EL, and GL Likert-type descriptive survey including modified items for the topic (questions 1-10) and open-ended questions modified from CLT and from research questions (questions 39-44) 2. Semi-structured interviews (questions 4-1

Researcher as Instrument

In basic qualitative research, the researcher is a human instrument (Merriam, 2009). Some sources of potential bias could exist on the part of the researcher. The researcher created the instructional video and is from a multimedia instruction background. As an instructional technology specialist in the library at the setting, the researcher is in a position of academic support to the participants, in an as-needed service model, where students can request multimedia assistance via email, Zoom, or in-person by appointment at any time during regular library business hours during the academic school year. The researcher is not in a supervisory or authority position to the participants. As the researcher is in a role of support to all undergraduate students in the setting, similar relationships would be present for all of the eligible participants who meet the criteria for this study. While the researcher has worked with the instructor in the past, the researcher has not previously interacted with the students in these courses as a group. The researcher does not have any conflicts of interest to address. To help address any further bias, the researcher used an instructional video created previously, using the multimedia principle, before this research began. As the researcher is familiar with multimedia principles, it is possible for the researcher to see more easily the multimedia principles appearing from the coding process. To alleviate this, the researcher strived for a goal of saturation of data, thematic analysis was employed, and member checking during and after the interviews was used, as well as peer review of coding and subject matter expert peer review of survey items.

As an instructional technology specialist based in a main library of a large public university, I recognized a knowledge gap between the expectations of instructors and the software abilities of undergraduate students. As technical support staff in a main library, I often respond to questions from undergraduate students on how to use multimedia software that is required for completion of course assignments. I noticed that many students turned first to informal ways of learning such as using free, online video sharing platforms. Often, the videos they tried to use were not sufficient or effective. Many videos they attempted to use assumed prior knowledge of the viewer or were not well-designed. I began considering ways to assist students in this knowledge gap that could be scaled to large numbers of students. I wondered about what qualities of video students perceive as effective for their software knowledge development, as I noticed students are more likely to use instructional video if they perceive it to be effective and thereby helpful to their learning.

Ethical guidelines for conducting research have been identified and were followed in this study. Participants were not subjected to mental or physical harm and had opportunity to provide consent with no consequences for declining participation. Data gathered from the study was stored in a locked filing cabinet and on a password-protected computer. Only university-vetted data collection tools were used to conduct the survey and interviews. For participants of the survey only, demographic information was collected but not identifying information. In the case of interviews, pseudonyms were used to provide anonymity.

As an instructional technology specialist who is familiar with multimedia principles, I may be biased toward viewing the data through my experiences as someone who works with multimedia daily. As the researcher, and as the researcher is a human instrument in qualitative studies, reflexivity is important to include throughout the study. I have self-reflected and disclosed my personal beliefs and views in order to prevent the research from being affected and potentially skewed due to bias. Reflexivity helps the researcher remember that the researcher is an integral part of the research, so it is not possible to stay exterior of the topic or process of the study (Savin-Baden & Howell, 2013). To practice reflexivity during this study, I kept a research journal to note the decisions made and the rationales for those decisions, as it is recommended to maintain a system of reflexivity that makes sense within the research context, including journaling and free writing ideas and reflections (Savin-Baden & Howell, 2013).

I bring a pragmatic philosophy to my thinking and learning, focusing on practice and the idea that efficacy in in practical activities is a main goal for humans to achieve (Rescher, 2000). Pragmatic approaches have been applied in education to promote change within school practice, problem-solving approaches to educational issues, and incorporating inter-disciplinary curriculum (Ozmon & Craver, 2008). A pragmatic philosophy is appropriate to implement in my area of work, the field of educational technology, as it encourages experimentation and involves problem-solving and work across disciplines (Smith, 2019).

Data Collection/Procedures

After securing Institutional Review Board (IRB) approval, within the time frame of the semester-long kinesiology course, the procedure was as follows:

1. All students in the course viewed the online multimedia instructional video
2. Volunteers within the kinesiology course were elicited through the LMS, email, and brief announcement in a class visit via Zoom for the survey and the interviews
3. Participants completed the online survey
4. Participants took part in an individual semi-structured interview via videoconference

Recruitment of Participants

A convenience sample of students enrolled in the kinesiology course viewed the library staff created online software instructional video through the LMS as part of a course assignment. Volunteers within the undergraduate kinesiology course for the study were elicited through an announcement through the LMS, a class visit, and email (Appendix A). The survey tool (Qualtrics) is university-vetted software. The survey to volunteer for the study contained an information letter which they read immediately before completing the survey (Appendix B). The goal was to have approximately 30 participants as this would include most of the class, as has been applied in other similar qualitiative studies (Andrade et al., 2014; Miner & Stefaniak, 2018; Yuen at al., 2018). At the conclusion of the survey, survey participants were invited to complete a second survey to enter a random drawing to receive a $15 gift card. Interview volunteers were elicited at the end of the survey which included that interview participants may complete a random drawing survey to receive a $25 gift card. Low participation, initially only having one survey respondent and one interview volunteer, led the researcher to modify the IRB to include that all participants of the survey will receive a $15 gift card and all interview participants will receive a $25 gift card. Following this modification and a second class announcement of the modification, two more survey respondents participated. With permission of the instructor, a second IRB modification was submitted and approved to include a second kinesiology class, to offer another distance kinesiology research class the opportunity to participate, increasing the potential pool to approximately another 30 students. The second kinesiology class was very similar; the second course, also fourth-year level, had also used the same software instructional video. The learners were also studying kinesiology research and were comprised mostly of undergraduate seniors using the software as part of their course and they were taught by the same instructor. A third IRB modification was submitted and approved to allow volunteers to participate in the survey, interview, or both, to allow participants to choose only the interview if they would like, in an attempt to increase the likelihood of participation and to allow for rich data collection despite low participation. Following these modifications, six more survey participants completed the survey and three more volunteered for the interview, totaling nine survey participants and four volunteer interviewees. A second class announcement to the second kinesiology class was made in an effort to increase participation. Following that announcement, one more survey participant completed the survey and two more volunteered for the interview, resulting in 10 survey participants. The additional two interview participants only completed the interview volunteer survey, as allowed by the third IRB modification, so more detailed demographics on these two participants was not collected.

The goal was to select interview participants based on their demographic information to provide the widest variety of interview participants. However, due to low participation, all interview volunteers were accepted as participants, with six participants completing interviews. A goal was to obtain a sufficient sample size of five to eight participants as recommended by Merriam (2009) and as utilized in similar studies given the population and sample and demographics (Hajhashemi et al., 2016; Mayer et al., 2020). Participants were advised that there are no physical risks associated with this research and that there are no consequences for declining to participate.

Instructional Intervention Procedure

A library staff created instructional video on a software topic was posted on the course LMS as already part of the course materials, which provided a shared experience to the participants to address the research questions. The video was designed for cross-platform and mobile viewing for ease of participant access. I employed peer review of the instructional video by additional subject matter experts, qualified by their knowledge of instructional video creation as university faculty and staff, to check for usage of the multimedia principle. Participants have email, LMS, internet, and technology access through the university. The researcher has access to necessary tools and skills to design and create the video to meet accessibility and copyright guidelines, and the participants do not need special software to view the videos and access the survey. As fourth-year students currently enrolled in the university, participants have the skills and technology access necessary to view the videos and complete the survey of their perceptions of the instructional video as well as complete interviews on the topic. The data collection setting was online. Participants viewed the video through the LMS as a course assignment, the survey was administered online through a link in the LMS, and the interviews were held over Zoom from the researchers' consistent office setting, within password-protected accounts.

Data Collection

Students in the first kinesiology course viewed the instructional video as part of their coursework within the first 3 weeks of the semester. Students in the second kinesiology course had previously viewed the video as part of their coursework in the previous semester and had access to the video within their current coursework as a review. Immediately after students viewed the instructional video, volunteer participants shared their perceptions via a ten-item Likert-type instrument (Leppink et al., 2013) and open-ended survey questions modified from Cognitive Learning Theory (Sweller, 2011; Valenti, 2019) and responded to demographic questions (Appendix C). At the conclusion of the survey, the researcher elicited volunteers to be interviewed. This was modified in the third IRB modification for the second kinesiology course to have the option to choose to participate in the survey or the interview or both, to increase the likelihood of participation in the interview. Semi-structured interviews were used to gather additional perspectives, allowing for more in-depth exploration of student perceptions. The interviews were scheduled and completed before the mid-point of the semester. An interview protocol (Appendix D) was implemented to have interview participants review a 2-minute segment of the video at the beginning of the interview to remind participants of the instructional video experience prior to questioning, as some time may have passed between the initial viewing of the video and the interview. Interview questions based on the open-ended questions included in the survey were expanded upon to address the research questions (Appendix D). Implementing semi-structured interviews allowed the reasearcher some flexibility in pursuing areas of interest regarding student perceptions, providing additional data for thicker description and enabling the researcher to acquire saturation of data (Merriam, 2009).

All data collected was stored on a password-protected computer accessible only to the researcher. Students who volunteered for the survey completed a demographics section and a Likert-type descriptive survey using Qualtrics which is password-protected and university-vetted (Appendix C). A unique ID was collected in the demographics section to enable the researcher to link the survey data to the interview data without collecting identifiable data. Initially, at the conclusion of the survey, the researcher elicited volunteer interview participants. Students could accept or decline to interview, with no consequences. Following an IRB modifiction, students could choose to participate in the survey or the interview or both (Appendix A). Due to low participation, all interview volunteers were selected for an interview. Interview participants were then individually scheduled with the researcher for a 60-minute semi-structured interview online via Zoom. Computer conferencing is an accepted form of interviews as it allows for real-time synchronous communication using both audio and video and when the research questions relate to the online environment (Savin-Baden & Howell, 2013), so this format fits this study as the research questions include online video.

The one-on-one interviews were planned to last 60 minutes, as 60-90 minutes is the recommended timeframe for interviews for qualitative studies (Savin-Baden & Howell, 2013) and were recorded. Demographic information and a unique ID were collected at the time of the survey, although participants were offered the option to participate in only the interview, thus some skipped the survey and demographics collection. General technology comfort level questions included in the interview protocol provided some baseline information. The recommended number of interview questions for semi-structured interviews (10-12) was followed (Savin-Baden & Howell, 2013) by starting with 12 question items. Open-ended questions based on CTML, CLT, and the research questions were asked in order to gain rich responses from participants (Table 5, Appendix D). Semi-structured interviews allow for the addition of probing questions as the interview develops, also increasing the thickness of the data gathered (Savin-Baden & Howell, 2013). As mentioned, I used member checking during the interviews to improve accuracy of the data collection (Savin-Baden & Howell, 2013). At the conclusion of each interview, I transcribed the interviews within 24 hours. Based upon the responses, I coded them using descriptive coding and studied the codes for themes that developed.

Table 5

Individual Interview Items Description and Correspondence with Research Questions

Question #	Modified question	Original question	Survey tool	Research Question Addressed
	Interview questions			
	Modified question	Original question	Source	
1		Tell me about your experience with using computers, mobile devices, and the Internet to help you learn. a. What video platforms do you use to learn? b. To what extent and frequency have you viewed online instructional video for software skills development previous to this study?	The research questions	1
2		What prior experience do you have with Adobe Creative Cloud applications?	The research questions	1

3		Tell me about the setting in which you watched the instructional video. a. Did you view the video on a computer or mobile device? b. Where were you when you watched it? c. What was the environment like?	The research questions	1

Table 5 (Continued)

Question #	Modified question	Original question	Survey tool	Research Question Addressed
4		Did you have any difficulties in viewing the video?	The research questions	1, 2
5		Did you have any difficulties in using the software?	The research questions	1, 2
6	How did the speaking style of the video influence your learning?	Personalization principle, Voice principle	Research questions, Multimedia principles (Mayer, 2014, Chapter 12)	2
7	How did the presence of the speaker's image on the screen influence your learning?	Image principle, Spatial Contiguity principle, Temporal Contiguity principle	Research questions, Multimedia principles (Mayer, 2014, Chapter 12)	2
8	How did the organization of the materials in the video influence your learning?	Pre-training principle, Coherence principle, Spatial Contiguity principle, Temporal Contiguity principle	Research questions, Multimedia principles (Mayer, 2014, Chapter 12)	2
9		How useful do you think these skills will be for you to have in the future?	The research questions	1, 2
10		Describe your experiences in general with	The research questions	1, 2

	using online instructional video to learn software skills.		
11	Describe how your learning is influenced by online instructional video to learn software skills.	The research questions	1, 2
12	Is there anything else you can tell me that would help me understand your experience?	The research questions	1, 2

The interview schedule was based on mutual schedule availability of the researcher and the interviewee and may have involved the use of an online scheduling assistant. Interview participants were encouraged to connect to Zoom in a setting and on a device with stable internet access and in a quiet setting where they would not be interrupted. Participants have access to this type of setting on campus. Participants were told to maintain their audio and video on for the duration of the interview. Before the beginning of each individual interview, each participant was provided an overview of the study again and was given an opportunity to accept or decline participation via the approved consent information letter.

The descriptive survey provided insight into the perceptions of the students which are not directly observable. A semi-structured interview including initial descriptive questions, evaluative and comparative questions, and probing questions with each participant provided insight into the thoughts of students as they use instructional video to learn multimedia. The use of a semi-structured approach allowed me to adjust probing questions as the interview unfolded, providing flexibility needed to discover student perceptions of qualities of effective video instruction. Utilizing both these types of data collection provided richer data for a broader picture of students' perceptions of instructional video effective qualities for software knowledge development.

Data Analysis

Analyzing the data collected from the survey and the interviews included descriptive statistics using Qualtrics for the Likert-type questions. Analysis also included coding of the information gathered from the open-ended survey questions and the interviews. Using descriptive statistics via Likert-type surveys is an accepted form of data analysis (Creswell & Creswell, 2018). The mean, median, minimum and maximum values and mode of descriptive surveys can reveal trends and themes in qualitative studies (Chen, 2016; Valenti, 2019). In this study, minimum, maximum, and median for each of the ten-item Likert-type questions were used as item responses were reviewed. Coding involves assigning a descriptive label that embodies the meaning of a set of data (Merriam, 2009; Savin-Baden & Howell, 2013). It requires close review of the information gathered. Coding provides a way to closely study the data, whether the data includes text, audio listening, or visual information (Merriam, 2009; Savin-Baden & Howell, 2013). For the open-ended survey questions and for the interviews, I used descriptive coding as this process helped me summarize the typed responses and the transcriptions with descriptive labels. It is possible to use analytical coding for the interviews as well to describe visual data captured in the interview notes such as body language observed during the videoconference. Coding is an appropriate fit for this study as it aligns with basic qualitative research and allows for thematic analysis, which is

one of the main analytical approaches recommended for use in basic qualitative research (Merriam, 2009; Savin-Baden & Howell, 2013). Then, I used thematic analysis to discover themes within the data collected.

Descriptive Coding

Descriptive coding was used in this study as the purpose was to describe participants' perceptions of their experiences. The first step of this data analysis involved open coding and identifying keywords and phrases of the open-ended survey responses and the interview transcriptions. I determined a descriptive label, usually in the form of an adjective for the data set that included emerging descriptions including adjectives describing the participant's perceptions of the instructional video. I identified terms, words, and phrases that were often repeated, and additional words within the context of the keywords. For the open-ended survey questions, an Excel sheet was developed from downloading the survey results from Qualtrics. I created another data column and copied and pasted highlighted words and phrases and corresponded each research question to the data row for each participant. After organizing the coding in the Excel sheet, I used Qualtrics' word cloud visualization feature to create a visual of the open-ended survey questions, using the raw data within the particpants' open-ended responses. The word cloud visuals show the most frequently used words used by participants for each open-ended question. Word cloud visuals are recommended as a starter tool for beginning to identify keywords in qualtitative research, so I compared the word cloud findings with the researcher-created Excel keyword data to provide continuity and as a form of data checking for keyword relevance (Savin-Baden & Howell, 2013). For the interview questions, I developed a Word document with each interview participant and entered the keywords and descriptive labels for each interview participant and each interview question. After compiling interview participant responses and keywords for each interview question and each participant, I re-read the transcriptions and codes to account for responses in other question responses that related to the keywords developed. The goal was to reduce the descriptive codes for the open-ended survey questions and the interview questions to around 40 to 60 codes each, and to then reduce those 40 to 60 codes to 20 to 30 codes each, as recommended by Creswell and Guetterman (2019).

Thematic Coding

Once the information was coded, the content was analyzed using coding systems that correspond to the data collected to discover themes. The different types of data from the survey and the interviews uncovered themes with regards to perceptions of students and provide thicker descriptions of student perceptions of the instructional video. The analysis involved qualitative thematic analysis using the coding systems described to uncover patterns among student perceptions of effective multimedia video instruction. Thematic analysis can be used across many types of qualitative studies and is a method used to reflect reality and to reveal what lies underneath reality (Savin-Baden & Howell, 2013). Thematic analysis is an appropriate fit for my study as it can be used with basic qualitative research in an organized process: a) examine the text or data, b) create initial codes, c) look for themes, d) review the themes e) name and define the themes, and f) produce a report (Merriam, 2009; Savin-Baden & Howell, 2013). The researcher goes through a process of immersing in the data and thinking about connections between codes, ideas, and themes in order to uncover the main themes as findings. This method of reviewing the data holistically and reviewing the coding is considered one of the best methods of analysis as the researcher can use intuition rather than being bound by more strict analysis rules that may not fit the data (Savin-Baden & Howell, 2013). Thematic analysis helps the researcher to analyze intuitively from the data, which provides findings that can be used to inform best practices.

In step two of the analysis, thematic coding, several themes emerged from the descriptive coding, providing an

overview of the perceptions described by participants in the survey and interview results. The unique ID collected enabled me to link the survey data to the interview data for thicker description for 4 of the interview participants. Creswell and Guetterman (2019) recommend collapsing codes into about five to seven themes. During the coding and thematic analysis, I maintained a data column in each Excel sheet of the code list found to be the most descriptive of the data for the open-ended responses. For the interviews, I reviewed the interview response compilation Word document, re-read the transcripts and codes, and organized key responses into themes discovered via a research journal. The themes were presented to the interview participants for member checking of the thematic codes. I also reviewed the video and audio recordings of the interviews again to make sure the themes matched with the interview data. I kept a researcher journal for documenting my thinking as I reduced the data to themes.

To ensure quality, I utilized recommended strategies such as peer examination of codes and thematic analysis findings (Merriam, 2009; Savin-Baden & Howell, 2013). I employed ongoing analysis during data collection which is a preferred method in basic qualitative research as it includes constant comparison (Merriam, 2009). I transcribed each of the interviews within 24 hours, listening to the audio recordings and reviewing the video recordings several times to increase accuracy. When transcribing, I expanded my notes in order to maintain accurate transcriptions while increasing the usability. When analyzing, I watched for saturation of data; when no new themes arise, saturation of data will be present (Merriam, 2009). Additionally, selecting a typical sample from a large group of undergraduate students provides a greater potential for collecting typical student perspectives, which can improve the quality of the findings. During the analysis, I examined all of the data collected and reviewed it in its entirety including subtle information, included all of the data when categorizing and demonstrated how patterns and themes emerged to improve practice in multimedia instructional videos for students. Table 6 outlines the alignment of the research questions, the data sources, and the data analysis.

Table 6

Research Questions, Data Sources, and Analysis Alignment

Research Questions	Data Sources	Analysis
Research Question 1. How do undergraduate university students describe the cognitive qualities of library staff created online instructional video for software knowledge development in a kinesiology research course?	1. Descriptive survey including ten-item questionnaire for measuring Il, EL, and GL Likert-type descriptive survey including modified items for the topic and open-ended questions modified from CLT and from research questions (questions 1-10, 39-44) 2. Semi-structured interviews	1. Descriptive statistics using SPSS for survey items; descriptive coding and thematic analysis of open-ended survey question responses 2. Descriptive coding and thematic analysis of semi-structured interview responses
Research Question 2. Considering Mayer's (2014, Chapter 12) multimedia principles of Cognitive Theory of Multimedia Learning,	1. Descriptive survey including ten-item questionnaire for measuring Il, EL, and GL Likert-type descriptive survey including modified items for the	1. Descriptive statistics using SPSS for survey items; descriptive coding and thematic analysis of open-ended survey question responses

what qualities of the library staff created video do undergraduate students perceive as most effective for their software knowledge development?	topic and open-ended questions modified from CLT and from research questions (questions 1-10, 39-44) 2. Semi-structured interviews	2. Descriptive coding and thematic analysis of semi-structured interview responses

Limitations

This study focused on the experiences of students enrolled in kinesiology classes and did not include the population of all undergraduate students. Increasing the number of student participants enrolled in a variety of courses would provide richer descriptions to analyze for the study. This study had lower participation levels than expected. To address this, the IRB was modified and approved (Appendix H) three times within a two-week period in an effort to increase likelihood of participation by 1) offering all participants a gift card, funded by the researcher, rather than a random drawing for a gift card, 2) adding the option to participate in the study to a second, very similar kinesiology class, and 3) offering students the option to choose to participate in the survey or the interview or both rather than only allowing the interview participation if the volunteer also participates in the survey. Low participation led to a lack of male representation. Potential explanations for the low participation may include that the sample is made up of mostly senior undergraduates who may not have time to participate as they are focused on preparing to graduate. As the study was conducted entirely online, students may have been experiencing screen and COVID fatigue (Ye et al., 2020). As seniors who were likely at the university last year as juniors, they experienced a move to all-remote learning in the spring of 2020. All survey participants reported that all of their courses have required the use of the LMS. Many, if not all of their classes have also been taught online since the move to remote learning in Spring 2020 until February 8, 2021, when the university's Provost Office declared a return to face-to-face learning for those courses that normally are designated as face-to-face classes but previously had the option to be conducted online. It is possible they experienced fatigue of being online and thus chose not to add another online activity (participation in this study) to their already lengthy screen time, or they may have been too busy navigating the return to face-to-face classes for their other courses to participate. Conducting this study online was necessary since the kinesiology courses were designated as distance courses. Additionally, conducting the study online met the need to maintain required social distancing and masking mandates on campus and to maintain safety of all involved.

The survey questions and interview questions were modified to focus on the topic of software knowledge, but integrity of the instrument was maintained. Similar modifications have been implemented in similar studies of perceived effectiveness of multimedia, perceived mental effort, and cognitive load (Chen & Wu, 2016; Miner, 2018; Raaijimakers et al., 2017; Valenti et al., 2019). As instructional video is within the category of multimedia, and a validated instrument is used followed by additions to the survey, the validity is maintained, following standardized survey modification and design methods (Creswell & Creswell, 2018). As this study is qualitative and relies on participants to self-report, it is not possible to verify each piece of information provided. Participants may inaccurately self-report based on a number of factors such as selective memory, embellishment, or linking previous experiences. Member checking was used to increase validation of the interviews and semi-structured interview protocols as outlined in expert methodology texts were followed. A sufficient number of survey and interview participants was used to reach saturation of descriptive survey information collected. There are no ethical or financial conflicts of interest for this study.

Trustworthiness

To address the limitations of this study, several techniques are used to provide creditability and trustworthiness:

- validated survey instrument
- recommended sample size
- descriptive coding
- thematic analysis
- multiple interviews
- member checking
- subject matter expert review of instructional intervention
- reflexivity journal
- transparency

Using acceptable forms of instrumentation, data collection and analysis as outlined in expert texts increases trustworthiness (Creswell & Creswell, 2018; Creswell & Guetterman, 2019; Merriam, 2009), especially when in alignment with the methodology chosen. As a descriptive survey and interviews was employed followed by descriptive coding and thematic analysis in this study, with the goal of reaching data saturation, recommended for use in basic qualitative studies (Merriam, 2009, Savin-Baden & Howell, 2013), trustworthiness increases. Implementing recommended methods of accountability such as expert review, member checking, unique ID's, a researcher reflexivity journal and examining potential biases as mentioned in this chapter are additional ways to demonstrate trustworthiness.

RESULTS

Introduction

The purpose of this study was to explore undergraduate students' perceptions of instructional video on a software topic for the development of software application skills. The research questions for this study are:

Research Question 1. How do undergraduate university students describe the cognitive qualities of library staff created online instructional video for software knowledge development in a kinesiology research course?

Research Question 2. Considering Mayer's (2014, Chapter 12) multimedia principles of Cognitive Theory of Multimedia Learning, what qualities of the library staff created video do undergraduate students perceive as most effective for their software knowledge development?

A descriptive survey including a Likert-type scale (Leppink et. al., 2013), demographic items, and open-ended question items (Appendix C) and interview questions (Appendix D) were used to collect data in response to the research questions. Participant characteristics are described via self-reported demographics. Identifying information was removed from the interview collection. The survey results are presented, followed by the interview results, through the lens of the research questions leading to themes that emerged.

Participant Characteristics

A convenience sample of undergraduate students enrolled in two kinesiology courses was used as representative of the population of university undergraduate students. These students are typically undergraduate students in their fourth year of college who have experience with online coursework. Demographic questions included software knowledge levels, instructional video learning experience as well as age, ethnicity, student status, and more, (see Appendix C).

Self-Reported Demographics of Participants: Descriptive Survey

Of the 10 participants who completed the descriptive survey, nine were female and one was male. Two were 21 years old, five were 22 years old, and two were 23 years old. Seven participants indicated this is their fourth year of college, two indicated this is their third year, and one indicated this is their fifth year. All survey participants indicated that all of their courses used Canvas (the course LMS) to post assignments and they live off campus with others. Three indicated that all of their courses required them to watch instructional videos, six indicated several courses required instructional videos, and one indicated no courses required instructional videos. All participants indicated that they used a laptop to access the video, they typically use a laptop to watch instructional videos, and they watched the video off campus in their living area. They all stated that they downloaded the software to their own computer and they did not request help with the software. Table 7 includes additional demographics on major and experience.

Table 7

Descriptive Survey Participant Demographics

Question Item	Responses
16. What level of experience do you have with Adobe Acrobat DC?	(3) None (6) A little (1) Some (0) A lot
17. What level of experience do you have with Adobe Creative Cloud (apps such as Photoshop, InDesign, Spark, Illustrator?)	(6) None (3) A little (1) Some (0) A lot
18. What is your major of study?	(5) Exercise Science (2) Kinesiology (1) Biomedical Sciences (1) Communication (1) Psychology
19. What year of college is this for you?	(0) First (0) Second (2) Third (7) Fourth (1)Fifth (0) Sixth (0) other: _____
26. To what extent do you have experience learning software skills from online instructional videos?	(0) None (4) A little (5) Some (1) A lot
37. Did you use the captions when viewing the video on Adobe Acrobat DC?	(4)Yes (6) No

All survey participants indicated that they are single, originally from a suburban area, and are full-time students, with two indicating they also work part-time. Four participants reported having a family income of $200,000 or more, another four reported an income between $100,000- $200,000, one participant indicated $50,000-$100,000, and one indicated $25,000-$50,000. Nine participants identified as Caucasian and one identified as Asian. Only one participant reported being a first-generation college student in their family. Participants reported having a GPA of 2.5 or higher, with three participants indicating a GPA of 3.6 or higher. Although four participants indicated they used the closed captioning on the instructional video, only one participant indicated having learning challenges and that this was not documented with the Office of Accessibility.

Descriptive Survey Results

Of the 60 students enrolled in the kinesiology courses, 10 students volunteered to participate in the descriptive survey (Appendix C), completing all of the Likert-type question items, the demographics items, and the open-ended question items regarding their shared experience of viewing the instructional video. The participation rate was 16.67%.

Likert-Type Items

Participants were asked to rate their responses to the Likert-type items based on the Leppink et al. (2013) ten-item 11-point scale where 0 meant "*not at all the case"* and 10 meant "*completely the case"* (Appendix C). Using Qualtrics, the minimum (min) and maximum (max) values and median were found (Table 8).

Table 8

Likert-Type Item Responses Descriptive Statistics

Question Item	Min	Max	Median
1. The topic/topics covered in the activity was/were very complex.	1.00	11.00	5.50
2. The activity covered software that I perceived as very complex.	1.00	11.00	6.50
3. The activity covered concepts and definitions that I perceived as very complex.	1.00	11.00	6.00
4. The instructions and/or explanations during the activity were very unclear.	1.00	9.00	1.00
5. The instructions and/or explanations were, in terms of learning, very ineffective.	1.00	10.00	1.50
6. The instructions and/or explanations were full of unclear language.	1.00	11.00	1.50
7. The activity really enhanced my understanding of the topic(s) covered.	1.00	11.00	9.50
8. The activity really enhanced my knowledge and understanding of the software.	1.00	11.00	9.50
9. The activity really enhanced my understanding of the software covered.	6.00	11.00	10.50
10. The activity really enhanced my understanding of concepts and definitions.	1.00	11.00	10.00

Open-Ended Items

Participants were asked to respond to open-ended question items based on Cognitive Load Theory principles (Chen, 2016; Miner, 2018; Valenti, 2019) and Cognitive Theory of Multimedia Learning principles (Mayer, 2014, Chapter 12) and the research questions. Descriptive coding was used to discover keywords and themes. I imported the open-ended responses into an Excel spreadsheet for organization and then read through the responses to identify keywords. I added researcher-identified keywords for each response as another column of data in Excel. Additionally, I used Qualtrics to create a word cloud for each group of responses per open-ended

question item, showing more frequently used keywords as larger words in a visualization and entered those keywords as another column of data in Excel (Figure 4). I aligned the word cloud images with the Excel data, comparing the word cloud keywords to the researcher-derived keywords. Then, I reviewed all of the keywords to discover common themes and included them in the data sheet (Appendix E). Final, derived keywords are listed in order of frequency in Table 9 below, with the most frequent keyword listed first.

Table 9

Open-ended Question Item Responses

Open-ended question item	Researcher- Derived Keywords
39. What qualities of the online instructional video you viewed are MOST helpful for your learning?	see screen, follow along, visual, step by step, easy to understand/follow along, able to pause video, explanation of software
40. What qualities of the online instructional video you viewed are LEAST helpful for your learning?	nothing, how applicable it will be later, too fast, too long, too technical
41. How could the online instructional video you viewed be used more effectively to promote student learning?	not sure, promote it to more students, segment videos, simplify, allow comments
42. Imagine that you could add features or technology to fundamentally change the learning experience of the video you viewed. What would you do, add, or modify to the video to enhance the learning experience?	nothing/not sure, more interactive/ entertaining, software within video, cc
43. To what extent have you viewed online instructional video for gaining software skills? What platforms have you used? (ex: YouTube, LinkedIn Learning, TikTok, Twitch, etc.)	none/not many, YouTube, Khan Academy, Course Hero
44. Considering all your previous experiences with online instructional video, what are your perceptions of online instructional video for software knowledge?	helpful, efficient, good tool, none, can be difficult

Statements participants provided in the open-ended responses indicated overall positive perceptions of online instructional video for software skills development. In response to question item 39, one respondent stated, “The most helpful quality was that I could see her screen and see exactly what she was clicking on.” Another participant shared, “Being able to see the instructor use Adobe Acrobat DC in the video and follow along with Adobe Acrobat DC open on my own computer was really helpful in understanding how to use the software.”

In response to question item 40, most participants stated there was nothing in the video that was least helpful for their learning. For example, a participant stated, “To be completely honest, I found the video to be incredibly helpful and efficient. I cannot think of something poor about the video.” One participant stated not being sure about the applicability of the software later on, “I’m not sure how often I will actually use this software.” A few participants stated some features of the video that they found unhelpful for their learning, stating, “It was a little bit too fast paced for me” and including, “Being too lengthy/technical” and “Some of the tangents when the instructor interacted with other people during the instructional video were not helpful to me.”

When responding to question item 41, most participants stated they were not sure how the video could be used more effectively to promote student learning. Some participants shared ideas of how this could be improved, including "Offering the video to a wider range of students would definitely promote student learning more effectively." Another participant shared, "Because the software is so complex, I think that having different videos to address how to perform specific tasks would be helpful to student learning." An additional respondent stated, "It could be used more effectively by allowing for comments."

Question item 42 asked respondents to imagine that they could add features or technology to fundamentally change the learning experience of the video they viewed, and what would they add to the video or modify it to improve learning. Most participants indicated they were not sure what they would add or modify, but others shared ideas, mainly around adding interactive features; "I would add a feature that allowed the user to have their own Adobe Acrobat pulled up so they could practice while they watched." Another participant suggested, "I would add an interactive portion. I think that would help solidify if someone was actually understanding the information or just following along."

Question item 43 asked participants to share to what extent they have viewed online instructional video for software skills and what platforms they have used. Most participants shared that they had either not viewed any or very few prior to this study. A few participants stated that they have used YouTube as the most common platform for instructional video viewing. One mentioned Khan Academy, a free online learning platform that offers personalized learning through videos including practice activities (Khan Academy, 2021), and one mentioned Course Hero, which is a site that describes itself as an "online learning platform of course-specific study resources" (Course Hero, Inc., 2021). Students and instructors can subscribe to the Course Hero site and share study materials and access tutoring, a type of crowdsourcing of resources. Respondents also replied: "I have very little experience and it's limited to YouTube tutorials" and "I have mostly used YouTube to view online instructional videos. This is the platform that the majority of my professors have used." Others included, "I have seen online instructional videos on many different platforms but I would say YouTube is the most common" and "Not a great extent but YouTube and Course Hero."

Question item 44 asked participants to consider all their previous experience with online instructional video and to share their perceptions of online instructional video for software knowledge. The majority of participants submitted a positive response, stating that online instructional video is a helpful, efficient tool for learning. One participant submitted a negative response, and one indicated a neutral response. Responses included: "I like online videos" and "I like seeing instructor click through so can follow along." Others included descriptions of "great tool", "efficient", "beneficial" and one respondent stated, "can be difficult."

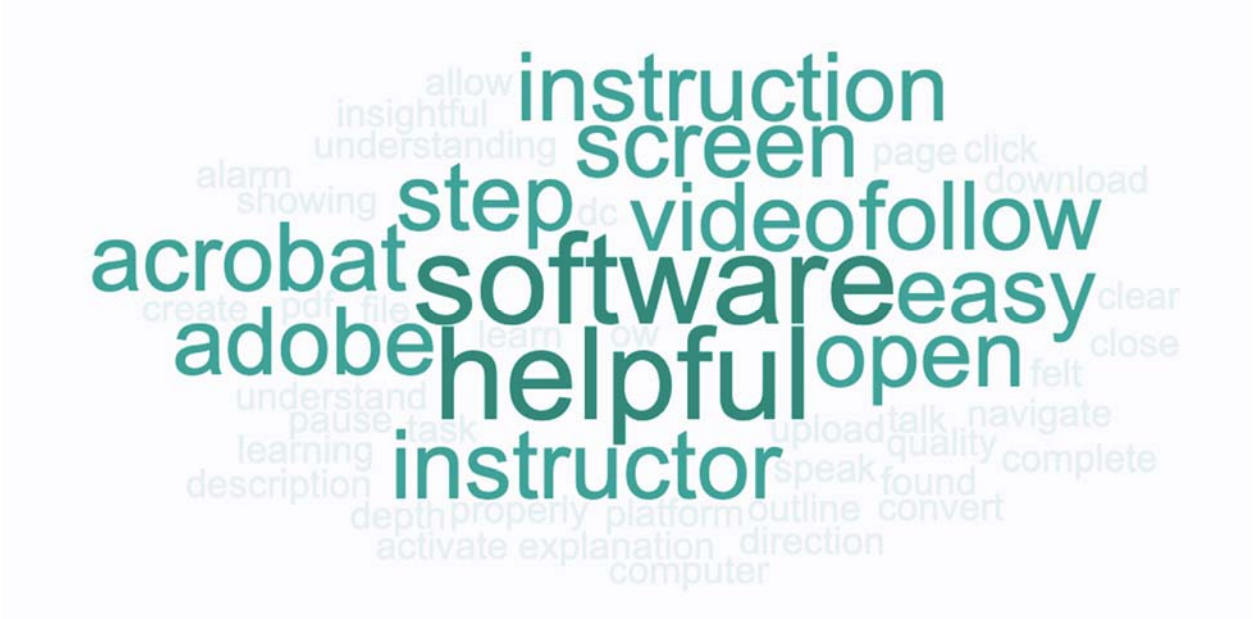

Figure 4
Qualtrics Word Cloud Visualization Example. What qualities of the online instructional video you viewed are MOST helpful for your learning?

Using descriptive coding to summarize the typed responses (Appendix E), I then used thematic analysis to look for themes developed across data according to the codes, reviewed the themes, named and defined them, and discovered the following themes across the open-ended responses.

Theme 1

In general, the paticipants perceived the online instructional video helpful to them for learning software skills. They mainly attributed this to the visual qualities of the video showing step-by-step screencasted instructions combined with explanations provided by the instructor in the video. One participant described video qualities most helpful for learning as,

> Clear step-by-step instructions that outline how to properly complete the task. I found it helpful that we were able to view the screen as the instructions were given because it helpful when it comes to navigating the page.

Another participant's response supported this theme, "…showing step by step, visually what the instructor is talking about instead of someone just speaking at you."

When participants found the video easy to follow along with, they perceived the video as more effective for their learning, "I felt like the instructional video was very easy to follow along which allowed me to really learn how to use Adobe Acrobat." Additional responses included:

> "I learn by videos well especially when I can see exactly what the instructor is doing and can replicate it. I like seeing instructor click through so I can follow along" and "I feel that online instructional videos are very efficient." Another shared, "I think they are helpful in gaining an understanding of the software."

Theme 2

Another theme that arose out of the responses was the lack of previous knowledge of the software, despite the fact that participants are in their third year of college or more, and all had access to Adobe Acrobat DC and Adobe Creative Cloud prior to this study as well as all reporting having access to their own laptop and many reporting having used instructional videos in the past. One respondent commented:

> Offering the video to a wider range of students would definitely promote student learning more effectively. I have been a student at [the university] for the last 4 years and have never heard of Adobe Acrobat DC. I also asked my two roommates who are also seniors and they have never used it either.

Three out of the ten survey participants had never used Adobe Acrobat DC before and none described having a lot of experience with it.

Theme 3

A third theme that arose from the open-ended responses included the idea of adding more interactivity to the video. Ideas from respondents included integrating the software into the video interface for ease of access and use and adding more interactive activities within the video to encourage learners to engage with the content. Participants perceived that increasing engagement with the content improves their learning. Comments included: "I would add a feature that allowed the user to have their own Adobe Acrobat pulled up so they could practice while they watched" and "I think I would try to make the video a bit more fun and entertaining while still doing a good job of explaining." Others shared, "I would make the video more interactive so the student is more likely to pay attention for the entire duration" and "I would add an interactive portion. I think that would help solidify if someone was actually understanding the information or just following along."

Participants noted that providing examples and including step-by-step demonstrative instructions allowing learners to follow along helped provide some interaction with the software, mentioning that being able to pause the video to help the learners to follow along was perceived as effective for their learning. A participant stated, "I liked the examples that were provided and feel it was thorough and effective." An additional comment included, "Showing step by step, visually what the instructor is talking about instead of someone just speaking at you."

Theme 4

A fourth theme discovered in the survey responses was the idea of segmenting and simplifying the video to improve student learning. These included ideas from the participants to create different videos on subtopics within the 1-hour instructional video or to divide the video into chapters or segments for easier access to particular subtopics. One response included:

> Because the software is so complex, I think that having different videos to address how to perform specific tasks would be helpful to student learning. If there were separate videos the student could access that address specific problems rather than one long video containing all the information, a student might be more inclined to use the resource.

Another respondent shared, "[They should] be in shorter, more specific segments that way if the students are only unfamiliar with one aspect they do not have to watch the whole video." Another participant suggested making the directions even simpler, recognizing that learners may not be as familiar with technology and/or the

specific software being demonstrated, stating, "I would add even simpler directions for people who are not as familiar with technology."

Interviews

Interviews with 6 volunteer participants were conducted using the approved interview protocol (Appendix B, Figure 5). Four interview participants also participated in the survey, as they were elicited at the end of the survey, allowing for the survey demographics to be linked to their interview responses. Two interview participants volunteered following the IRB modification allowing participants to choose only to participate in the interview, in an effort to increase data collection due to low participation.

All 6 interview participants were female. Pseudonyms were applied to provide anonymity. The 4 interview participants who also completed the survey indicated they were between 21-22 years old and in their fourth year of college. All four indicated they are full-time students not working part-time and listed their annual family income as $50,000 or higher. All four identify as Caucasian, report no learning disabilities, and none are first-generation college students in their families. Additional demographics of the majors of study and experience of the four volunteer interview participants who also participated in the survey (Gina, Anne, Lila, and Julie) are included in Table 10 . Demographic information of the two interview participants who did not complete the survey (Mary and Katie) was pulled from the interview responses and included in Table 10 below.

Table 10

Interview Participant Demographics

Pseudonym	Demographics
Gina	Kinesiology major, several courses have required watching instructional videos, a little experience with Adobe Acrobat, no experience with Adobe Creative Cloud, did not use closed captions when viewing the video
Anne	Communications major, several courses have required watching instructional videos, no experience with Adobe Acrobat, a little experience with Adobe Creative Cloud, used closed captions when viewing the video
Lila	Psychology major, several courses have required watching instructional videos, a little experience with Adobe Acrobat, a little experience with Adobe Creative Cloud, did not use closed captions when viewing the video
Julie	Kinesiology major, all courses have required watching instructional videos, a little experience with Adobe Acrobat, some experience with Adobe Creative Cloud, used closed captions when viewing the video
Mary	Kinesiology student, describes herself as a self-starter, familiar with self-teaching using the internet, usually uses written guides before using video, a little experience with Acrobat, some experience with Adobe Creative Cloud
Katie	Kinesiology student, states YouTube as her first step in figuring out something new, no experience with Acrobat, some experience with Adobe Creative Cloud

Participants joined the password-protected Zoom meetings individually in quiet locations and there were no interruptions or technical issues (Figure 5). Interviews lasted from 25 to 35 minutes in length. While 60 minutes were scheduled for each interview, this range of length was found to be sufficient for participants to respond to interview and follow-up questions that developed as part of the semi-structured interview.

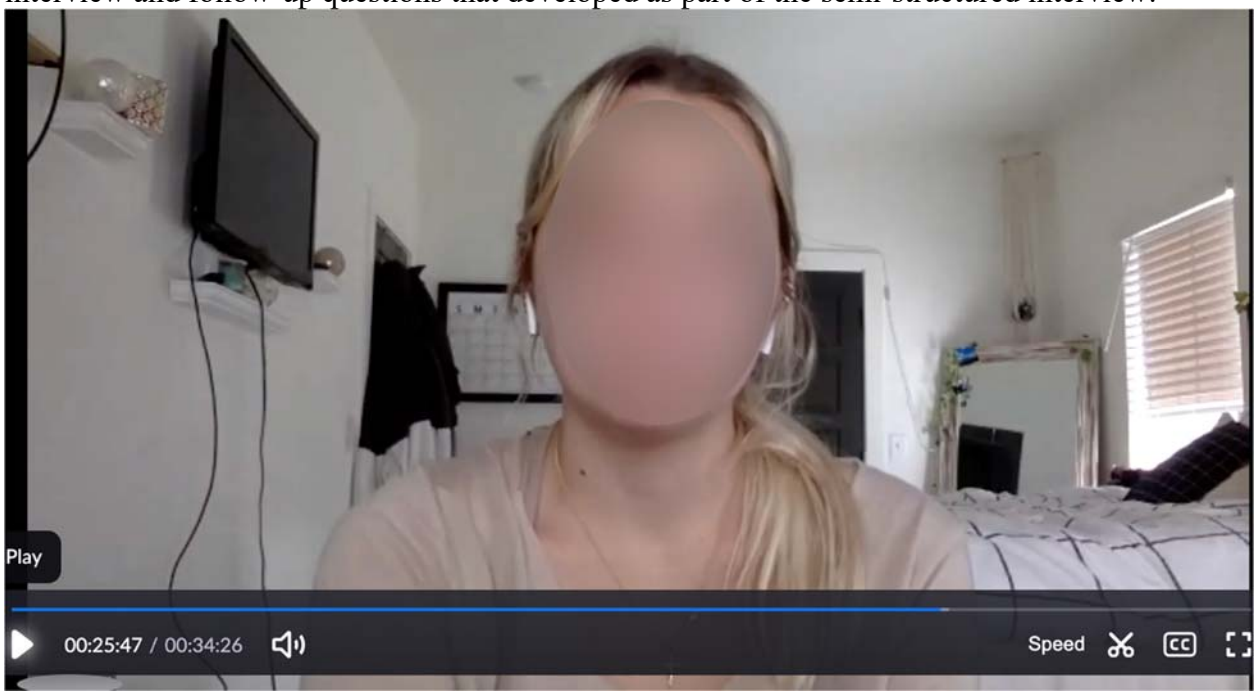

Figure 5
Screenshot of Recorded Zoom Interview (with participant blurred for anonymity)

Interviews were transcribed verbatim and coded using descriptive coding within 24 hours of each interview (Appendix F). The descriptive coding for each interview was first compiled according to each interview question for comparison of content to derive themes aligned with the research questions, as in the sample section from the coding shown below, with #1 representing the responses of the first interviewee, and so on.

“Interview Questions

RQ1

1. Tell me about your experience with using computers, mobile devices, and the Internet to help you learn.

Gina: Lots of tech in HS, in college,”hit or miss” depending on professor. Comfort level with tech is average, reports “pretty comfortable.” Had never used Adobe before this class. Adobe is helpful and easier than other programs for making PDF’s.

Anne: Fourth year of being a student at the university, used to using Canvas, email, MS office. Use a computer more for schoolwork and a phone for personal items instead of schoolwork.

Lila: Powerpoint, MS office, computer for schoolwork, phone for personal, also Pages

Julie: for classes, used to using Zoom, Panopto. Use a laptop and a phone. I have the basics to get work done.

> Mary: I find resources from other people, usually other presenters working on the same thing. Most of this stuff, I end up being kind of a self starter.
>
> Katie: I feel like that's my go-to for getting started, especially to look at YouTube videos, that's like my first step in trying to figure out something new."

Following this compilation of interview responses, I completed additional descriptive coding by reviewing the transcripts again and creating notes in a research journal to discover which responses from different interview questions matched current themes and developed new themes. Then, I reviewed all of the themes and matched them to each research question. As a result of the interview descriptive coding and analysis, the current themes derived from the open-ended responses were supported.

Theme 1: Positive Video Perceptions

All interview participants also expressed a positive perception of online instructional video for software knowledge, stating that in general using video to learn software is helpful. In particular, asynchronous video is perceived as more helpful than synchronous. This is likely due to the viewer's ability to pause and rewatch the video. Gina, a kinesiology major with little experience with Acrobat and no experience with Adobe Creative Cloud, shared, "It was better that it was a video and not a live Zoom. Being able to pause it and go back and re-watch and take your notes slowly helps. I did it step by step with the video. The instructor had a written list step by step from your video but the video was easier to use." Similarly, Anne, a communications major with no experience with Acrobat and a little experience with Adobe Creative Cloud, said "no problems, easy to understand, after watching the video, I had a better idea of how to use it."

Five interview participants agreed that they perceived video as an easier mode for learning software rather than screenshots and/or written directions. Julie stated,

> Sometimes I use the images in Google but I feel like videos are…they just flow better. It's more like you can see the person literally moving, that video allows. I find video more engaging, you can follow along. If you have just a screenshot, you don't really have a reference point of where that screenshot's from. So a video shows you more reference and it's more general. I like to work better with step by step instructions and audio at the same time. It just helps me understand. I don't get bored. It's easy for me to follow.

Anne agreed, "I prefer a video because I like to visualize things. I like to see someone doing it instead of just reading." Mary, a kinesiology student who describes herself as a self-learner with some experience using Adobe Creative Cloud, described video as a "great first introduction" but indicated a preference for written guides when looking for a specific item, "it's much easier to find a specific piece of information where video tends to be much more holistic."

Theme 2: Previous Knowledge of Software Is Desired

Interview participants also noted a lack of previous experience with Adobe software, indicating a perception that previous experience with or earlier knowledge of the software would have been helpful before this semester, especially as most participants were in their fourth year of college. Gina stated she had never used Adobe applications before and had never downloaded it before.

> My instructors had not required it before this one. Adobe would have been helpful to know before, it could have helped me in other classes with submitting assignments using PDF. Professors and I have even had problems with submitting a document. And then my professor can't view it because they don't have a Mac or they don't have the ability to open it. So I think that with Adobe, it's nice knowing all your information's going to be there.

Gina's response indicated a perception that if technology doesn't work when submitting assignments, some professors might not believe it and take points off the assignment, so using Adobe Acrobat is helpful in ensuring the formatting stays the same when submitting assignments to the LMS; "some professors are nice…and they believe it it was an honest mistake and they let you resubmit it…some professors think that's just a way for you to get that extra day or so to do the assignment and they won't accept it." All interview participants noted little or no past experience with or knowledge of the concepts or tools of Adobe Acrobat. When asked about prior experience with the software, Julie stated, "not at all until Acrobat for this class."

Theme 3: More Interactivity in Video Is Desired

Three interview participants noted features of the video that enabled some interactivity, such as the ability to review the video, refer back to it as a memory aid, use the captions, and expressed the visual nature of the video as positive for their learning. Gina shared, "It's nice to watch a video like yours so you can see it step by step and follow along. We can go on Adobe ourselves and we know exactly where the tools are because we've seen it." Anne shared, "I prefer a video because I like to visualize things and rewatch parts of it." Julie stated, "When I was going back to try to do it myself, there were some things I forgot, so I had to go back and refresh my memory." Lila commented, "I prefer video, because you can see step by step how it's going with the software." Using captions was another way the interview particpants engaged in some interactivity by listening to the audio and reading the captions at the same time to understand it better. All interview participants reported using the closed captions available on the video. Lila, a psychology major with a little experience with Acrobat and Adobe Creative Cloud stated, "I'm a very visual learner and the captions help me understand all that's being said, if there's a new term I don't know for example." Julie, a kinesiology major with a little experience with Acrobat and some experience with Adobe Creative Cloud agreed, "I always have captions on, no matter what I'm watching, movie, TV show, instructional YouTube video I always have captions on. If I didn't understand all the words, I can also read them." Anne stated, "I used closed captions, I do that with everything I watch, TV, everything, it's easier for me to understand and follow, I'm not missing anything they're saying."

Katie, a kinesiology student who often uses YouTube, with no experience of Acrobat and some experience with Adobe Creative Cloud, shared that she finds the interactive nature of video enabling her to see the software before beginning to work in the software was helpful to her learning, "it helps me visualize it before I even open it. So when I get into it, I already know like what to expect…and being able to pause a video and go back if something tripped me up."

Theme 4: Segmenting and Simplifying Video Improves Learning

Interview participants agreed that the organization of the materials in the video was important to their learning. In particular, participants noted starting from the very beginning of the tasks, including downloading the software, then going over the interface, then demonstrating to use of the tools, was perceived as positive for their learning. Gina stated, "I liked that you started with generic tools. If you know how to work those, then the other tools will be easier to learn." Julie shared, "You started with the basics first which I liked. And then you didn't

go into all of the other tools, just mostly the ones we needed. But, I felt like I could figure out the other tools later if I needed to since you showed the basics."

Two interview participants agreed that segmenting and/or simplifying the video would improve learning, supporting the perception that how the material is organized affects learning.
Anne commented on the length of the video, "If it was a little bit shorter it would be better but I know you have to add everything in the video. Some people might think it's long and then they don't want to watch it, it's hard to follow. I was more engaged at the beginning of the video." Mary shared, "it's not usually like in segments so like you can miss something and lose your train of thought." She also stated, "typically, I could take what I learned from the video, kind of either review it or find the right [written] guides to just get where I needed to be."

New Themes: Interviews

Additionally, due to the more in-depth questions afforded by the interview and the semi-structured interview format which allowed follow-up questions, new themes emerged.

Theme 5: If Skills Are Perceived as Useful, Learning Improves

If the skills presented in the video are perceived as useful, then learning improves as the video is perceived as easier to use. As Lila commented, "I definitely think I've been using the software a lot more in general. So I think this video helped me out a lot." Julie agreed, "Everyone uses PDF so it's like very useful to have that and be able to do it fast and not have to teach yourself in the future." Participants perceived the video as useful for gaining skills for continued use in the future. Anne shared that she perceived the software skills as "Very useful in my job in the future, I will do an internship then will look for a job in the fall, and I will likely be using some kind of software and computers, so it's very beneficial, a good learning experience." Gina echoed these thoughts, "Also I'm going to go to grad school, to go into the medical field, I will need to be able to share documents in a format that people can read." Katie shared, "having Adobe under your belt, it's definitely helpful and will put you like a little above people who may not be able to use the software." This supports the perception that the video is more useful to them if they can use the software skills beyond a class assignment which may increase learning, as this perception may increase motivation.

Theme 6: Learning from Video Requires Focus And Attention

Interview participants reported the need to focus when learning from video. When asked about the setting in which they watched the video, Gina shared, "I was at home. So it was quiet, easy for me to concentrate. If I was at home with my parents like I was last year [due to COVID], it would have been a lot more difficult with everyone around." Julie agreed, she viewed the video "in my own room, not with my roommates so I don't miss details. If you zone out or hear what your roommate said for a second, you might miss a step." Katie shared, "I was with my roommate, but I put in my earbuds so it's quiet." Anne and Lila also viewed the video at home, in a quiet environment, and reported using earbuds to help focus on the audio and visual content. This supports the perception that it's more difficult to focus on instructional video if the learner is not in a quiet or calm environment or if the learner is not focused. Anne reported, "You had to pay attention, but if you paid attention, then it was easy to follow." All participants reported using their laptops to access the video rather than a mobile device. Mary shared, "I watched it on a computer because I think it's helpful for that kind of thing to be able to follow along, to some extent, that wouldn't really be possible on a mobile device."

Theme 7: Natural Class Setting and Personalization Improves Learning

The more natural aspects of the video were perceived as helpful to learning. Participants reported the setting of the video being a recording of a live session with student attendees present and student employees helping to present was perceived as conducive to learning. Gina stated,

> It was also helpful that you recorded a live session as the recording, because there were other students in it. When the students in the video had questions, I was thinking those are my questions too, and then the questions were answered. Also, you had a student worker explain some of it and that made it really easy when I watched the video and went over it. Like, I remember the scan app, like that was the question I had too.

In the video, a student employee demonstrated the Adobe scan mobile app as a complement to Adobe Acrobat, demonstrating how she scans her artwork to present it digitally in an online portfolio. This statement by the first interview participant led me to add a follow-up question to all of the other participants regarding the presence of students and student employees in the video. Anne shared that including the students in the video made it "more relatable because I'm a student…they were showing us how to do it, it made it more easy for me to…relate to them…like, I can do it too…kind of encouraging." Lila shared, "It was good to see students in the video because it shows like what you can do with the software. So it's interesting and probably good for motivation to see things like that." I was curious if it mattered to the participants if it was student employees in the video doing a demonstration, or if they thought it would have the same effect if it was a faculty member doing a demonstration. Responses were split on this; three interview participants stated that it was better to have students demonstrating, three stated it wouldn't matter who, that it depended on the information shared. When comparing these opinions across majors or experience with software, no consistencies were found. Katie, a frequent user of YouTube with some experience, liked the students demonstrating, stating, "student perspectives really helps." Julie, also with experience in using instructional videos and some experience with software shared,

> As for the other students in the video, sometimes that was kind of neutral for me, but sometimes I was interested in them explaining their process and how they did it, like, ok, I can do it too. So I found it helpful when the student showed an example. It gives you a little reassurance. So maybe I can do it. [It] might not be as hard as I think.

Lila, with experience using instructional videos and a little experience with the software stated, "Whoever's talking isn't that important, just maybe what they are sharing and if it's valuable to you." Mary, familiar with teaching herself on the internet and with some experience in Adobe Creative Cloud, shared, "I don't think it matters either way, it's just the idea that, this is how I use it."

Continuing with the theme of a more natural setting, interview participants also noted that the speaking style of the video and the presence of the speaker's image on the screen helped improve their learning. Lila shared, "I liked that you didn't read from a script, that can be kind of boring." Julie agreed, and also commented on the combination of the speaking style and the presence of the speaker's image on the screen, "I liked the tone, very clear, detailed. I like how you can also see you're talking and you can also see what you're doing on the screen. If it was a video of just you talking, I wouldn't like that style." Gina commented that the speaking style was "not too fast, not too slow, clear and concise, not a lot of extra wordy content." With regards to the speaker's image, she continued,

Especially when you are watching an instructional video and you're not in a classroom, it's nice to know an actual person is explaining to you. Just voiceovers are ok but seeing a face is better, you feel kind of face to face

with the instructor. It sounds like an actual person sitting down to talk to you even though it's a recording. Other interview participants reported that the speaker's image on screen was perceived as just normal or natural, or that they felt neutral about the image being present. Lila noted, "I would honestly say I didn't notice. It was just sort of like a natural setting. It doesn't feel forced or pressured." Julie shared, "I think if I was just watching the screencast, I would've figured it out but it's easier when you're saying the words and I can see you are saying them. It's easier to understand than when you're just moving your mouse." Katie stated, " I think it helps make it personal, too, because when you're just staring at like a PowerPoint, for example, it just feels like you're staring at a PowerPoint. I really like seeing interaction with someone. I think a lot of people kind of like seeing that maybe there's an actual person behind it." This supports the perception that the video is easier to understand when more natural presentation styles are used. One participant, Mary, expanded upon this idea futher by stating that how useful she perceived the video to be depended on the presenter,

> …the baseline expectation of where the person is [skill-wise] in the software is not set, especially when you are trying to learn something specific, so they may start bringing up concepts you've never heard of before. But if you're on the [skill] level of the presenter, it's every effective and fast.

Summary

The results of the descriptive survey led to the discovery of four themes, including:

- a generally positive perception of online instructional video for software knowledge development and learning, particularly asynchronous video
- a perception that lack of previous exposure or experience to or with the software decreased learning
- a perception that increasing interactivity within the video would increase student engagement with the content and thus increase student learning
- perceptions that the organization of the materials in the video affected learning, including starting with basics and building up positively affected learning, and that segmenting and/or simplifying the content within the hour-long video would increase learning

The results of the semi-structured interviews supported the four themes discovered via the descriptive survey and expanded upon the perceptions revealed by the descriptive survey. Additionally, three more themes were revealed through more in-depth inquiry via individual interviews using a set of interview questions and follow-up questions:

- An idea that the more useful the information in the video is perceived to be, the more effective the instructional video will be
- A perception that video requires concentration and that if the learner is focused on the instructional video, learning increases, while a loss of concentration results is less effective learning, particularly from video instruction
- Perceptions that more natural settings and casual presentation styles used in an instructional video lead to more effective learning

In total, seven themes were uncovered by gathering descriptive qualitative results to answer the research questions of this study regarding the cognitive qualities of the online instructional video for software skills development and undergraduate student perceptions.

DISCUSSION AND CONCLUSIONS

Introduction

The purpose of this basic qualitative study was to explore undergraduate students' perceptions of instructional video for acquiring software skills knowledge. Participants included undergraduate students enrolled in a kinesiology course at a university. Ten participants completed the descriptive survey and 6 participants took part in individual interviews. Question items were developed from current instruments and the research questions. Analysis of the data as described in Chapter 3 resulted in the emergence of seven themes. Themes 1, 3, and 5 aligned with research question 1 and themes 2, 4, 6, and 7 aligned with research question 2. In this chapter, the interpretation and implications of the findings are discussed, as well as the limitations of the study, suggestions to improve practice, and recommendations for futher research in the field.

Summary and Discussion of the Findings

The two research questions are presented with an interpretation and implications for each question through a discussion of the findings from the descriptive survey and interviews. The discussion also includes the findings' relations to literature and theoretical framework described in Chapter 2.

Research Question 1

How do undergraduate university students describe the cognitive qualities of library staff created online instructional video for software knowledge development in a kinesiology research course?

Interpretation of Findings for Research Question 1

Undergraduate university students describe the cognitive qualities of library staff created online instructional video as generally positive for their learning, a desire for more interactive elements, and tended to view the video more positively and learn more effectively when they believe the software skills learned will be useful to them in the future as well as in the present.

Likert-Type Survey Item Findings

For the ten-item Likert-type Leppink et al. (2013) scale on cognitive qualities, participants responded to each of the questions on an 11-point scale with 0 to meaning *not at all the case* and 10 meaning *completely the case* (Appendix C, Table 8). Using descriptive statistics of minimum and maximum and median, the results indicate that in general, participants viewed the video as containing positive cognitive qualities for their learning. Participants viewed the activity of learning from the online instructional video on software as of average complexity. Items 1-3 focused on the level of complexity of the activity. The minumim of 1 and maximum of 11 for items 1-3 indicate differing responses at each end of the the scale. However, the results of items 1-3 indicated medians of 5.5, 6.0, and 6.5, falling a little higher than the middle of the 11-point scale. Items 4-6 were negatively worded, asking about the level of clarity of the explanations in the activity. The minumim of 1 and maximum of 11 for items 4-6 also indicate differing responses at each end of the the scale. However, the median results of 1.0, 1.5 on the 11-point scale indicate strongly that the participants did not believe that the instructions were unclear or ineffective. Items 7-10 include the topic of if the activity improved their knowledge and understanding of the topic. The minumim and maximum of 1 and 11 for items 7, 8, and 10 indicate differing responses at each end of the the scale. The minumim of 6 and maximum of 11 for item 9 indicate a tendency towards the maximum value of the scale. These question items had the highest medians of 9.5, 10, and 10.5 on the 11-point scale. These

results from the Likert-type items provide a baseline of data indicating that the online instructional video on a software topic contained generally positive cognitive qualities, maintaining low cognitive load, as the Leppink et al. (2013) scale includes the measurement of cognitive load by incorporating measures of intrinsic load, extraneous load, and germane load (Sweller et al., 2011).

Open-Ended Survey Item Findings

To gain richer data beyond the Likert-type scale, participants responded to open-ended question items based on Cognitive Load Theory principles (Chen, 2016; Miner, 2018; Valenti, 2019) and the research questions and participated in semi-structured interviews. Themes 1, 3, and 5 that were discovered in this process aligned with research question 1. Theme 1 involved the perception of participants that video is an effective way for them to learn software, mainly due to the visual nature of video and being able to follow along to a screencast. Participants reported asynchronous video as better for their learning so they could pause the video and return to it as a memory aid, and use the captions to help them understand. This aligns with findings from other studies (Andrade et al., 2014; Ibrahim, 2012). Theme 3 involved the perception that interactivity with the video or with an embedded activity using the video increases learning.

Many participants reported using the captions to stay engaged with the content as well as referring back to the video and following along step by step with the software also up on their computer screen. Several participants suggested increasing interactivity through an embedded software window within the video or similar ways to increase student engagement with the content such as seen in other studies (Li & Liu, 2012; Ou et al., 2019). Theme 5 includes the idea that if learners perceive the knowledge in the video as useful then their learning improves, as the video is perceived as easier to use. This perception of ease of use may be more of a motivation factor. Many participants reported that they realized they would be using the software not only for their class assignment this semester, but also in their future internships, job searches, and careers. Participants viewed the video as more useful to them when the skills learned could be applied to other scenarios in the future and perceived the video as helpful to their learning, as seen in other studies that incorporated worked examples and focus on skills development (Galanek et al., 2018; Miner & Stefaniak, 2018). Participants indicated viewing the instructional video increased their confidence in their ability to use the software, enabling them to apply the skills learned in the future.

Implications of Findings for Research Question 1

For the ten-item Likert-type scale on cognitive qualities (see Leppink et al., 2013), results indicated that participants positively perceived the overall cognitive qualities of the video for learning. The middle-range medians for items 1-3 may indicate participants perceived the topic to be fairly complex and thereby would benefit from cognitive load management. The low medians for items 4-6 may indicate participants considered the video to contain clear and effective explanations. The higher medians for items 7-10 may indicate participants perceived the video to enhance their understanding and knowledge of the software. Videos created or used by librarians in the future for software knowledge development should maintain low cognitive load and aim for clear, effective explanations, particularly when the topic is complex as is the case with software knowledge development. When creating videos in the future, library staff could use the Leppink et al. (2013) scale to review the cognitive qualities of the video as part of an assessment or follow-up survey to lower cognitive load and increase learning. Having the scale results as a baseline is useful going forward when reviewing the open-ended survey and interview results for richer data.

The implications of the findings with regards to theme 1 include creating instructional videos with step-by-step demonstrations of the software combined with clear explanations by the instructor that are available for on-demand use by students. All participants indicated asynchronous video as an effective learning tool for software knowledge development as they perceived it to be easy to follow along. As participants often indicated using the video as a memory aid, librarians could also provide easy ways for students to find the instructional videos on a main library web site or embedded within their LMS courses, as was the case with the video used in this study, and provide ways for students to control the video, including ways to pause it, promoting engagement (Powers, 2020). Librarians could use a video platform students are already familiar with, as was the case in this study. Additional memory aids such as brief text and screenshot guides could be included with the video as supportive learning materials.

Library staff could focus video and resource production or curation on university-specific information, such as what software is available, what is it used for, and how to access software packages provided to students by the university. Focusing content on university-specific tasks, such as where to request and download software, what software and resources are available to enrolled students, and how to get started with the basic tools of the software, can assist students by bridging the gap between software provided and student access and use. This can empower students to begin working in the software and enable them to access additional software-company resources or YouTube or LinkedIn videos that are more advanced as students grow in their skills and confidence. Locating or curating university-specific software informational videos and resources on the main library website can assist students with finding valuable academic assistance as students are accustomed to visit the library website for informational searches (Mayer et al., 2020). This would expand upon the library's campus status as a main source of learning resources and academic support services for students (Tuamsuk et al., 2013). This expansion could have the added benefit of libraries demonstrating or increasing their value to the university.

In regards to theme 3, the implications of the findings include that increasing interactivity with the video or adding interactive activities with the video increases student learning. Ways to increase student engagement with the material in the video could be explored, perhaps by having the instructor explicity include an activity and request that viewers pause the video, complete the activity with the software, rewatching a segment as needed, and then continuing the video when the activity is accomplished. Libraries could offer live online instructional sessions along with recorded sessions to provide opportunities for interaction with the instructor and the content. Quizzes or other formative assessments could be embedded within the asynchronous video to "help solidify if someone was actually understanding the information or just following along," as one participant commented. Interactive segments could be added to the video to increase student engagement with the content, thereby increasing learning. This could be particularly helpful in the case of this type of topic, software skills development, as it is a complex topic; adding interactive segments could reduce cognitive load by separating the topic into subtopics (Galanek et al., 2018). As many participants indicated that they used closed captions to help them understand and stay engaged with the content, closed captions should always be included as an option for the viewer and has been found as positive for learning despite the redundancy principle (Ozdemir, 2016). Additionally, the ability to control the video by being able to pause, adjust the volume, open it in a separate window on their computer, and locate the video easily can increase the ability to interact with the video and the content (Mayer et al., 2020).

The implications of the findings with regards to theme 5 include that if students perceive the knowledge shared in the instructional video as useful, then they perceive the video as easier to use, and learning improves. When creating instructional videos, library staff should explicitly include how the information shared in the video and the software skills to be acquired will help students in areas other than for one assignment. Software videos

should include ways the skills gained can be used now and in the future. The perception of ease of use may derive from increased motivation or a viewpoint that the topic of software skills is practical and relevant (Hajhasmi et al., 2016; Sligar et al., 2020). It may also derive from a feeling of increased confidence in their software abilities. Sharing a variety of relevant ways in which the students can use the software in their future activities and/or careers should be included as part of online instructional videos for software skills development, as well as encouraging basic software skills to build upon, empowering learners to continue to learn on their own.

Research Question 2

Considering Mayer's (2014, Chapter 12) multimedia principles of Cognitive Theory of Multimedia Learning, what qualities of the library staff created video do undergraduate students perceive as most effective for their software knowledge development?

Interpretation of Findings for Research Question 2

Considering Mayer's (2014, Chapter 2) multimedia principles of Cognitive Theory of Multimedia Learning, the qualities that undergraduate students perceive as most effective for their software knowledge development involve multimedia principles that relate to earlier exposure to the software, the organization of the materials in the video, the importance of being able to focus on the video, and the setting and delivery methods of the video. To gain rich data, participants responded to open-ended question items based on Cognitive Theory of Multimedia Learning principles (Mayer, 2014, Chapter 12) and the research questions and participated in semi-structured interviews. Themes 2, 4, 6, and 7 that were discovered in this process aligned with research question 2.

Participants noted a lack of previous experience with Adobe software and indicated the desire to have been more familiar with the software application prior to this class. Theme 2 involved the perception that previous experience or prior knowledge of the software or the Adobe software suite of applications before encountering the application for the first time this semester would have increased learning. In particular, as the participants were in their third year of college or higher, it is surprising that many did not have any knowledge of or familiarity with the software suite (or even just knowledge that they have free access to it). This finding is consistent with Mayer's multimedia principle of pretraining, the idea that people learn better from a multimedia lesson when they know the names and characteristics of the main concepts (Mayer, 2014, Chapter 12) and supports undergraduates' need for software knowledge for academic success (Alexander et al., 2020; Tang & Chaw, 2016). As students at the university, participants very likely had been exposed to the library as a source of acadmic support and to additional resources available to them, such as Adobe Creative Cloud software. However, they may have been made aware of these services as younger students or as part of orientation to the university. If the students did not need the software knowledge at that time, it is likely that they did not access the resources, as students tend to access resources they perceive valuable to their learning at the moment of need (Hajhashemi et al., 2016). Students may benefit from ready-access to on-demand videos available to them at their time and point of need.

With regards to theme 4, participants noted that the organization of the materials in the video was perceived as important to their learning. This included demonstrating the tasks involving the use of the software from the beginning, including how to access and download the software, reviewing the interface and the tools, and including step-by-step screencast examples of how to use the software to accomplish tasks. Participants noted that starting from very basic beginning tasks and scaffolding the knowledge within the video was helpful to their

learning. Participants gained confidence in their software skill abilities through the use of instructional video, reporting afterwards feeling empowered to learn additional, more difficult features on their own. They also noted being able to visually follow along step-by-step was perceived as helpful to their learning. These findings are consistent with the spatial contiguity principle, the idea that people learn better when corresponding words and pictures are presented near rather than far from each other, and the temporal contiguity principle, the idea that people learn better when corresponding works and pictures are presented simultaneously rather than successively (Mayer, 2014, Chapter 12). Some participants commented on the length of the one-hour video, stating the segmenting and/or simplifying the video would help their learning by dividing the content into smaller sections, as seen in similar studies (Mahajan et al., 2020; Sentz et al., 2019; Sweller at al., 2019). These findings are consistent with the segmenting principle, which states that humans learn best when information is presented in sections or segments, rather than one long continuous stream of information (Mayer, 2014, Chapter 12).

Theme 6 addressed the idea that students need to be able to focus their attention on the video in order to take in the software skills knowledge. Participants reported needing to pay attention to the video to increase their learning. All participants reported using laptops to access the video and downloading the software to their laptop. They also reported viewing the video in a quiet area, most of them stating they watched it in their own room, with no other people around or they used earbuds to only listen to the video rather than extraneous noise. This would help them reduce their extraneous cognitive load, and this finding is consistent with the coherence principle, which is the idea that people learn better when extraneous words, pictures, and sounds are excluded rather than included (Mayer, 2014, Chapter 12). This finding is also consistent with other studies involving the reduction of extraneous load resulting in improved learning (Schilling et al., 2016; Szulewski at al., 2016).

In theme 7, it was revealed that students perceived more the more natural aspects of the video, such as the casual learning setting of the video and the conversational speaking style of the presenter as helpful to their learning the software. A part of the setting that participants noted was that since the video was a recording of a live instructional session, students were present in the video, some as learning participants and some as student employees who helped to explain and demonstrate projects they had created with the software. Many participants noted that the presence of students in the video in each of these roles was helpful to their learning as it made the topic more relatable. This was particularly strengthened when participants perceived themselves to be on a similar skill level of the presenter, for example when students were included as presenters, demonstrating the software. These findings are consistent with the personalization principle, which is the idea that people learn better from multimedia lessons when words are in conversational style rather than formal style, and the voice principle, which is the idea that people learn better when the narration in multimedia lesson is spoken in a friendly human voice rather than a machine voice (Mayer, 2014, Chapter 12). This is also consistent with medium naturalness, which includes the idea that the more natural the learning media is, such as including the speaker's image and using a conversational voice and delivery style, the more learning takes place (Weiser et al., 2018). Some participants noted that the presence of the speaker's image on the screen was helpful while others stated that it had no effect or that they had a neutral opinion of the speaker's image being present on the screen. This finding is consistent with the image principle, which states that people do not necessarily learn better from a multimedia lesson when the speaker's image is added to the screen (Mayer, 2014).

Implications of Findings for Research Question 2

The implications of the findings for research question 2 include creating opportunities for earlier exposure to software for students, organizing video materials and segmenting video to improve learning, encouraging the

reduction of extraneous cognitive load to enable students to focus on video, and implementing natural settings and speaking styles into instructional video to increase learning.

The findings within theme 2, which involve a lack of exposure to the software prior to the viewing of the video and being asked to use it in an assignment, suggest that library staff could work to create opportunities for earlier exposure to software suite applications to which students have free access. Libraries typically assist students with general information literacy and knowledge development (Dahlstrom & Bischel, 2014; Khoo et al., 2018) and may have access to first-year courses where software terminology and initial access and basic information about the software applications available to students could be shared earlier on in their academic experience as students, exposing them to the possibilities and basic uses earlier, resulting in an increase in software knowledge. As it was effective to include the use of the software within a kinesiology course in this case, library staff could work with faculty across the university to embed the usage of the software within coursework, helping students learn software skills both for their classwork and for future career work beyond university.

Theme 4's reveal of the importance of the organization of the material in the video suggest that videos created by library staff continue to contain scaffolding material, starting from very basic beginning use and adding tools and more difficult demonstrations, building upon previous information to help learners create permanent knowledge or schema (Sweller et al., 2011). Based on the findings, library staff should segment or divide instructional videos into smaller subsections to enable easier access to specific parts of the software knowledge to increase learning, since learner's working memory is limited (Sweller et al., 2011). In this case, the one-hour video could be divided up into several shorter videos by subtopic, such as a video on accessing, downloading the software, and an overview of the interface, and another video overviewing the tools, and another video demonstrating using specific tools to complete a project, and so on, using segmenting to decrease cognitive load (Mayer, 2014, Chapter 12). Providing shorter videos may also increase the likelihood of students using the video as well as improving their access to use the videos as memory aids, as decreasing the length of the video could decrease germane load (Stanković et al., 2018; Sweller et al., 2019).

Theme 6 revealed that students need to focus on the video to effectively learn from the video. While participants in this study reported using laptops and having access to a quiet setting helped them retain focus, not all learners may have access to computing and quiet study space. Library staff can help provide similar access to students that proved helpful to participants in this study. University libraries can provide laptops available for checkout to students (with the software already installed) or access to desktop computers (with the software already installed) in quiet locations as well as internet access. Libraries can provide inexpensive earbuds for free to students upon request. Libraries can offer quiet study spaces that students can book in advance to use when accessing instructional video. When creating instructional video, library staff can include a brief introduction at the beginning of the video, suggesting that the viewer watch the video on a computer rather than a mobile device and that the viewer access the video in a quiet location to help the learner focus on the video content, using earbuds or headphones as needed. During this brief video introduction, library staff can profile the equipment and quiet study spaces available to students, increasing the likelihood of helping students reduce extraneous load (Sweller et al., 2019). The video introduction could be part of a video template that library staff use when creating all of their instructional videos.

Theme 7 addressed the perception that when students view a video with more natural instructional aspects, learning is more effective. Library staff can implement a more natural video setting by recording a live instructional setting where student participants ask questions and the instructor responds, or by having student employees present software demonstrations, as in the case of the video used in this study. To resolve privacy issues, library staff could "stage" students with questions who agree to be on video, or invite a student guest presenter

who agrees to be on video, if they want to make their video available to the public. Library staff can use Panopto or a similar video storage management platform to manage the privacy settings desired. When creating instructional video, library staff can use conversational styles of speaking when presenting in video as findings show participants found the more casual but still professional style effective for their learning. As participant responses to the speaker's image being on the screen was mixed, library staff could create videos both with the speaker's image on the screen and without, enabling students to choose the mode they prefer.

Limitations

Limitations of this study include:

- This study sampled the population of undergraduate students at one university in kinesiology courses, including 10 survey participants and six interview participants in their third year of undergraduate college or higher. Including participants in a variety of types of undergraduate courses would provide more varied viewpoints and more varied demographics, as well as increasing the number of participants. Participation was lower than expected and was addressed by modifiying the IRB (approved) to include the option for each participant to receive a gift card, an additional, similar kinesiology course was added to increase potential participant pool, and the option was given to participate in the survey or the interview or both.

- Participant's overall technical abilities were not measured and considered in this study (apart from one interview question addressing general experience with technology). Including additional measurements on participant's technical abilities would provide richer data for consideration with the results.

- In this study, the researcher issued the survey, was the interviewer, and created the video on software used as the instructional intervention. Social desirability (Given, 2008) may have been a factor in gathering results as participants may have tended to report their answers in a more socially acceptable way to the researcher rather than expressing their true responses.

- This study used an instructional video on a specific software topic currently in use within the course. Including more instructional videos on varying software topics or in various delivery formats would provide richer data.

- By including a survey and interviews, this study relied on participants self-reporting their perceptions and experiences, which can be inaccurate, as participants could have linked previous experiences or experienced selective memory.

- The interview questions were developed specifically for this study, and the survey questions were slightly modified to align with the research questions.

Suggestions to Improve Practice/ Recommendations for Futher Research

The purpose of this study was to explore undergraduate student perceptions of instructional video for software skills development. Based on the findings, suggestions to improve practice include:

1. Library staff should develop instructional videos on software skills in addition to more traditional library information literacy skills. Libraries typically offer a central location on campus with access to computing and software, and students are used to accessing library facilities for quiet study and information access. Creating supplemental asynchronous video instruction in the area of software skills development fills a software

knowledge gap that many students experience and increases the value of the library and library staff to the university. Library staff unable to create videos due to lack of time or access to tools should curate instructional software videos for easier student access. Once supplemental asynchronous video is created or available, Library staff should work to use these resources to empower students by showing students the value of software skills knowledge for use beyond their course assignments and improve the software skills confidence of students by seeking to share at minimum basic software access information with students early on in their college careers. As a central source of supplemental instruction across campus, library staff can work with faculty to incorporate software use into coursework and can also work with entities across campus such as career services to expose students to the long-term value of software skills development. Offering live presentations including these topics and including this type of information in asynchronous video created by library staff could help to spread the message of long-term skills development to students (Anthonysamy et al., 2020), leading to increased likelihood of use of the videos and software skills confidence in students and potentially leading to industry-recognized software certification programs based in the central location of the library, for example.

2. Library staff should incorporate multimedia principles when creating online instructional videos to enable more effective learning for students. In particular, this study found the multimedia principle of segmenting (Mayer, 2014, Chapter 12) as a key improvement suggestion from student participants. Chunking information makes the complex software skills information more manageable for students, decreasing cognitive load (Mayer & Moreno, 2003) and promoting confidence in their new software abilities. Increasing confidence leads students to feel empowered to continue learning the more advanced features of the software on their own. Creating shorter videos on subtopics within a topic will also allow the students to more easily find and access specific topics as needed for use as memory aids (Sweller et al., 2011) and will allow library staff to more easily create and update videos as software changes. Library staff unable to create videos should curate instructional software videos that utilize segmenting for improved student learning.

3. The spatial contiguity principle (Mayer, 2014, Chapter 12) was found to be effective for student learning and students indicated a desire for interactivity with the presented content within the instructional videos. Library staff should implement step-by-step screencast directions for software skills development and add interactive aspects such as embedded formative assessments to instructional videos to encourage student engagement with the content to improve learning. Videos should also always include closed captioning as an option, as students also reported using the closed captioning as a way to interact with the video and remain focused. Library staff unable to create videos due to lack of time or access to tools should curate effective instructional software videos with closed captioning and interactive learning activities such as modules with built-in quizzes or small project-based activities using the software being learned.

4. The additional multimedia principles of the personalization principle and the voice principle (Mayer, 2014, Chapter 12) were found to be effective for student learning and easily incorporated using basic video creation tools that university libraries typically have access to.
Library staff should consider including student presenters or guest presenters in instructional videos to provide personalization via speakers in the video and to provide demonstrations of the software in an actual project use to show students immediate relevance (Hajhashemi et al., 2016). Students viewed student presenters as a person on their same skill level, which instilled confidence in their ability to learn the software. A similar positive effect would likely be gained from faculty presenters, as some students indicated the background of the presenter did not matter, just if they presented the demonstration on their skill level, and if students perceived the content to be valuable. Library staff should personalize the videos by including presenters who speak on the students' level of software knowledge to create confidence and empower student learners. Library staff should also create more natural learning video settings by recording live classes where participants ask questions, using a more

conversational style when speaking, and including the option to view the speaker's image on screen if desired (Weiser et al., 2018).

Additional research in this area would improve understanding of student perceptions of instructional video for software knowledge. Recommendations for further research include:

1. Continuing to utilize the Leppink et al. (2013) ten-item scale in various types of knowledge settings to contribute to the field of cognitive knowledge and multimedia learning.

2. Additional qualitative research involving Cognitive Theory of Multimedia Learning (Mayer, 2014) as recommended by Leppink at al. (2013) to gather understanding of cognitive processes via perceptions and richer descriptions.

3. Replicating this study at other universities or libraries or with other courses and levels of undergraduate students to compare results and advance the area of library and other academic support entities.

4. Developing a longtitudnal study to explore changes in perception of instructional video over time, for example first-year undergraduate students through their final year of undergraduate courses to determine if experience, type of major or other demographic data reveals additional results that could assist creators of instructional videos to improve practice.

Conclusion

The findings of this study demonstrated that exploring undergraduate student perceptions of library staff instructional video qualities to support software knowledge development informs video design in a positive way to improve learning. Understanding students' experiences when seeking to fill a knowledge gap through asynchronous instructional video provided valuable insight into how students view instructional video for software knowledge and will help to improve the practice of library staff-created instructional video. Viewing student perceptions through the lens of Cognitive Theory of Multimedia Learning (Mayer, 2001) and incorporating multimedia principles when designing software support videos increases the likelihood of student success. Through this increased understanding of students' perceptions via qualitative study, library staff and other educators will be able to design and evaluate effective instructional software videos to address the knowledge gap experienced by undergraduate students in the area of software applications and implementation. A handout highlighting recommendations for library staff based on the findings of this study is included as Appendix G. Additional qualitative research in the area of perceptions and cognition will improve practice and advance the field of instructional technology through a greater understanding of learning processes.

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APPENDIX

Descriptive Survey

Part 1: Likert-type descriptive survey questions

Directions: All of the following questions refer to the activity (software skills instructional video on Adobe Acrobat DC) that just finished. Please respond to each of the questions on the following scale (0 meaning *not at all the case* and 10 meaning *completely the case*)

1. The topic/topics covered in the activity was/were very complex.

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

Not at all the case — Completely the case

2. The activity covered software that I perceived as very complex.

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

Not at all the case — Completely the case

3. The activity covered concepts and definitions that I perceived as very complex.

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

Not at all the case — Completely the case

4. The instructions and/or explanations during the activity were very unclear.

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

Not at all the case — Completely the case

5. The instructions and/or explanations were, in terms of learning, very ineffective.

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

Not at all the case — Completely the case

6. The instructions and/or explanations were full of unclear language.

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

Not at all the case — Completely the case

7. The activity really enhanced my understanding of the topic(s) covered.

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

Not at all the case — Completely the case

8. The activity really enhanced my knowledge and understanding of the software.

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

Not at all the case — Completely the case

9. The activity really enhanced my understanding of the software covered.

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

Not at all the case — Completely the case

10. The activity really enhanced my understanding of concepts and definitions.

☐0 ☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9 ☐10

Not at all the case — Completely the case

Part 2: Demographics
Directions: Please complete the following demographic questions.

11. Unique ID: enter your AU username _____ (the researcher will not search up your username. The unique ID will only be used to link survey data to interview data if you also volunteer to be interviewed)
12. What gender do you identify as?
☐Female ☐Male ☐_____
13. What is your age?
☐18 ☐19 ☐20 ☐21 ☐22 ☐23 ☐24 ☐25+
14. In the past year, how many of your courses have used Canvas to post assignments?
☐None ☐A few ☐Several ☐All
15. In the past year, how many of your courses have required you to watch instructional videos?
☐None ☐A few ☐Several ☐All
16. What level of experience do you have with Adobe Acrobat DC?
☐None ☐A little ☐Some ☐A lot
17. What level of experience do you have with Adobe Creative Cloud (apps such as Photoshop, InDesign, Spark, Illustrator?)
☐None ☐A little ☐Some ☐A lot
18. What is your major of study? _____
19. What year of college is this for you?
☐First ☐Second ☐Third ☐Fourth ☐Fifth ☐Sixth ☐other: _____
20. Do you live on campus or off campus?
☐on campus ☐off campus
21. Do you live on your own or with other people? (ex: roommate, family)
☐on my own ☐with others
22. On what kind of device did you watch the instructional video on Adobe Acrobat DC?
☐desktop computer
☐laptop
☐tablet
☐phone
☐other:_____
23. On what kind of device do you typically watch instructional videos?
☐desktop computer
☐laptop
☐tablet
☐phone
☐other:_____

24. Where did you watch the instructional video on Adobe Acrobat DC?
☐ on campus in a study area such as the library or a classroom
☐off campus in my living area
☐other:_____
25. Where do you typically watch instructional videos?
☐ on campus in a study area such as the library or a classroom
☐off campus in my living area
☐other:_____
26. To what extent do you have experience learning software skills from online instructional videos?
☐None ☐A little ☐Some ☐A lot
27. How did you access Adobe Acrobat DC?
☐ I downloaded it and used it on my own computer
☐ I used it on a computer on campus
☐ other:_____
28. Did you request help in person or online to use Adobe Acrobat DC?
☐ Yes ☐ No
29. Are you originally from an urban, suburban or rural area?
☐Urban ☐Suburban ☐Rural
30. Please specify your ethnicity:
☐Caucasian
☐African-American
☐Latino or Hispanic
☐Asian
☐Native American
☐Native Hawaiian or Pacific Islander
☐Two or more
☐Other/ unknown
☐Prefer not to answer
31. What is your student status?
☐Full-time student ☐Part-time student
32. What is your current employment status?
☐Full-time student
☐employed part-time
☐employed part-time with more than one job
☐employed full-time; part-time student
33. Are you a first-generation college student in your family?
☐Yes ☐No
34. What is your annual household income? (include your family's household income if you are their dependent and receive assistance)
☐less than $25,000
☐$25,000- $50,000
☐$50,000- $100,000
☐$100,000-$200,000
☐More than $200,000
35. What is your marital status?
☐Single ☐Married ☐Divorced

36. What is your current GPA?
☐less than 2.0
☐2.0-2.4
☐2.5- 2.9
☐3.0 – 3.5
☐3.6 or higher
37. Did you use the captions when viewing the video on Adobe Acrobat DC?
☐Yes ☐No
38. Do you have a disability documented with the Office of Accessibility?
☐Yes ☐No ☐No, but I do have learning challenges

Part 3: Open-ended survey questions

Directions: Respond descriptively to the following questions based on the instructional video on Adobe Acrobat DC you recently viewed as part of your coursework.

39. What qualities of the online instructional video you viewed are MOST helpful for your learning?
40. What qualities of the online instructional video you viewed are LEAST helpful for your learning?
41. How could the online instructional video you viewed be used more effectively to promote student learning?
42. Imagine that you could add features or technology to fundamentally change the learning experience of the video you viewed. What would you do, add, or modify to the video to enhance the learning experience?
43. To what extent have you viewed online instructional video for gaining software skills? What platforms have you used? (ex: YouTube, LinkedIn Learning, TikTok, Twitch, etc.)
44. Considering all your previous experiences with online instructional video, what are your perceptions of online instructional video for software knowledge?

Thank you for participating in this survey. After submitting the survey, you may complete a survey to receive a $15.00 Amazon or Panera gift card. Also, after you submit the survey, you may follow the link on the survey submitted page to the interview volunteer survey if you would like to volunteer to be interviewed as part of this same study (your information will only be used to schedule and conduct an interview, then this personal information will be deleted). The time commitment is a 60-minute interview via Zoom at a time convenient for your schedule. You need to have access to a device with clear audio and video and a stable internet connection. You may use a device on campus if you do not have access at home. There is no consequence for declining participation in the interview. After the interview, you may choose to receive compensation in the form of a gift card not to exceed $25.00.

If you decline participation in the interview, please Submit the survey and on the next screen, you may close your browser. Your participation in the survey is complete when you submit the survey.

Presenter's Bio:

Dr. Chelsy Hooper is an Instructional Technology Specialist in the Auburn Libraries' Innovation and Research Commons. Chelsy assists students, faculty, and staff with digital creation skills and technology to support innovative learning, teaching, and research across campus.

Tools to Use in an Information Technology Class – and Best of All They are FREE, Version 2.0!

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Abstract

We developed a paper for the 2016 ASCUE Conference with the topic of software tools to use in the classroom. As mentioned in the original paper, our Computer and Information Technology Department (CIT) curriculum at Purdue University statewide locations includes classes in database, networking, programming and systems areas. Most of these classes have labs using software that our graduates may use when they enter the workforce. The cost of purchasing software for the university labs and for students to use on their laptops can get very high. With a limited budget, it can be difficult to install all of the tools in the labs and expect students to purchase software they may only use one semester.

In our original paper, we covered tools, such as SQL Developer, Oracle Data Modeler, GameMaker, Microsoft Visual Studio Community Edition, and Unreal 4. Since the original paper came out, some licensing policies have changed, newer versions have become available, and we have found software that is a better fit for our classes. Besides giving an update on the original tools, we will discuss new tools that we have added to our toolset in the computer labs. In addition to the software utilized in the labs, we will expand our discussion to software that is not necessarily used in the labs, but can be used by our students on their own machines for our classes. Once again, best of all they are all free!

Presenters' Bios:

Dewey Swanson is an Associate Professor in the Computer and Information Technology Department at Purdue University's Columbus Indiana location. He teaches classes in the area of Database technology and Systems Analysis at Purdue. He has regularly attended the ASCUE conference since 1996.

Dmitri Gusev is an Associate Professor in the Computer and Information Technology Department at Purdue University's Columbus Indiana location. He teaches classes in the area of Application Development and Networking at Purdue. He has regularly attended the ASCUE conference the last several years.

Introduction

Computer and Information Technology Department (CIT) is part of Purdue University's Purdue Polytechnic. The Polytechnic offers Purdue University degrees around the state of Indiana in their Polytechnic Statewide

program. The CIT program is offered in three statewide locations — Anderson, Columbus, and Kokomo, Indiana — besides the main campus in West Lafayette, Indiana. At the Columbus site we offer the Computer and Information Technology degree. This is the general degree program and classes offered focus on application development, systems analysis, database and networking. At the 3 sites offering our program, we have a total of 6 labs with hardware and software installed to support our program. Overall, in our Statewide system there are approximately 30 labs supporting the different degrees offered throughout the state of Indiana. There is not a set budget for hardware and software for the labs, but in recent years Statewide has spent approximately $125,000 a year to support the labs, with that number lower since the Covid pandemic. That is an average of just over $4,100 per lab. The Statewide budget, which is separate from the main campus in West Lafayette, has been flat for the last several years. With this flat budget, it can be difficult to get the software/hardware needed in the labs. Our CIT students may take up to 15 courses that contain a lab component. There is overlap in the software used in these classes, however the licenses for lab machines can be very pricey. As mentioned in our last paper, we are always looking for viable options to add software to our labs that come at either low cost, or no cost. In this paper, we will take a look at the software we used in 2015-2016 and discussed in our original paper. Some of the software is still used and has been updated, while other software is no longer being used and has been replaced by other options. Finally, we have a new section that will discuss free software that we have our students use, but it is not installed in our labs. The best news is, all of the options we will discuss in this paper are free.

UPDATE ON TOOLS WE USED PREVIOUSLY

In this section, we will take a look at the software we discussed in our previous paper. Are we still using the software, and has the software been updated or replaced? We will answer those questions. For complete details on each of these tools, see our original paper, ***Tools to use in an information technology class – and best of all they are FREE!*** from the 2016 ASCUE conference.

VirtualBox

VirtualBox is a category of virtual machine software or VM that can provide the user with an emulation of a particular computer that the user can manage and use. We have been using VirtualBox since 2013. This product can be a complete substitute of a real machine, in which the user can install operating systems and other software of choice. VirtualBox is free, open-source and owned by Oracle Corporation with its official name *Oracle VM VirtualBox*. VirtualBox runs on Windows, Linux, Macintosh, and Solaris hosts and supports a large number of guest operating systems.

VirtualBox has been used differently than our other software tools. We used the software for an asynchronous online class, and the software was not loaded in the labs. Instead, students load the software on their computers. There are several advantages for our students to use VirtualBox. The biggest advantage is that it is standalone, meaning that, once installed, the student does not need to be connected to the network to use the product. Another advantage is that Oracle provides pre-built virtual machines that the student simply loads and is ready to go. The disadvantages for Virtualbox are that it can require a powerful machine to support some of the virtual machine appliances and the lack of support for the students, unlike the software installed in our labs.

We continue to use VirtualBox in CNIT 48700 Database Administration. This is an upper-level CIT class used as an introduction for students in the role of Database Administrator (DBA) using an Oracle database. As mentioned, we offer the CNIT 48700 as an online course to all of our locations. Students download the software from the website and are provided the appliance to use in the class. In 2016, we were running version 5.0 of the software with the latest version of VirtualBox, which is 6.1, as shown in **Figure 1**. With the update in software,

there are no major changes in ease of use and functionality. In addition to the newer version of the software, we now have VirtualBox installed in at least one lab at our three CIT locations.

One difference for students is, we now have VirtualBox installed in labs at all of our locations, in case students prefer to run VirtualBox on university machines or they are having issues with their machines. Also, since we originally started using VirtualBox, Oracle has provided additional pre-built appliances including Oracle WebCenter Portal VM, Oracle Big Data Lite VM and Database App Development VM. All of these come completely configured with the latest versions of Oracle and tools such as NoSQL and XML databases, along with their Big Data toolset.

VirtualBox is free and documentation and downloads can be accessed at : https://www.virtualbox.org/ . Oracle pre-built appliances can be accessed at: https://www.oracle.com/downloads/developer-vm/community-downloads.html.

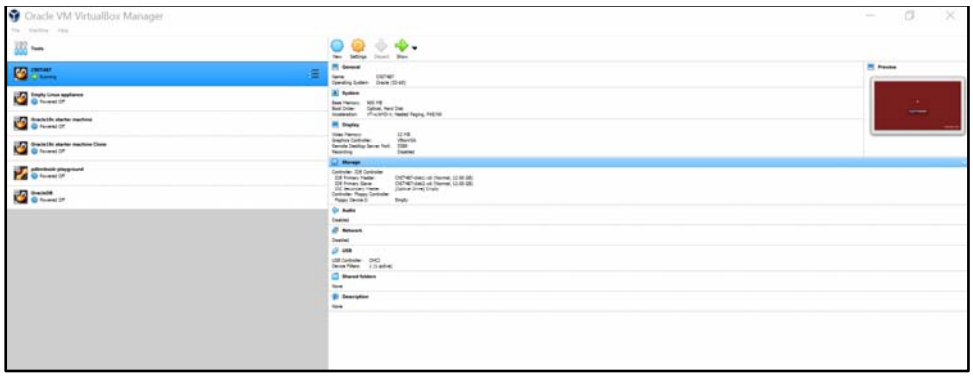

Figure 1. VirtualBox Version 6.1

Oracle SQL Developer

Oracle SQL Developer is an Integrated Development Environment (IDE) that provides programmers and administrators with tools to automate many of the development functions. SQL Developer is used on versions 10g and later and can run on any operating system that runs Java. SQL Developer is free and replaces SQL*Plus, a command line interface and other third-party tools that require a license or subscription to use on lab machines. SQL Developer provides an editor that can be used with SQL and PL/SQL to create code to execute queries, execute, test and debug code. Oracle SQL Developer will run on Windows, Mac OS and Linux platforms.

SQL Developer has several advantages over previous tools, such as SQL*Plus that was strictly a command line editor. It has a rich toolset that allows for program development and database administration. SQL Developer requires no installation and is simply an .exe file that is run. Students can also download and use the same software on their own device. The only real disadvantage is that it must be used with an Oracle database, which is not a problem, since all of the classes other than our introductory class use Oracle database. Note also that SQL Developer does not come with a database. You must connect to an existing database. Oracle does have a free database, Oracle Express, that is a free download. SQL Developer is installed in our labs in Anderson, Columbus and Kokomo. All students download and utilize SQL Developer on their own machines as well. We use Oracle SQL Developer in three classes — CNIT 272 Database Fundamentals, CNIT 372 Database Programming, and CNIT 392 Enterprise Data Management. The latest version of Ora-

cle SQL Developer is version 21.4.3, **Figure 2** features a screenshot of running version 21.2.1. In 2016 we were running version 4.1.4 and, with the update in software, there are no major changes in ease of use and functionality of SQL Developer.

Oracle SQL Developer is a free product and can be accessed at: https://www.oracle.com/downloads/index.html.

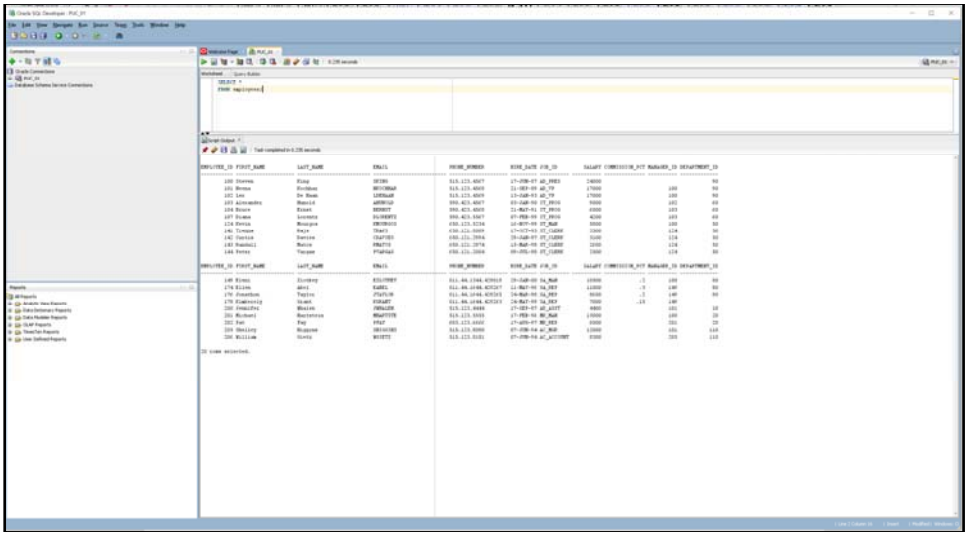

Figure 2. SQL Developer Version 21.2.1 with SQL code

Oracle SQL Developer Data Modeler

SQL Developer Data Modeler is a standalone product graphical tool that can be used to create and maintain logical, relational and physical models. The main model used in database design is an Entity Relationship Diagram (ERD). Data Modeler supports development of ERDs using both the Bachman and Barker notation. Besides creating and maintaining Entity Relationship Diagrams (ERDs), the tool can be used to forward and reverse engineer databases. The tool can also be used to develop process models – Data Flow Diagrams (DFDs).

Data Modeler was used to replace two tools — Oracle Designer and Microsoft Visio. An advantage of Data Modeler like SQL Developer is that it requires no installation, because it is an .exe file that only requires an operating system that can use Java. This makes it easy not only for lab machines, but also for students to access the tool at home. We still have Visio in our computer labs to support systems classes that model heavily using UML diagrams that are not supported by Data Modeler. The biggest disadvantage for Data Modeler would be that it does not support a wide variety of models.

Oracle SQL Developer Data Modeler is installed in all of the labs in Anderson, Columbus and Kokomo. All students download and utilize SQL Developer Data Modeler on their own machines as well. Unlike SQL Developer, you do not need a connection to a database to use it. We use Oracle SQL Developer Data Modeler in three classes — CNIT 272 Database Fundamentals, CNIT 372 Database Programming, and CNIT 392 Enterprise Data Management. The latest version of Oracle SQL Developer Data Modeler is version 21.4.2, **Figure 3** is running 19.2.0. In 2016 we were running version 3.1.4 and, with the update in software, there are no major changes in ease of use and functionality of SQL Developer Data Modeler.

Oracle SQL Developer Data Modeler is a free product and can be accessed at: https://www.oracle.com/downloads/index.html.

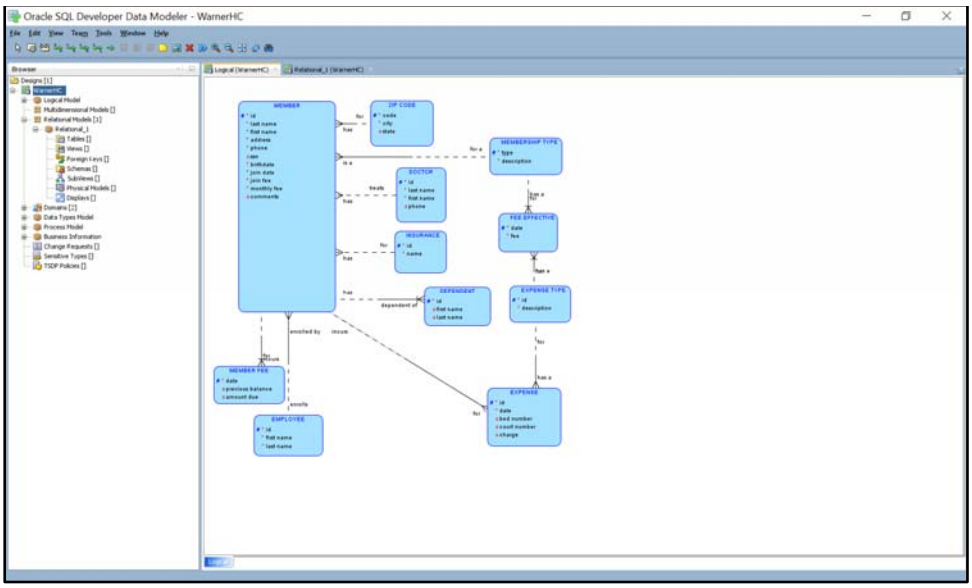

Figure 3. SQL Developer Data Modeler Version 19.2.0 with a logical model

GameMaker

GameMaker (formerly *GameMaker: Studio*) is a series of 2D game engines developed by YoYo Games and currently available at https://gamemaker.io/en. We considered it for adoption in our pilot course, CNIT 381 Introduction to Game Development Technology, that ran in Spring 2021. However, the decision was made to concentrate on 3D game development with Unreal Engine 4, which will be discussed next. The up-to-date pricing options for different GameMaker configurations, including the free one, are shown in Figure 4. GameMaker Educational licenses are available, per https://gamemaker.io/en/education.

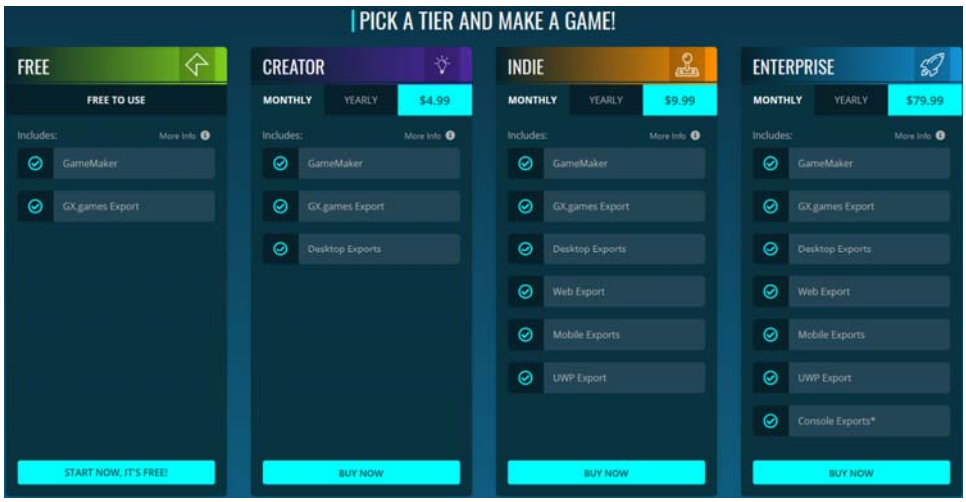

Figure 4. Pricing Options for GameMaker subscription products

Unreal Engine (UE)

For our Spring 2021 offering of CNIT 381 Introduction to Game Development Technology, our pilot course that succeeded CNIT 399 Introduction to Game Development, we switched from Unity, a popular game engine available at https://unity.com/, to its formidable competitor, *Unreal Engine (UE)* that we had discussed as an option in our ASCUE 2016 paper. Unreal Engine by Epic Games is known as the foundation of Fortnite, a popular online video game released in 2017. UE's newest Version 5 released on April 5, 2022, is available at https://www.unrealengine.com/en-US. Unreal Engine is free to use in many cases for game development — a 5% royalty only kicks in if and when your title earns over $1,000,000. In Spring 2021, our students used Unreal Engine 4.26.2. Figure 5 shows a screenshot of Runaway Robot, a puzzle game that a team of 5 students developed as their team project that semester.

Figure 5. Runaway Robot, a video game developed by our students using Unreal Engine 4

Figure 6 shows a screenshot of the control panel of the Epic Games Launcher, a tool that complements Unreal Engine by helping update and start it.

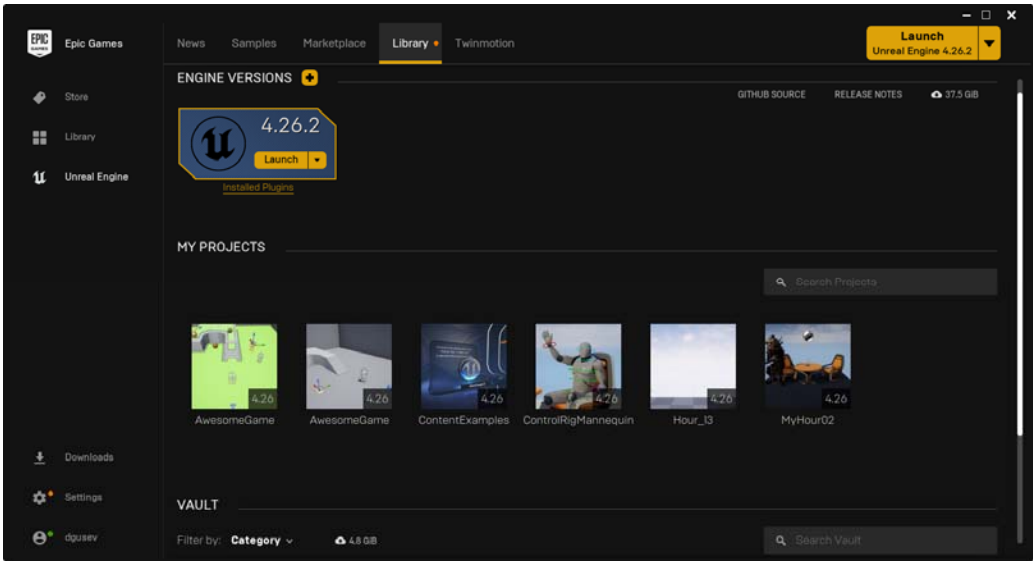

Figure 6. Epic Games Launcher, a tool that complements Unreal Engine (UE)

In the future, we intend to use Unreal Engine in the newly introduced CNIT 306 Game Development I: Core Skills and Technologies and/or CNIT 308 Game Development II: Design and Psychology.

Microsoft Visual Studio Community Edition

In our ASCUE 2016 paper, we discussed the rationale for using Microsoft Visual Studio 2015 Community Edition in three of our courses — CNIT 155 Introduction to Software Development Concepts, CNIT 175 Visual Programming, and CNIT 255 Object-Oriented Programming Introduction. Our latest offerings of these courses (Fall 2021 and Spring 2022) involved using Microsoft Visual Studio 2019 Community Edition. The latest version currently available at https://visualstudio.microsoft.com/vs/ is *Visual Studio 2022*. Figure 7 shows a screenshot of feature comparison of the product's three editions (Community, Professional, and Enterprise) captured at the manufacturer's web page https://visualstudio.microsoft.com/vs/compare/.

Supported Features	Visual Studio Community Free download	Visual Studio Professional Buy	Visual Studio Enterprise Buy
Supported Usage Scenarios	●●●○	●●●●	●●●●
Development Platform Support	●●●●	●●●●	●●●●
Integrated Development Environment	●●●○	●●●○	●●●●
Advanced Debugging and Diagnostics	●●○○	●●○○	●●●●
Testing Tools	●○○○	●○○○	●●●●
Cross-platform Development	●●○○	●●○○	●●●●
Collaboration Tools and Features	●●●●	●●●●	●●●●

Figure 7. Epic Games Launcher, a tool that complements Unreal Engine (UE)

As you can see, the Community Edition remains free, while providing the essential development platform support under the auspices of a production-strength Integrated Development Environment (IDE).

Android Studio

In the Fall 2021 and Spring 2022 semesters, we continued to use Google's *Android Studio*, a free IDE for Android application development based on IntelliJ IDEA. Android Studio is available at https://developer.android.com/studio. In the latest offerings of the corresponding courses — CNIT 355 Software Development for Mobile Computers and CNIT 425 Software Development for Mobile Devices II — we have switched from Java to Kotlin, a closely related language that has become Google's recommended choice for Android development and reportedly crossed the 50% mark in developer preferences a couple of years ago. The courses taught Kotlin programming for smartphones or tablets running Android 6+. Figure 8 features screenshots from Dante, an arcade-style mobile game built by a team of students in CNIT 355. Figure 9 shows the PhotoGallery app (CNIT 425) running in an emulator.

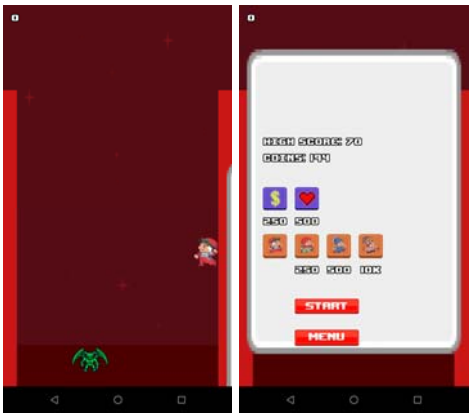

Figure 8. Screenshots of Dante, a mobile game built by students using Android Studio

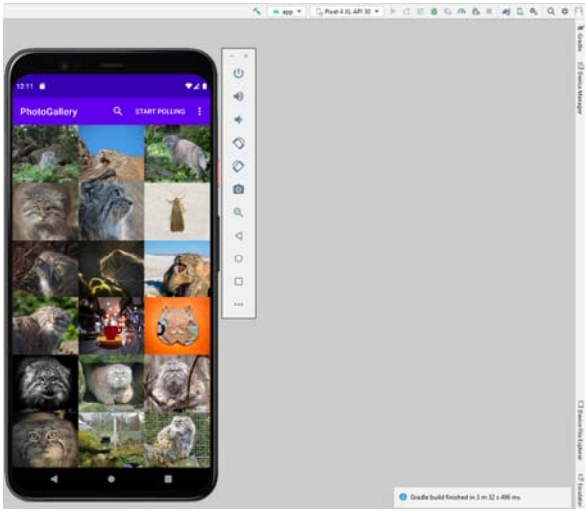

Figure 9. PhotoGallery app submission running in an Android Studio's device emulator

NEW FREE SOFTWARE IN THE LABS

In this section we will review some options that we have incorporated or plan to incorporate into our labs since our previous paper in 2016. Again in our search we were looking for low cost or no cost options. The best news is, all of the options we will discuss in this paper are free.

Tableau

Tableau is a software tool used to analyze and provide data visualization from a variety of inputs including many of the popular relational databases and spreadsheets. As they market themselves on their website Tableau is "the market-leading choice for modern business intelligence, our analytics platform makes it easier for people to explore and manage data, and faster to discover and share insights that can change businesses and the world". Beginning next year our CIT department will offer a new major, Data Analytics, Technologies, and Applications (DATA) major. As the name implies the major focuses on training students in the area of data analytics. Over the last three years we have been developing the program. This has involved revising several existing core classes and the development of new classes to add to the curriculum. One of the classes that is part of CIT core is CNIT 272 Database Fundamentals that is common across all CIT majors. This class has focused on designing databases and programming using SQL with relational databases. With the new DATA major we have added a new section to the class focusing on an introduction of data visualization. We were not able to use existing software we had installed on our labs. After investigating several tools from basic spreadsheet to Microsoft's Power BI and Tableau we decided on Tableau. Tableau offers a huge selection of interactive charts that can be used for data presentation. It is ranked as one of the leading tools on the market today. As with all of the tools Tableau is free to accredited, degree-granting, academic institutions. Currently, Tableau offers an Instructor License, Student Bulk License and Lab Bulk License which we have at our Statewide location in Columbus. A plus of using Tableau is that they have instructional material free for instructors and allow faculty to sit in on Tableau classes when there are open seats in a some of their courses. The only issue we have had so far is due to the lab we are using it in. The lab is a shared lab among 3 institutions using virtualized machines and occasionally we have had issues utilizing it in the lab. Students are also able to use the Public version of Tableau on their own machines. As we offer additional classes in the DATA major, we anticipate additional classes to use the Tableau software.

Tableau is a free product for use in educational settings and can be accessed at https://www.tableau.com.

Code::Blocks

We used *Code::Blocks* to teach the fundamentals of C programming (CNIT 105 Introduction to C Programming, Spring 2017) and advanced C++ programming (CNIT 315 Systems Programming, Spring 2021). Code::Blocks is a free C/C++ and Fortran IDE available at https://www.codeblocks.org/. Importantly for the latter course that involved a great deal of parallel/concurrency programming (an essential component of modern systems programming), the latest Code::Blocks release 20.03 (Mar. 29, 2020) supports makefiles and the C++17 programming standard.

FREE TOOLS TO USE IN CLASS BUT NOT IN LABS

Visual Paradigm

In many of our systems courses students need to use modeling tools. Oracle Data Modeler will handle entity relationship diagrams but would not support many of the Unified Modeling Language (UML) diagrams that are

incorporated into the systems curriculum. We have had a license to use Microsoft Visio Professional edition that supports those needs for many years. The problem we had until recently is that students were not able to access that on their own machines. The cost of the latest version for a one-time purchase is $579 licensed to 1 machine. So that students would not have that expense for 3 classes in their plan of study we allowed students to use Visual Paradigm for their modeling. The advantage to Visual Paradigm is that it is free and supports all of the diagrams we use in our systems classes such as Data Flow Diagrams, Use Case Diagrams, Class Diagrams, Activity diagrams and many more. The downside is that we were not able to install the free version in our labs. The latest version of Visual Paradigm is version 16.4 shown in Figure 11. Within the last several years Purdue University has entered into an agreement with Microsoft to allow students to access Microsoft Visio Professional Edition, however after the first class in the systems curriculum, CNIT 180 Introduction to Systems Development we are not tool specific in our systems courses so student can use whatever tool they prefer.

Visual Paradigm Community Edition is a free product and can be accessed at:
https://www.visual-paradigm.com/download/community.jsp

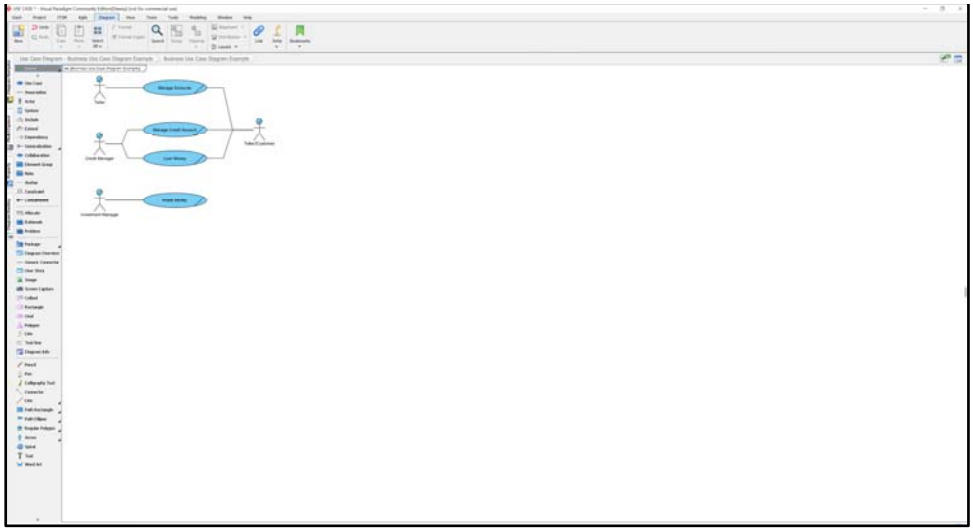

Figure 10. Visual Paradigm Version 16.4 with a Use Case Diagram

Oracle Academy and Cloud products

Our Columbus campus has been a member of Oracle Academy for over twenty years. They have provided free software, curriculum, discounts for instructors to attend Oracle University classes, and discounts for students to take Oracle certification exams. The membership is free for higher education but also K-12 schools. In the last several years, Oracle appears to have put more resources into the program with many new free resources. As a member the Oracle software is available for free to use in our labs.

With the Oracle Academy we have the latest version of the Oracle database software available in our labs and at home for the students. This is free for the university as long as it is used in an educational environment and not used for commercial purposes. Our IT support install and configure the databases for student use. Students are allowed to download and use the same software as long as they download and sign a Student User Agreement. This is the method we support our database needs in CNIT 272 Database Fundamentals, CNIT 372 Database Programming and CNIT 392 Enterprise Data Management.

Another option Oracle Academy provides is to host the database for a course. The big advantage is this eliminates the university from having to install and maintain the database on university resources. Our Columbus campus as mentioned installs the Oracle database on our own servers, however our main campus in West Lafayette just recently utilized this in the CNIT 272 Database Fundamentals course. The disadvantage is that the user has a standard configuration and you have to go through Oracle to make any modifications.

Finally, in the past couple years Oracle Academy has developed the Oracle Academy Cloud Program, which provides universities free access to Oracle and open-source technologies. The instructor at the university requests a Cloud account, requests Cloud resources and then requests Cloud resources for the students. From the Oracle Academy website you can :

Teach and learn Oracle Autonomous Database in Oracle Cloud
Access Compute VM, Oracle APEX, SQL Developer, storage, and network resources
Work with Oracle, MySQL, NoSQL, big data, and open-source databases
Develop in Java, Node.js, Python, PHP, and Ruby

At this point we have not utilized the Oracle Academy Cloud Program in our courses but with our new DATA major that was mentioned previously there appears to be many useful resources in the program.

Oracle Academy is free and can be accessed at https://academy.oracle.com/en/oa-web-overview.html.

Conclusion

In this paper, we have updated our review of numerous software products that we are either incorporating into our computer labs, or have considered for use in our labs, or had our students install on their computers to support their coursework. All of these software products are free. These products are replacing products that would in some cases be very expensive for the University and/or students. Although the features may not be exactly the same as those of the software that was replaced, the reviewed products all have the functionality required to meet the learning outcomes of our CIT classes and in some cases are superior to previous products.

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Android Studio https://developer.android.com/studio

Code::Blocks https://www.codeblocks.org/

GameMaker, https://gamemaker.io/en

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Oracle Academy, https://academy.oracle.com/en/oa-web-overview.html

Oracle SQL Developer and Data Modeler, www.oracle.com

Tableau, https://www.tableau.com

Unreal Engine, https://www.unrealengine.com/en-US

VirtualBox, www.virtualbox.org

Visual Paradigm, https://www.visual-paradigm.com/download/community.jsp

COVID Impact on Higher Education Classrooms

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Abstract

The COVID-19 pandemic has created many problems in our society today from psychological, political, economic and educational standpoints, just to name a few. This is a generational event that we will look back on as creating "the new normal" for our society.

In March of 2020, Purdue University transitioned from teaching students in a traditional face-to-face format to an online format. Over Spring Break of that year, faculty and staff worked tirelessly to create an online environment that served over 40,000 students in thousands of classes to complete the spring 2020 semester. The following semesters have led to additional changes as we have eased back into the classroom.

In this paper we are going to focus on how this pandemic has influenced the classrooms over the last two years at our regional campus in Columbus. While we hope to get back to the way things were done in the classroom before the pandemic, some things are going to change permanently. The good news is, some of these changes are positive for our campus. We will take a look at what we think will be the permanent impact on our higher education classroom environments. In our presentation, we would also like to hear from you and learn what your thoughts are on how the teaching processes and techniques will be affected in the years to come.

Introduction

The COVID-19 pandemic has created many problems in our society today from psychological, political, economic and educational standpoints, just to name a few. This is a generational event that we will look back on as creating "the new normal" for our society. In this paper we will take a look at the timeline of events at Purdue and other institutions and how it affected the university. Some of the effects were temporary, but others will have a permanent impact on our campus and more broadly on higher education. The good news is, some of these changes are positive for our campus and higher education.

The start of the pandemic

In late November 2019, COVID-19 had broken out in Wuhan, China. Early in January 2020, the United States Center for Disease Control and Prevention (CDC) became aware of cases in China, and on January 21st the CDC announced the first confirmed case in the United States, of a 35-year-old male from Washington state. Events moved quickly, and by late February there was growing awareness of the coronavirus across the U.S.

The first confirmed death in the U.S. was on February 29th. Confirmed cases in the U.S. continued to rise, and on March 6th the state of Indiana reported the first confirmed COVID-19 case of an Indianapolis man who returned from travel to Boston. At this point in March, major changes started to occur as more states reported cases and deaths, with states declaring the state of emergency, school districts closing, and sports leagues such as the NHL, NBA and MLB suspending their seasons, and the NCAA cancelling all postseason tournaments for the winter and spring season.

Spring and Summer 2020 - Surviving the Semester at Purdue University

On March 10th as Purdue was about to embark on Spring Break, administration announced that faculty were to move their courses online and be prepared to continue as long as needed. A few days later Purdue announced classes would move online for the remainder of the spring 2020 semester. Over Spring Break, faculty and staff worked tirelessly to create an online environment to serve over 40,000 students in thousands of classes.

At our Purdue Polytechnic Columbus site we resumed classes online after Spring Break. Faculty used different methods to deliver classes in the online environment, some teaching asynchronously and most delivering classes synchronously to students. Faculty had the option to use different tools to host the online environment, with WebEx the standard along with Zoom, Teams and Purdue's course management systems — Blackboard and Brightspace.

The results by all accounts was a successful transition. One of the major fears was that the system would not be able to handle the increased load of all Purdue students online. The IT staff made a few changes and upgrades, and for the most part it worked flawlessly. Support was available for faculty to assist in using what for some were new tools.

Outside of the classroom on campus in the spring, all on-campus activities, such as advising and meetings, were moved online, and activities that could not be moved online, such as recruiting events, graduation, or travel, were cancelled for the spring and summer.

We will share some of our personal experiences from teaching this semester. Professor Swanson was teaching 5 classes (one an overload at the Anderson campus) in the spring 2020 semester. Three classes were hybrid and two were asynchronous online classes. The online classes were asynchronous with recorded lectures, readings, assignments and quizzes on Blackboard. Both classes had virtual office hours using WebEx and having used this from the beginning of the semester it was not different than earlier in the semester. Exams were scheduled to be taken in person on the local campus (either Anderson, Columbus or Kokomo) and students had just finished midterms when classes went online. The only major change was after classes moved online the final exam was delivered in Blackboard. The hybrid classes all were being delivered in a flipped format so the lectures were recorded, quizzes and assignments were on either Blackboard or Brightspace and class time was used for in class exercises, team projects and discussions. Like the online classes, the exams were developed in either Blackboard or Brightspace. The transition involved moving the in-class meetings to WebEx. During the meeting time, we used WebEx for the discussions, questions and exercises. When students were doing team project assignments, they would use their own WebEx room (each student at Purdue has access to their own WebEx personal room) and the instructor would drop in to each group's room (another option was to use WebEx breakout rooms). There were minor technical issues in the hybrid classes. Many of the students were not familiar with WebEx, and many errors were operator errors. These usually centered around audio issues where the class could not hear the instructor, or vice versa, or individual connection problems. There were a couple students that lived in rural areas where high speed internet access was an issue. The only other issue for the in-

structor was Purdue was transitioning from Blackboard to Brightspace and having volunteered to test Brightspace in one of his classes, Professor Swanson was trying to learn how to use Brightspace features with limited support while transitioning all classes to the online environment. The one thing Professor Swanson did in all his classes was send out a letter to students to try and ease their minds. This was a very stressful situation for everyone, with many students unable to work, worrying about their health and families' health, being isolated and all their classes transitioning to an online environment. In the letter, Professor Swanson wanted to reassure them that they were not alone and we were all trying to get through this together, both students and faculty. The instructor told the students that we would be flexible in assignments and grades, but we would try to maintain the format and structure of the class and that he was there for them if they need to talk. A small gesture, but Professor Swanson had several students tell him they appreciated the letter that gave them some reassurance in the middle of their world turning upside down.

Professor Gusev taught four courses, all of which started with traditional face-to-face delivery. The abrupt transition to online delivery proved the hardest for the CNIT 242 System Administration course, because it is loaded with hands-on labs, a major portion of which could not possibly been done by the students under the newly imposed restrictions on physical access to the AMCE building that houses the networking lab. With remote help by Professor Phil Rawles and the system administrator from West Lafayette, Labs 2 and 3 were reworked to form one lab assignment that the students could complete via remote connection after the instructor reconfigured the lab, completed the portions of the original lab assignments that could not be done remotely, and enabled remote connectivity to the lab computers. Even that ad hoc solution worked only partially, due to slow Internet connections of some of the students.

CNIT 270 Cybersecurity Fundamentals had labs that utilized virtual machines (VMs) set up for us by the system administrator in West Lafayette, and this factor proved to be a major advantage that has simplified transition to remote delivery of the course a great deal. The other two courses were on software development, so they transitioned gracefully.

2020-2021 School Year - Being Flexible at Purdue University

After the spring semester, Purdue announced the fall academic calendar that allowed face-to-face instruction and eliminated fall breaks and ended face-to-face instruction before the Thanksgiving break with the last week and Final Exams offered online. This was incorporated to minimize student travel during the semester. The Protect Purdue Plan was introduced, a plan to keep the campus and community safe by limiting the spread and included the Protect Purdue Pledge that students were required to agree to. Along with that all faculty and staff were required to complete COVID-19 Employee Safety Training and all students were required to be tested before attending classes in August. The fall schedule at the main campus in West Lafayette offered a fully online option for students who could not or chose not to come to campus. At our Columbus campus this was not an option, although some classes were converted to hybrid and WebEx was used in the class to allow for flexibility. For classroom safety, students were required to wear masks, shields in lab classes where the instructor circulated, no in-class group work, wipe down computers before and after use, hand sanitizer was provided in all classrooms and occupancy was reduced to approximately 50% in each classroom. A liberal attendance policy was imposed and faculty were to work with students that tested positive or quarantined to allow students to make up work. Our department Computer and Information Technology (CIT) has many lab classes using licensed software that in many cases is cost-prohibitive for students to purchase for their own laptops. Purdue's IT support set up connections so students could remotely access the lab (and the software on the lab machines) and did not have to purchase the software.

Outside of the classroom in the fall many faculty and staff were working remotely when possible. On campus activities were still cancelled, including on-campus recruiting events and meetings, and advising was still completed remotely.

For the spring 2021semester, the same rules were in effect from the fall semester, including student testing before being allowed in classes. In an effort to minimize mass travel by students, the semester was started a week later than normal and Spring Break was eliminated and substituted with "reading days" interspersed throughout the semester. Also, the main campus offered a fully online option and the Columbus used a mixture of hybrid and WebEx to accommodate students.

Outside of the classroom in the spring semester, all on-campus activities like advising and meetings were moved online, and activities that could not be moved online were cancelled for the spring. The commencement ceremony was held after being cancelled the previous year. The event was held outdoors in a spacious courtyard on campus. Recruiting events were cancelled. This was very troubling, because in the best of times it is a struggle to recruit students, and without events it was almost impossible.

Sharing some of our personal experiences from the 2020-2021 school year. Professor Swanson again taught five courses (one overload in Anderson) in the fall semester. Of the five classes, one was an asynchronous online course, two were hybrid classes and two were face-to-face courses. The asynchronous online course met two times in person and the hybrid courses met once a week all using the precautions put in place by Purdue University. The regular face-to-face classes were scheduled to meet twice a week, with one day being a lab session.

Over the summer, there were concerns about if we would be able to make it through the semester without going back to a fully online format as we had done in the spring semester. In anticipation of that possibility, Professor Swanson recorded lectures for the two face-to-face courses. During the semester, we met one day via WebEx and would answer questions about the lecture and work on team exercises and a team project in groups, and on the second day we physically met in the computer lab to work on labs. Overall, the courses worked well as the instructor and students got more accustomed to using safety measures and became more technically savvy with using WebEx on a regular basis. The most alarming part was the enrollment. Typically a freshman class would have eight to twelve students. Our campus typically gets many students late in the process, accepting new students up to August. We would normally have several recruiting events late in the spring semester, but because of Covid they had all been cancelled. Our freshman CIT course had two students enrolled. Besides our freshman group it appeared some students had decided not to return or to delay returning. Two other classes had enrollments of two and three students.

In the Spring 2021 semester, Professor Swanson taught five courses (one overload in Anderson). Of the five classes, two were asynchronous online courses, and three were hybrid classes that met one time a week in person. As in the fall semester, classes worked well using the safety measures and available technology. Throughout the fall and spring semester several students were out with either Covid or being exposed to someone with Covid. Students who had been infected were required to report it to Purdue and encouraged to work with the faculty to make up lost work. Most students did a good job of communicating with the instructor and they were able to make up for any lost work.

In the fall of 2020, Professor Gusev taught three courses, as he was given an opportunity to develop the spring 2021 offerings of CNIT 315 Systems Programming with emphasis of parallel programming / concurrency in C++17 and CNIT 381 Introduction to Game Development Technology using Unreal Engine 4, instead of its competitor Unity. Two of the courses taught in the Fall involved software development in C# and Java and went

well, including the joint projects with Professor Swanson's CNIT 272 that involved development of C# apps that accessed Oracle databases designed and built in Professor Swanson's course. The other course, CNIT 340 UNIX Administration, which is de facto UNIX/Linux administration, benefited greatly from use of UNIX/Linux VMs.

Professor Gusev's spring 2021 semester proved very challenging, even though the two freshly developed courses were delivered without a glitch, including the online offering of CNIT 381. Unfortunately, the delivery of the other two courses — CNIT 242 and CNIT 270 — was hampered by such factors as some students going online due to the liberal COVID-19 policy and not contributing enough to team work in the lab, old and slow lab equipment for CNIT 242 not keeping up with the needs for speedy software downloading and installation, as well as with support for new versions of VMware virtualization software on the part of the old chips built for the infamous Windows Vista, and, in the case of CNIT 270, by poor setup of the VMs by a new system administrator, further compounded by the stressful COVID-19 situation and particularly by many students' lack of prior familiarity with command-line interface (CLI) Linux environment. The location's leadership was forced to take swift corrective action by hiring a very capable lab assistant mid-semester to help the students in those two courses deal with the challenges, and this decision helped remedy the issues in CNIT 270 to a great extent. In CNIT 242, the students were allowed to write "lessons learned" team reports for extra credit. In those reports, the students explained the issues that prevented them from completing most of the lab work and how this work could have been completed if the lab equipment worked as intended.

2021-2022 School Year - Getting Closer to Normal at Purdue University

With the development of the vaccination for COVID-19 in late 2020 and rolling out in 2021 there was growing hope that the university could get back to a more normal environment on the campus in the 2021-2022 school year. Intended changes for fall 2021 included:

- Return all campus spaces to full density.
- Welcome back visitors.
- Reinstate pre-pandemic attendance policies for academic courses.
- Return to fall break and in person classes throughout the semester.
- Little or no use of face masks. However, before the start of the semester this was changed to require face masks in all indoor spaces regardless of vaccination status.

As the fall semester began, 79% of the faculty staff and students at Purdue University were vaccinated. Those that were not vaccinated were subject to routine surveillance testing (possibly as often as once a week) and those vaccinated were excused from routine surveillance testing and did not have to quarantine after high-risk exposure to the virus as long as they remain symptom-free, avoiding possibly disrupting their studies and work duties. The online only option at the main campus was eliminated and on our campus we were not required to deliver the class in person and via WebEx (although some faculty chose to still offer that option). Remote access to Purdue's computer labs and the software in the labs that was provided in the previous year was removed.

Outside of the classroom in the fall semester, most faculty and staff were working on campus. On campus activities were restarted, including on-campus recruiting events and meetings and advising. The SAT and ACT scores were not required for admission. With the lack of outside recruiting events last year our numbers continued to struggle with only four incoming freshmen in CIT.

In the spring semester, there was a continuation of the fall semester practices. The calendar for the spring restored the typical semester start date, spring break, and graduation. Midway through the semester the mandatory mask requirement was lifted.

Sharing some of our personal experiences from the 2021-2022 school year. Professor Swanson taught four courses in the fall semester. Of the four classes, one was an online course, one was a hybrid class and two were face-to-face classes. The WebEx component was gone in all courses and face-to-face meetings other than mask wearing were back to normal with students allowed to work in groups in class and regular attendance policies in place.

Professor Swanson taught three courses in the spring semester. Of the three classes, one was a hybrid course that met once a week, and two were asynchronous online classes. The only difference between these classes and pre-pandemic was in the online classes prior to the pandemic Professor Swanson was present at each site for the midterm and final exams. In the spring 2022 semester the exams were offered in Brightspace using Lockdown browser and Respondus monitoring system. Talking with students during the past year, most students were glad to get back in the classroom. The instructor didn't hear any students say they preferred completely online classes. Some did say they liked the flexibility of the hybrid class where they still had the face-to-face interactions with the faculty and students and many said they would prefer the regular face-to-face format.
Professor Gusev taught four courses in the Fall 2021 semester (two of them face-to-face and two online) and earned the Certificate of Practice in College Teaching for his work on CNIT 325 Object-Oriented Application Development with Professor Dennis Owen as mentor. The online delivery of CNIT 40500 Software Development Methodologies for the first time under informal mentorship by Professor Rick Homkes proved a success as well.

In the Spring of 2022, Professor Gusev taught three courses, including online delivery of CNIT 425 Software Development for Mobile Devices II to students at our Anderson location.

Lasting effects of the COVID-19 in the higher education classroom

It is two years later and, in many ways, it seems like a lifetime ago. Stepping back into the classroom at the end of this semester, it looks very much like it did prior to March 2020. The question is, are there lasting effects of COVID-19 in our higher education classrooms?

First of all, we know that as long as students, faculty and staff have access to the internet that we can, if necessary, offer our classes remotely. Some people say it is not if this will ever happen again but when. Having said that, it is important to take a look back and perform a "lessons learned" and determine what we did that worked and what didn't work. This is something we have not had to go through before.

At our Purdue Polytechnic Statewide locations, where we offer our CIT programs – Anderson, Columbus and Kokomo — we have gradually been incorporating more online classes. In the past there have been issues with internet access of students, software and, in some cases, a reluctance to move to online classes. In some cases, it has been the philosophy that we prefer not to offer online classes, for instance, freshmen classes where we want students on campus, with our instructors and fellow students. Also, some classes in the curriculum tend to work better than others online. With upgrades to infrastructure it is more viable today. We don't expect to move all classes online, but many upper-level classes will be candidates to offer online. With a limited number of instructors at each site, they can be shared by offering the classes online. This moving from the traditional environment to digital environment in education has been occurring for a while, but COVID-19 has acted as a cata-

lyst (Tam & El-Azar, 2020). In 2019, global investments for the digitalization in education was $18.66 billion. It has been estimated that digitalization in education will reach $350 billion in 2025 (Li & Lalani, 2020). This will require efforts to make sure that students and faculty alike are literate in the skills needed to succeed in this growing environment.

Purdue is not requiring the SAT or ACT for incoming freshman in the fall semester. Our website states that we are test flexible, which means that we prefer the student take one of the tests, but it is not required. If you take a look, you will see that schools like Purdue, Indiana University, Harvard, Northwestern, Yale, and many more are not requiring the SAT or ACT this fall, they are test optional. Other universities are adopting a test-blind policy, which is different from a college going test-optional, which many campuses have done in recent years due to COVID-19. Test-optional colleges, such as Arizona State University, Texas A&M University, and Drexel University, will consider ACT and SAT scores when selecting a student — but only if the student chooses to submit them. Test-blind colleges completely ignore exam scores when assessing a student's application, placing more emphasis on the person's high school GPA, admissions essay, and other factors.
According to Margeurite Dennis, universities will embrace online recruiting methods and certain cohorts may increasingly look to stay closer to home (Dennis, 2020). Dennis said this is true with foreign students, especially Asian students.

Bonnie Kristian with *The Week* suggested that we will see colleges close permanently as economic pressures grow. Up until now, it has been mainly small colleges, but even in larger schools, she states, there will be a trend toward cutting less profitable majors. Bianca Quilantan in POLITICO warns of the coming cliff stating high school graduates will peak in 2026 at 3.6 million, but then will decline to 3.3 million by 2030. At Purdue we have run into that at our Statewide locations with several degree programs being put on hold and not accepting new students next fall.

Quilantan goes even farther based on discussions with university leaders. One idea is going from one centralized campus to an entirely location-agnostic hybrid model with no dependence on a centralized campus. This could be the type of innovation needed to succeed in today's economic and educational environment while maximizing all of our physical assets. Quilantan continues it citing a report from "The Hybrid Campus" that doing away with physical campuses won't be the norm, but they will need to rethink how to best utilize their physical space and incorporate technology into it.

Conclusion

We have traced the Purdue events and policy changes related to the COVID-19 pandemic from its beginning and through the spring of 2022 as they impacted our delivery of CIT courses at Purdue Statewide locations in the face-to-face, online and hybrid formats. We have discussed the lessons learned and posed an open problem of how we should solve the Statewide undergraduate student recruitment challenge under the current circumstances and limitations. Finally, we have reviewed the diverse opinions on the lasting effects of the COVID-19 in the higher education classroom.

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Textbooks 101: What You Really Need to Know About Textbook Access Codes, Inclusive Access, Open Access, and More!

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Abstract

Over the past decade there has been a lot of discussion about the rising cost of textbooks in higher education, which has resulted in an increased interest in electronic textbooks and digital coursework. When classes moved to a virtual environment in 2020, due to the COVID-19 global pandemic, many campuses needed to quickly provide students with alternatives to traditional print texts and course materials.-This scenario resulted in many challenges for faculty, course management administrators, librarians, and campus IT to provide students with access to online and electronic resources. This session will examine the need for affordable and accessible materials and provide a basic overview of textbook options including open education resources (OERs), inclusive access resources, course access codes, and more. In addition, there will be discussion about the benefits and challenges these formats provide students, faculty, and information professionals.

Presenters' Bios:

Jennifer Hughes has over 25 years of library experience and currently serves as the Associate University Librarian at Coastal Carolina University. She received her MLIS from the University of South Carolina and MBA from Coastal Carolina University.

Joseph Taylor has served as a Circulation Supervisor at Kimbel Library of Coastal Carolina University for the last 7 years with current responsibilities including Course Reserves. He received his MLIS from the University of Missouri.

Introduction

Textbook costs have long been a topic of discussion in higher education due to the significant and rapid escalation of prices. With increased access to and interest in used print textbooks, electronic textbooks, and digital course materials in recent years, faculty, publishers, and vendors have sought better solutions to make learning more affordable. When classes moved to a virtual environment in 2020, due to the COVID-19 Global Pandemic (COVID-19), many campuses needed to quickly provide students with alternatives to traditional print texts and course materials. This scenario resulted in many challenges for faculty, course management administrators, librarians, and campus IT to provide students with access to online and electronic resources. This paper will examine the need for affordable and accessible materials and provide a basic overview of textbook options includ-

ing course access codes, open education resources (OER), and inclusive access resources. In addition, the paper will identify some of the benefits and challenges these formats provide students and the faculty and information professionals who support students.

Rising Textbook Costs

Textbook costs increased by over 1000% between 1977 and 2015, while overall inflation during this time increased by less than 300%. (Hanson, 2021 and Webster, n.d.). However, many publishers and vendors began initiatives that would allow them to maintain profit margins while reducing the cost to students. Those programs, focused on rental options and electronic formats, led to textbook costs finally stabilizing and even decreasing for students from 2016-19. During the period between 2015-2019, the higher education publishing industry revenues decreased by $1.3 billion (Hanson, 2021).

In January 2020, Kimbel Library of Coastal Carolina University hosted a #textbookbroke event to obtain a sample of how much money students spent on textbooks for Spring 2020. The high textbook costs were reported by students in all disciplines: 12% spent over $600, 12% spent $500-599, $17% spent $400-499, 18% spent $300-399, 14% spent $200-299, $13% spent $100-199, and 14% reported spending less than $100. Though not solicited, the library received 66 comments from the 215 participants. There were complaints about the high prices, especially the cost of access codes. Those who commented about their low prices mentioned the library, free online sources, Amazon, Chegg.com, or their decision not to purchase required materials.

As COVID-19 impacted in-person education, many professors adopted electronic textbooks (e-books) and other digital content and publishers offset the profit loss from print textbooks by focusing on the electronic content. Between Fall 2019 and 2020 the average cost of print textbooks decreased by 3.5%. During this same period, however, the cost of e-books rose by 23%, and Pearson and Cengage both reported profit increases of 30-40% in 2020 (Hanson, 2021). Due to the additional financial struggles students face as a result of the pandemic, textbook affordability remains a serious concern for students despite the textbook prices being lower now than they were in 2017.

Consequences of High Prices

Federal law requires colleges to post their cost of attendance including tuition and fees, room and board, books and supplies, and other associated expenses. College Board estimates the cost for full time undergraduate students' books and supplies to be $1,298 annually (2022). Even though the price of textbooks is not as expensive as other costs associated with higher education, it does cause a financial burden to many. For example, federal work study programs are often awarded to those students with the most financial need. Earning minimum wage working an average of 11 hours per week, it would take a student a full semester's wages to cover the cost of textbooks.

Because tuition, housing, and board, are the essential and non-negotiable costs for attending college. Many students consider textbooks to be a non-essential cost. Often students will begin the semester without a textbook until they decide if the readings are essential to their success in the course or choose not to purchase the textbook at all. According to the 2018 Florida Virtual Campus Survey measuring the impact of textbook costs on students, 64% of students reported that high textbook costs caused them to not purchase the required textbook (2019).

Students without textbooks are more likely to receive poor grades, take fewer courses, withdraw from courses, and fail courses. The study also revealed that 36% of students reported earning a poor grade, 43% took fewer courses, 41% chose not to register for a course, and 23% dropped a course because they could not afford the textbook (Florida Virtual Campus, 2019).

As part of the #textbookbroke event in January 2020 at Kimbel Library students were asked when they buy their textbooks. Almost half (49%) of the students who participated indicated that they waited to buy them when the text became necessary for an assignment, 16% said they buy them for the first day, 13% wait for financial aid checks to be distributed, 10% borrow textbooks from their friends or the library, and 12% indicated that no textbook purchases were necessary because they used free online resources. There were 42 comments from the 216 participants. There were two topics that received the most comments: gratitude for access to free textbooks available in the library and statements in support of tuition including the cost of textbooks.

Print Textbooks

Print textbooks are physical textbooks that are printed on paper. There are a lot of advantages to print textbooks, which is why they have been the preferred resource for hundreds of years. Academic libraries typically have course reserve collections that house professor-provided textbook copies for students to use while studying in the library, and some libraries commit funds to purchasing textbooks for some or all the course offerings. In many cases one student would purchase a textbook and share the use of the book with their roommates and classmates. At the end of the semester, many campus bookstores offer buy-back programs that encourage students to sell their used textbook to the bookstore for a small fraction of the price they paid, which allows future students the opportunity to purchase the used textbook at a reduced cost.

The disadvantage of the print textbook is that it must be physically present to access it. Students have to carry the book to class, the library, and back home to use it at all those locations. In addition, hardcopy textbooks can cost as much as $400. Updates to the book's content require new editions to be published, which occurs every 3-4 years on average. Each edition of textbook increases its cost by about 12%, and the cost of the new edition is often 50% more than a used copy of the previous edition (Hanson, 2021).

For many, a physical book is still their preference. A 2017 study found that over 90% of the students said they focused better when reading print textbooks and a majority of faculty believe their students perform better with print textbooks (Domtar, 2020). Between 2018-20 Kimbel Library spent $28,267 to purchase 300 textbooks for all core curriculum courses and courses with a Drop Fail Withdrawal (DFW) rate greater than 20%. Use of the collection was popular, and the books were checked out a total of 1644 times ($17.19 per use). Students who checked out textbooks from the library's collection were less likely to drop, fail or withdrawal from a course than students who did not check out textbooks from the library at a statistically significant level. In Fall 2018, the DFW rate was 15.84% for those students who checked out a library textbook and 20.35% for those students who did not. Also, courses with materials in the library's textbook collection had lower DFW rates than courses without materials in the library. In Spring 2019, the University saw a 0.22% increase in the DFW rate for all courses, however, courses with materials available in Kimbel Library saw a decrease of 3.86% in the DFW rate.

Electronic Textbooks

Electronic textbooks (e-books) are electronic versions of a text that can be read on a desktop computer, mobile device, or e-reader. The obvious advantage with an electronic format is portable access that does not require a

student to carry a five-pound biology book around campus. The textbook can be accessed wherever the student is with their device. Another advantage of electronic textbooks is that they may also include additional content, such as multimedia content and hyperlinks, which would be impossible to render in a printed text. Some electronic textbooks may also include interactive content, self-assessments, or guided questions that provide real-time feedback.

To access e-books, the student will need some type of device that has access to power and the internet. Financially users are often disadvantaged because there is not a resale market. Students cannot resell their book at the end of the semester and are unable to purchase a used copy at a reduced price. In addition, some e-books are not eligible for a refund at all even if the student drops the course within the allotted period. On top of this, individual e-book vendors determine the digital rights management and control access to copyrighted material. The license limits the number of users and devices to prevent sharing. There are also limits on the number of pages that can be printed and downloaded, and some e-books are only available for a limited duration of time, usually 120 days.

Textbook Rentals

Textbook rentals allow a student to pay a fee for access to print or electronic textbooks for the semester. Print textbooks are returned to the vendor at the end of the semester and electronic access automatically becomes restricted. The student knows up front the cost of using the book for the semester without guessing how much they might receive during buy-back periods. There can be financial advantages to renting textbooks as rentals are less expensive than buying them.

Although many campus bookstores and online vendors offered rental programs, the popularity really seemed to increase as vendors and publishers introduced innovative programs and partnerships. For example, Chegg sought partnerships with book distributors and publishers and in 2017 Pearson made 50 digital and print textbooks titles available as rentals only with Chegg as the exclusive outlet. Pearson also reduced the price of 2,000 e-books by up to 50% that year (Paige, 2017). In 2019, Pearson became the first higher education publisher to commit to “digital-first” when they announced that 1,500 U.S. titles would be born digital. The original digital copy will be updated on an ongoing basis, and the print copies will only be available for rental in limited quantities. (Katzman, 2019).

In 2018, Cengage developed their own solution as well, Cengage Unlimited, a textbook subscription service that provides unlimited access to all of Cengage’s titles for one price (Cengage Group, 2017). Initiatives like these had a positive impact on students’ use and perception of textbook rentals. During the period between 2016 to 2018 the number of students willing to rent print or digital textbooks increased from 51% to 59% and when asked how to reduce costs renting digital textbooks jumped from 30% to 41% (Florida Virtual Campus, 2019). Textbook rentals are a great option for students who do not wish to keep their textbooks beyond one semester, but if a student wants to keep it longer, they may be better off buying instead of renting. In addition, students should be aware that they are charged additional fees if the textbook is returned late or damaged.

Access Codes and Courseware

In the last ten years, access codes have become a necessity for students since they provide online access to required readings and assignments that will be necessary to be successful in their chosen course. The literature indicates that this is especially true for introductory courses, particularly within the areas of STEM and Foreign Language. Traditionally students in these areas could source required course materials from the used textbook

market, through friends and/or acquaintances that previously took the course or from their local library lending programs (Nagle & Vitez, 2021). The widespread adoption of Access Codes has essentially removed these options (Young, 2012).

In addition to the above complications, the online nature of most course materials means that students must have a stable internet connection just to read a chapter in their text, complete homework assignments, answer essay questions or to take tests and quizzes (Nagle & Vitez, 2021). Even though students may have purchased the codes to access course material, they are limited by their access to a stable internet connection, the lack of which renders the access code completely useless to the student (Nagle & Vitez, 2021).

While many have voiced concerns regarding the use of access codes for courseware, there are clear benefits to these programs. Courseware requires a greater level of commitment and engagement from students as they interact with materials such as homework assignments, quizzes, and tests. There is evidence to suggest that courseware may be effective in reducing Drop Withdraw and Fail rates. A study of nutrition students published in the Journal of Nutrition Education and Behavior evaluating the utilization of e-books and courseware, showed those enrolled in a course utilizing and electronic and online supplemental course materials, had significantly reduced DFW rates of a period of 5 years (Armstrong, 2019). Research also indicates that students in introductory courses can have favorable impressions of online courseware with regard to its impact on study habits. In some cases, students have found that online assignments and supplemental materials have increased the amount of time spent studying for a class and improved understanding (Smolira, 2008).

The need for online access reached a crescendo during COVID-19 which saw rapid and widespread adoption of online learning materials as educators struggled to rapidly convert traditional courses into an online format. (Florida Virtual Campus, 2019). This shift from traditional in-person classes to online occurred at nearly every level in the education system. The increased demand that resulted from this shift would accelerate movement toward the Inclusive Access model, which will be discussed in another section.

Open Educational Resources (OER)

In response to rising textbook costs and adoption of courseware access codes, many in education began to look toward Open Education Resources (OER) as an alternative strategy to reduce student costs. OER are generally defined as materials provided at no-cost and with free and open access for usage, and also carry legal permission for open use. These materials may include articles, books, multimedia, tests and examinations, apps, and even entire courses (Coastal Carolina University, 2022).

OER present many advantages for adoption as course materials in that they are adaptable, provide opportunities for inclusion of new research, and can be continuously updated and improved as needed. OER provide faculty with the ability to customize course materials, creating the “perfect” course packet or textbook instead of being bound to a traditional one-size-fits-all model. (Penn State University, 2022). In addition to the above benefits, research suggests student perceptions regarding OER are favorable, however it should be noted that financial savings may be a contributing factor (Hilton, 2016).

While there are clearly documented benefits to utilizing OER regarding cost and adaptability, adoption rates of OER by faculty have remained relatively low. Bay View Analytics survey of over three thousand faculty found that while awareness of OER has increased steadily, their use as required materials has plateaued since 2019 (Seaman & Seaman, 2021, p. 35). Many faculty were forced to rapidly adapt their in-person courses to online

during COVID-19, and it is suggested that as a result, chose not to alter required texts and materials from Spring 2020 to Fall 2020 to avoid adding further complications and confusion to an already stressful situation (Lederman, 2021).

In addition to complications brought on by COVID-19, faculty have expressed reservations regarding the quality of OER materials. In some cases, faculty feel that OER materials are not as comprehensive, and that OER do not provide inquiry-based approaches when compared to conventional texts from publishers (Seaman & Seaman, 2021, p. 44). OER quality concerns can also be linked to IP, copyright, language and cultural barriers as well as the technology and internet access concerns previously noted with access codes and courseware (University of the Pacific, 2021).

It may also be argued that the slowdown in OER adoption is also due to the rise of Inclusive Access programs between educational institutions, publishers, and campus bookstores. This program offers a turn-key solution to provide faculty with online and supplemental course materials (InclusiveAccess.org, 2022). There is however considerable debate in the academic community as to whether this is a benefit to students (Seaman & Seaman, 2021, p. 17). This topic will be explored further in the following section.

Inclusive Access

The newest solution to the problem of high textbook costs is the Inclusive Access model of e-text and courseware distribution. This model is being actively promoted by the various major publishers such as Cengage, McGraw Hill, Pearson, Wiley, VitalSource, RedShelf and Macmillan, and among the two major campus bookstore retailers, Barnes and Noble and Follett (Cullier, 2018).

There are essentially two variants of Inclusive Access. In the first variant, which appears to be the more common among publishers and retailers, students pay discounted rates for textbooks, courseware, and materials. These discounted rates may apply to all courses, texts, and courseware offered, or only a select few courses based on the agreement between the educational institution and the publisher and/or bookstore retailer. The cost of the course materials is then added to the tuition or charged as a flat fee where institutions are unable to raise tuition. On the first day of classes, the required materials are digitally loaded into the institution's Learning Management System (LMS) and made available to the student. Enrollment in the program is automatic although the student has the right to opt out.

The second variant of the Inclusive Access Program is quite similar to the first in terms of the delivery but is considered to be "All Inclusive" meaning there are no additional fees for courseware, access codes, texts, and supplemental materials. Rather than paying discounted rates, the cost is bundled into tuition sometimes on a per credit hour basis or may be charged as a flat fee (Barnes and Noble, 2022). Delivery of materials is the same as the first variant. Digital materials are loaded into the institution's LMS and made available to the student on or before the first day of class. Physical materials are considered rentals and will be ready for the student to pick up at the campus bookstore (Barnes and Noble, 2022). Students still have the right to opt out of this variant during the period agreed upon by the vendor and the institution. In some cases, students can opt out of the program until the end of the drop/add period, and students can also opt back into the program if they change their mind (Barnes and Noble, 2022).

Both programs carry a host of advantages for students and faculty. Students can get access to course materials, access codes, and supplementary items on the first day or before the start of class at discounted prices. If the Inclusive Access program is offered through a retailer such as Follett or Barnes and Noble, faculty can choose a

wide range of materials from various publishers rather than being locked in to using materials from a single publisher. For each variant, the cost is a known amount and often represents a savings over traditional textbook purchases. It should be noted; however, that even with all the perceived advantages, there is still some uncertainty among educators, activists, and students regarding Inclusive Access Programs.

There is a great deal of concern that publishers or retailers could drastically alter the price of course materials or cancel agreements based on usage quotas. In 2017 the University of Central Washington entered an Inclusive Access contract with Cengage publishing which gave Cengage the right to terminate the agreement should Central Washington fail to achieve purchases for 85% of students enrolled in relevant courses (Koenig, 2020). Advocacy groups, such as USPIRG, warn that quotas and could cause further financial problems for students if discounts are cancelled due to missed quotas (Vitez, 2020, p. 11). In addition to usage quotas, there is concern over unclear pricing terms from publishers which are carefully guarded as trade secrets and there is worry that prices and quotas could increase drastically over time (Vitez, 2020, p. 9).

Outside of economic and usage concerns, questions arise regarding the collection of learning analytics and student data through usage of Inclusive Access. What kind of data is being collected and how is it being used? Can this data be used to identify the student, is it in compliance with FERPA, and who has access to this information (Cullier, 2018)? Additionally, concerns have also been raised regarding access to material and user support concerning technological issues over the initial roll out phase and life of the program (Cullier, 2018).

User Support Considerations

Division of Labor – Who provides front line assistance and service to inclusive access students?
Just as there are multiple forms of Inclusive Access programs, there seem to be myriad procedures for providing support to users that encounter technical issues in terms of access and LMS integration. In some cases, local campus IT provides the initial support for access issues (Liberty University, 2022). In other cases, the campus bookstore is the first point of contact (Austin Community College, 2022). It is important to note that while the bookstore can aid regarding transaction or delivery problems, issues regarding integration with LMS will require additional assistance from the publisher and from local campus IT. In still other cases, such as distribution of access codes to course materials, the course instructor might be the first point of contact to resolve access issues, or students might be directed to a publisher's customer service department (Kutztown University, 2022).

The lack of customer technical support standardization across the platforms and institutions is a matter that can cause confusion for students and users requiring assistance. Clearly defined roles and responsibilities of each of the partners to provide support will reduce confusion and frustration for students when a technical problem is encountered (Cullier, 2018). Furthermore, clearly defined roles will produce further dialog between partners that may lead to other opportunities for collaboration.

A further consideration, and one that is not particularly new, is that the program requires a stable internet connection to access course material and bundled courseware. Universities have acted during the pandemic to provide emergency support by providing hotspots or remote access points for students. These measures provided a stop gap solution as courses were forced online during lock down. Now as COVID-19 protocols are ending or have ended, Universities are discontinuing internet access assistance at a time when inclusive access is ramping up. How will this affect students enrolled in distance programs or those that may be resident students but reside in areas where internet connectivity is not readily available? How will the university and affiliated parties ensure that the student is able to access the course materials that they paid for in their tuition?

University Libraries, especially those with a technology lending program can be valuable partners in this effort. Kimbel Library has taken steps to increase access to online materials by adopting a laptop lending program. The library currently has 450 Dell Laptops and 150 MacBook laptops which currently registered and enrolled students may borrow for an entire semester. In addition to the laptop program, during COVID-19, CCU and Kimbel Library along with other SC universities and Colleges in partnership with the SC commission on Higher Education loaned WIFI hotspots to remote and resident students that did not have access to a reliable internet connection. A similar program could be adopted for students in need of WIFI connectivity to access their online course materials.

The Inclusive Access model will require a new level of collaboration and cooperation among IT, Faculty, Library, Campus Bookstore, and Publishers that is unprecedented. In an ideal situation a joint committee composed of members from the above parties should be formed. This Inclusive Access Committee could facilitate open communication and transparency as well as provide a source for the creation of new policies and procedures to support users. This committee may also reveal opportunities for further collaboration, cooperation, and lead to the formation of stronger partnerships between all parties.

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Tips for Building a Future-Proof Communications Platform

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Abstract

It's imperative colleges and universities develop a sustainable communication strategy that incorporates traditional voice calling and modern channels (chat, video) for effective onsite and mobile collaboration without exhausting their budget. We'll share best practices for building a modern, unified phone platform, discuss why cloud systems are more cost effective, and present specific ways colleges and universities can use phone technology to improve operations, reduce costs, and mobilize their campuses.

Presenter's Bio:

Jonathan Bain joined ENA in 2014 and serves as a Solutions Engineer supporting the ENA Sales Team. His primary role is collaborating with current and future customers to develop solutions that will best meet the needs of their organization.

From Accomodation to Adaptation: Expanding Access with Proctorio

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Abstract

Proctorio was created with the goal of reinventing remote proctoring by providing a solution that is accessible and usable by test takers everywhere. We recognized that the requirement to travel to a physical institution or testing center was creating a roadblock for many test takers, preventing them from engaging in a traditional educational experience. Because Proctorio was developed as an accommodation, it was our vision to offer a solution with the lowest bandwidth in the industry, so test takers aren't required to have the latest technology just to take their exams, in addition to being limitlessly scalable, user-friendly, and secure. What started as an accommodation, though, quickly moved to the forefront of education during the COVID-19 pandemic, and suddenly everyone was turning to remote proctoring to protect the integrity of their assessments as institutions moved online. Join us for this session hosted by Ross Barash, Account Executive at Proctorio, as we discuss how our platform was designed to expand access to learners everywhere, and our unique approach to protecting privacy and security.

Presenter's Bio:

Ross Barash is Account Executive with experience in the EdTech sector, primarily in sales and successful client operations. He had obtained a B.S. in Supply Chain Management from Arizona State University's W.P. Carey School of Business. Today, he focuses on helping institutions expand their distance learning capabilities through the use of remote proctoring platform, Proctorio. An expert in the solution, Ross strives to educate the message and benefits of these technologies in our fast-moving, ever-changing educational landscape.

Future Massive Disruptions in Online Higher Education

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Abstract

Over the past 15 years, we have seen significant change in the development of online teaching and learning from a purely text-based medium to today's live interactive video and web-based technologies. What is the next step in this evolution and how will it not only have massive effects in the online learning landscape, but also much larger effects on brick and mortar schools?

Ted Brodheim, Global CIO Advisor for Education for Zoom and Keith Fowlkes, Vice President for E&I Technology will discuss how technologies such as virtual reality, augmented reality and artificial intelligence could be used to change the entire paradigm of the way we teach, learn and interact inside and outside the classroom. Don't miss this insightful session on the future of higher education in the next 25 years.

Presenters' Bios:

Ted Brodheim is recognized for his accomplishments using technology to transform K-12, higher education, and adult learning. He has managed technology for the largest school district in the US and global Fortune 500 companies. He is a trusted advisor to colleges and universities, state governors, and learning companies around the world.

Keith is a 25+-year veteran chief information officer serving as CIO for Saint Mary's College- Notre Dame, IN, University of Virginia-Wise and Centre College. Keith taught in all of these institutions in business and/or computer science departments. He is the executive director, co-founder and board member of the Higher Education Systems & Services Consortium (HESS Consortium - www.hessconsortium.org). He currently is vice president of the technology contracts practice for E&I Cooperative Services in Jericho, NY. Keith is also a frequent speaker and has served as a contributing writer on technology for EDUCAUSE, Campus Technology, InformationWeek and the ACUTA Journal. He has a B.S. in Business Administration from the University of Tennessee at Martin and a Masters in Information Systems and an M.B.A. in Economics and Finance from Webster University in St. Louis, MO.

Celebrating Faculty and Staff Success with Digital Badges

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Abstract

Rewarding faculty and staff who attend and participate in professional development is "central" to the mission of the Office of e-Learning (OeL) at North Carolina Central University (NCCU). Recently, the OeL launched a new digital badging initiative to recognize members of the university community who engage in e-learning training. The badging program is used to verify learning and recognize specific skills of NCCU faculty and staff. The badges also contribute to the process of evaluation, promotion, and tenure for faculty members. Digital badges have replaced certificates and provide verified credentials through a secure platform. The OeL has partnered with Credly (badging platform) to provide digital badges with metadata that describe the skills obtained by the badge earner. This engaging session will identify helpful strategies involved with selecting a badging platform to meet your institutional needs. Also, a discussion about how to begin the process of a badging initiative such as establishing a committee, badge development, and governance structure will be presented. Additionally, there will be a description of how the badging initiative marketing strategy was customized based on analytics.

Presenters' Bios

Dr. Charlotte Russell Cox is an Instructional Designer at North Carolina Central University and adjunct professor at UNC-Greensboro. Dr. Russell Cox was an Instructional Technology Specialist at Campbell University. She has an e-Learning certificate and doctoral degree from NC State University.

Dr. Racheal Brooks is Director of the Office of e-Learning and Co-Chair for the University of North Carolina System Quality Matters Council. She serves on the Quality Matters Academic Advisory Council and is a Spanish and research methods instructor at North Carolina Central University (NCCU).

D2L Sponsor Session: Improving Faculty Efficiency & Learning Outcomes with Brightspace

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Abstract

This session will focus on how faculty can save time and improve learning outcomes with Brightspace. We will highlight multiple actions within a faculty members day-to-day operation that can be simplified at scale in Brightspace. Some areas of focus will include personalized messaging at scale, individualized learning paths at scale, and automated feedback and touchpoints.

Presenter's Bio:

I am a Solution Engineer on the Higher Ed team and have been with D2L since the beginning of 2021. I work closely with universities and colleges across the Southeast and Southwest helping them achieve their goals using Brightspace. Prior to D2L, I spent 5+ years working in the Higher Ed market selling and supporting textbook and online homework solutions, and as a college instructor where I built practical Higher Ed teaching and LMS experience.

Digital Mentorship with Microsoft 365

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Abstract

Microsoft 365 offers communication, collaboration and accessibility at levels that empower students to be independent learners while staying connected to others. Join us to discuss ways Microsoft 365 can mobilize success for academia, athletics, campus life and more. Participants will learn about devices options, built in accessibility tools and the newly launched Career Coach. Imagine a connected campus where digital mentorship is the norm supporting collaboration and career pathing in a relevant and meaningful way for all students.

Presenter's Bio:

Cindy Daniels is an MIE certified Professional Development Specialist for Connection. She has a strong background in school improvement planning, curriculum and instruction, and school leadership with 10 years of teaching experience and 13 years as a school administrator.

Gamification and Persistence: Using Gamification Strategies to Help Students Finish Thesis Research

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Abstract

One of the most common issues hindering graduation is a lack of student persistence. In an effort to encourage undergraduate students to complete high-quality thesis research and writing in a timely manner, a course developer gamified her senior-level writing course. Students pursuing an undergraduate degree in cross-disciplinary studies must complete a two-part thesis sequence designed to help organize, outline, conduct research, and construct a major research essay that displays evidence of interdisciplinarity within each student's program of study. The first course, Research Intervention, helps students narrow their topics to focus to something manageable within the two-semester timeline. The students also practice correct MLA citation style through several activities aimed at helping students improve research and citation skills. The second and final course of the sequence, Thesis Writing, is a course designed to guide and direct the writing process of this final paper. Typically, an undergraduate thesis from this program is no less than 20-pages.

Presenter's Bio:

Chelsie Dubay, Ed.D., currently serves as a Clinical Instructor and Director of Instructional Design for the Department of Computing at East Tennessee State University. Previously, she worked as an instructional designer and software trainer for over ten years. Her research interests include learning experience design and usability studies, culturally responsive teaching, and engagement strategies in online and hybrid classrooms.

Leadership Development in Education for Sustainable Development; Evaluation of Higher Education Students in Sustainable Development Programs

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Abstract

The 2030 Agenda was created as an urgent call to action to create peace and prosperity for people and the planet by working towards achieving the UN 17 Sustainable Development Goals (SDGs). For this study, the focus is on Goal 4- quality education and the impact of leadership on Education for Sustainable Development (ESD). Leadership on ESD has been a recent topic in research. It is known that by making advancements in leadership on ESD, there will be positive global impacts by 2030. Higher Education Institutions (HEIs) have been implementing ESD programs in efforts to achieve the SDG goals. The purpose of this mixed methods case study analysis is to evaluate the leadership development of 40 higher education students across 4 ESD programs at Coastal Carolina University. Leadership development is investigated through integrating findings across multiple measures and involves a critical analysis of formal and informal learning experiences. The study is significant and provides a holistic view, demonstrating overall growth in leadership as a result of participation in the sustainability programs. This furthers our understanding of the positive impact leadership has on ESD, which is necessary to create a more sustainable future.

Presenter's Bio:

Michelle Dzurenda is an alumna of Coastal Carolina and the first graduate assistant in the Spadoni College of Education Doctor of Philosophy in education program.

Authenticity of Online Testing

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Abstract

A primary concern in the current online environment of higher education is the authenticity in testing of students in online courses. How do you ensure that the testing is free from cheating and assurance of learning is successful? Many of our faculty have chosen to use online testing through a couple of software platforms. We have Desire2Learn (D2L) as our university learning platform that allows instructional content, news, communication, and various evaluation methods including drop boxes, testing, and grading. Integration of video hosting tools like Panopto and Zoom are offered through individual courses in D2L as well. An alternative in the ETSU Department of Accountancy is the use of Pearson's MyAccountingLab (MAL). All students in principles of accounting and intermediate (financial) accounting courses must purchase the MAL access code for the textbook in order to have online access to this effective learning tool. This proposal is intended to investigate through discussion the best practices for student assessment of learning with authenticity of testing a primary consideration for measurement.

Presenter's Bio:

Dr. Joel Faidley, CMA, is the Chair of Accountancy, a Professor of Practice, and multiple graduate of ETSU. He earned a Doctor of Education in 2018, an MBA degree in 1987, and a BS degree in 1982 with a dual major in Computer Science/Accounting. He has 33+ years of corporate business experience.

E&I Cooperative Services: Higher Education Technology Contracts to Save Money & Time

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Abstract

E&I Cooperative Services has served the needs of higher education for nearly 70 years as the largest non-profit buying cooperative in the U.S. This session will give you insight into how your institution can save money and time in using E&I competitive contracts in technology. You will learn about the variety of contracts available in technology hardware, software, consulting, cloud services and much more.

Presenter's Bio:

Keith is also a frequent speaker and has served as a contributing writer on technology for EDUCAUSE, Campus Technology, InformationWeek and the ACUTA Journal. He has a B.S. in Business Administration from the University of Tennessee at Martin and a Masters in Information Systems and an M.B.A. in Economics and Finance from Webster University in St. Louis, MO.

Don't Throw Out the Baby with the Bathwater: Transitioning to Online Teaching in a STEM Methods Course

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Abstract

In 2020, COVID forced a transition to online learning for traditional face-to-face courses in teacher education. It encouraged the discovery of what was possible in a time when uncertainty was at the forefront. One common challenge faced by traditional college professors was to reimagine a hands-on, in-person course as something that could be taught in a virtual format. For example, how could one teach STEM Methods to students who need to interact with materials and collaborate with others in order to learn effectively? Learn how two professors successfully made the transition from a traditional to a virtual format and not only survived the semester but enjoyed the experience and enhanced students' learning! Strategies discussed in this presentation can be generalized across different disciplines at the collegiate level.

Presenter's Bio:

Holly Gould is a Professor of Curriculum in the College of Education, Leadership Studies & Counseling at the University of Lynchburg. Her 31-year career has spanned teaching in elementary and gifted classrooms in Alaska and teaching undergraduate, master's, and doctoral level students.

Using Technology to Improve a Manager's Productivity

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Gary Rogers
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Abstract

I intend to discuss how several technology tools I employ as a Department Chair are indispensable to my effectiveness. Quite frankly, it would be almost impossible to be truly effective without these tools in a wide range of endeavors from monitoring faculty performance to interactions with other management at multiple levels as well as community outreach. I intend to show how specific technologies are employed in this role. For example, as a faculty member, I can access and communicate with a student through the LMS on any assignment he or she might be working on. I can grade all of their assignments directly from the LMS. I can submit feedback to the student(s). Likewise, I can safely send confidential emails within the LMS. In addition, in my administrative role of Department Chair, I am able to access the professors' materials they have uploaded into the LMS (e.g., syllabus, assignments, discussions). I can see the interaction that the professor has with the students. Without the LMS, my ability to gauge the professor and students' interactions would be non-existent. These are just a few of the reasons why working through a LMS is beneficial not only to the student, but also to the professor, and their supervisor.

Presenters' Bios

Dr. Joseph Holloway has an earned PhD in Organizational Leadership from Regent University, a Master's degree from the University of West Alabama, and a Master of Public Administration from Jacksonville State University. Dr. Holloway has been the Department Chair since Fall 2019.

Dr. Rogers has a Ph.D in Information Systems Management from Walden University as well as a Master's degree in this field from Webster University and forty years of It and management experience in the academic, business and government sectors.

Using the 7RD2 Process to Develop and Deliver High Quality Online Courses

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Abstract:

The 7RD2 process outlines the pedagogical method and logistics for creating high quality re-usable online courses with balanced course developer and instructor input. It covers planning the course, designing the activities, and delivering instruction. It also integrates information literacy at the core of the course and incorporates cutting-edge learning technologies. The end-product is a high quality 7-unit course, where each unit includes 7 key learning activities for the development phase, and 7 tasks during the delivery phase.

Presenter's Bio

Sali been serving as Director of Cairn Online and Educational Technology at Cairn University since February 2012. Prior to this position, he served as Manager of Academic Computing for the 14 years for the University.

Enabling the Student Journey: The Role of Technology in the Future of the Campus

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Abstract

Most technology solutions on campus are there to make things easier for the users, turning manual processes into automated. How do you make sure that the new solution you are selecting will deliver the experience that you want your students to have? How do you ensure that you are meeting the needs of your students, faculty, staff and alumni when you undertake an IT project and that they will actually buy in to the finished product? You start with ensuring you know and understand how they currently interact with your institution and how you want to change or improve that interaction. Come learn about how institutions are doing that and how partners are assisting them in those projects to make sure they are set up to successfully achieve the end results.

Presenters' Bios:

Moira Kirkland, Vice President Advisory Services, Doctums Global

Joe Street, Director of Higher Education Sales, NA, Doctums Global

Tom Gavin, Principal New Business Developer, ACI Worldwide

Bryan Carmichael, Senior Business Developer, ACI Worldwide

Digital Leadership: How to Become a Leader in the 21st Century

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Abstract:

Being a leader today means being a recognized brand both personally and professionally. Gain knowledge on how brands are built, what it takes to be seen as an expert, and how to leverage LinkedIn and other online technologies for success. Also, learn ways to eliminate head trash that distract people from becoming true leaders who inspire others. Dr. Mitroff explains the psychology behind leadership and how to create a lasting impact in your industry today.

Learning Points:
• Leverage social media platforms to build online influence
• Discover the biggest mental blocks holding leaders back from inspiring others
• Uncover how long it takes to become an industry expert

Presenter's Bio:

Keynote speaker, Business growth strategist, and Author who founded Piedmont Avenue Consulting, Inc. David inspires individuals and organizations to think differently through his keynote talks on a wide range of topics including Business & Entrepreneurship, Leadership, Branding and Innovation

Google Workspace for Education Editions & Storage – Admin Roadmap

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Abstract

In this IT focused session we will review recent changes to Google Workspace for Education. We will cover what new editions are available and how they may fit into your Google roadmap at your institution. Google has reimagined its paid options for Workspace, giving schools the flexibility to select, plan and deliver the features and impact that fits schools best. The session will continue with a deep dive into the announced 2022 storage changes, whether or not the changes will affect your environment and provide real tools and resources to determine and track your storage footprint. This session is for any stakeholders, Workspace for Education Admins or decision makers that plan and drive their Google for Education use and adoption at their organization

Presenter's Bio:

Eric lives in Oklahoma and joined the Amplified IT team in 2020 after working 8 years as a Technology Director in public schools. During his time in the public education system he helped move multiple districts to Google for Education both directly and indirectly through consultative support to other districts. Today, he is a Technical Account Manager who works with school districts on understanding all things Google for Education and partner products for K12. Eric received his Bachelor's degree from the University of Arkansas - Fort Smith in Media Communications and his MBA from Western Governors University in IT Management. When he isn't working he enjoys kayaking, yelling at the TV when the Sooners are playing, attending OKC Thunder games, and taking road trips with his dog Riley. His favorite food is tacos and his favorite drink is a COOP F5 IPA.

Some Ways to Think about Programming a Computer without Thinking like a Computer

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Abstract

There are many ways to think about programming a computer. Unfortunately, the beginning programming course tends to overemphasize operational semantics such as thinking like a computer, thinking in a particular language, etc., with an over-emphasis on traditional mathematical expertise. No matter how smart the person, there is a limit to what a human can do when programming is based primarily on operational semantics. Other ways of thinking about programming and the programming process will be presented that are not based on thinking like a computer and which allow one to more easily create larger and more complicated software systems. Ways to incorporate these ideas into the beginning programming course will be covered (as done by the author). The (now retired) author, with a PhD in computer science in the area of applied programming language theory, has spent many years teaching in academia, doing software research and development in industry, and, in the process, writing about a thousand pages of code each year for useful programs, small and large, in many different programming languages.

Presenter's Bio:

Robin has a BS (physics) from West Point, a PhD (computer science) from Penn State, and has attended/presented at ASCUE many since 1994. After 25 years of teaching and 15 years of software research and development in industry, he is now retired and programming in areas of personal interest.

Some Fallacies in Programming and Teaching Beginning Programming that can be Avoided before Becoming a Learned Habit

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Abstract

A programming fallacy is something about programming that many people believe is true, but is not actually true. For various reasons, many of these fallacies get taught in beginning programming courses. Eventually, the student needs to realize this and change how they do programming before they start teaching new students the same fallacies. Some of these will be covered with examples and how one might integrate the ideas into a beginning programming course (as done by the author). Understanding the general nature of the fallacies is useful for anyone working with programmers, managing programmers, etc. The (now retired) author, with a PhD in computer science in the area of applied programming language theory, has spent many years teaching in academia, doing software research and development in industry, and, in the process, writing about a thousand pages of code each year for useful programs, small and large, in many different programming languages.

Presenter's Bio:

Robin has a BS (physics) from West Point, a PhD (computer science) from Penn State, and has attended/presented at ASCUE many since 1994. After 25 years of teaching and 15 years of software research and development in industry, he is now retired and programming in areas of personal interest.

Cultivating Student Employability Skills through an Online Course

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Abstract

It is projected that students will remain interested in pursuing a college or university degree through a variety of formats, especially online and blended delivery formats for additional flexibility and work-life-family-academic balance (Busteed, 2021; Friedman & Moody, 2021). Similar projections are also being experienced in the workplace. Fifty-four percent of U.S. adults working full and part-time prefer to continue to work from home beyond the pandemic (Pew Research Center, 2020). The shift to remote work will require employees prepared to work and learn online. Online high-impact practices, namely first-year experiences, will be critical to prepare students for online courses and remote work, to address the needs of the changing workplace, and especially if a crisis like COVID-19 were to occur again. This presentation will address post-pandemic employability skills and demonstrate how an evidence-based, online high-impact practice first-year seminar course was used prepare undergraduate non-traditional online students for the reimagined remote academic and career environments.

Presenters' Bios:

Jacqueline S. Stephen has over eighteen years of national and international experience in higher education. She is an Assistant Professor, Director of The Office of Distance Learning, and Instructional Designer, in the College of Professional Advancement at Mercer University, USA.

Ashley Fru is an undergraduate psychology major at Mercer University's College of Professional Advancement. Her research and career interests include personal and professional development, diversity and inclusion, and individual and organizational partnership collaboration.

Enabling Greater Access and Growth

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Abstract

Decreasing enrollments in higher education continue to challenge leaders as the impact of the pandemic reverberates across all types of institutions in the United States. Best practices in student engagement, expanded experiential learning opportunities, high-impact programs, creative financial incentives, and reimagined curriculum are all important parts of the playbook for minimizing attrition and maximizing success. However, identifying when and which students are most likely to benefit from these programs requires integrated and data-enabled strategies and systems.

Institutional leaders must give serious consideration to any opportunity to mitigate attrition, improve enrollment, enhance equity and the student experience, and future-proof both human structures (i.e., "great resignation") and technological systems. Modernizing, integrating, and transforming technological infrastructure is an inevitable next step to best enable staff and faculty to deliver just-in-time interventions and engage students in their critically important programs and initiatives.

These integrated systems and platforms will help leaders to sense/detect the relevant factors in the learning environment, perceive/understand indicators that might signal trouble, decide what actions can/should be taken, and act on those decisions through university staff, faculty, and available resources

Presenters' Bios:

Peter is a Chicago-based leader in education and workforce development. As a Senior Principal for Slalom, he partners with organizations in public, private, and non-profit sectors to grow talent, lead change, and transform culture. He focuses on building pathways from K-12 t higher education to the workforce. He is an experienced author and speaker on the emerging trends in learning and talent development. Peter is a graduate of the University of Michigan.

Randy is the US Sales Leader for Slalom's Public & Social Impact practice. He has partnered with 145+ education, government, and non-profit organizations from across the country on strategy and technology modernization initiatives. He has also served as an Adjunct Faculty at Saint Martin's University, Seattle University, University of Southern California, and currently at The Johns Hopkins University. Randy is a graduate of UC Davis and the University of Southern California

Technology and the Wabash Day of Giving

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Abstract

The Wabash annual Day of Giving is a 24-hour fundraising push that relies heavily on technology and social media to drive alumni, parents and friends to give to the College. In this talk, I'll share how our Day of Giving has evolved over the last nine years, shared what's worked well for us, and discuss the collaboration between the Information Technology, Advancement, and Communications & Marketing offices to make the day a success.

Presenter's Bio:

Brad Weaver is the Director of Information Technology Services at Wabash College, a position he has held since 2001. He is a long-time ASCUE attendee and currently serves as the ASCUE treasurer.

A Course to Help Choose an Engineering Major at a College with a Pre-Engineering Program Only

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Abstract

Colleges having their various engineering departments can offer courses to help students choose their engineering major with the support of faculty and lab activities from various engineering departments. However, students at colleges with a pre-engineering program only usually cannot have that kind of support from various engineering departments. A new course was designed to help them decide whether they want to study engineering or help them choose their engineering major. This new course consists of three parts: conducting projects related to various engineering majors, preparing presentations related to various engineering majors, and listening to presentations on the general information of engineering. A survey was conducted to measure the effectiveness of this new course offered in the author's institution. Results show that 87% of the respondents answered that conducting projects help them know better the engineering major they choose, and 84% of the respondents answered that preparing and presenting presentations help them know better the engineering major that they choose. Therefore, this course is very effective for students to gain knowledge of various engineering majors to choose their engineering discipline.

Presenter's Bio:

Il Yoon is an Assistant Professor of the Pre-engineering Program at the University of North Georgia. He received a Ph.D. in Mechanical Engineering in 2013 from the University of Missouri at Columbia. His fields of interest are Heat Pipes, Neutron Imaging, and Engineering Education.

Digital Equity among Housing Insecure Higher Education Students

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Abstract

The global pandemic of the coronavirus or COVID-19 caused higher education institutions (HEIs) in the United States to rethink their priorities and reassess issues of equity in education. As HEIs began to close their campuses, teaching was promptly shifted to an online format, and students were asked to move out of campus housing. These abrupt changes caused unexpected challenges to one of the most vulnerable populations: housing insecure students. Housing insecure students struggled with the uncertainty of returning to unstable housing which was further complicated by the predicament of securing means of remaining connected to the required digital learning environment. While overcoming the barriers of housing insecurity, students had to also secure internet access and required technology tools for digital participation. Certainly, these sudden transformations at HEIs exposed a noticeable difference between students who had access to the tools and resources needed to continue to digitally participate in their education and those who did not. This presentation will center ways higher education institutions can support students facing housing insecurity in a technology rich environment.

Presenter's Bio:

Dr. Young is a clinical instructor and the Director of Using Information Technology at East Tennessee State University. Her research interests focus on the multi-dimensional impact of housing insecurity on higher education student success and equitable educational access among vulnerable populations

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