E-Learning Essentials 2020

E-LEARNING ESSENTIALS 2020

Participants in EDUC5104G (Winter 2020)

Power Learning Solutions
Sydney, NS, Canada

CONTENTS

III. Tool Reviews

WELCOME

Welcome to the eLearning Essentials 2020 eBook! Our focus is to provide evidence-based guidance, useful design tools, and useful examples to guide the creation and design of eLearning Modules.

This digital resource has been authored by participants in EDUC5104G: Analysis and Design of Web-Based Learning Tools — a graduate-level course offered through Ontario Tech University. From the course description:

> This course allows students to investigate, analyze and design web-based learning tools. Key areas addressed include establishing an operational definition and categorization of web-based learning tools (WBLTs), exploring learning theories and instructional design principles that support the design of WBLTs, understanding the advantages and disadvantages of using WBLTs, analyzing and assessing qualities of effective WBLTs, and exploring strategies for using WBLTs. After developing a strong foundation of theory and design, students will create their own WBLTs.

Our focus in this eBook is on providing a lasting resource for other educators and instructional designers and developers. The eBook has three main parts:
1. Learning Theories
2. Instructional Design Principles
3. Tool Reviews

Part 1: Learning Theories focuses on background

information, guiding principles for use, and examples of good use in the design and development of web-based Learning Tools. Part 2 focuses on key Instructional Design Principles and, similarly, offers guidelines for use and examples of good use. In Part 3, course participants provide reviews of digital tools that can be used in the creation of your own web-based learning tools.

Each course participant has contributed two chapters to this eBook — one focusing on either a Learning Theory or an Instructional Design Principle, and one tool review.

We hope you find this resource useful to help with your design and development of your own web-based learning tools!

Rob Power, EdD
Assistant Professor, Educational Technology

COVER ART ACKNOWLEDGEMENT

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PART I

LEARNING THEORIES

1

SOCIAL LEARNING THEORY

Overview

[Social Learning Theory](#)

The Social Learning Theory, also known as the Social Cognitive Theory was theorized and developed by Albert Bandurais in 1963. This theory is described as a bridge between the behaviourism and cognitive learning theory as it involves attention, memory, and motivation. It is

centralized around the view that individuals learn and grow through observation, imitation, and modelling and that learning occurs using a 4 step modeling process; attention, retention, reproduction, motivation.

Guidelines for Use

Guideline 1 – Attention

This phase of the instruction involves the observation and modelling process

where the student is required to pay attention to who (the model) or what (skill/behavior) that needs to be observed. Learners have a greater chance of focusing on a model if they are engaged and interested in what is being modeled. Educators must ensure that they have the attention of the learner through the use of unique contexts, discussions, exciting "hooks" or "innovative introductions", ensuring the learner is engaged thus capturing the learners' attention.

Guideline 2 – Retention

Internalizing the information into our memories is a crucial part of this process. This phase of instruction is where the learner is required to retain what they have observed through the mirroring or mimicking process. The educator or their peers model the behaviour and/or skill allowing the learner to see and practice the skill in order to "retain" or "recall" the observed behaviour and/or skill.

Guideline 3 – Production

This phase of instruction is the process where the learner is reproducing the learned behaviour, skill or knowledge. The learner practices then replicates the behaviour or skill that has been observed on their own without anyone "showing/modelling" for them. By practicing the skill, the learner is able to improve their responses.

Guideline 4 – Motivation

This phase is where the learner becomes motivated or has a reason to continue to produce the skill or behaviour because they see and recall the rewards/outcomes of someone else's behavior. This then motivates the learner to continue to or avoid the behaviour due to recalling the outcome thus supporting the idea that if learners see positive outcomes of a particular behaviour, they are more likely to repeat that skill or behaviour independently. If the reward is not seen as 'important' to the learner, they will most likely not repeat or imitate the behaviour and/or skill.

Good Examples of Use

Example 1 – YouTube Cake Baking Tutorial

This tool helps teach the learner through the video, the skill of baking a cake. When using YouTube, the video captures the learner's attention, then the learner is observing the model to attain the skill that is being taught. Once the learner has completed watching the video, they then try to replicate or imitate what the model has taught them. Lastly, once the learner has observed the

outcome, they become motivated to continue to pursue that skill as they have recalled the model's outcomes, in this case the results of their cake baking.

Example 2 — Khan Academy www.khanacademy.org

This resource tool was created to help students with their homework, giving students and parents access to educational activities, lessons, quizzes and videos in various strands. These videos outline the process of various skills allowing the learner to mimic and practice the skills online.

Helpful Resources

Resource 1 — Bandura — Social Learning Theory by Saul McLeod

This page on the Simply Psychology website was written by Saul McLeod defining and elaborating on various aspects of the social learning theory.

Resource 2 — Social Learning Theory By Albert Bandura

This is a text written by Albert Bandura outlining the theory and implications for its use.

Resource 3 — Video on The Social Learning Theory by Edutopia

This video speaks to the importance of the social learning theory and how it is a human's first mode of learning from birth.

Resource 4 — Youtube Video (What Is Social Learning?) by Fuse

This video (by Fusion Universal for Social Learning) is a

snippet of a series of videos explaining the social learning theory and how this type of learning best suits the society we live in today.

Research

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Author

Submitted By: Alana Craigg

Email: alana.craigg@ontariotechu.net

Bio: Primary Educator with a focus in Music, Physical Education STEM and Global Competencies

2

ELABORATION THEORY

Overview

[Elaboration Theory](#) (4:30)

Description

Introduced in 1979 by Charles Reigeluth, Elaboration Theory suggests delivering instruction beginning with simple, foundational concepts followed by more detailed, specific and complex concepts. Information should be chunked and sequenced to facilitate anecdotal

connection and allow learners an element of control over consumption of information so they can independently decide what information requires more elaboration or attention in order to best master and understand concepts being taught.

Guidelines for Use

Guideline 1 – Simple and broad to complex and narrow

Beginning with a broad and wide view (zoomed out) without specific details allows foundational concepts to be discussed first. With these generalized concepts understood, learners can focus (zoom in) to more specific details and acquire richer understandings. An example could be understanding the shape of the earth before understanding gravity, rotation and revolution concepts later.

Guideline 2 – Sequencing through strategic organization

Sequencing delivery and material depending on type of information to be learned is essential. Conceptual Elaboration should be used when many related concepts are to be learned (scientific concepts). Procedural Elaboration should be used when there is order or steps to be taken to get from a means to and end (mathematical concepts). Theoretical Elaboration should be used when several concepts exist, often with a cause and effect relationship (liberal arts concepts).

Guideline 3 – Synthesize and summarize

Several   times   during   information   delivery,

summarization and synthesis should be encouraged in order to foster opportunities for review and deeper understanding. Comparing prior knowledge with newly understood concepts will encourage bridges between understandings and applications for learners to elaborate on their knowledge base.

Guideline 4 – Analogies

Allow learners to identify a familiar idea or conceptual understanding and use that familiarity to help define and build into a new concept. A child with a family dog has plenty of foundational knowledge and experience to apply to adding a cat to the family and can elaborate from K9 behaviour to feline behaviour – same but different but same.

Guideline 5 – Learner control

Learners and users should have the ability to self-direct learning through activity relationships. The amount of time spent with material, number of times activities are completed and order the material is interacted with should be in control of the learner so learning can be independently determined and applied.

Good Examples of Use

Example 1 – Typing.com

Whether a user is learning to type or has a goal to improve typing skills, this program begins with simple, foundational exercises that develops proper use of the homeroom and finger placement and gradually works

towards complex sentences, paragraphs and large blocks of text with complex punctuation.

Example 2 – Khan Academy

Allowing complete learner control, this learning tool offers instruction on many different topics, organized by grade level and by complexity. Lessons are delivered with examples and stories, where applicable with the option for users to complete quizzes to evaluate whether concepts have been understood and mastered. Learners can skip lessons, redo lessons and move between topics, at their leisure.

Example 2 – Google Earth

Google Earth allows users to take a zoomed out look at large geographical areas. Users have control and ability to zoom in to gain understanding, information and context and zoom out again to organize and synthesize the information.

Helpful Resources

Resource 1 – Website: Charles M. Reigeluth

Reigeluth has created and maintains this website that includes biographical, professional and contact information. This is a tool purposed to share theoretical vision as well as opportunities and tools for practice with other educators and institutions.

Resource 2 – <u>Article: A Critical Review of Elaboration Theory</u>

Article written by Brent Wilson and Peggy Cole offering a critique of Elaboration Theory.

Resource 3 – <u>Video: What Education Could Be</u>

Video hosted by Charles Reigeluth describing different roles and technology required to best meet the needs of current educational requirements.

Resource 4 – <u>Graphic: Seven Treatments of Elaboration Theory</u>

Simple graphic illustrating steps and elements of Elaboration Theory.

Research

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Author

Alison Sprayson

Email: alisonsprayson@gmail.com

Bio: Post-secondary instructor with interest and focus in technology, marketing and instructional design

3

OPERANT CONDITIONING

Overview

[Operant Conditioning](#) (4:05)

Description

Operant Conditioning (OC) is a method of learning developed by behaviourist, B.F. Skinner, who believed that human behaviour is extrinsically motivated. OP is a process of learning through reinforcers and punishers that result from our behaviours. This learning process

is categorized by positive and negative reinforcers and punishers.

Guidelines for Use

Guideline 1 – Reinforcement

Reinforcement aims to increase desired behaviour, and can be accomplished in two ways: positively and negatively. With positive reinforcement, behaviour is increased by rewarding the learner with favourable stimuli. An e-learning module could utilize positive reinforcement by, for example, providing the learner with tokens, badges, or desirable feedback after the completion of a milestone or task; this would encourage further completion of the module. Negative reinforcement refers to the removal of an undesired stimuli to reward behaviour. In an online game-based learning module, negative reinforcement could be accomplished by, for example, removing the added pressure of a timer once the learner reaches a certain level or milestone; this would encourage the learner to continue playing.

Guideline 2 – Punishment

Punishment seeks to decrease undesired behaviour, and can also be accomplished positively and negatively. Positive punishment refers to providing a learner with unfavourable stimuli to weaken undesired behaviour. In an online game-based learning environment, positive punishment can be accomplished by, for example, giving a student an loud warning signal for not completing a learning task in the dedicated time-frame; this would

weaken the learner's relaxed approach to the task completion. With negative punishment, undesirable behaviour is weakened by removing favourable stimuli. In a game-based learning environment, negative punishment could be exercised by, for example, withdrawing a student's tokens, badges, or rewards for incompletion of a game-based learning task in the dedicated time-frame; this would also weaken the learner's relaxed approach to the task completion.

Good Examples of Use

Example 1 – https://tinyurl.com/marketingsimulation

The linked PowerPoint is a guideline on how to navigate Harvard Business Publishing's online Marketing Simulation. This simulation provides marketing students with an opportunity to learn about strategic management of segments and customers by playing the role of a company's new CEO. This simulation uses stimuli (i.e., money, customer satisfaction scale, and stakeholder feedback) to reinforce or punish behaviour to ultimately encourage students to develop the most effective marketing strategy. This simulation creates healthy competition among the class while teaching students marketing curriculum units.

Example 2 – https://www.duolingo.com/

Duolingo is an example of a gamifying WBLT that fosters language learning through operant conditioning techniques. This WBLT uses stimuli (i.e., experience points to advance levels and gain access to more difficult

exercises) to teach language learners grammar and vocabulary lessons.

Helpful Resources

Resource 1 – https://www.simplypsychology.org/operant-conditioning.html
This is an article that explains Operant Conditioning in-depth, including video summaries and educational applications.

Resource 2 – https://doi.org/10.1002/9781118468135

This is an eBook explaining associative learning, including classical and operant conditioning.

Resource 3 – https://www.youtube.com/watch?v=H6LEcM0E0io

This video provides a summary of the differences between classical and operant conditioning, both of which need to be understood to apply associative learning effectively.

Research

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Author

Submitted by:	Amareen Brar
Email:	amareen.brar@ontariotechu.net
Bio:	I have a background in Education administration. I am a Master of Arts (Education) student pursing my thesis and assisting with research regarding multiliteracy and curriculum development.

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SITUATED LEARNING THEORY

Overview

 <u>An Introduction to Situated Learning Theory</u> (4:18)

Description

Situated Learning Theory was initially proposed by Jean Lave and Etienne Wenger in the late 1980s. The concept

of Situated Learning Theory is that learning occurs within authentic context, culture, and activity and that it is widely unintentional.   It promotes the idea that students learn better in collaborative group settings and when the activities are based on real-life experiences.

Guidelines for Use

Guideline 1 – Authentic Contexts

Learning involves a setting that creates an authentic real-life context. Activities should include opportunities for students to explore and investigate from a wide variety of sources. The investigation should focus on a relatively wide focus rather than smaller fragmented tasks so that relevant information can be sought.

Guideline 2 – Legitimate Peripheral Practice/ Scaffolding

Students start at the periphery of the learning as a novice in the subject matter and instructors become more of a facilitator and provide scaffolding of the learning. As the students expand their knowledge, the scaffolding is removed, and they move toward becoming an expert in the subject.

Guideline 3 – Community of Practice/ Collaboration

Students move from the periphery within the community of practice circle as they learn and collaborate with one another. Activities are designed with the group setting that allows for various viewpoints and difference of opinion. Opportunities for students to interact with

experts in the subject matter is another important aspect of building their community of practice.

Good Examples of Use

Example 1 – Nearpod

This tool allows the instructor to create lesson and insert activities such as collaborate, quizzes and virtual field trips. Nearpod lessons could be either teacher led in the classroom or student led. There is an opportunity for reflective practice in open ended questions.

Example 2 – Google Classroom

This tool allows the instructor to create lessons that can be student led. There is the ability to insert activities and links to outside sources for discovery. Instructors can facilitate the learning and students can collaborate and work on activities through add-ins such as Google Slides and Google Docs.

Helpful Resources

Resource 1 – Video on Situated Learning Theory

This is a short 4-minute video explaining the Situated Learning Theory.

Resource 2 – Situated Learning Theory on Learning-Theories.com

This website provides a brief overview of the Situated Learning Theory.

Resource 3 – [Paper on Using Situated Learning](#)

This paper by Ron Oliver and Jan Herrington is a helpful resource on how to use situated learning as a design strategy for web-based learning.

Research

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Author

Submitted by:	Andrea Dyack
Email:	andrea.dyack@ontariotechu.net
Bio:	Faculty at Southern Ontario Dental College and current graduate student in the Master of Education program at the University of Ontario Institute of Technology.

5

EXPERIENTIAL LEARNING THEORY

Overview

[Video Description](#) (4:59)

Description

Experiential Learning theory is based on the idea that learning is a cyclical process involving experience, perception, cognition, and behavior in a holistic manner

where all four stages of the process are necessary for learning to occur. These stages include concrete experience such as a lab or module, observations and reactions, forming of abstract concepts, and applying or testing this knowledge in new contexts. The learning theory states that learners learn best from their experiences and from mistakes that are made.

Guidelines for Use

Prepare the learner

Make sure the learner is prepared before the learning event so they are aware of the expectations you have and the needs they should be focusing on. The instructor should pose problems, set any necessary boundaries, explain the purpose and objectives of the learning event and facilitate the learning process.

Sequential Ordering of Cycle Stages

Although learners can enter the cycle of learning at any stage, it is imperative that those stages follow the sequential order in the cycle. The first stage is concrete experience, the second stage is reflection and observation, followed by abstract conceptualization and then testing knowledge in new situations. Although the cycle must be in this order, the starting point is not prescriptive.

Be Less Teacher-Centric

Learning events or lessons should not be teacher-centric. Instead, they should allow opportunities for students to

show agency and active engagement by asking questions, investigating and solving problems, and learning from both success and mistakes with their natural consequences. Instructors should be facilitators of learning and sources of support.

Holistic Learning & Assessment

All class materials, readings, assessments, and activities in the classroom or online should be directly linked to the experience so that all learning events are connected. Ideally, there should be a major project that guides the learning throughout the entire course or process, which helps keep students focused on forward momentum, progress, and the ultimate goals of the learning. The learning cycle itself can be seen as a rubric for any lesson.

Dynamic Matching Model of Roles

The experiential learning cycle stages should be aligned with the learner focus, knowledge focus, subject focus, and action focus, which in turn connect to certain roles of educators in the learning process, where the instructor may be the facilitator, the subject expert, the standards setter & evaluator, and the coach.

Good Examples of Use

Example 1 – Brock University's Experiential Education Program

Brock University has experiential learning opportunities integrated into many of their programs, including the more traditional practicums and internships, but also labs, simulations, design projects, and field experiences.

Example 2 – Prodigy Math Learning Platform

This engaging game based online tool allows students to choose their own avatar and play through a series of complex math challenges and problems. Teachers can link this to course objectives and assignments and design a holistic learning experience.

Example 3 – Experiential Learning at University of Calgary

This article provides five concrete examples that The University of Calgary conducts online and in the classroom or community. This includes community program experiences like tutoring in libraries followed by online reflection exercises through D2L, learning labs on campus, placement opportunities, and intercultural immersion experiences over reading week.

Helpful Resources

Resource 1 – Association for Experiential Education

This website gives a broad definition of experiential learning and provides access to professional development, research, publications, and accreditation programs that are all based on the experiential learning theory.

Resource 2 – Learn Through Experience

This website provides contacts of organizations and projects that offer real-world experiential learning opportunities and categorizes those opportunities based on the type of experience, such as wilderness

opportunities, and the demographic targeted, such as K-12 students or higher education opportunities.

Resource 3 – 8 Things To Know About the Experiential Learning Cycle

This informative video details the entire experiential learning theory and cycle and explains real life examples and applications of the theory for educators.

Resource 4 – Ontario's Ministry of Education

The Ministry of Education website details the definitions, learning objectives and outcomes, community roles, and assessment and evaluations involved in experiential learning.

Resource 5 – Experiential Learning Online: A "how to" handbook

This is an incredibly helpful handbook on eLearning Industry's website that helps instructors apply experiential learning to online learning and module and course design.

Resource 6 – Experiential Learning Toolkit

This resource was created by Niagara College, Brock University, and Georgian College. It's a resource made for instructors to provide guidance and tools to integrate experiential learning into the classroom.

Research

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Author

Submitted by:	Blair Trewatha
Email:	Blair.trewartha1@ontariotechu.net
Bio:	Blair Trewartha is an educator and instructional des Masters of Education at Ontario Tech University. H Bachelors of Education degree, and over ten years e: post-secondary institutions across Ontario.

6

ARCS MODEL OF MOTIVATIONAL DESIGN

Overview

[An brief overview of the ARCS Model](#) (6:18)

Description

The ARCS Model of Motivational Design was formulated by John Keller in 1983. Keller was interested in exploring how we might design learning experiences to create and to sustain student motivation in learning new content. Keller was interested in the concept of motivational design because it could systematically produce replicable results over time in improving a learner's motivation to learn. Keller (2016) defines motivational design as a "process of arranging resources and procedures to bring about changes in motivation." According to Keller (1983), the ARCS Model of Motivational Design suggests that an instructional designer can routinely improve a learner's motivation to learn by focusing on Attention, Relevance, Confidence, and Satisfaction (ARCS).

Guidelines for Use

Guideline 1 – Attention

The first step in instructional design for motivation is to capture the learners' attention through either perceptual arousal or inquiry arousal. Using surprise, novel, engaging, and incongruous events at the start of a lesson will create perceptual arousal in learners and captivate their attention. Stimulating curiosity, wonder, and questioning by stating challenging problems and questions will create inquiry arousal in learners and capture their attention through intellectual or cognitive engagement. Key Question: is the content catching and keeping the learner's attention?

Methods to Activate Attention:

- Active Participation: encourage active participation by using games, roleplay, simulations, and other hands-on strategies to involve learners.
- Variability: use a variety of modalities (e.g. video, infographics, audio, short lectures, discussion groups) for presenting content.
- Humour: use cartoons, humourous anecdotes to maintain interest.
- Incongruity and Conflict: use debate and play the devil's advocate with comments that go against the learners' past experiences.
- Specific Examples: provide specific examples of the content through images, stories, and biographies.
- Inquiry: Ask questions, present problems or dilemmas for the learners to grapple with and discuss.

Guideline 2 – Relevance

Finding ways to connect the content to the learner's world ensures that the learning process is useful. Relevance helps connect the content to the real world. You can help establish relevance by using concrete language and examples that the learners will be familiar with. To establish relevance, you need to consider how the content connects to the learner's goals, motives, and past experiences. Key Question: Why should the learner care about this content and how does it connect to the learner's world?

Methods to Activate Relevance:

- Experience: show learners how new learning will use their existing skills and experience.
- Present Worth: help to show how the content will be immediately useful to them.
- Future Usefulness: help to show how the content will be useful to them in the future.
- Needs Matching: show how the content connects to the learner's needs.
- Modeling: show learners how to apply the learning and what to do. This helps them to walk the walk, so to speak. Other strategies include guest speakers, videos, and having learners function as tutors once they have the content.
- Choice: Build in choice so learners can use different ways of showing what they know. It allows them to play to their strengths.

Guideline 3 – Confidence

Learners have to feel they can succeed. If a learner perceives the content as being too difficult, they may not even try to learn the content, or they may not try their hardest because they expect to fail. If the difficulty is too high, motivation will decrease. The content has to be organized in such a way so that the learner feels they have the skill and ability to accomplish the task or understand the content. Key Question: does the learner feel like they can succeed in learning this content?

Methods to Activate Confidence

- Provide Objectives & Prerequisites: objectives & prerequisites empower learners to estimate their likelihood of success. Objectives let learners see what is expected of them by the end of the learning. Prerequisites empower learners to self-check if they have the prerequisite knowledge or skills. Learners can then take steps to address any deficiencies.
- Plan for Meaningful Success: scaffold and organize the learning so learners can experience success. The success should be substantial enough, so it is meaningful and represents some accomplishments. There is a fine balance between too hard and too easy.
- Grow the Learners: scaffold and organize content so the learning increases in difficulty. This allows for growth in the learner.
- Feedback: provide feedback that supports the learner in attributing their effort to their success with learning the content.
- Learner Control: learners should have some degree of control over their learning path and assessment. They need to see that their success is a direct result of their choices and effort.

Guideline 4 – Satisfaction

Learning should be rewarding and satisfying for the learner. Satisfaction comes at the end of learning the content as the learner meets the goals and objectives as well as has their needs met by the learning. Satisfaction can also come from achievement and praise. Key

Question: does the leaner feel good about their accomplishment in learning this content?

Methods to Activate Satisfaction

- Intrinsic Reinforcement: encourage the pleasure of learning for its own sake or to achieve personal goals. Learning should be useful and beneficial to the learner. Help them to see this benefit by applying the learning in a real-world setting.
- Extrinsic Rewards: give unexpected rewards and direct encouragement to learn.
- Equity: keep standards high so learners know they are achieving. Do not over-reward simple tasks.

Good Examples of Use

Example 1 – LinkedIn Learning (Formerly Lynda.com)

Linkedin Learning provides over 15, 000 online courses on subjects related to technology and industry. You can learn how to analyze big data, develop an app, or leverage digital storytelling and multimedia to communicate a message. Linkedin Learning courses are designed to activate a learner's attention through active participation in several hands-on activities, variability in modality of content delivery, and by providing specific examples of how and where to use skills and content in a real-world context.

Example 2 – Prodigy

Prodigy is a research-based, online mathematics platform that gamifies the learning of mathematics. The platform assesses the level learners are at with their number sense and numeration skills, and then differentiates content for learners based on that initial diagnostic assessment. Prodigy activates satisfaction by extrinsically rewarding students with in-game content and micro-credentials. Prodigy activates intrinsic motivation by allowing students to set their own goals and seeing growth in their mathematical proficiency.

Helpful Resources

Resource 1 – ARCS: A Conversation with John Keller (Video)

This 1 hour 13-minute video is a recording of an interview with John Keller. In the interview, Dr. Keller explains the ARCS model and its grounding in research.

Resource 2 – ARCSModel.com (Website)

This website was created by Dr. John Keller to share the concept of the ARCS Model of Motivational Design. There is a section explaining the model in detail, as well as a section documenting and explaining various research themes around the contemporary study of the ARCS Model of Motivational Design.

Resource 3 – The ARCS model of motivational design: applied in practice (Blog)

This blog was posted by Alexander Todorov, and

workshop presenter, that teaches learners how to code. The blog is a reflection piece that shows how the presenter tried to employ the ARCS Model of Motivational Design as he presented a workshop on coding.

Research

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Author

Submitted by:	Chad Mowbray
Email:	chad.mowbray@uoit.net
Web Page:	https://elearning-essentials-2020.weebly.com
Bio:	A graduate student exploring and learning about 21st Century teaching and learning.

7

CONSTRUCTIVISM THEORY

Overview

 [An Introduction to the Constructivism Theory (4:29)](#)

Description

Constructivism is a learning theory that explains how students learn. All students have prior existing knowledge and by using their existing knowledge coupled with teacher-designed learning activities that are

active, collaborative, and socially constructed, students can cognitively process new information. From participation in student-centered learning activities and experiences, students construct new knowledge and personal meaning.

Guidelines for Use

Guideline 1 – Use Active Learning Activities

Develop e-learning modules that are student-centered. Begin the lesson with learning activities that are active and engage the learner's prior knowledge. Some learning activities may include posing a question, solving problems, performing experiments, posing real-world problems, and/or generating discussions. Ensure learning activities are relative to the field of study. An example is a lesson on mathematical word problems. The lesson is introduced by dividing students into groups, then providing each group with a mathematical word problem and asking each group to explain how and what strategies they can utilize to solve the word problem.

Guideline 2 – Educator's Role as Facilitator

The educator assumes the role of facilitator, guide, coach, and/or mentor whose role is to prob, question, and to relinquish control of the learning to the learner. Students are active learners, not passive learners. An example is to begin a biology lesson about the anatomy of a frog with students using a dissection simulation exercise as opposed to a lecture. Afterward, the educator encourages students to participate, discuss, and engage with others

on what they have learned from the dissection simulation exercise.

Guideline 3 – Learning is Socially Constructed

Ensure students are active learners who construct the meaning of their learning in a collaborative environment. Learning must be socially constructed, reflective, and include multiple perspectives. Students take ownership of their learning. Educator's learning environments include group work, discussion forums, debates, group projects, and/or journal entries. Learners should share their learning with others to ensure multiple perspectives are considered.

Good Examples of Use

Example 1 – Problem-based Learning in Biology

Problem-based Learning is used as a learning activity in a biology course.

Example 2 – Classroom Example of Constructivism

An educator applies a constructivist approach in a primary classroom to conceptualize the need for a formal unit of measurement.

Helpful Resources

Resource 1 – Constructivism in Action

This website is designed as a workshop aimed at defining, demonstrating, exploring and providing tips on how to

implement constructivism in an educational environment.

Resource 2 – <u>Constructivist Learning Theory</u>

This website is authored by Associate Professor (Emeritus) John Lawrence Bencze on the theory of constructivism and provides learning principles, recommendations on how to implement this theory in education, and has links to additional resources.

Resource 3 – <u>Video Critique of Constructivism Theory</u>

This 8-minute video by Craig Ferguson in 2017 provides a critique, some challenges, and the need for further study of constructivism.

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Author

Your Name	Charlene Di Danieli
Email:	charlene.didanieli@ontariotechu.net
Twitter:	@CDidanieli
Bio:	A professor with over 13 years of teaching experience in a community college in Ontario.

8

AN INTRODUCTION TO PROBLEM-BASED LEARNING

Overview

[An Introduction to PBL (4:30)](#)

Description

In the late 1960's, PBL was brought to the forefront of education by medical school educators at McMaster University in Canada to breathe new life into traditional teaching methods. It has since been adopted in other disciplines such as education, law, engineering, and the social sciences. The theory positions authentic, real-world problems as the focus of inquiry, and in small groups, students are given the freedom to use their prior knowledge and critical and creative thinking skills to solve problems in unique ways.

Guidelines for Use

Guideline 1 – Present/Identify the problem

Problems are defined by students and initiated by ambiguous triggers provided by the facilitator (teacher's role in a PBL scenario). Triggers should be multi-faceted and demand a high cognitive load from students. Some examples of triggers are case studies, simulations, and testing hypotheses. There are multiple strategies for reaching a solution, as there are multiple solutions.

Guideline 2 – Group collaboration to develop a plan

Together, students develop a plan for solving the problem. They engage in brainstorming, research, and share their prior knowledge and different perspectives to add layers to the problem and possible solution. The end goal is not so much to solve the problem, but to enhance the final presentation.

Guideline 3 – Implementation of the plan

Here students test out the plan to see if they can solve the problem. Both solving the problem and discovering that there may not be just one, or any solution to the problem, are successful outcomes, as long as students can demonstrate critical thinking and clearly articulate their ideas.

Guideline 4 – Evaluation and Reflection

Students evaluate the implementation of the solution to the problem and/or reflect on the process of inquiry. Assessment is completed by self and peers and is based on the depth and clarity of the final presentation. Constructive and critical feedback is encouraged as opposed to cheerleading.

Guideline 5 – Importance of authenticity

The goal is of PBL is to encourage learners to dream, wonder, imagine, and feel empowered to solve real-world problems. Triggering problems that actually exist in the learners' context is most effective to increase the interest and motivation of the learners.

Good Examples of Use

Example 1 – Brainmass

Trello uses a card system which allows team members to interact and collaborate with each other on projects. Users can add comments, links, files, and photos to cards.

Example 2 – [Venngage Case Study](#)

Case studies are a classic way to trigger a problem in a PBL unit. Case studies activate analytical thinking and reflective judgement by reading and discussing real-world scenarios.

Helpful Resources

Resource 1 [Study guides and Strategies (PBL)](#)

This is a great link in that it provides a step-by-step process to implementing PBL, and the descriptions are concise, simple, and motivating to both teacher and learner. Clearly establishing guidelines and expectations of a PBL scenario are critical to successful implementation, and this website delivers!

Resource 2 – [PBL An Overview](#)

This is a recent paper (2016) that describes the process of PBL, and through research reviews, examines the efficacy of all phases of PLB – problem analysis, self-directed learning, and reporting to understand the long and short-term effects of PBL on learning.

Resource 3 – [PBL in 5 minutes](#)

This is a link to a fun video which describes PBL in less than 5 minutes. It uses simple examples to show how using imagination and creativity is the most effective way to learn.

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Author

Your Name	Deborah McDavid-Pesikan
Email:	Deborah.mcdavidpesikan@ontariotechu.ca
Bio:	Deborah is an English as a Second Language teacher with research interests in innovative teaching methodologies to advance teaching and learning. She has diverse experience in guiding and mentoring international students, with an inclusive student-centered approach to ensure that learners are supported and encouraged to achieve their academic goals.

9

PBL: ANOTHER TAKE

Overview

[Problem Based Learning (5:03)](#)

Description

Initially developed at McMaster University in the 1960's, PBL is an instructional approach that uses real-world, open ended problems or scenarios to prompt learners to collaboratively research, test and implement solutions. In PBL, students create their own learning agenda, identify

their own learning needs and hold each other collectively accountable for contributions (Wood, 2003). Tasks may blend individual and group study. The goal is not necessarily for learners to solve the challenge, but to engage in the process of self-directed researching, knowledge sharing, collaborative work and problem solving.

Guidelines for Use

Guideline 1 – Prepare and support students in the rigour of collaborative work.

Scaffold in expectations for productive group collaboration by using community agreements and regular meetings with groups.

Guideline 2 – Incorporate across curriculum planning

PBL usually forms a core basis of curriculum planning and design, rather than individual lesson planning or course delivery (Wood, 2003). Expecting learners to engage frequently and consistently in the tasks of PBL will enhance their intrinsic motivation, research skills, and collaboration skills over time.

Good Examples of Use

Example 1 – PBL in Practice by The University of Hong Kong (via Coursera)

This video both explains and shows the PBL approach in action in a university tutorial.

Example 2 – <u>Using Project-Based Learning in the Classroom</u> by LD@School

This Ontario-specific resource shares examples of the ways PBL is used in classrooms to promote global competencies, engagement and differentiation. Scroll down to the PBL in Action section for concrete examples, tied to Ontario curriculum.

Example 3 – <u>Problem Based Learning: Project Examples</u> from Learning is Open

These examples outline the cross-curricular integrations and processes of applied PBL approaches in K-8 contexts in the United States.

Helpful Resources

Resource 1 – <u>Instructional Guide on PBL</u> from Queen's University's Center for Teaching and Learning

This resource gives an overview of this approach, why it is in use, and it's processes. It outlines advice for designing and developing a PBL course, along with suggestions for assessment.

Resource 2 – <u>The Tutor in PBL</u> by Dr. Allyn Walsh

Intended as a guide for faculty new to teaching in PBL in the post-secondary context, this resource from McMaster University clearly identifies steps, the role of the educator, and processes to get groups started with PBL.

Resource 3 – What Works? Research into Practice tip sheet on

Problem Based Learning in Mathematics

This 4 page tip sheet is backed by research and gives examples of PBL use across K-8 classrooms.

Resource 4 – Fifty Years On: A Retrospective on the World's First Problem-based Learning Programme at McMaster University Medical School by Virginie Servant

This article contextualises the history of how and why PBL was developed, and offers insight into how this method succeeded in its infancy in the McMaster medical school.

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Author

Submitted by Jesslyn Wilkinson

Contact Info: @jesslyndw

Bio: Jesslyn is the Educational Technology Officer at Conestoga. An Ontario Certified Teacher, and a M.Ed candidate, Jesslyn researches and promotes new technologies for faculty to enhance pedagogical practices. She brings to the role her experience as a Google and Microsoft certified technology trainer and as a classroom teacher internationally and in Ontario, focusing on special education, tech-integrated learning and assistive technologies.

10

CONNECTIVISM

Overview

[An introduction to Connectivism (2:03)](#)

Description

The Connectivism theory founded by George Siemens explains learning in the digital age. Information is circulated across networks and connects us to new information over these networks. Without technology, the information wouldn't be able to be shared worldwide as quickly as it is now.

Guidelines for Use

Guideline 1 – Using the Web to Expand Knowledge

The key feature of this theory states that learning can happen over networks online. (Learning Theories, 2017) When designing an online course taking a connectivist way would mean to step away from the idea of teaching and guide the students to do research online to find answers and expand their knowledge. A module activity can take what the student already knows and connect it to new knowledge they will find online.

Guideline 2 – Connecting to Others

The second way to use connectivism in an e-learning module is by using the connections the student has outside of the classroom to gain knowledge. By using twitter, email, and other social networks students can ask questions to their peers to help obtain knowledge outside of the classroom. This way they gain knowledge but as well could receive an opinion and new viewpoint.

Good Examples of Use

Example 1 – Canvas

Having access to classes online is key to being able to access knowledge anywhere and anytime. Using Canvas provides a community of individuals where you can connect and share information no matter the location that you are.

Example 2 – <u>YouTube</u>

Nowadays students aren't just in the classroom and we use online platforms such as YouTube to teach us how to do tasks we don't know how to do. For example, if a student wants to learn about editing they can search a YouTube video about how to edit a picture and follow the instructions from the experts in the video.

Helpful Resources

Resource 1 – <u>https://www.youtube.com/watch?v=a8kqcs2aR9c</u>

This is a 3-minute overview video on Connectivism from YouTube.

Resource 2 – <u>https://www.learning-theories.com/connectivism-siemens-downes.html</u>

This article provides some overview of the Connectivism theory.

Resource 3 – <u>http://edutechwiki.unige.ch/en/Connectivism</u>

Wiki with information on connectivism created by the University of Geneva.

Research

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Author

Submitted by:	Delaney Jones
Email:	delaney.jones@uoit.net
Bio:	Delaney Jones works with children who have been diagnosed with learning disabilities or ADHD.

11

COLLABORATIVE LEARNING THEORY

Overview

[An Introduction to the Collaborative Learning Theory](#) (4:34)

Description

The Collaborative Learning Theory is a process whereby a group (or groups) of individuals learn from each other

by working together to solve a problem, complete a task, create a product, or share one's thinking. This theory is rooted in the work of Lev Vygotsky's (1934) social development theory and zone of proximal development, which highlighted the importance of communication and social interaction in learning. In 1972, Kenneth Bruffee introduced the learning method, Classroom Consensus Group, in which the teacher allocated students into groups and assigned them questions to answer or problems to solve together.

Guidelines for Use

Guideline 1 – Distinction between Cooperative and Collaborative Learning

Both cooperative and collaborative learning differ from the traditional teaching and learning methods, as both learning processes have students working together in a group/team environment to complete a task. Cooperative learning is a structured approach in which the teacher is directly involved in the learning process by making each member within the group accountable for a specific task, and it is the responsibility of this individual to help others learn their specific task. An example of a cooperative learning activity would be the teacher using a Jigsaw strategy, whereby each student is required to research one section of the material and then teach it to the other members of the group. Collaborative learning is group-structured, whereby the students come together to organize and divide the work between themselves. Each student is responsible for his/her work separately, but are also in charge of the work of the team as a whole. Think-Pair-Share or Write-Pair-Share is an example of

collaborative learning where students are given a discussion prompt, question, short problem, or issue to consider. Individuals work briefly on response and then share with a partner, then to the larger group.

Guideline 2 – Utilizing Informal and Formal Collaborative Learning Groups

Informal collaborative learning groups consist of smaller clusters of students assigned to work together, temporarily (usually one class period), on a specific task for a short period. An example of this type of collaborative learning would occur in groups of 3-5 students working on the solution to a problem-solving question. A smaller group helps to keep all students on-task, enabling everyone to participate and share their ideas with the solution, i.e., smaller breakout groups in an online course. With formal learning groups, learners are arranged into specific teams and are required to work together for longer periods on an extensive project(s). An example of this type occurs when an instructor defines the learning objects and success criteria for the activity and assigns the student groups with specific tasks. The instructor continues to monitor the work, evaluates group and individual performance.

Guideline 3 – Applying Problem-based Learning (PBL)

Problem-based learning is where a particular problem is introduced for students to solve, often in groups, over a given period. In some cases, the group may only be given the topic and they must develop the problem to solve. It is required that students ultimately understand the problem before proposing a solution or response. The

PBL method can be incorporated effectively into a post-secondary biology class to engage students in solving authentic biological case studies to reinforce learning. This process begins with the instructor forming small groups and then presenting the problem statement. Each group works collaboratively with its members to brainstorm ideas/solutions to the problem and then shares their results with other groups (and the entire class) to come to a final solution, through consensus.

Guideline 4 – Integrating Technology in Online Collaborative Learning

Once students have been taught the general skills of working collaboratively during face-to-face group interactions, the next step is to support students in developing their online social presence through the integration of technology. This can be accomplished through various online collaborative tools that provide document collaboration (Google Docs, Sheets, Slides, or Office 365), as well as, class discussions that can extend online through technologies such as, Slack, WebKF, Padlet or other Learning Management System (LMS) discussion board. Technological tools can be a good way for students to exchange information online whether synchronously or asynchronously.

Guideline 5 – Providing Assessment Through Feedback and Reflection

Collaborative learning is enhanced through assessment as it encourages students to take responsibility for their participation in teamwork and to help them understand the nature of collaboration as opposed to competition. Assessment is vital to evaluate group productivity and

how well individuals work together as effective members within a group. Grading of individuals can be accomplished through individual contributions and the use of self, peer, and group assessment, feedback and reflection. Examples of individual and group contributions may include tests or assignments, rubrics, performance-based assessments, participation, media works, and/or anonymous feedback.

Good Examples of Use

Example 1 – G Suite (Google Suite)

The Google Suite (better known as G Suite) of applications is an easy and effective collaboration tool for users working together on group tasks in a team learning environment. It also allows group members to share their ideas with others, while also receiving valuable feedback and input from group members. Within the G Suite application, there several collaboration tools such as Google Drive, Docs, Sheets, Slides, Sites, Forms, and Google Classroom that can be incorporated into any collaborative group dynamics when working together on a problem or project.

Example 2 – Padlet

Padlet is an online collaborative tool that can be used as an 'electronic bulletin board' for gathering ideas, sharing them and modifying them later. Users can organize the information by adding links, YouTube videos, files, and images to the Padlet notes. The link to the padlet can be shared with others in a collaborative network, as well as, being embedded into webpages.

Example 3 – [Slack](#)

Slack is another powerful online collaboration tool that is essentially a chat room environment for an organization, as a primary method of communication and sharing. Its workspace allows for the instant organization of communication by channels for group discussions, while also allowing for private messages to share information, files, videos, etc., all in one site location.

Helpful Resources

Resource 1 – [Difference Between Cooperative and Collaborative Learning](#)

The terms collaborative learning and cooperative learning have often been interchanged to mean the same thing, but there are slight differences in each learning mode. This website provides a distinction between learning theories.

Resource 2 – [Video on Collaborative Learning by SimplyInfo.net](#)

This is a 4-minute video that explains Collaborative Learning and its benefits. It also provides some general tips and strategies for educators to implement collaborative learning in the classroom.

Resource 3 – [A Critical Review of Mobile-Computer-Supported Collaborative Learning](#)

This journal article provides a critical analysis for implementing mobile devices as an effective collaborative learning tool.

Research

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Author

Submitted by:	Gary K. Lew
Email:	gary.lew@ontariotechu.net
Twitter:	@GaryLew1506
Bio:	Currently, I am an elementary school principal within the Durham District School Board. As a lifelong learner, I am completing my Master of Education program, with an interest in instructional design and leadership in educational technology.

12

GAMIFICATION

Overview

[Gamification](#) (3:32)

Description

Gamification is the incorporation of game-related elements to non-game contexts such as education. In education, gamification is used under the assumption that the type of engagement experienced by gamers can be translated to support students' learning. After considering the contexts, learning objectives and distinctive needs of their students, educators in a

gamified classroom setting may integrate such game-related elements as progress indicators, fun, narrative, immediate feedback, mastery, player control, social connection and scaffolded learning to impact students' attitudes, behaviours and actions and enhance their motivation, engagement, creativity, retention and overall learning outcomes. The term gamification was first penned by Nick Pelling in 2003. But gamification in education can be traced back to Thomas Malone's 1980 study on motivating computer games and Woodrow Wilson International Center for Scholars 2002 exploration of game principles in public policy studies. In recent years, Katie Salen, Jessica Hammer, Joey J. Lee, Jane McGonigal, Jesse Schell, and Karl Kapp have further advanced the application of gamification in education.

Guidelines for Use

Guideline 1 – Identify Context and Learner Audience

Identify the learning abilities, age group, skill set or current knowledge of students as well as context such as learning environment, time frame, subject or topic. For example, the beginning of a gamified e-learning module would state that it is aimed at biology students in grade 11 who have taken grade 10 biology and are familiar with cell structure, specialization, and mitosis as well as dissections. You would specify that this module is aimed at grade 11 students and will focus on cellular functions, genetic processes, biodiversity, evolution, and the anatomy, growth, and function of plants.

Guideline 2 – Define the Learning and Behavioural Objectives

Define the overall learning goals that you want the student to achieve. For example, at the completion of the first task, the student will understand a particular concept such as taxonomy and, also, be able to work collaboratively with a classmate to identify parts of the concept of taxonomy.

Guideline 3 – Structure the Learning

Decide how you want to structure the learning whether by stages, tasks, levels, or assignments completed, time spent, levels of complexity reached in a challenge, points or badges accumulated, or missions completed in a quest. Assess if you want the learning to be individually focussed or collaborative as part of a team or group or a mixture of both. Identify what students need to achieve, reach, know at each point, level or stage as they progress through their learning.

Guideline 4 – Identify and Define Rules and Means Used to Gamify the Learning

Define the rules that govern students' progress and achievement of tasks. Identify the tools you will use to track or measure students' progress throughout the lesson, i.e.: incorporating such game elements as points, badges, deadlines, scores, unlocking a clue, giving them access to the next level, etc. Pinpoint when it is appropriate to measure, i.e.: specific stages or completion of tasks or assignments. Evaluate if the means enable timely and effective feedback to the student and you as the instructor. For example, you may decide that a

student must achieve 100% on a task before progressing to the next task. And you equate achieving 100% with 5 points for a particular task.

Guideline 5 – Decide What Gamification Elements to Apply

There are several gamification elements that can be incorporated such as giving students the freedom to choose but also to fail, showing student progress through points, scores, progress bars, dashboards or leaderboards, giving immediate, specific and individualized feedback, creating personalized experiences or challenges, inventing narratives or stories, enabling students to choose different identities or roles or giving them individual or team tasks or a mixture of both. For example, students can choose and have control over the shape, size or colour of a programmed object they create when programming and have the freedom to able to change, adjust and return to it until they are satisfied with it or until they get it right.

Good Examples of Use

Example 1 – Learning Spanish with Duolingo for Schools

This example shows how teachers can incorporate Duolingo for Schools to create a gamified online classroom for learning Spanish for students in various grades Teachers can create the Spanish class, share the link with students, schedule the class, add assignments specific to grade level and Spanish curriculum, set up class activities and incorporate game elements such as personalized feedback, flashcards, power practice, accrual grading connecting points to correct answers.

Example 2 – Learning to Program with Khan Academy

This Khan Academy video uses game elements such as freedom to fail by allowing students to return to their program and change the code, showing progress by allowing them to see their coding screen and the results of their coding, providing immediate feedback if they have made an error in coding, enabling them to have freedom of choice in choosing sizes, colours, shapes, and unlocking content by giving them access to other learners' creations.

Helpful Resources

Resource 1 – The Innovative Instructor Blog About Gamification

This John Hopkins University blog by an instructor defines gamification and explores the process of gamifying education. It provides links to definitions, research, talks, and websites about gamification.

Resource 2 – Video about Incorporating Gamification Elements in the Classroom

In this video a high school teacher explains how she has incorporated gamification in the classroom environment to motivate and engage her students.

Resource 3 – The Difference Between Gamification and Game-Based Learning.

This University of Waterloo website explains the difference between Gamification and Game-Based Learning, the pedagogical role of game elements, types

of gamification strategies and provides examples of gamification and game-based learning tools.

Research

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Author

Submitted by: Ivetka Vasil

Contact Info: ivetka.vasil@ontariotechu.net

Bio: I am a graduate student in the M.Ed. program in Education and Digital Technologies at Ontario Tech University with an interest in incorporating gamification into healthcare learning environments.

13

BACKWARD DESIGN

Overview

[Backward Design](#) (3:54)

Description

The Backward Design allows instructional designers, educators and or instructions the ability to create a course, unit or lesson based on a three-stage process. Developed by Wiggins and McTighe, the main idea of this design is based on starting with your end goal first

and working backwards to unveil what your learners need to know in order to attain the goal. The learner's knowledge and understanding are assessed through activities provided. it is equally important to collect evidence throughout this process instead of at the end to witness their comprehension of the content.

Guidelines for Use

Guideline 1 – Identify Desired Results

Establish your desired outcome also consider the goals and curriculum expectations. Focus on the "big idea" like theories, points of view or concepts. Key questions here are What do you want your learners to know? and What is important for them to know?

Guideline 2 – Identify What is Acceptable Evidence

At this stage, assignments and specific tasks are thought out so that learners will be able to practice and demonstrate their skill and understanding. These could include a combination of opportunities like tests, quizzes, papers, presentations, small and or large group activities projects and so much more. This is also a chance to assess and reflect if the activities will develop learner's understanding and competencies through the collection of evidence. Key questions here are What is the evidence of understanding? and How will you know if learners have achieved the desired results?

Guideline 3 – Design the Learning Experiences

Once there is a clear understanding of the outcome, goals

and how the learners are going to tested activities can be designed. The activities should be developed to help learners achieve the learning outcomes but also designed to comprehensively work on assessment tasks. Keep in mind that the learners should walk away with an understanding of the content from the planned activities. This is successful when the learner can transfer the content to new situations or scenarios.

Good Examples of Use

Example 1 – Backward Design Explained

This video provides a framework on how to use the backward design to create post-secondary courses with instructions on how to create objectives, choosing learning activities as well as designing assessments.

Example 2 – Youtube Professors Explanation of Backward Design

This video provides examples of examples professors use to create their backward design models. They discuss and use in detail units or lessons of what their goals are for their students to make a deep connection to the instruction.

Helpful Resources

Resource 1 – UDL in classrooms

This resource allows educators to learn how to create an inclusive environment using the backward design model.

Resource 2 – <u>The Logic Of Backward Design</u>

This website gives a step by step process of how to create a backward design. This guide leads one through from the beginning of the design all the all to the end and also provides process sheets.

Resource 3 – <u>ASCD Understanding By Design</u>

This website provides overview frameworks, articles and books that explain the understanding by design framework.

Resource 4 – <u>Education.com</u>

This website provides lesson plans in various subject areas. It also gives a quick overview of the learning objectives but also gives the instructor the chance to create with templates provided.

Research

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Author

Submitted by Jamila Bentham

Contact Info: jamila.bentham@ontariotechu.net

Bio:
I am an Early Childhood Educator working in the full-day kindergarten program. I am also currently in the MEd program at Ontario Tech U. I am interested in technology in education especially at the kindergarten and primary levels.

14

SOCIAL DEVELOPMENT THEORY

Overview

Overview of Social Development Theory (2:37)

Description

Social Development Theory explains that socialization directly affects the process of learning by an individual.

By socializing with someone who has more knowledge of the topic to be learned, i.e.: peers or an adult, we transfer knowledge and start the learning process.

There are three concepts of Social Development:

1. Vygotsky states that cultural development develops first on the social level called interpsychological, and secondly on the individual or personal level called intrapsychological.
2. The More Knowledgeable Other (MKO) is a person with a higher level of understanding of the topic than the learner. This person can be a peer who knows more in a given subject than the learner. This person can also be a teacher or a parent.
3. The Zone of Proximal Development (ZPD) is the delta between how much is known and what is unknown by the learner. When a learner completes a task with their MKO and then completes the same task independently, this is where learning takes place.

Guidelines for Use

Guideline 1 – Observation

When creating a Web-based learning tool, it is important for the learner to observe the instruction or task by someone with more knowledge of the subject (MKO). For example, in teaching a class on how to create a slide show, it is important for a teacher or the MKO to first expose the learner to how they would create it, and provide explanation on how.

Guideline 2 – Application

Once the learner observes the MKO, the learner should be able to apply the learned knowledge by themselves. For example, once the learner observes the teacher create a slide show, the learner will then become more comfortable and knowledgeable in creating their own, independent of the MKO.

Good Examples of Use

Example 1 – YouTube

Learners have the opportunity to view the MKO over a video. YouTube can be closed caption as well and has the ability to reach more learning types.

Example 2 – Adobe Connect

Learners have the opportunity to interact and participate with their peers and the MKO. Learners can observe their peers or the MKO, discuss, and then apply their understanding.

Helpful Resources

Resource 1 – Social Learning Theory & Web Based Learning Environment

This paper examines the how social learning can be used in design, development and execution of Web-based learning environments (WBLEs).

Resource 2 – Social Development in Human Growth and Development

This video reviews the three major developmental theories.

Resource 3 – A Theoretical Analysis of Social Interactions in Computer-Based Learning Environments: Evidence for Reciprocal Understandings

The Journal of Educational Computing Research analyzes the social interactions between computer-based learning environments.

Research

Hill, J, Song, L. & West, R. (2009) Social Learning Theory and Web- Based Learning Environments: A Review of Research and Discussion of Implications. *American Journal of Distance Education, 23*(2), 88-103, DOI: 10.1080/08923640902857713

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Author

Submitted by: Jessica Hunter

Contact info: jessica.hunter1@uoit.net

Bio:

Jessica Hunter is a post-secondary instructor; she has a passion for app development and universal design for learning (UDL). She is currently pursuing her M.Ed. at Ontario Tech with an anticipated graduation date of 2021. She has a strong passion for helping students with accessibility needs. She hopes to write policy for the Ministry of Education to help support students access all of the tools they need to succeed. She is an out-of-the-box thinker.

PART II

INSTRUCTIONAL DESIGN PRINCIPLES

15

A QUICK OVERVIEW OF THE MULTIMEDIA PRINCIPLE

Overview

Instructional Design Multimedia Principle Online Learning Quick Overview (3:21)

Description

The multimedia principle simply states that text and relevant images are superior to just text or graphics in isolation. There is a growing consensus that the multimedia principle is one of the most recognized principles of learning. The literature consistently demonstrates that courses with words and graphics are better received and people learn more deeply than just words alone. In 10 studies, learners' understanding increased by 89% in the material that included images or video compared to text-only resources.

Guidelines for Use

Guideline 1 – Include Both Words and Graphics

Words can include both written or spoken. Graphics can include static illustrations such as drawings, charts, graphs, maps or photos and dynamic graphics such as animation or video.

Guideline 2 – Pictures Should Not Be an Afterthought

When using graphics, they should carefully be integrated and planned together with the words so they create meaning to the learner.

Guideline 3 – Select Graphics That Are Relevant

The type of optimal graphics is organizational, transformational, and interpretive. These are superior to presenting a decorative picture. For example, in a module about cellular biology, a labeled diagram (organizational)

would be superior to a cartoon picture of a cell with a smiley face (decorative).

Guideline 4 – Multimedia Principle Works Best for Novices

Novice learners can find more meaning and integrate knowledge better through a multimedia approach. When learners are experts on a subject it may not be as important to have as many graphics as experts tend to create their own versions of images while reading text.

Good Examples of Use

Example 1 – Khan Academy: Genetic Linkage & Mapping

This page has a good mix between text and carefully thought out graphics. It helps create meaning and connections to the material being taught.

Example 2 – Crash Course: Biology Videos

These videos use spoken words and have closed captioning to follow along. There is a great use of animation helping a learner visualize the very complex inner processes of a cell. The only criticism is the material may be presented at too fast of a pace. This can be overcome by pausing and re-watching content that may have been hard to absorb the first time.

Helpful Resources

Resource 1 – <u>Blog Post on Using the Multimedia Principle</u>

11 minutes read titled: 5 Multimedia Principles You Need to Know to Design Interactive Courses

Resource 2 – <u>University of Buffalo</u>

A very brief read summarizing multimedia design theory.

Resource 3 – <u>UW School of Medicine</u>

A summary of Dr. Rich Mayer's principles of multimedia including links to his taks at Harvard University.

Research

Clark, R.C., & Lyons, C. (2011). *Graphics for learning (2nd ed.)* San Francisco: Pfeiffer.

Fletcher, J.D., & Tobias, S. (2005). The multimedia principle. In R.E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 117–134). New York: Cambridge University Press.

Mayer, R.E., Hegarty, M., Mayer, S., & Campbell, J. (2005). When static media promote active learning: Annotated illustrations versus narrated animations in multimedia instruction. *Journal of Experimental Psychology: Applied, 11*, 256–265.

Author

Submitted by:	Dr. Jory Basso
Email:	jory@hybriddrj.com
Web Page:	www.hybriddrj.com
Bio:	Dr. Jory Basso is an Associate Professor of Biological Sciences and has built and facilitated online Science courses in addition to traditional on-ground lectures and labs. He also serves as a Faculty Lead overseeing and training adjunct instructors. You can find many educational videos on his YouTube channel: HybridDrJ

16

ANOTHER LOOK AT THE MULTIMEDIA PRINCIPLE

Overview

[Multimedia Principle](#) (3:26)

Description

The multimedia principle, as set out by Richard Mayer in

2001, recommends that e-learning courses include words and graphics, as opposed to just words. Based on cognitive theory and research evidence, learners are more likely to understand material when they can actively engage with it. Multimedia presentations can encourage learners to engage in active learning by mentally representing the material in words and in pictures and by making connections between the pictorial and verbal representations.

Guidelines for Use

Guideline 1 – Pictures Should Not be an Afterthought

Pictures should not be an afterthought. Instead of selecting pictures after the words are written, instructional designers should consider how words and pictures work together to create meaning for the learner. Therefore, visuals as well as words should be planned together as the job analysis is conducted and the course is designed.

Guideline 2 – Selecting the Appropriate Combination of Content and Graphics

Depending on the type of information you plan to present, selecting the appropriate combination of content and graphic types is essential to creating material that fosters active learning. See table below for examples:

Table 1

Aligning content and appropriate graphics

Content Type	Content Description	Useful Graphic Types*	Graphic Examples
Facts	Unique and isolated information such as specific application screens, forms, or product data	Representational, Organizational	A screen capture A table of parts' names and specifications
Concepts	Categories of objects,events, or symbols designated by a single name	Representational, Organizational, Interpretive	A tree diagram of biological species Three Excel formulas to illustrate formatting rules
Process	A description of how something works	Transformational, Interpretive, Relational	Animations of how the heart pumps blood Still diagrams to illustrate how a bicycle pump works An animation showing how a virus invades a cell

Procedure	A series of steps resulting in completion of a task	Transformational	An animated illustration of how to use a spreadsheet
			A diagram with arrows showing how to install a printer cable
Principle	Guidelines that result in completion of a task; cause-and-effect relationships	Transformational, Interpretive	A video showing two effective sales approaches
			An animation showing genes passing from parents to offspring

Table 2
Definitions of graphic types

*Graphic Type	Definition
Decorative	Visuals added for aesthetic appeal or for humor
Representational	Visuals that illustrate the appearance of an object
Organizational	Visuals that show qualitative relationships among content
Relational	Visuals that summarize quantitative relationships
Transformational	Visuals that illustrate changes in time or over space
Interpretive	Visuals that make intangible phenomena visible and concrete

Good Examples of Use

Example 1 – YouTube https://www.youtube.com/watch?v=n4e5UPu1co0

This short video explains climate change. Through the skillful use of narration and appropriate graphics (in this case animations), viewers can easily connect the words to the images and make connections.

Example 2 – LinkedIn Learning https://learning.linkedin.com/

LinkedIn Learning is primarily aimed at the adult professional demographic group and offers a variety of professional development courses online. Many of these courses demonstrate the multimedia principle with graphics or animations combined with narrated slides.

Helpful Resources

Resource 1 – https://www.youtube.com/watch?v=CbvpPdxoJiI

This is a short and concise video explaining the multimedia principle.

Resource 2 – http://instructionaldesign.io/toolkit/mayer/

This article provides some background to Richard Mayer as well as an explanation of his multimedia principle. There are also examples of graphic/ word combinations as used in real-life webpages.

Research

Clark, R. & Mayer, R. (2008). *E-Learning and the Science of Instruction*, USA, Pfeiffer

Author

Submitted by:	Tobie Pilloy
Email:	tobie.pilloy@ontariotechu.net
Bio:	Tobie Pilloy has been working in education for almost 2 decades. After working as a teacher for almost 10 years, he transitioned into management and is currently the Education Coordinator for English Testing Canada.

17

MODALITY PRINCIPLE

Overview

[Modality Principle](#) (3:19)

Description

The Modality Principle as outlined by Clark and Mayer (2011) is a fundamental e-learning principle that focuses on the need for narration when presenting important information related to a displayed graphic. The goal of this principle is to not overload the learner by using only

one cognitive pathway such as visual presentation instead, words should be presented as speech rather than onscreen text (Clark & Mayer, 2011; Oberfoell & Correia, 2016). This allows the learner to focus on the visual graphics and listen to the explanation to increase understanding and knowledge transfer (Clark & Mayer, 2011; Oberfoell & Correia, 2016).

Guidelines for Use

Guideline 1 – When to Apply the Principle

The Modality Principle should be applied in e-learning environments where graphics are complex, terminology is familiar to the learner and the overall lesson is fast paced (Clark & Mayer, 2011). For example, a diagram is displayed illustrating blood flow through the heart after key terms have been presented to the learner. The diagram will include text outlining the anatomical structures while speech narration describes the concept.

Guideline 2 – How to Apply the Principle

Choose your graphic, then write out a narrative that can be used to describe the applicable concept. When the narrative is complete utilize appropriate speech media such as Voice Thread or PowerPoint voice-over to provide a detailed description of the displayed graphic (Clark and Mayer, 2011).

Guideline 3 – When to Avoid Applying the Principle

Clark and Mayer (2011) recommend that under the

following circumstances both narration and onscreen text descriptions should be present with a graphic:

1. When English is not the learners first language
2. When the words presented are technical
3. When the words are unfamiliar
4. When information is required for future reference

Adding closed captioning to presentations is a simple way to include onscreen text descriptions with speech narration when presented with the above scenarios.

Good Examples of Use

Example 1 – Khan Academy

When studying Anatomy and Physiology Khan Academy provides video tutorials for specific topics related to the central subject. Within the tutorials, the professor provides narrative descriptions of the graphics being displayed. Learners can turn on closed captioning if needed.

Example 2 – Mystery Science

Mystery Science is an interactive website for students of varying ages to learn about several different science-related topics. Information for older students is presented using slideshow videos where the graphics displayed are narratively described by Science Doug. Learners can turn on closed captioning if needed.

Helpful Resources

Resource 1 – [Modality Principle Website](#)

This website created by the European Heart Association provides additional information surrounding the Modality Principle and outlines its rationale for use and limitations.

Resource 2 – [Video Example By Josh Walter](#)

This video provides a short example and explanation of the utilization of the Modality Principle.

Resource 3 – [Current Research Surrounding the Modality Principle](#)

This research paper by Oberfoell and Correia (2016) provides an excellent in-depth explanation of the Modality Principle. Their research focuses on the application of the principle with todays technology advanced student populations.

Research

Abusaada, A., Lee, L., & Fong, S. (2013). Effects of Modality Principle in Tutorial Video Streaming. *International Journal of Academic Research in Business and Science,* *3*(5), 456-466. Retrieved from https://pdfs.semanticscholar.org/919c/22e5ba072391adcca6f6422ccafa693aac37.pdf

Clark, R. C., & Mayer, R.E. (2011). Applying the Modality Principle. In R. Taff (Ed.), *E-Learning and the Science of Instruction*. (pp. 115-130). San Francisco, CA: Wiley.

European Heart Association. (2017). Modality Principle: Rationale and Limitations. Retrieved from https://www.heartassociation.eu/the-modality-principle-rationale-and-limitations/

Oberfoell, & Correia. (2016). Understanding the role of the Modality Principle in Multimedia Learning Environments. *Journal of Computer Assisted Learning, 32*(6), 607-617. Retrieved from https://doi.org/10.1111/jcal.12157

Author

Submitted by:	Kristen Marks-Riberdy
Email:	kristen.marksriberdy@ontariotechu.net
Bio:	Post-secondary nursing professor, Academic and Clinical Coordinator for Internationally Educated Nursing Program.

18

REDUNDANCY PRINCIPLE

Overview

[Redundancy Principle](#) (4:33)

Description

The Redundancy Principle is an instructional principle that occurs when on-screen text and audio narration about a graphic are the same. When adding on-screen text to a narrated image, the user may experience cognitive overload as multiple pieces of information are

trying to be processed simultaneously. When experiencing working memory overload, the user may have difficulty learning and understanding the content that is being explored.

Guidelines for Use

Guideline 1 – Explain a visual through audio or text, NOT both

When including a visual within your web-based learning tool or presentation, it is important to keep in mind to explain the visual through audio or text. When we choose one or the other, we limit the chance of the learner experiencing cognitive overload. An example of this guideline can be a discussion. When discussing the image, the presenter has chosen to do so through only audio or narration, therefore preventing the chance for cognitive overload to occur.

Guideline 2 – Do not add on-screen text to narrated graphics

When including a visual within your web-based learning tool or presentation, it is important to keep in mind to not add on-screen text to a narrated graphic. In the case that we add on-screen text to an image already narrated, the user may fail to understand as their working memory may be overloaded. An example of this guideline can include a presentation in which there are multiple images. The presenter should choose between adding on-screen text to the presentation which they can read, or the presenter can choose to explain the visual through a narration. When doing so, the learners will not experience cognitive overload.

Guideline 3 – On-screen text should only be added with graphics and audio in specific situations

When creating a web-based learning tool or a presentation, we should keep in mind specific situation(s) where it may be applicable to add on-screen text to a narrated image. The situation(s) include a presentation where there is no video or image, when there is ample opportunity to process the visual, when the learner must exert greater cognitive effort to comprehend, including English Language Learners and those who have low vocabulary skills, or when a few key words are presented next to the element in the graphic. When doing so, the learners will not experience cognitive overload, and may instead understand the concept in greater detail.

Good Examples of Use

Example 1 – Not all Scientific Studies are created equal

The tool includes a video which was created in mind of the redundancy principle. In the video, the creator decided to use audio to reach its users. The users may have little to no chance of experiencing cognitive overload as there is no need to focus on on-screen text while listening to the audio. In the case that an English Language Learner or a student with poor language skills is viewing the video, they may decide to access the closed captions feature.

Example 2 – PowToon Example

The link is a great example of the redundancy principle as the creator of the video chose to only have on-screen

text in their video. Users will not experience working memory overload as no channel is being overloaded with incoming information. English Language Learners or students with poor language skills can read the text and pause the video whenever needed.

Helpful Resources

Resource 1 – <u>Six Principles of Effective e-Learning: What Works and Why</u>

This resource is an article exploring six principles of effective e-learning. Within the article, they explore the various principles of e-learning, such as multimedia, contiguity, modality, redundancy, coherence and personalization. This is a great resource that can be used as an introduction to some principles of effective e-learning.

Resource 2 – <u>The Redundancy Principle</u>

This resource is a 3-minute video explaining the Redundancy Principle.

Resource 3 – <u>Revising the Redundancy Principle in Multimedia learning</u>

This resource is an article summarizing research done in which where there two groups receiving the same information, the only thing being different is one group experienced redundancy, while the other experienced non-redundancy. Throughout the research, they found that the redundant group performed better on retention but not on transfer.

Research

Clark, R.C., & Mayer, R.E. (2002). *E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning.* San Francisco: Jossey-Bass Pfeiffer.

Mayer, R. E., & Johnson, C. I. (2008). *Revising the redundancy principle in multimedia learning. Journal of Educational Psychology, 100*(2), 380-386. doi: 10.1037/0022-0663.100.2.380

McCrudden, M. T., Hushman, C. J., & Marley, S. C. (2013). Exploring the Boundary Conditions of the Redundancy Principle. *The Journal of Experimental Education., 82*(4), 537–554. doi: 10.1080/00220973.2013.813368

Author

Submitted by:	Marta Masnyi
Email:	marta.masnyi@ontariotechu.net
Bio:	Recent Graduate of the Bachelor of Education Degree which was completed at the University of Ontario Institute of Technology.
	Current student of the Graduate Diploma in Education and Digital Technologies in which I am studying how to effectively integrate technology within the classroom setting.

19

COHERENCE PRINCIPLE

Overview

 [Video presentation on the Coherence Principle](#) (5:25)

Description

The coherence principle refers to the removal of words, audio and graphic that does not support instructional goals. This principle assumes that the learning process is hindered when learners' working memory is overloaded

with seductive details that do not contribute to the learning goals. Based on the cognitive theory of multimedia.

Guidelines for Use

Guideline 1 – Avoid e-lessons with Extraneous Audio

Learners will experience deeper learning from multimedia presentations which contain less interesting and extraneous sounds and music. Narration, background music and sounds compete for limited cognitive resources and as a result, learners are less able to pay attention to narration when they pay attention to sound and music.

Guideline 2 – Avoid e-lessons with Extraneous Graphics

The learner has limited cognitive capacity and is actively trying to make sense of the presented material, adding extraneous pictures, graphics or diagrams can interfere with this process. Extraneous pictures can interfere with learning by creating a distraction, guiding the learner's attention away from relevant material, they can also be a disruption and prevent the learner from building a link to the information presented and they can serve as a seduction priming inappropriate existing knowledge (Harp & Mayer, 1998). Using a simple visual and diagrams for example during science presentations will lead to a better understanding of the material than a detailed visual.

Guideline 3 – Avoid e-lessons with Extraneous words

Avoid adding words for interest, for elaboration, or for technical depth that would interfere with the learning process creating greater distraction away from relevant material. The inclusion of additional words on a slide during the narration can distract the learner and overload cognitive memory.

Good Examples of Use

Example 1 – Khan Academy

Khan Academy presents a simple step by step lessons without extraneous sounds, graphics audio that would interfere with students learning. The learner's attention is directed to the writing on the board the corresponds and supports with the narration.

Example 2 – Duolingo

This free language app. does not include extraneous background music or sounds that do not enhance the learning. Learners can choose to listen to questions after it is presented while viewing appropriate graphics or text that enhances learners' vocabulary.

Helpful Resources

Resource 1 – Youtube video on the Coherence Principle

This well explained in less than 3-minute animated video on the main ideas of the coherence principle.

Resource 2 – <u>Cognitive Theory of Multimedia Learning</u>

This site presents a description of the Coherence principle and examples of violations and critiques of the principle.

Resource 3 – <u>A review of research and a meta-analysis of the seductive detail effect</u>

In this review, the writer examines 36 experimental effects of seductive details. The review also discusses the theoretical and practical implications of text passages, illustrations and other kinds of seductive details as well as limitations and future studies.

Research

Harp, S.F., & Mayer, R.E. (1998). How seductive details do their damage: A theory of cognitive interest in science learning. *Journal of Educational Psychology, 90,* 414–434.

Moreno, R., & Mayer, R.E. (2000a). A coherence effect in multimedia learning: The case for minimizing irrelevant sounds in the design of multimedia instructional messages. *Journal of Educational Psychology, 92,* 117–125.

Rey, G. (2012). A review of research and a meta-analysis of the seductive detail effect. *Educational Research Review, 7*(3), 216–237. <u>https://doi.org/10.1016/ j.edurev.2012.05.003</u>

Author

Submitted by:	Melissa Hippolyte
Email:	Melissahippolyte2@gmail.com
Bio:	Melissa Hippolyte is an OCT and RECE with the Halton District School Board. She is also presently enrolled in the Master of Education program at Ontario tech university.

20

SEGMENTING PRINCIPLE

Overview

[The Segmenting Principle](#) (4:40)

Description

The Segmenting Principle refers to the process of breaking down, or segmenting, complex lessons into smaller parts, which are then presented one at a time. The aim of this process within the context of e-learning is to help learners in managing the complexity of the content/

tasks they are presented with, so as to not exceed the threshold of the learners' cognitive system. Segmenting provides the learner(s) with the opportunity to manage essential processing; that is, they are able to efficiently and effectively engage essential processing. Most importantly, as the segments are not presented as a continuous unit, the learner is afforded the appropriate level of control to consolidate the information they are being presented with as they make their way through the material.

Guidelines for Use

Guideline 1 – Gauging the Complexity of the Lesson

Prior to determining the best approach to take in segmenting a complex lesson, the complexity of the lesson should first be identified. Gauging the complexity of a lesson may be accomplished by determining the number of elements, or concepts, in addition to the interactions between these elements. Though this may imply that the complexity of the material may be alleviated by reducing the number of elements in the explanation, the accuracy (and perhaps even the intuitiveness) of the lesson in its entirety would ultimately suffer as a result.

Guideline 2 – Determining the Appropriate Delineation of Segments

An important instructional decision required within the context of segmenting is determining the most appropriate delineation between segments, as these segments must sequentially flow from beginning to end without sacrificing the integrity of the information. To

facilitate this process, the lesson designer has several options, including breaking the lesson down into parts that convey between one to three steps in the process or procedure at hand, or instead explaining between one to three major relations or interactions among the elements.

Guideline 3 – Facilitating Learner Control

Learners should have sufficient control over the pace at which they proceed through the segments. Because the segments are inherently not presented as a continuous unit, learners should be able to identify when the appropriate level of knowledge consolidation has taken place and thereafter determine when they are ready to proceed to the next segment.

Good Examples of Use

Example 1 – [Gizmos (Cell Energy Cycle)](#)

Gizmos are a collection of interactive math and science web-based simulations that develop conceptual understanding through inquiry-based learning processes. For instance, in the Cell Energy Cycle simulation, learners are given the opportunity to explore the biological processes of Photosynthesis and Cellular Respiration, as well as their cyclical relationship with one another. These processes are also further broken down into their sub-stages (e.g. the stages of Glycolysis, the Calvin Cycle, and the Electron Transport Chain that comprise Cellular Respiration). The delineation between segments is intuitive, and learners are given control over determining their readiness to proceed from one segment to the next.

Example 2 – <u>Animated Overview of DNA Replication</u>

This tool provides learners with an animated overview of the DNA Replication process. The animation is segmented for each step of DNA Replication, and learners can advance to the next step by clicking the "Next" arrow. Learners can also move back and forth between steps, should they choose to do so.

Helpful Resources

Resource 1 – <u>Practical Application of the Segmenting Principle</u>

This article describes the process of applying the Segmenting Principle to geography lessons, and the impacts this had on student performance.

Resource 2 – <u>Relationship between the Segmenting Principle and the Modality Principle</u>

This paper examined the possibility of the Segmenting Principle counteracting another principle of instructional animation, the Modality Principle.

Resource 3 – <u>Video Explaining the Segmenting Principle</u>

This is a video explaining the Segmenting Principle.

Research

Cheon, J., Crooks, S., & Chung, S. (2014). Does segmenting principle counteract modality principle in instructional animation? *British Journal of Educational Technology, 45*(1), 56–64. https://doi.org/10.1111/bjet.12021

Clark, R.C. and Mayer, R.E. (2012). Applying the Segmenting and Pretraining Principles: Managing Complexity by Breaking a Lesson into Parts. In Clark, R. & Mayer, R (eds), *e-Learning and the Science of Instruction*. doi:10.1002/9781118255971.ch10

Johanna PG. (2018, April 1). *Segmenting Principle Mayer* [Video file]. Retrieved from https://youtu.be/KS1xmdUVUA8

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Author

Submitted by:	Zahra Harbi
Email:	zahra.harbi@ontariotechu.net
Twitter:	https://twitter.com/ZahraHarbi1
Bio:	Zahra Harbi is a current Masters student at the Faculty of Education, Ontario Tech University. She received her Honours Bachelor of Science at the University of Toronto. Her research interests include translanguaging, technology-assisted language acquisition, eLearning and in particular mobile-assisted language learning.

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PRE-TRAINING PRINCIPLE

Overview

[An Overview of the Pre-Training Principle](#) (2:15)

Description

The Pre-Training Principle encourages instructors to introduce key terms and concepts before asking learners to engage with the actual lesson material to reduce cognitive load. This process helps learners progress to

more advanced thinking as a lesson or course proceeds. Evidence suggests pretraining can help improve knowledge transfer and retention. Instructional designers often implement the Pre-Training Principle in conjunction with the Segmenting Principle, which promotes the compartmentalization of lesson content into separate but related components.

Guidelines for Use

Identity important terminology and learning concepts during lesson preparation

What do learners need to know to accomplish the planned learning activities? Does their learning environment contain new elements? Plan to introduce these ideas and vocabulary first – perhaps with a practice or review exercise, so students understand the lesson context before moving to higher-order thinking tasks such as problem-solving.

Incorporate the terms and ideas from the pretraining activity into the subsequent activities

Leverage the content introduced into the core learning events of the lesson or course so students can use them to inform their practice.

Consider learner's knowledge level

While research on the pre-training principle is not yet robust, studies done to date suggest stronger effects for students at an introductory level in a particular subject.

Good Examples of Use

Example 1 – LinkedIn Learning

A large suite of business and technology self-directed tutorials, LinkedIn Learning starts most courses with short video chapters explaining the topic's practical value, core principles, and key terminology.

Example 2 – Code.org

The non-profit organization Code.org provides free online lessons to promote computer science learning. Many lessons start with an introductory video and notes that define key terms and offer screenshots to orient users to their learning environment by indicating the various areas of the screen, the available features and where users can find them.

Helpful Resources

How to Use Mayer's 12 Principles of Multimedia Learning – Water Bear Learning

A simple guide to implementing Mayer's principles, including the Pre-Training Principle with effective illustrations.

Designing Assistive Technology for Users with Learning Disabilities – IGI Global

This guide incorporates the Pre-Training Principle in its recommendations for creating effective learning

technology solutions specifically for learners with disabilities.

Research

Ayres, P. (2015). State-of-the-Art Research into Multimedia Learning: A Commentary on Mayer's Handbook of Multimedia Learning. *Applied Cognitive Psychology. 29*(4), 631–636. https://doi.org/10.1002/acp.3142

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Author

Submitted by:	Rich Freeman
Email:	richard.freeman@ontariotechu.net
Web Page:	https://twitter.com/infrontofthenet
Bio:	Rich Freeman is a Professor of Computer Studies at Georgian College in Barrie, Ontario and a Master of Education candidate at Ontario Tech University.

22

WORKED EXAMPLE PRINCIPLE

Overview

 [The Worked Example Principle](#) (4:00)

Description

The worked example principle is based on using solved examples that guide learners through a step by step process to solve a task or a problem to reduce cognitive

load as they are learning a new concept. Using worked examples allows students to build procedural skills such as setting up an Excel spreadsheet, and strategic skills such as how to negotiate. It focuses on two models: cognitive models, where an individual demonstrates how to solve a problem and an interpersonal skills model that uses an expert individual performing a task. The goal is to help learners transition from relying on worked examples to solving problems on their own. The evidence from research focuses on instructional methods to maximize the benefit of worked examples and can be categorized into five principles.

Guidelines for Use

Guideline 1 – Transition from worked examples to Problems

The goal is to fade from a fully worked example to the learner solving the practice problem. Initially, a fully worked example is provided followed by a second example where most steps are solved, and the student is responsible for completing the final steps. Over time, through many faded worked examples the learner has to solve the assigned problem entirely on his or her own.

Guideline 2 – Promote Self Explanations

When reviewing worked examples, learners should explain key concepts and principles to themselves to understand it in a meaningful way. To ensure students can identify the rationale that underlies the worked examples, it is beneficial to add questions to worked examples and also encourage this practice through active observation.

Guideline 3 – Include Instructional Explanations of Worked Examples in Some Situations

Adding an explanation for the worked examples helps students form a concrete conceptual understanding shown in the example itself. It is very effective when there are no self-explanation questions provided. A good example of this in e – learning is having a "help" button for the student to learn more details on the worked example.

Guideline 4 – Applying Multimedia Principles to Examples

When needed it is important to provide visuals to complement the steps in worked examples. Complex problems contain a higher cognitive load thus, it is optimal when information is explained with audio alone and should be made the default modality as stated by the multimedia principle and contiguity principle respectively. Finally, students learn best when the content is segmented into smaller chunks and the associated illustrations are familiar to the learners.

Guideline 5 – Support Learning Transfer

The objective is to help learners achieve near transfer, where they can successfully apply the steps learned to similar situations in the work environment. To achieve near transfer, various examples from different contexts should be used to demonstrate the same underlying principles. Moreover, self-explanation questions and encouraging active comparison of given examples increase the likelihood of effective learning transfer.

Good Examples of Use

Example 1 – [Khan Academy](#)

When learning about differential calculus, the video provides a worked example with audio and illustrations of how to solve a problem. It allows users to move through the screen at their own pace.

Example 2 – [Iorad](#)

This is a tutorial maker that allows teachers to record examples in real – time to create lessons or tutorials for learners.

Helpful Resources

Resource 1 – [Teaching Strategies](#)

This web article outlines different teaching strategies that can be used when applying the worked example principles.

Resource 2 – [Video on the applications of Worked Example Principles](#)

This 3-minute video by eLearningExpert provides an overview of real-world applications of worked example principles.

Resource 3 – [Worked Examples at an Impasse](#)

This paper offers an insightful perspective on the limitations of worked examples.

Research

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Author

Submitted by Riya Patel

Email: riya.patel1@ontariotechu.net

Twitter: @riya_08

Web Page: https://www.weebly.com/editor/main.php#/

Bio: Riya Patel is an elementary school teacher and is passionate about fusing technology with education to bridge achievement gaps. She graduated from the University of Toronto, St. George, with a double major in Human Biology and Ecology and Evolutionary Biology. Currently, she is perusing a master's with Ontario Tech University and leveraging her experience as an educator to connect current research to practice.

23

PRACTICE PRINCIPLES

Overview

 [Instructional Design Principle: Practice Principles](#) (4:00)

Description

Practice in e-Learning incorporates interactions through questions. When creating questions for interactions, creators must keep in mind that the questions being asked should allow learners to be both behaviourally and

psychologically active. Learners should be given a chance to actively apply their knowledge rather than just regurgitating answers. The practice must be deliberate. Any type of practice offered to learners should be relevant to their jobs, dispensed all over their learning space and be offered frequently as it leads to improvement. Six practice principles are set as guidelines for creators of web-based learning tools.

Guidelines for Use

Practice Principle 1 – Sufficient Practice Interactions

There should be enough practice assignments for learners to help them learn without overloading them with repetitive types of questions. Since the benefit of practice reduces over time it is not helpful to bombard students with the same types of practice questions and/ or questions with the same content, and it is not a good use of their time. One way this can be accomplished is to give the students a choice regarding how many questions they wish to practice. If they feel like they have sufficient knowledge of the concept then they can choose to move on.

Practice Principle 2 – Mirror the Job

The interactions provided must have job-realistic content. It is important to avoid only knowledge-based questions and should include application questions where learners can respond to scenarios that might happen in real-life at their job. An example of this is a nursing simulation used by nursing students to help them

understand daily circumstances that might occur. A link to that website is provided below.

Practice Principle 3 – Provide Effective Feedback

The feedback provided should include relevant explanations – especially when the answer is incorrect. Learners must understand why the answer they chose is correct or incorrect. One way this can be done is to deliver a summary of the learner's answers after the practice session is complete and provide detail explanations of each answer.

Practice Principle 4 – Distribute and Mix Practice

Research shows that distributing practice produces long-term retention. Therefore, instead of teaching an entire unit and then having a practice session, it is important to divide the unit into smaller lessons and have the learners practice after a few lessons. Also, if the unit has different concepts that need to be learned, mix up those concepts when learners are practicing. An example of this is when students are learning different types of sentences (declarative, imperative, interrogative or exclamatory). Instead of chunking the questions into groups based on their type, it is better to mix them up when students are practicing so they can get a better sense of the differences.

Practice Principle 5 – Apply the Multimedia Principles

For students to benefit from practice, make sure to include visuals, keep everything in line and avoid anything extra that might be distracting. If the students

are learning about the solar system, not every slide needs to have a background full of planets as that might be visually distracting.

Practice Principle 6 – Transition from Examples to Practice

Slowly release the amount of responsibility given to the learner to practice the lesson by scaffolding. Ensure that students are shown a fully worked out example and can work on smaller parts of the problem before introducing them with a problem to figure out on their own. In math when students are trying to analyze a word problem, ensure that they know how to work the math component of the problem before they are shown how to make sense of a word problem and how to analyze it.

Good Examples of Use

Example 1 – Lippincott Nursing Education

This tool teaches nursing students how to engage with patients by mirroring the job they would be expected to perform at work.

Example 2 – Chess

Learners hoping to get better at the game of chess can navigate this website by learning how to play, watching videos by experts, practicing by engaging in different scenarios, receiving feedback from skilled coaches and much more.

Helpful Resources

Resource 1 – How to Create an Effective Feedback System for eLearning

This page gives three steps that must be included when giving feedback to ensure that it is effective.

Resource 2 – Mayer's Multimedia Principles

This gives a quick outline of the twelve multimedia principles and some examples of how they can be integrated into the learning content.

Resource 3 – 10 Ways to Scaffold Learning

The page shows how lessons can be taught so students can effectively transition from seeing examples to tackling a problem successfully themselves.

Research

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Author

Submitted by:	Roohi Jawas
Email:	roohi.jawad@ontariotechu.net
Twitter:	@RooJ33
Bio:	I am a grade 5 homeroom teacher and I have been an Ontario certified teacher (OCT) since 2009. I am currently pursuing a Master's of Education degree at Ontario Tech University. I am always looking for new ways to engage and educate my students, and often it is through some form of technology.

24

LEARNER CONTROL

Overview

[Learner Control](#) (4:36)

Description

Learner control is allowing learners to govern the content and the rate at which they navigate topics and instructional elements. It will, however, allow students to bypass what might be perceived as critical information such as examples, practice elements, and/or knowledge

challenges. This learning design is ideal for those that are highly self-motivated and works best with learners that have higher metacognitive skills.

Guidelines for Use

Guideline 1 – Give Experienced Learners Control

Most learners want control over the process in which they learn, however, they do not always make the best choices. This design works well if the learner has prior knowledge of the content and/or skills in the module.

Guideline 2 – Make Important Instructional Events the Default

Remove the option to bypass the key components. Remove the 'next' and 'skip' buttons for important content. This forces the learner to deliberately choose to circumvent that component (examples, practice, etc.). By having the learner consciously choose to bypass content, they are more likely to participate in the activity. This, in turn, can reduce the likelihood of a disconnected view of how confident the learner is in their performance versus what their actual performance will score at. This is known as calibration.

Guideline 3 – Design Adaptive Control

Allow for a change in difficulty based on the learner and their skill level. Have the content be tailored to the individual and as the learner progresses in their knowledge, we can increase the difficulty of the assignments and reduce the amount of support – called expertise reversal. A difficult balance to achieve. You

want to challenge the learner, but not so much so that it is too challenging. There is a fine line between a difficulty that is beneficial (i.e., desirable) and a difficulty that is harmful (Westlin, Day & Hughes, 2019).

Guideline 4 – Give Pacing Control

Divide content into smaller chunks for manageability (segmenting principle). Giving the learner control over the speed of which the material is presented (controls like stop, rewind, replay, etc.), the learners spend almost three times longer on content.

Guideline 5 – Offering Navigational Support in Hypermedia Environments

Use links sparingly as many will bypass, but give a short preview of what is behind the link. Too many links are associated with cognitive overload, so use links sparingly. Use navigation options to avoid too much mouse movement. Use headings and descriptions as they help to improve memory and comprehension – just like in a traditional text document.

Good Examples of Use

Example 1 – AME Engage

This program illustrates accounting procedures for learners that progresses at their own pace. There are short tutorials where the user can receive a brief overview of the topic. There are navigational buttons that allow the user to go to the next screen, return to the previous screen, pause, play and even replay the same

section. There is a page counter at the top of the screen that will indicate what screen you are on out of how many. Additionally, there is the option to bookmark a spot where the student had to pause the lesson, to return to later. There is also the option to view a full script, or to turn closed captioning on. There are practice assessments, examples and additional help and support. The learner is also able to skip complete sections and increase the complexity of the workload based on their skill level.

Example 2 – Duolingo

This web-based learning tool is designed to assist learners in mastering a new language using segmented lessons. Segmenting the lessons, allows the user to revisit any lessons(s) they choose if need be, implementing the Learner Pacing Control design element. Once the learner had determined which language they wish to pursue, Duolingo will present a short skills assessment to determine their current knowledge, which will then categorize them into a level of prior knowledge. This adaptive control design helps to avoid any redundancy with users that have some previous knowledge to bypass the introductory pieces should it be not necessary to continue.

Helpful Resources

Resource 1 – Segmenting Principle Learning Theory

This theory works well for the overall design and structure for a module with the Learner Control Principle. According to Mayer (2009), Segmenting is best

applied to complex material and when the user is inexperienced with the material. This reference can assist in the completion of this process.

Reference:

Clark, R.C., & Mayer, R. E., (2011). Applying the segmenting and pretraining principles: Managing complexity by breaking a lesson into parts. In Matthew Davis (Ed), *e-Learning and the science of instruction: proven guidelines for consumers and designers of multimedia learning* (pp. 204-220). San Francisco, CA: Pfeiffer

Resource 2 – Understanding Calibration Accuracy

Learners tend to overestimate their understanding of a topic. When the estimation of their perception of understanding is compared to their actual performance: this differential is called Calibration Accuracy. To understand this concept in further detail, the following resource will aid.

Reference:

Hacker, D. J., Bol, L., & Bahbahani, K. (2008). Explaining calibration accuracy in classroom contexts: the effects of incentives, reflection, and explanatory style. *Metacognition Learning, 3,* 101-121. DOI: 10-1007/s11409-008-9021-5

Resource 3 – Understanding Metacognitive Skills

Recent research has determined that there is a significant correlation between the Metacognition Awareness

Inventory (MIA) and academic achievement (e.g., GPA, course grades, etc.) Regulation of Cognition is not easily achieved, as these applications are time-consuming to learn and implement. This reference can assist instructors in building the ability for students to improve their own ability to monitor and improve their Regulation of Cognition strategies.

Reference:

Vancouver Island University (2020). *Ten Metacognitive Teaching Strategies*. [Web Page]. Available from https://ciel.viu.ca/teaching-learning-pedagogy/ designing-your-course/how-learning-works/ten- metacognitive-teaching-strategies#

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Author

Submitted by:	Roxanne Stewart
Email:	roxanne.mullin@ontariotechu.net
Bio:	Completing M. Ed program at Ontario Tech University. Partial Load Professor with Durham College specializing in SAP, Microsoft Office and Basic Accounting Principles.

25

AN INTRODUCTION TO COLLABORATION

Overview

[An Introduction to Collaboration](#) (4:16)

Description

Collaboration involves the instructional use of small

groups to facilitate increased learning outcomes through the use of certain conditions. Collaborative learning can improve student achievement, long-term retention, higher-level reasoning, metacognitive thought, problem-solving skills, and perseverance in difficult tasks. Computer-supported collaborative learning (CSCL) requires groups of two to five to work together on synchronous and asynchronous activities that support a learning goal. CSCL is constantly changing with additions of new platforms that allow for multiple users to interact online.

Guidelines for Use

Guideline 1 – Social Interdependence

To ensure all group members actively contribute to their learning and the learning of their group members, the grade or goal of each member should be dependent on the achievement of all group members in a group. Incentives or roles can be assigned to ensure that all group members are engaged in the learning activity. In a Jigsaw method, each group member is responsible for a given topic and they are required to become an expert in the topic. The students then meet in expert groups (people who have reviewed the same topic). Finally, they bring all of their findings back to their original group and are responsible for teaching the concept.

Guideline 2 – Outcome Goals

When facilitating collaboration, educators must consider whether the goal of the collaboration is for project quality or individual learning. Collaborative learning

does not necessarily result in both of these goals simultaneously, as it depends on a variety of variables including the type of learning and group size. When the goal requires creativity or problem-based learning, virtual collaboration results in the best quality outcomes, as learners have the opportunity to reflect upon the activity. In regards to group size, pairs can better support the goal of individual learning, where groups of three to five support project quality. Educators must determine the goal of collaboration so that they can structure their collaboration approaches to best meet the desired goal.

Guideline 3 – Quality of Collaboration Discussion

Collaborative learning relies on effective dialog amongst all participants in a group, which promotes an increased depth of processing. Group members should build off of the statements of others, pose or answer questions, and challenge or clarify what has already been said.

Guideline 4 – Groupings

Careful consideration should be given when creating groups, in terms of which learners to place in a group together and the size of groupings. Collaborative learning is most effective when groups are comprised of learners with both high prior knowledge and low prior knowledge or learners with all high prior knowledge.

Good Examples of Use

Example 1 – G Suite for Education

G Suite for Education is a platform that includes many

different applications including Docs, Slides, Sites, and Hangouts. All applications allow multiple users to contribute to documents or presentations and provide and receive feedback. All applications provide opportunities for users to engage in discussions through chats, comments, and audio calls.

Example 2 – Explain Everything

Explain Everything is an interactive whiteboard that allows users to create presentations and videos that can be uploaded to YouTube or shared on Google Drive. Explain Everything allows multiple users to collaborate on a project on the same devices or several devices. Users can utilize the voice chat feature to enhance virtual dialog.

Helpful Resources

Resource 1 – Collaboration in Online Learning Communities

A book, written by Donatella Persico and Francesca Pozzi, examines strategies and techniques that can be used to enhance online collaboration.

Resource 2 – The Jigsaw Method

A video that describes a collaborative learning strategy that can be used in a face-to-face learning environment or an e-learning setting, known as the Jigsaw Method.

Resource 3 – A Review and Critique of Online Collaboration

A literature review of the use of collaborative learning in

online university courses, accompanied by a critique of collaborative learning.

Research

Clark, R. C., & Mayer, R.E. (2011). Learning together virtually. In R. Taff (Ed.), *E-learning and the science of instruction* (pp. 279-306). Wiley.

Lou, Y., Abrami, P., & D'apollonia, S. (2001). Small Group and Individual Learning with Technology: A Meta-Analysis. *Review of Educational Research, 71*(3), 449–521. https://doi.org/10.3102/00346543071003449

Resta, P., & Laferrière, T. (2007). Technology in support of collaborative learning. *Educational Psychology Review, 19*(1), 65–83. https://doi.org/10.1007/s10648-007-9042-7

Author

Submitted by:	Sarah Baillie
Email:	sarah.baillie@ontariotechu.net
Twitter:	@MsBaillie_
Bio:	I am an elementary Occasional Teacher with York Region District School Board and Durham Catholic District School Board. I am currently enrolled in the Master of Education program at Ontario Tech University, with an interest in integrating technologies into the classroom.

26

THE
COLLABORATION
PRINCIPLE

Overview

 [An Introduction to the Instructional Design Principle: Collaboration](#) (4:41)

Description

Collaboration is an instructional design principle whereby groups of learners work together to complete

specific tasks, solve problems, partake in discussion, and learn from one another's thinking, views, and ideas. Individuals may work together in a traditional, face-to-face environment or computer-supported collaborative learning (CSCL) environment, either synchronously or asynchronously (Clark & Mayer, 2011; Kirschner, Paas, & Kirschner, 2009). The collaboration process involves discussion, argumentation, and reflection regarding the task at hand, which can lead to deeper processing of the information, resulting in more meaningful learning (Kirschner et al., 2009). In order for collaboration to be effective, group members must actively communicate and interact with one another and share similar intentions of establishing a common focus and achieving a desired goal (Beers, Boshuizen, Kirschner, & Gijselaers, 2006).

Guidelines for Use

Guideline 1 – Social Interdependence

In order to ensure that each team member is purposely contributing to the collaborative group, the learning and grade outcome of each learner in the group should be dependent, in part, on the learning and accomplishment of the individual's teammates (Clark & Mayer, 2011). Educators must keep in mind the incentives for each learner to interact, participate, and support the learning of the rest of their group members. For example, an educator teaching a Science class may have students work in groups to complete a particular task. In order to ensure each student is participating and everyone is doing their fair share of work, the teacher may provide or allow students to take on a specific role within the group.

The learning of the group and the mark given would be dependent on the completion of each part assigned to each individual. It is important, however, to make certain that the roles assigned to members of the group require collaboration rather than individual completion, as this would defeat the purpose of group work. Careful consideration and planning on the educators part is required.

Guideline 2 – Quality of Collaborative Dialogue

Collaborative learning activities must involve communication by all members of a group where each member builds upon the contributions of the other members, clarifies or challenges ideas, and asks and answers mutual questions (Clark & Mayer, 2011). Rather than regurgitating what they already know, learners must critically think and contribute ideas that may expand each other's knowledge (Clark & Mayer, 2011). Therefore, educators must create instructional conditions that inspire and require in-depth, quality dialogue. Providing students with a model of how effective groups function may prompt meaningful discussion (TeachThought, 2020). This model may include initiating discussion, clarifying points, summarizing, challenging assumptions, providing or researching information, and reaching a consensus (TeachThought, 2020). It is important for educators to provide students with activities or problems that are not too easy but rather, spark curiosity and engagement, with relevance to the learners.

Guideline 3 — Incorporate Problem-Based Learning (PBL)

Problem-based learning involves collaboration in which students work together to solve a real-world problem. Howard Barrows, who was involved in the development of PBL at McMaster University describes it as student-centred, taking place in small groups, whereby the teacher acts as the facilitator and group work is organized around a problem (Graaff & Kolmos, 2003). The type of problem is dependent on the curriculum expectations of a particular subject and can be created by the teacher or can be constructed by groups of students after being given a particular topic. Students are required to come to a consensus on solution(s) to the problem and later present their problem and accompanying solution(s) to the whole class to spark discussion around the problem. Teachers can apply PBL to any subject. For example, in a Grade 8 History class, a teacher can divide students into groups and provide them with the topic of Global Inequalities or a problem pertaining to this topic. Students will communicate, research, and pose solutions to the problem, present their material in an organized way (ex. Prezi), and share their findings and ideas with the class. This activity may take one or multiple classes depending on the complexity of the problem and the learning abilities of the students. Checking in with students' progress may help to establish a time frame.

Guideline 4 — Utilize Web 2.0 Tools for Collaboration

Allowing students to utilize Web 2.0 Tools to collaborate with others is an engaging and meaningful way to incorporate technology into the classroom. Collaborative tools such as Google Docs, AdobeConnect, Knowledge

Forum, and Canvas are platforms that allow for collaboration through discussion both written and verbal. Students can work on activities simultaneously, while utilizing the World Wide Web to complete research. Utilizing Web 2.0 tools allows students to practice how to effectively and safely communicate online as the use of technology is integral to many career paths. For example, a teacher may have groups of students work together utilizing a tool of their choice, such as Google Slides, to create a presentation on a particular learning strand. It is crucial for educators to introduce netiquette and safe Internet use before the introduction of Web 2.0 tools into the classroom.

Guideline 5 – Collaborative Learning Process as part of Assessment

Assessment for learning involves the process of understanding where learners are at in their learning, where learners are going, and how best to get them there. Assessment as learning involves the process whereby students assess their own learning, the learning of their peers, and their group's learning. As students collaborate with others, it is important to use assessment for and as learning to provide students with appropriate feedback to be utilized to enhance their group work experience. Allowing students to reflect on their learning and their role as a member of a collaborative group as well as reflect on the work of their group, students are able to take necessary steps to improve their role and enhance their learning. This type of assessment should be done throughout the process of learning and working in a group rather than at the end of a finished task. Checking in on students while they work, giving them opportunities to reflect on their learning through

checklists, rubrics, reflection journals and allowing groups time to discuss how the collaborative process is going and how they may proceed for the betterment of the group, are ways to accomplish this.

Good Examples of Use

Example 1 – Edmodo

Edmodo is an educational website that provides students a platform to communicate, share ideas, share documents, create polls, create and edit assignments, provide feedback, and other features that are conducive to collaborative learning. Teachers can use this site to keep track of their students' work and provide feedback to learners when needed. This platform can be used by learners both at school or at home, allowing for synchronous and asynchronous contributions.

Example 2 – G Suite

G Suite is comprised of a number of Google Apps that make collaboration simple and effective. These Apps include Google Docs, Slides, Sheets, Hangouts, Drive, Forms, and Google Classroom. Students and educators are able to use these Apps to collaborate synchronously or asynchronously and work on tasks simultaneously, sharing their ideas and work with one another in a group of learners. Educators and students are easily able to provide feedback to one another through these platforms.

Example 3 – [Fleep]

Fleep is a communication application that includes built-in collaboration tools to allow groups of learners to communicate online through messaging and virtual online meetings. Students are able to use private group messaging to work exclusively with their groups members. This application supports students in discussing their group tasks, making suggestions, sharing ideas and links, uploading files, and providing feedback.

Helpful Resources

Resource 1 – [Video on Collaborative Learning by Maddie Edwards]

Maddie Edwards, a high school student at Woodgrove High School and the Academies of Loudoun in Purcellville, Virginia discusses her experience with collaboration and and how to create a better future through collaborative learning.

Resource 2 – [Theory and Practice of Online Collaborative Learning]

This book by Tim S. Roberts takes an in-depth look at computer-mediated collaborative learning.

Resource 3 – [Collaboration Tools for Learning Online]

This article discusses collaboration and online learning. It includes examples of collaboration tools that can be used for educational purposes.

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Author

Submitted by:	Chelsea Santoli
Email:	chelsea.santoli@ontariotechu.net
Twitter:	@ChelseaSantoli2
Bio:	I am currently an Occasional Teacher with Dufferin Peel Catholic District School Board and York Region District School Board. I am completing a Master of Education and Digital Technology degree through Ontario Tech University. I am a lifelong learner and passionate educator interested in utilizing technology to enhance the learning experience of my students.

27

THINKING
SKILLS DESIGN
PRINCIPLE

Overview

Thinking Skills Design Principle (4:05)

Description

The Thinking Skills Design Principle was developed to build job-specific thinking and problem-solving skills, this approach is real-world focused for progressive

learning and thinking skills that are unique to a specific area of focus. The three main bodies of thinking skills are creative thinking, critical thinking, and metacognition. These thinking skills focus on a whole-task or part-task training process which is applicable for different learners. These two instruction methods separate learners based on their level of complexity and include explicit learning based on a case study approach.

Guidelines for Use

Guideline 1 – Analysis of Process

Instruction can begin with an assessment of desired thinking skill outcomes, this should be developed and used as a benchmark to ensure the content is focused on specific outcomes based around creative thinking, critical thinking or metacognition.

Guideline 2 – Determining your Approach

The content can be organized using one of the following approaches depending on the skills and context of the case study situation. Part-Task takes content into smaller areas of focus and learners are given smaller amounts of content to practice and build their thinking skills gradually. This approach works well with novice learners as it doesn't overwhelm them with content. Whole-task takes the approach where an authentic situation is given and integrates the knowledge and skills needed to solve that problem into the learning. This approach works well with more complex learners.

Guideline 3 – Specific Context

Engage learners with expert examples and simulations of content. This process can be done individually or in collaborative group assignments where learners can observe, analyze, describe and act on their case study situation. Taking this element one step further, learners can observe (O) a case study and make a summarized assessment. They can then analyze (A) their observation summary and describe (D) how they would respond in a specific professional experience. From there, the learner can design an action (A) plan and respond to the situation based on feedback from peers, facilitators or mentors creating a deeper understanding of content.

Guideline 4 – Interact with the Resolution

Use a reflection assessment on the learning process as an effective way for learners to further engage with content and analyze why actions were taken. This reflection reviews what they have learned throughout the process inclusive of the solution but also on the problem-solving skills that were used to find a solution.

Guideline 5 – Learner Focused

The learner should have control over their learning through the OADA phases, but the case study can be provided to the learners to ensure it specifically meets the problem where certain thinking skills are required to solve. Implement this by giving the learner a specific problem that related to their professional field, they can work through the OADA phases to solve. This process triggers specific thinking and problem-solving skills.

Good Examples of Use

Example 1 – [Minecraft]

This interactive learning tool teaches users to build, gather resources and survive in an augmented reality world. Users gather resources to advance and build acquired resources to maintain good health and sustainable life. The further you progress by setting your own goals and working towards their accomplishment, the more complex the game features become.

Example 2 – [Science Journal by Google]

This documenting tool allows users to pick a general science experiment to start and utilizes the user's phone to capture photos, sounds, videos, and light sensors. The user measures the content and develops findings to help them explore that area of focus on a granular level. As you develop your skills, you can conduct new experiments and areas of focus and the advancement of learning is controlled by the learner.

Helpful Resources

Resource 1 – [Critical Thinking Skills in E-Learning]

This research highlights critical thinking in an online learning environment including what design factors play a role in creating interactive learning environments and what kinds of critical thinking skills activities engage learners.

Resource 2 – [Teaching Methods for Inspiring Learners](#)

This TedEx describes a student's natural ability to be a problem-based learner and use their critical thinking and creative thinking skills to observe, analyze and act on focused problems. Authentic learning happens when learners engage in inspiring content and importance is based on student-centered learning environments.

Research

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Author

Submitted by:	Sarah Patience
Email:	sarah.cuttress@uoit.net
Twitter:	@spatience3
Bio:	Sarah Patience is a Master of Education Student at Ontario Tech University, where she plans to focus her research on Indigenous Communities of Practice. She graduated from the AEDT program at Ontario Tech University and lives in the Toronto area. She currently works in marketing at AB World Foods and has a passion for food and travel.

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THE PERSONALIZATION PRINCIPLE

Overview

[Personalization Principle](#) (5:22)

Description

The Personalization Principle is one of Mayer's 12 Principles of Multimedia Learning. The theory views simulating a social discourse as an event that promotes

active cognitive processing, allowing people to feel they are engaged in a conversation with a partner instead of passively receiving information. This theory suggests you can use an informal, conversational style and virtual coaches to increase learning outcomes and increase learner engagement.

Guidelines for Use

Guideline 1 – Use Conversational Style Rather Than Formal Style

Using an informal conversational style helps learners relate to the presented material. Language should use some first- and second-person language to help create the feeling of conversation. Instructions should be polite by offering suggestions, asking questions, or phrasing as though working cooperatively with the learner. It is important to use personalization in moderation because it is important not to distract the learner.

Guideline 2 – Use Effective On-Screen Coaches to Promote Learning

On-screen coaches are characters, real or animated, that guide the learning process during an e-learning episode. Coaches help provide the feeling of being engaged in conversation and should move, sound, and use eye movement in a human-like manner. Coaches should be used for instruction rather than entertainment by providing hints, worked examples, demonstrations, and explanations.

Guideline 3 – Make the Author Visible to Promote Learning

Visible authors give information about themselves and

highlight their perspectives. Newer learners may be encouraged by the author as a guide to the topic and can make the topic seem less intimidating. Learners at a middle level of interest also become more engaged in the topic.

Good Examples of Use

Example 1 – Duolingo

Duolingo uses polite and cooperative language on its instructions to progress to the next steps. The Duolingo owl acts as a coach to new users, providing advice on learning techniques from useful tips to overall learning advice like practicing consistently. Visible authors establish a presence by providing feedback and answering questions on the forum.

Example 2 – Udemy

Udemy has a variety of programs available for e-learning. In the course overview, the author acts as the on-screen coach. They provide study techniques, descriptions of course and lesson content, and resources for practice questions.

Helpful Resources

Resource 1 – Applying the Personalization Principle

Clark and Mayer provide direct advice on how to use the Personalization Principle.

Resource 2 – <u>The Learning Pod</u>

In this episode of The Learning Pod, Kell Hansen and Jeanine Sullivan discuss what the Personalization Principle is and how it can be used in the workplace.

Resource 3 – <u>Contrasting Study of the Personalization Principle</u>

The study found learners in personalized simulations spent 20% more time on it but no differences in achievement.

Research

Brom, C., Bromová, E., Děchtěrenko, F., Buchtová, M., & Pergel, M. (2014). Personalized messages in a brewery educational simulation: Is the personalization principle less robust than previously thought? *Computers & Education, 72*, 339-366.

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Author

Submitted by:	Stephen Lizak
Email:	stephen.lizak@ontariotechu.net
Web page:	https://elearning-essentials-2020.weebly.com/personalization-principle.html
Bio:	Stephen has worked for over a decade educating students across a variety of ages in the math and sciences. He has worked at Conestoga College as a teaching assistant, as a tutor for the drop-in service in the math center, at CHELP Tutor School, and as an independent tutor.

PART III

TOOL REVIEWS

29

ARTICULATE 360

Overview

 [Articulate 360 for E-Learning Design](#) (11:07)

Description

[Articulate 360](#) is an authoring program used by instructional designers, e-learning developers, and educators for creating innovative and interactive online learning modules, simulations, and instructional or

promotional material. You can sign up with a free sixty day trial, and after that subscribe to a yearly subscription. With an Articulate 360 account, you will have access to several apps that can be downloaded to your desktop, each serving a different purpose, as detailed below.

Rise 360

This is a web-based design tool and by far the most user-friendly out of the Articulate 360 suite because it is web-based and does not require any installation of software and very little training in order to create a course, lesson, or assessment. Rise 360 is used primarily to create responsive courses directly in your web browser in a timely manner.

Storyline 360

This is a desktop authoring tool used to create customized courses and learning modules. Although there is a bit more of a learning curve, it is still fairly intuitive and the interface is designed to be similar to Microsoft powerpoint to make it an easier transition. Storyline is more commonly used for more cumbersome or complex course design, including customized interactions, scenario based activities, and screencast videos with step by step simulation options for demonstrating software or products.

Content Library 360

Provided with each account, the content library contains over five million course assets that users can utilize in their own design projects without any royalties or extra

fees. This includes images, templates, videos, characters, and slide templates. The templates in particular are a great way for new users to design professional looking, effective courses with minimal training.

Review 360

This web-based app is where you can publish your courses and invite others to provide feedback. This really brings out the collaborative nature of the program and allows instructors or designers to co-construct courses and lessons.

Articulate 360 Training

This section provides numerous tutorials and instructional videos showing you how to use the various features in Articulate 360. There are recorded webinars and also live webinars that subscribers can access for free.

Justification for Using this Tool

Practice Principle:

Articulate 360 aligns extremely well with many learning theories and instructional design principles. Both Storyline and Rise (the main authoring tools in Articulate 360) offer several opportunities for instructors to create meaningful interactions and formative assessments to practice and test the skills and knowledge learned in the module. This supports the practice principal of effective e-learning design, which states that learners should have ample opportunities to practice the skills learned in the module through multiple question types that can be

distributed throughout the learning event (Clark & Mayer, 2011). In Storyline, designers can create scenario based assessments to provide authentic assessment and feedback can be added for all answer options, which also aligns with the feedback and job-mirroring aspects of the practice principle and the worked example principle (Clark & Mayer, 2011).

Learner Control:

In Storyline and Rise, the wide range of user navigation tools like interactive buttons and control buttons for various media allows designers to give learners full control over the pace, navigation, and amount of material that they consume in a learning module, which supports the principle of learner control in effective e-learning design (Clark & Mayer, 2011; Kay, 2001).

Personalization:

Personalization of learning, which encouraged personal, informal tone and teacher presence, is also supported in Storyline where designers can custom record their own voices between slides and interactions, giving test instructions and user prompts with a human voice rather than just text or automated voice (Clark & Mayer, 2011).

Multimedia Principles:

It's interactivity and multi-modal capabilities with inserting video, audio, graphics, interactive quizzes, and animation allow for the creation of learning modules with most of Clark & Mayer's multi-media, instructional design principles in mind, particularly the principles of

multimedia, modality, and contiguity (Clark & Mayer, 2011). Each module can also be organized into different "scenes" so that large, cumbersome modules can be chunked into smaller, more manageable learning events to avoid cognitive overload and promote the chunking of learning material (Doyle & Fountain, 2012).

Strategies for Use

Strategy 1 – Simulation Practice Exercises

Simulation Practice Exercises through Screencasting (4:51)

Strategy 2 – Promoting Learner Control

Promoting Learner Control through Navigation & Triggers (5:27)

Helpful Resources

Resource 1 – eLearning Articulate 360 Resources

This website offers tons of examples, tips, resources, and articles related to Articulate 360 and other authoring

tools. It is a great resource for extra training once you have developed the foundational skills in Articulate.

Resource 2 – eLearning Brothers Articulate Resource Bank

eLearning brothers have a wide range of resources available including training videos, templates, and exemplars. This is quite useful for both novice and advanced users of Articulate.

Resource 3 – Udemy: Learn Articulate 360 from Scratch

This is not a free resource, but for only $15.00, it is a great full resource for a completely new user wishing to learn how to use the authoring tool from the very first steps. Linkedin Learning has a very similar course as well.

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Author

Submitted by:	Blair Trewartha
Email:	Blair.trewartha1@uoit.net
Bio:	Blair Trewartha is an educator and instructional designer currently completing his Masters of Education at Ontario Tech University. He holds a B.A. in English/History, a Bachelors of Education degree, and over ten years experience teaching in post-secondary institutions across Ontario.

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BUNCEE

Overview

 [Buncee](#) (3:43)

Description

[Buncee](#) is a fun and easy tool that can be used to create interactive content that is visually appealing and multimodal. This tool is similar to Microsoft PowerPoint or Google Slides, but with more advanced features. Using Buncee, individuals can create stimulating presentations that can be easily accessed online through tablets or computers. This tool offers the drag and drop feature,

making it easy to use for all. A great advantage of Buncee is that the user can create almost anything, using their imaginations. Although this tool presents great elements, it is not free to use after 30 days.

Justification for Using this Tool

The most important feature of Buncee is being able to provide Connectivism. The theory states that the worldwide web has created new opportunities for individuals to learn, connect and share content (Siemens, 2005). Essentially anyone with a Buncee account can access the site with the link. When thinking about this theory through an educational lens, teachers can easily connect and guide students to the information needed to answer any questions.

Buncee is a tool that can be used to create interactive presentations. In order to do so, the innovators need to adhere to the thinking skills design principle. The principle has been developed to build job-specific thinking and problem-solving skills such as creative thinking, critical thinking and metacognition (Clark & Mayer, 2011). When creating an interactive and effective Buncee presentation, the creator needs to be equipped with all three skills for the presentation to be stimulating.

Strategies for Use

Strategy 1

[Strategy 1](#) – Buncee (1:16)

Buncee can be used in a variety of ways, including lessons and assessment tools. The educator can create slides that explore a topic or theory. Students can refer back to the presentation when needed. The educator is also able to create slides in which the students need to answer a series of questions. All student answers are stored in the Buncee classroom portal.

Strategy 2

[Strategy 2](#) – Buncee (1:15)

Buncee can be used by students in various ways, including an interactive presentation, personal portfolio, notebook sharing or read aloud responses. When creating an interactive presentation, the tool can be used to engage students while also summarizing learning. After creating the presentation, the students can present their slides to the class and review them when needed. When thinking about a personal portfolio, notebook

sharing or read aloud responses, students are given the opportunity to use their creativity to complete the task(s) designed.

Helpful Resources

Resource 1 – Buncee Tutorial

This Youtube video quickly provides a tutorial on how to use the tool Buncee. It goes through logging into the tool and creating an interactive presentation.

Resource 2 – 10 ways to use Buncee Board in the Classroom

This blog explores ten different ways to use Buncee in the Classroom.

Resource 3 – Buncee for Education Review

This review quickly summarizes the tool and provides teachers with benefits and cons.

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Author

Submitted by:	Marta Masnyi
Email:	marta.masnyi@ontariotechu.net
Bio:	Recent Graduate of the Bachelor of Education Degree which was completed at the University of Ontario Institute of Technology. Current student of the Graduate Diploma in Education and Digital Technologies in which I am studying how to effectively integrate technology within the classroom setting.

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CANVA

Overview

[Web-based Learning Tools](#) • Canva (3:15)

[Canva](#) assists users in the creation of professional quality media to be used in a variety of applications including both digital and print environments. Both free and paid (pro) subscriptions are available.

Canva makes it very easy to create and re-size graphical social media elements. Users have the ability to save, organize and share their files under individual profiles. Educators are able to easily create professional-looking

graphics and students can use tools to demonstrate creativity in their work without any real design experience.

Justification for Using this Tool

The focus of Canva is to allow users to express their learning through creativity, which, in many ways, is foundational to learning (James, Lederman Gerard & Vagt-Traore, 2010). Embracing the Multimedia Principle which states active learning is more likely when learners are exposed to both words and images that assist with mental integration of material (Colvin Clark & Mayer, 2008) will aid in the success of lesson delivery in the classroom. The Canva platform can be effectively leveraged to add engaging multimedia to everything from handouts to lectures to hands-on learning activities.

In order to best enhance learning, educators should create and utilize their own multimedia material (Babiker, 2015). Canva offers templated and step-by-step creation of everything from newsletters to presentation, from infographics to logos. Equipped with tutorials and collaborative libraries, this application is accessible and necessary to assist educators with the changing multi-sensory learning requirements of today's learners.

Strategies for Use

Strategy 1 – Students

[Strategies for use of Canva in the Classroom (for students)](#) (0:49)

Brief overview video created by the author of some of the options Canva offers to students. Get a list of some of the tools students can create using the many templates available in Canva.

Strategy 2 – Teachers

[Strategies for use of Canva in the Classroom (for teachers)](#) (0:50)

Brief overview video created by the author listing some of the options Canva offers for teachers to bring some creativity into their classroom. Get some suggestions of the tools teachers can use to spruce up tired material and be inspired to update class material.

Strategy 3 – Creating Certificates

[How to create certificates on Canva](#) (2:44)

Educators can use Canva to create certificates of appreciation or achievement to reward students in the classroom. Easily produce formal certificates that can be printed on card stock and sent home as an identifier of notable achievement.

Strategy 4 – Creating Presentations

[Canva 2.0: Create better presentations](#) (12:33)

Capturing students' attention is often paramount when delivering new information and teaching curriculum. A bedrock of delivery is how it is presented. Canva offers tools to best present your information to assist you in captivating your audience.

Helpful Resources

Resource 1 – How to use Canva in Education (Video Tutorial)

This video points out valuable uses of Canva for educators, in particular. Learn about tools to use for producing teaching materials as well as options to create lessons that allow hands-on learning for students within the application.

Resource 2 – 10 ways to take your lessons to the next level with Canva (Blog)

This blog provides resources and tips to best incorporate Canva with classroom learning, educator collaboration and available resources.

Resource 2 – Canva in the classroom: Getting started, example designs and tips (Blog)

This blog provides a thorough overview of the application and details many of the available uses, requirements and options to best utilize the application.

References

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Author

Submitted by:	Alison Sprayson
Email:	alisonsprayson@gmail.com
Web Page:	www.ourbrightideas.ca
Bio:	Post-secondary instructor with interest in technology, marketing and instructional design.

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EXPLAIN EVERYTHING

Overview

[Explain Everything Introduction](#) (1:42)

Description

Explain Everything is a mobile and online interactive whiteboard that allows users to create presentations and videos that can be uploaded to youtube or shared on Google Drive. There are a variety of features including a pen and highlighting tool, the ability to add documents,

images, and videos, and the ability to add voice annotations. These features promote the creation of multimodal presentations or videos. Explain Everything also allows multiple users to collaborate on a project on the same devices or several devices.

Justification for Using this Tool

Explain Everything is often used as a presentation tool, as its features promote the use of many instructional design principles, including the modality principle and contiguity principle. The modality principle states that audio better supports learning outcomes in comparison to written text (Clark & Mayer, 2011). Explain Everything includes a built-in recording feature, that allows users to narrate a presentation or explain their thinking process. The contiguity principle states that audio and visuals should be presented in an integrated fashion (Clark & Mayer, 2011). The recordings can be paired with live drawings or writing to allow information to be shared through auditory and visual channels simultaneously.

The invite feature in Explain Everything enables computer-supported collaborative learning (CSCL). CSCL promotes social interactions which allow for deeper mental processing of content (Stahl, Koschman, & Suthers, 2014). A shareable code allows for multiple users to access a project simultaneously, which enables users to share questions, participate in inquiry learning, and share thoughts and opinions.

Strategies for Use

Strategy 1 – Collaborative Whiteboard

[Collaborative Whiteboard](#) (2:15)

Explain Everything can support student collaboration through the upload of a file feature. Students can utilize the highlight and text feature to improve understanding of course materials, while working simultaneously with their peers.

Strategy 2 – Explain Everything E-Book

[Explain Everything E-Book](#) (2:51)

Explain Everything can be used to create an E-Book with voice narration. Students can add multiple pages, which incorporate pictures and text.

Helpful Resources

Resource 1 – [Explain Everything Webinar](#)

The video discusses a hope to connect Explain Everything with the Google platform to allow educators

to post content on Google Classroom, and provide a place for students to share their projects on Google Drive. The video also presents a variety of different ways to incorporate the WBLT into the classroom to enhance student learning.

Resource 2 – Creative Uses of Explain Everything

The blog post includes 11 creative and practical uses of Explain Everything in the classroom setting. Explain Everything can be used by teachers to support instruction or by students to promote collaboration.

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Author

Submitted by:	Sarah Baillie
Email:	sarah.baillie@ontariotechu.net
Twitter:	@MsBaillie_
Bio:	I am an elementary Occasional Teacher with York Region District School Board and Durham Catholic District School Board. I am currently enrolled in the Master of Education program at Ontario Tech University, with an interest in integrating technologies into the classroom.

33

FLIPGRID

Overview

[Flipgrid Overview](#) (5:02)

Description

[Flipgrid](#) is a free video-based platform that can be embedded into a website and/or a learning management system. Its purpose is to allow students to respond in video format to a learning activity posed by educators. Video responses by students are limited from 15 seconds – 5 minutes and each video posted is presented in a grid format. Students can post their video responses using

any camera accessible digital tool. Flipgrid also allows educators to assess, provide feedback, and include attachments to videos. Students may also respond via text to text questions posed. The video responses have accessibility features such as closed captions, immersive reader, and students can add characters, emojis, and graphics. The platform allows for more than one moderator, access to a help center, and access to a library of shared grid templates.

Justification for Using this Tool

Supports Constructivism Learning Theory

Flipgrid allows students to be active, reflective, and collaborative learners by creating short videos to demonstrate their learning (WNET/Education, 2004).

Supports ARCS Model of Motivational Design

When educators have students design videos either before, during or after a lesson as a learning activity, using the Flipgrid platform, it can stimulate students' engagement and motivation to learn (Mobraw, 2020).

Supports Personalization Principle

Flipgrid supports the multimedia Personalization Principle of design as empirical research has shown that using printed and/or spoken conversational style of writing over formal style of writing is more effective, especially in the case of novice learners. Cognitive theories of multimedia communication research have proven that a user's cognitive processes are further

ignited and engaged when conversational style of communication is used as it simulates human to human conversation (Clark & Mayer, 2011).

Strategies for Use

Strategy 1 – Flipgrid Resource

[Flipgrid Resource](#) (4:24)

Flipgrid has over 12,000 topic grids available in the Disco Library for educators to utilize for their web-based learning modules.

Strategy 2 – Flipgrid App and Flipgrid Twitter

[Flipgrid App & Flipgrid Twitter](#) (2:20)

Flipgrid's App and Twitter promote social engagement, collaboration, and is pedagogically beneficial to both educators and students.

Helpful Resources

Resource 1 – [Getting Started with Flipgrid Guide](#)

- This online blog provides educators with the foundations of Flipgrid including step-by-step instructions on how to use this tool and lists all the resources available.

Resource 2 – [10 Ways to Use Flipgrid](#)

- An educator provides 10 tips on how to use Flipgrid as a tool and as a solution to teacher troubles.

Resource 3 – [A Technological Review of Flipgrid](#)

- This article review's Flipgrid as a social learning and engagement educational tool along with discussing its strengths and weaknesses.

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Author

Submitted by:	Charlene DiDanieli
Email:	charlene.didanieli@ontariotechu.net
Web Page:	@CDiDanieli
Bio:	A professor with over 13 years of teaching experience in a community college in Ontario.

34

GOOGLE DOCS

Overview

 [Google Docs Overview](#) (2:27)

Description

[Google Docs](#) is an interactive, web-based, word processor that allows students to produce text documents that live entirely on the cloud (Alharbi, 2019). Students can create, share, and collaborate in real time. Google Docs is distinguished from other Web 2.0 tools by its editing feature that enables both author and reviewer to contribute to the text synchronously (simultaneous

editing of writing by learners) and asynchronously (non-simultaneous editing by learners) (Alharbi, 2019). The ability for teachers to monitor their students' progress and provide feedback on students' work right on this innovative platform supports students' Zone of Proximal Development as they are guided by teachers from the start of planning their work to the final stage of editing, through to feedback and drafting practices and activities (Alharbi, 2009).

Justification for Using this Tool

Google Docs is an interactive tool that allows users to work on a document simultaneously (Alharbi, 2009), on a one-to-one or one-to-many basis (Desjardins, 2005a). As suggested by a constructivist learning approach, collaborating and conversing with others enriches student understanding (Jonassen et al., 1999). Students can work on the document at the same time, building off each other's ideas, research, brainstorming, and suggestions. Collaboration using Google Docs is not restricted to the classroom environment, providing flexibility, as students can work together at any time, anywhere, through the doc (Suwantarathip & Wichadee, 2014). Students can also utilize the chat function to partake in discussion with group members or teachers to further enhance knowledge construction (Suwantarathip & Wichadee, 2014). Virtual collaboration can lead to more reflections and sharing of ideas than face-to-face collaboration (Clark & Mayer, 2011). Working collaboratively reflects a wide range of perspectives and as such, results in a more complete and comprehensive product (Suwantarathip & Wichadee, 2014).

Google Docs also supports a Problem-Based Learning (PBL) approach where a given or student constructed problem is the starting point of the learning process to be solved by a group of students (De Graaff & Kolmos, 2003). Students can use Google Docs as a learning tool, where they come together to understand the problem and document various solutions on the Doc. The immediacy of the tool allows teachers to monitor students' progress and provide constant suggestions, pose questions, and seek clarification, using the comments feature that the tool provides (Alharbi, 2009; Suwantarathip & Wichadee, 2014). Research shows that the use of constructive feedback can enhance students' quality of work in terms of content, organization of ideas, language and grammar, conventions, and referencing (Ciftci & Kocoglu, 2012).

Strategies for Use

Strategy 1 – Feedback

[Google Docs as a Teacher and Peer Editing/Feedback Tool](2:36)

Google Docs has many features that are conducive to teacher and peer, editing and revision. The features available for students and teachers to use for review and editing purposes support writing and learning as a process.

Strategy 2 – Problem-Based Learning

[Using Google Docs for Problem-Based Learning](#) (1:35)

Students can utilize Google Docs as a way to collaborate with peers when trying to solve a given or student-created, real-world, meaningful problem.

Helpful Resources

Resource 1 – [Getting Started with Google Docs](#)

G Suite Learning Center has created an in-depth guide to using Google Docs. This guide outlines all the functions and features that Google Docs offers.

Resource 2 – [Using Google Docs in Education](#)

This video outlines ways to use the basic features of Google Docs and how these features can be used for learning purposes. It also outlines ways to use this tool for collaboration, editing, and providing feedback to learners and group members.

Resource 3 – [Using Google Docs to Support Collaboration](#)

This information guide provides the readers with ideas on how to use Google Docs as a collaboration tool in

education. It also provides a description on the features that help to foster collaboration.

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Author

Submitted by:	Chelsea Sontoli
Email:	chelsea.santoli@ontariotechu.net
Twitter:	@ChelseaSantoli2
Bio:	I am currently an Occasional Teacher with Dufferin Peel Catholic District School Board and York Region District School Board. I am completing a Master of Education and Digital Technology degree through Ontario Tech University. I am a lifelong learner and passionate educator interested in utilizing technology to enhance the learning experience of my students.

35

HYPOTHES.IS

Overview

[Hypothes.is Intro](#) (3.03)

Description

Study the web with this browser extension. Designed to open up web writing to discussion and annotation, Hypothes.is supports learners, researchers and educators as they critically analyze and reflect on readings online, allowing them to highlight and annotate passages. Annotate privately, as a group, or out in the open as part of a larger community discourse.

Justification for Using this Tool

Social annotation apps and extensions, like Hypothes.is, let learners mark up a digital text much like they would a paper version – adding highlights, comments and margin notes, but in a collaborative and socially connected way (Novak, Razzouk, & Johnson, 2012, citing Huang et al., 2008, Kawase et al., 2009). These annotations and highlights are specific to individuals and the groups they share them with, whether private, in groups or fully public.

In a 2012 literature review, Novak, Razzouk, & Johnson noted little formal or relevant research yet on these types of tools. Of that which is available, there is evidence to suggest that annotation tools support effective learning, enhancing engagement, communication skills, and peer-to-peer learning. Digital annotations tend to be shorter, intended to be searched, shared or commented on in order for digital tools to affect learning in parallel ways to paper, they need to be engaging, easy and shareable, to prompt deeper thinking. The key pedagogical value of these tools are their social sharing features – through the collaborative and social annotation of texts, learners become more able to engage in metacognitive processes, recognizing patterns and synthesizing knowledge (Novak, Razzouk, & Johnson, 2012). Patterns across studies also indicate that social annotation improves learners' motivation and enjoyment of the reading experience. Learners express enjoyment of these types of tools, and more and better quality annotations is correlated with improved learner performance.

Hypothes.is facilitates collaboration through active

sharing of reading insights and questions in any of the learner-to-facilitator, learner-to-learner, or learner-to-global-community environments. Learners exert a variety of control within this tool – from the quantity and quality of their annotations, responses to peers, and depth of their reading of the text. Depending on how learners are prompted to read and interact with the selections, Hypothes.is can help learners express, and educators measure, critical and creative thinking. If the researchers dashboard is incorporated into learning activities, metacognitive thinking skills may also be addressed. Educators should be careful that there is typically an initial learning curve with taking on a social annotation tool like Hypothes.is. Learners take a while to adjust to their use, and may demonstrate reduced performance as they learn the expectations of a tool use. Learners also report that they often find each others' annotations interesting to the point where they can become distracted from their learning task. Supporting and directing learners' attention and purpose in readings is paramount to their success in using these types of tools.

Strategies for Use

Strategy 1 – Guided Reading

[Guiding Reading](#) (2:01)

Pre-populate a text or reading with questions for learners to discuss. Ask questions that prompt for active reading

strategies, including visualize, calrify, question, predict, connect and evaluate. These prompts should escalate through the reading, culminating in the more challenging prompts.

Strategy 2 – Researching in the PBL Cycle

[Researching in the Problem Based Learning Cycle](#) (2:41)

Facilitate the research stage of problem based learning or supervise collaborative research projects. Create groups of students and monitor their research and discussions. Facilitate their work by adding questions or additional resources for them to explore. Using the groups tool, and even the LMS integration, associate marks to these monitored interactions as learners acquire research skills.

Helpful Resources

Resource 1 – [Hypothes.is Teacher Resource Guide](#)

THis comprehensive guide helps prepare educators to facilitate the use of this tool from a technical perspective. It includes visual and video tutorials, and samples of [real student work](#).

Resource 2 – [10 Ways to Annotate with Students]

This blog post offers 10 ideas for incorporating Hypothes.is into classroom learning exercises.

Resource 3 – [Marginal Syllabus]

Educators globally use Hypothes.is to collaboratively and socially annotate and discuss relevant research on technology equity. Join in the effort to develop participatory research about this valuable topic.

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Author

Submitted by:	Jesslyn Wilkinson
Twitter:	@jesslyndw
Bio:	Jesslyn is the Educational Technology Officer at Conestoga College. An Ontario Certified Teacher and a M.Ed candidate, Jesslyn researches and promotes new technologies for faculty to enhance pedagogical practices. She brings to the role her experience as a Google and Microsoft certified technology trainer and as a classroom teacher internationally and in Ontario, focusing on special education, tech-enabled learning and assistive technologies.

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KAHOOT!

Overview

[Kahoot! Overview](#) (3:46)

Description

[Kahoot!](#) is an interactive game-based, web-based
learning platform that can be accessed on any device and
used in a school, work or home environment. Individuals
(teachers, facilitators, trainers, students and others) can
create, host or play learning games which are called
kahoots, reviewing or introducing topics and concepts
or elaborating on them. Games (kahoots) can take the

form of any combination of quizzes, surveys (polls) or discussions (content slides) and can lead to further discussion, collaboration or research. They can consist of various question types that are connected to colours, shapes and music, as well as uploaded images and embedded YouTube videos. Quizzes can consist of multiple-choice, true or false, open-ended or puzzle (sort/ sequence) questions. Surveys (Polls) can consist of multiple-choice questions or free form answers that can be visualized in a word cloud and discussion in the form of content slides can contain additional information about a topic or concept. Learners connect to a game through a generated pin on a shared screen and can see their name, nicknames or team names, that they have created, on the leaderboard. They are able to get immediate feedback when choosing, answering or sorting questions. And they can see how their responses rate relative to their fellow learners or colleagues by the number of points they have been awarded for correct and timely answers. Teachers, facilitators and trainers can use the games (kahoots) to help them with formative assessment, evaluating learner knowledge and identifying the learners who may need help. They can also gather feedback about content and structure of their games (kahoots) from learners. The results of each game can be downloaded into an Excel spreadsheet or Google drive. Games (kahoots) also provide opportunities for learners to assess and reflect on their knowledge. Games (kahoots) can be shared with others, edited, published online and teachers, facilitators or trainers can assign them as homework in the form of Kahoot! challenges for learners to play at their own pace on their own devices at home within a timeline set by them.

Justification for Using this Tool

The most important feature of Kahoot! is its ability to engage and motivate learners to learn. It is tied to "gamification of education" (Dichev & Dicheva, 2017) in employing such "game design elements" (Deterding, Dixon, Khaled, & Nacke, 2011) as fun, rewards connected to units of measurement such as points and time, immediate feedback, visual tracking of progress and recognition through a leaderboard, and "social elements" such as "competition and cooperation" with other learners where "their progress and achievements are made public" (Huang & Soman, 2013).

Games (kahoots) can also be used to facilitate discussion "between an entire class" (Plump &LaRosa, 2017) and promote collaboration and problem-solving. Instructors, facilitators, and trainers can also invite learners to create their own games (kahoots) either by themselves or as part of a team, edit them, and share them with others.

Games (kahoots) also offer help with formative assessment. They offer learners opportunities for "self-reflection and self-assessment" (Ismail et al., 2019). Teachers, facilitators and trainers are able to identify which learners are having difficulty with a topic or concept. They are able to see who is answering questions incorrectly and whose name is lower down in the leaderboard. They can then adjust games (kahoots) or create new games (kahoots) to address those areas of difficulty.

Strategies for Use

Strategy 1 – Using Kahoot! for Review

[Using Kahoot! for Review](#) (1:18)

Teachers, facilitators or trainers can use Kahoot! to review topics, subjects or concepts previously covered in class as preparation for tests and exams. They can also create review quizzes for formative assessment or access public ones and edit them for their own use. Learners can work in small teams to create review kahoots on a particular concept or topic covered previously to prepare for a test or exam, or for simple review, and share them with their classmates.

Strategy 2 – Using Kahoot! to Introduce New Material

[Using Kahoot! to Introduce New Material](#) (2:08)

Kahoot! can be used to introduce learners to new material through the creation of "blind" Kahoots.

Helpful Resources

Resource 1- <u>A Teacher Tutorial on How to Create a Kahoot!</u>

In this YouTube video a teacher takes you through the various steps involved in creating a kahoot!

Resource 2 – <u>A Guide to Using Kahoot!</u>

This Kahoot! guide explains how to play and create a kahoot!. It offers suggestions, tips and examples on different ways of integrating it in educational settings.

Resource 3 – <u>A Master Class Video by the Co-Founders of Kahoot!</u>

This YouTube video by Kahoot! co-founders explores different uses of this platform. In it they articulate their vision for Kahoot! And they delve into various features and functionalities of Kahoot!

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Author

Submitted by:	Ivetka Vasil
Email:	ivetka.vasil@ontariotechu.ca
Bio:	I am a graduate student at Ontario Tech University in the M.Ed. in Education and Digital Technologies program with an interest in incorporating gamification in healthcare learning environments.

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LIVEBINDERS

Overview

[LiveBinders Introduction](#) (3:27)

Description

[LiveBinders](#) is a free online program that allows teachers to create classroom textbooks, evidence-based documentation, and e-portfolios. The free option permits the development of up to 5 different binders with file size limitations. The binders are updated in real time, can be private or public and are easily accessible for students. A pro option does exist which costs $9.99

(USD) per month and allows for unlimited binders with several extra options.

Justification for Using this Tool

Working in education it is extremely important to have the ability to network and share curriculum information with colleagues. Livebinders provides a platform for information to be organized, stored and shared. The owner of the binder can add individuals as collaborators with editing capabilities for content information. This tool can also be used by students when working on projects which require online group collaboration through Computer-Supported Collaborative learning (Clark & Mayer, 2011). Hammond (2016) noted that online group collaboration increases the transferrable skills necessary for employment and societal participation.Graphics and videos can be incorporated into the binder to address various learning needs and increase visual esthetics. Carmicheal, Reid, and Karpicke (n.d.) outline that the inclusion of video stimulates greater course performance and positively impacts students' motivation, confidence, and attitude towards their course. The Redundancy Principle also outlines that narration improves learning when paired with graphical representations of a concept (Clark & Mayer, 2011). The binder is user-friendly, information is organized into tabs like a table of contents supporting the Segmenting Theory where information is broken down into smaller more manageable topics to help increase understanding (Clark & Mayer, 2011). Students can access the binder for free from different electronic devices with internet capabilities. Incorporating Livebinders into education can help decrease textbook

costs while increasing student accessibility to curriculum tools.

Strategies for Use

Strategy 1

[LiveBinders Getting Started](#) (2:39)

Short video outlining how to sign up for LiveBinders.

Strategy 2

[Creating Your First Binder](#) (5:45)

Short Video outlining how to create your first binder, and different functions available in the program.

Helpful Resources

Resource 1 – [Educators Guide to LiveBinders](#)

This blog post provides detailed information surrounding different ways that [LiveBinders](#) can be incorporated into the classroom.

Resource 2 – [4 Steps to Creating a Digital Binder for Free](#)

This tutorial outlines step by step how to easily create a digital binder using [LiveBinders](#).

Resource 3 – [LiveBinders for the Classroom](#)

This blog post provides detailed information surrounding different ways that educators and students can use [LiveBinders](#). The post also outlines the positives and negatives associated with this tool.

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Author

Submitted by:	Kristen Marks-Riberdy
Email:	kristen.marksriberdy@ontariotechu.net
Bio:	Post-secondary nursing professor, Academic and Clinical Coordinator for Internationally Educated Nursing Program.

38

MICROSOFT TEAMS

Overview

[Microsoft Teams](#) (4:47)

Description

[Microsoft Teams](#) is a collaborative tool that allows a multitude of users in various locations to work and share in a common space. It is a workspace that multiple users can edit files collaboratively in real-time. It is linked to the online Microsoft Office suite of products and allows

for the integration of third-party apps. There are options to work on and off-line. There is also a mobile app so that there is access to work anywhere. It is designed to be a central hub for productivity.

Justification for Using this Tool

Microsoft Teams connects to various Learning Theories and Instructional Design Principles. The following are just some examples of how Teams has been developed using these principles thus being classified as a good Web Based Learning Tool.

Segmenting Principle

Segmenting is best applied to complex material and when the user is inexperienced with the material. This is achieved from being able to break material down into smaller learning 'chunks'. These are called 'channels'. The limit for channel creation is 200, giving the user ample opportunities to segment the work appropriately.

Practice Principle

The ability for the learner to practice what they are learning is instrumental in them being successful in mastering the content. There are multiple platforms in Microsoft Teams to accomplish this. There is a choice to integrate third Party apps to provide feedback on completed work, or the Assignments option within Teams itself can be used to provide even more detailed grading and feedback. Students can also collaborate with peers for instant feedback with the use of the chat, video call or with the use of the class notebook.

Collaboration Theory

Teams supports this concept by granting multiple users to have the ability to give input on a multitude of topics by allowing collaboration on assignments and projects in real-time. (CLICK) Students can also video call other classmates or their instructor to discuss 'face-to-face' for a more personalized experience. The integration of the third-party app Flip-grid will allow participants to record small videos of their progress or words of encouragement to share with the group for an additional motivation to others. Having a designated chat area, allows students to brainstorm with their peers for possible problem solutions.

Learner Control

Students are free to navigate through content while taking as much or as little time as they like with any materials posted within each channel. Teams supports the Learner Control Principle as there is no set way that the student must navigate through content. Students can also revisit any or all material as needed. External resources can be used for students for a deeper understanding of material being presented, and by incorporating third-party apps like 'Forms', students can be polled and then placed within a level that is appropriate to their skill set, allowing for the implementation of Adaptive Control for the learner.

Strategies for Use

Strategy 1 – Assignment and Rubric Creation

[Assignment and Rubric Creation](#) (8:38)

There are so many benefits to using Microsoft Teams for the classroom. The focus of this video is to demonstrate how to create an assignment and a corresponding rubric. Ensuring AODA compliance is also featured

Strategy 2 – Grading and Feedback

[Assignment Grading and Meaningful Feedback](#) (7:26)

There are so many benefits to using Microsoft Teams for the classroom. The focus of this video will be to demonstrate how to grade an assignment submission and to provide detailed and meaningful feedback for your students.

Helpful Resources

Resource 1 – <u>Building a Collaborative Classroom</u>

This website gives great examples on how teachers can use it to work collaboratively with other faculty. Using a quick video call to another instructor in another part of the school will increase the likelihood of collaboration, which leads to better teaching. Using Teams also levels the field for all participants. For the student that isn't likely to share in a group environment, is more likely to participate when discussions and collaboration is held on-line

Resource 2 – <u>Best Practices for Teams in Classroom</u>

What better way to learn about a tool, than from the developers themselves?! This website hosted by Microsoft details how to effectively use Teams, by demonstrating the possible ways to set up your 'channel' so that everyone is getting the most out of the software as possible. There are many examples on how to set-up, organize, label, and describe the purpose of each channel.

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Author

Submitted by:	Roxanne Stewart
Email:	roxanne.stewart@ontariotechu.net
Bio:	Completing M. Ed program at Ontario Tech University. Partial Load Professor with Durham College specializing in SAP, Microsoft Office and Basic Accounting Principles.

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MINDMEISTER

Overview

[MINDMEISTER OVERVIEW](#) (3:24)

Description

[MindMeister](#) is a cloud-based mind mapping tool where users can create and share their ideas in a visual way. The platform is customizable in nature and allows for multimedia attachments and group collaboration and shareability. Features of this tool are the ability to have multiple contributors, import attachments, graphics,

images and links, export into workable PowerPoint or word documents and customize formats and themes.

Justification for Using this Tool

MindMeister is most effective when used for collaboration, brainstorming and presenting ideas and concepts. This tool offers dynamic presentation capabilities where supportive content can be linked to ideas and maps can be turned into engaging presentations. Each idea carries the capability to have media files attached to support learning content and develop metacognition, critical and creative thinking skills. These three main bodies of thinking skills development are led by a whole task approach where complex learning can happen through the exploration of individual learning components (Clark, R. C., & Mayer, R. E., 2016).

- Collaboration allows students to critically and creatively assess tasks and develop content.
- Mind maps work to create relationship between topics.
- Whole task approach allows students to explore each individual topic for a richer understanding of subject matter.

Mind Meister relies heavily on the connectivity and collaboration theories by allowing the opportunity for multiple users to share information through the use of technology. Within the Connectivity theory, learning happens over online networks (Learning Theories, 2017). This tool functions on a web-based platform where multiple users can revise, edit, upload, share and present

content allowing for learning to happen in a social connectivism manor. This tool is offered in a user-friendly standard web-browser, on Chromebooks, iOS and Android devices.

- Network connections allow for easy use of MindMeister, and connectivism links student ideas and knowledge together into one shareable domain.
- Using this collaboration tool, students are able to socially share their expertise on the subject matter and learn from each others contributions. Easy functions such as comments, chats and voting, make this professional tool a social learning platform.

Strategies for Use

Strategy 1 – Media Features

[MINDMIESTER MEDIA FEATURES](#) (1:46)

MindMeister is an excellent tool to add notes, media, links and image content to ideas and concepts. Each new component can have media attached to it where further exploration and detail of the idea can be shared.

Strategy 2 – Presenting Features

[MINDMEISTER   PRESENTING FEATURES](#) (3:19)

MindMeister can be used for seamless presentations. Content and ideas can be shared collaboratively and then seemly transitioned into a PowerPoint presentation.

Strategy 3 – Collaboration

[MINDMEISTER   COLLABORATION FEATURE](#) (1:50)

MindMeister is a great way for groups to work together on ideas and concepts by brainstorming and exploring content.

Helpful Resources

Resource 1 – [Getting Started with MindMeister](#)

This tutorial and instructional video offers an easy to follow overview of the main features of MindMeister, it offers editing tips and tricks and an overview of how to add media content into the mind map.

Resource 2 – <u>How to Create a Presentation in Minutes with MindMeister</u>

This blog resource offers hidden tricks of MindMeister, touching on how to make a great presentation using this tool and how you can communicate your message most effectively, it also walks you through how to export your mind map into PowerPoint which highlights all of the key discussion points for your easy reference.

Resource 3 – <u>Advanced Features</u>

This advanced feature list is an easy to navigate of advanced user features that MindMeister has, each embedded link offers additional information and "how to" guides for areas such as printing, formatting, chat options, zooming, exporting, sharing and presenting.

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Author

Submitted by:	Sarah Patience
Email:	sarah.cuttress@uoit.net
Web Page:	www.s.patience.com/MINDMEISTER
Bio:	Sarah Patience is a Master of Education Student at Ontario Tech University, where she plans to focus her research on Indigenous Communities of Practice. She graduated from the AEDT program at Ontario Tech U and lives in the Toronto area. She currently works in marketing at AB World Foods and has a passion for food and travel.

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MURAL

Overview

 [Overview of Mural: A Virtual Collaborative Whiteboard](#) (7:08)

Description

[Mural](#) is a collaborative, online, cloud-based, virtual whiteboard that excels at supporting problem solving and creative thinking. With Mural students can visually document their thinking using a variety of modalities like text, images, videos, and drawing. The built-in templates empower creative, visual thinking. With Mural a team

of students can plan, brainstorm, evaluate, design, learn, and empathize to solve challenging problems. Mural is an excellent virtual container, or canvas, for making thinking and thinking processes visual. Because Mural is cloud-based, students can collaborate synchronously and asynchronously. Mural is web-based, device agnostic and mobile friendly with apps available on major mobile platforms. It should be noted that Mural was not designed for Educational use; however, it is a great tool for collaboration, thinking and project management.

Justification for Using this Tool

Mural's strength is its ability to make thinking and thinking processes visual in a collaborative online environment. Other collaborative tools like Google Docs, or Google Slides, tend to be very linear in nature. The tools themselves do not offer flexibility in design so content can be arranged in a creative way that reveals one's thinking. In Mural, users can make contributions in the form of pictures, drawings, videos, documents, and even sticky notes. These can be arranged on the canvas/whiteboard in a variety of ways. This open, non-linear organization makes it easier to show how ideas are connected to one another. Mural also comes with a variety of templates that can be used to introduce learners to what Clark and Mayer (2011) call expert thinking models. For example, when designing a new product, or a solution to a user problem, you can select an empathy map template that helps learners to build empathy with a user's needs by examining what the user says, thinks, feels, and does. The template models the process of empathy mapping and design thinking for

creating solutions. Thinking skills and routines are explicitly modeled.

Learning content designers can also create their own canvases and templates within Mural to create engaging open-ended tasks. For example, a teacher might challenge a group of students to create a social media campaign to target a societal problem they see in their community. This type of task allows students to choose a problem of interest and apply their learning from the class to tackle that challenge. This type of learning is what Bransford (2000) calls anchored learning where students work collaboratively, for a sustained period of time, to solve a problem of interest, much like problem-based learning. Tracking the creative thinking involved anchored learning can be challenging in a virtual environment; thus, Mural could be used to record the groups' thought processes as they move through the challenge.

Strategies for Use

Strategy 1 – Empathy Mapping for Design Thinking

[Empathy Mapping for Design Thinking](#) (3:20)

Strategy 2 – Project Management

[Project Management](#) (2:25)

Helpful Resources

Resource 1 – Interview: Using Mural for Distance Education
([Interview](#))

An interview with Michael Dain, an online instructor at Northwestern University that shows how he makes his lectures come alive using Mural. The transcript of the interview also includes screenshots of how he uses Mural to support his classes.

Resource 2 – Mural YouTube Channel ([Link](#))

The Mural YouTube channel has over a hundred videos ranging from webinars, workshops and short tutorials. The webinars provide background information on the concepts behind the numerous built in templates for supporting creative and visual thinking.

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Author

Submitted by:	Chad Mowbray
Email:	chad.mowbray@uoit.ca
Web Page:	https://elearning-essentials-2020.weebly.com
Bio:	A graduate student exploring and learning about 21st Century teaching and learning.

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NEARPOD

Overview

[Nearpod overview](#) (3:34)

Description

Nearpod is a web-based tool used to promote active learning and student engagement in the classroom. It is a web-based, interactive version of Microsoft PowerPoint or Google Slides. PowerPoint presentations or Google Slides easily upload into Nearpod, and the presentations interjected with many interactive activities. Nearpod

presentations can be teacher-led in the classroom or assigned as student-led homework.

Justification for Using this Tool

Active learning in the classroom is when students engage in the material through collaboration with one another and participation (Stanford University, n.d.). As compared to traditional learning, students are expected to retain information that is presented through teacher-led lectures; active learning allows the student to take on responsibility for their learning and their performance in the course (Stanford University, n.d.). Nearpod promotes active learning and student engagement in the classroom by creating interactive slide presentations. Features of Nearpod that increase interactivity among students include inserting content such as 3D Viewer, videos and live Twitter feeds or activities such as polls, quizzes and matching.

Nearpod also facilitates collaboration in the classroom among students. Collaboration among students develops critical thinking skills as it fosters discussion, sharing of ideas and evaluation of others' ideas (Gokhale, 1995). Nearpod offers several activities that allow for student interaction with one another. The open-ended questions activity feature can foster in-class discussion while students share different viewpoints and answers. The collaborate feature is a digital billboard-style where students can pin their responses to the board while they brainstorm and work together to form ideas.

Strategies for Use

Strategy 1 – Adding Engaging Elements

[How to Add Engaging Elements to Your Nearpod Presentation](#) (3:40)

This video outlines how to add fun and engaging activities and content to your Nearpod presentations to promote active learning in the classroom.

Strategy 2 – Collaboration

[How to Use Collaboration in Nearpod](#) (2:39)

This video outlines how to create a collaboration activity within your Nearpod presentation.

Helpful Resources

Resource 1 – [Top 10 Reasons to use Nearpod in the Classroom](#)

This is a helpful blogpost to get you started on ideas for using Nearpod in your classroom.

Resource 2 – Making Room for Interactivity

The authors of this paper introduce Nearpod into a second-year undergraduate program of bioscience students in order to gain feedback on the student engagement and interactivity.

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Author

Submitted by:	Andrea Dyack
Email:	andrea.dyack@ontariotechu.net
Bio:	Faculty at Southern Ontario Dental College and current graduate student in the Master of Education program at the University of Ontario Institute of Technology.

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OPEN EDX

Overview

 [Open EdX – An Open Source MOOC Platform](#) (6:50)

Description

Open EdX is a Massive Open Online Course (MOOC) provider created by the Massachusetts Institute of Technology and Harvard University. As a course provider, it allows multimedia content, learning exercises with potentially immediate grading, online discussion

forums, and other tools such as online laboratories to be integrated into the content.

Justification for Using this Tool

Extremely flexible in scale, availability, and course design

As a MOOC, Open EdX can be scaled to any number of participants, can provide open available content or be monetized, can be used in local networks or openly online, and the content and approach the course takes is up to the creators. Open EdX works across devices and platforms and can work with third-party programs.

High levels of support and widely available documentation

Open EdX is a platform widely used by university, corporations, NGOs, and entrepreneurs and has a corresponding amount of documentation and technical support. Documentation assists those who want to self-manage Open EdX or want more customization such as analytics or accessibility (Ruiperez-Valiente, J. A., Munoz-Merino, P. J., Gascon-Pinedo, J. A., & Kloos, C. D., 2016; Sánchez Gordón, S., & Luján-Mora, S., 2015). Full management by service partners is another option, allowing difficult high scale implementations to be available to people and organizations regardless of technical skill level (Aune N., 2015)

The Open EdX Studio allows for many powerful learning features

The Open EdX studio allows for a variety of components, including multimedia, interactive elements and tools. Users can be allowed to create their own units for

different approaches such as project-based learning. Collaboration can be done synchronously through chat components with video or asynchronously. Other learning tools can be integrated into Open EdX as components, such as Google Docs or internal wikis. I feel it is an incredibly powerful tool capable of making courses for the 25 learning principles presented by Halpern, Grasser, and Hakel (2007).

Strategies for Use

Strategy 1 – Self-Managed Strategy with Tutor One-Click Implementation

[Self-Managed Strategy with Tutor One-Click Implementation](#) (6:26)

Strategy 2 – Full-Managed Strategy with Appsembler

[Full-Managed Strategy with Appsembler](#) (4:48)

Helpful Resources

Resource 1 – <u>Open EdX website</u>

The Open EdX website provides options for starting and content available through the platform in a user-friendly and easy to digest format.

Resource 2 – <u>Open EdX Documentation</u>

This documentation covers the usability of Open EdX across multiple roles, whether as a course learner, instructor, developer, or educational researcher.

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Author

Submitted by:	Stephen Lizak
Email:	Stephen.lizak@ontariotechu.net
Web Page:	https://www.youtube.com/channel/UCvIMZf8XxLQBRpEG569MUpw
Bio:	Stephen has worked for over a decade educating students across a variety of ages in the math and sciences. He has worked at Conestoga College as a teaching assistant, as a tutor for the drop-in service in the math center, at CHELP Tutor School, and as an independent tutor. He is now a graduate student at Ontario Tech University. Stephen's projects include development of Augmented and Virtual Reality (AR/VR) manipulatives and AR/VR online course content.

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PADLET

Overview

[Padlet Design Tool](#) (3:30)

Description

[Padlet](#) is a free collaborative application that allows multiple users to create visual stories, bulletin boards or documents at the same time. You can add pictures, videos, links and more. It is available as a wed based tool as well as available for Android and iOS. It's a tool that can be used by beginners as well allowing non designers to produce professional quality content/graphics.

Justification for Using this Tool

Padlet is known for its online collaborative learning capabilities in real time allowing learners to engage in a shared task. Padlet is often used as a presentation tool as well as a mind-mapping tool assisting learners in brainstorming their ideas on a specific topic on an organized bulletin board.

Padlet exemplifies aspects of both the social and collaborative learning theories. Social and collaborative learning theories suggest that learners acquire more knowledge when they are learning from and with others thus allowing them to engage and capitalize from others' skills, resources and knowledge. (Al-Rahmi, Othman, Yusof, & Musa 2015). Through Padlet, students can collaborate, brainstorm, and learn from each other through an interactive and engaging platform.

Strategies for Use

Strategy 1 – Consolidating in STEM

[Padlet for Consolidating an STEM Activity](#) (1:11)

This video demonstrates how Padlet can be used to show a consolidation of learning on a specific topic or unit. Using Padlet encourages and fosters creativity, collaboration and critical thinking skills in the classroom.

Students can work on the same Padlet, adding links, pictures or ask questions about how their peers achieved specific results relating to an activity, project or assignment.

Strategy 2 – Ways to Use Padlet

Ways To Use Padlet (1:57)

Padlet can be used as a way for students to collaboratively or individually organize their brainstorming ideas. This application is appropriate for a large range of learners, children as well as adults. This video is a compilation of just a few ways that Padlet can be used in and out of the classroom.

Helpful Resources

Resource 1 – (Video Tutorial) Padlet YouTube Tutorial

This YouTube page was created by Dear Dises. It is a detailed step-by-step video describing various uses for Padlet and how it can be used in the classroom.

Resource 2 – (Blog) 5 Ideas For Using Padlet

This site is an informational page written by Dyan Branstetter discussing 5 ways to use Padlet in the classroom and how to integrate Padlet into your STEAM lessons.

Resource 3 – (Journal) Using Padlet for Whole-Class Engagement

This is a journal written by Beth Fuchs that speaks to how the use of Padlet supports differentiated instruction within the classroom and also includes some risks and benefits to using online collaborative real-time applications in the classroom.

Resource 4 – (Article) Padlet for Agriculture Teachers

This is an article written by Meghan Wood that describes ways that Padlet can be used in the classroom and speaks to how Padlet is used by agricultures teachers to creatively manage various aspects of their classroom and program.

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Author

Submitted By:	Alana Craigg
Email:	Alana.craigg@ontariotechu.net
Bio:	Primary/Junior Educator with a focus in Music, Physical Education STEAM and Global Competencies

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PEAR DECK

Overview

[Pear Deck Overview](#) (2:10)

Description

Pear Deck is an educational web-based tool that can be used from kindergarten to grade 12. This interactive tool brings life to a presentation through google slides and engages students through active, social and individual learning. This tool can be used by the educator to ask questions spark inquiry and quiz knowledge on just about anything.

Justification for Using this Tool

Pear Deck is an important tool as it falls under the constructivist learning theory. Through this theory, it plays on two significant umbrellas which are active learning and social constructivism. Constructivism's main idea is that students construct new knowledge from prior knowledge and experience (Mc Leod, 2019). While constructing new knowledge educators prompt discussion to engage students in their learning (active learning) (Mc Leod, 2019). Through discussion, students will engage with one another on the lesson provided by the educator building on collaborative skills, problem-solving skills and student motivation increases (social constructivism) (Mc Leod, 2019).

Pear Deck is used through google slides which are a fun and easy platform to use. Using Pear Deck as an add-on in slides makes this tool even easier to use as there are many different templates that can be used to engage learners. Each slide can be tailored to what the lesson is on and explains what the student expectations would be for that particular slide. Since the slides in Pear Deck are well designed with pictures it is difficult to add a lot of text to the slides limiting the educator to segmenting and chunking information on more slides than just one (Clark & Mayer, 2011). This is also a great multimedia tool where educators can use their own graphics and wording to help students grasp the concepts presented in the lesson (Clark & Mayer, 2011). With these design principles, it allows classroom engagement and reduces cognitive load.

Strategies for Use

Strategy 1 – For Educators

[Pear Deck for Educator Use](#) (3:04)

This is a quick overview of how educators can get the Pear Deck add-on and some of its many features.

Strategy 2 – Student Session in Pear Deck

[Student Session in Pear Deck](#) (2:15)

This is a quick video of a student session. This displays an example of what they would see if they were in a session set up by the educator.

Helpful Resources

Resource 1 –[Pear Deck in Google Slides](#)

- This video shows users how to use Pear Deck in Google Slides as an add-on.

Resource 2 – [Review Student Answers in Pear Deck](#)

- This video shows educators how to retrieve student answers from a lesson that is no longer live.

Resource 3 – [Help in Pear Deck](#)

- This website can help answer questions that one may have when it comes to using Pear Deck.

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Author

Submitted by:	Jamila Bentham
Email:	jamila.bentham@ontariotechu.net
Bio:	Jamila is an Early Childhood Educator in the full-day kindergarten program, and also a Master of Education student at Ontariotechu.net.

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PIKTOCHART

Overview

[Overview – Piktochart (3:40)](#)

Description

[Piktochart](#) is a cloud-based infographic application that allows users to use various templates to create infographics, presentations, reports for many purposes. Piktochart is unique from other applications because it creates content that is web-publisher ready and can stand alone as a part of multimedia content. It is intuitive, produces fast templates, and can personalize content and

designs as needed. All projects are stored in an online library which also affords real-time collaboration to streamline the workflow and reach desired objectives.

Justification for Using this Tool

One of the most crucial aspects of Piktochart is its ability to embed the multimedia principle. It allows users to showcase their learning by using pictures to support the text which is in accordance with the multimedia principle. People learn better from words and pictures than from words alone and benefit all types of learners (Fletcher & Tobias, 2005). The foundation of Piktochart is to use images, graphics, and designs to communicate meaningful information with intended audiences. Moreover, most of the templates provided by Piktochart contain the option to include both words and graphics and helps viewers engage in active learning (Clark & Mayer, 2011).

Piktochart supports the collaborative learning approach as it encourages learners to share information and collaborate with others to share resources and information. It is a learning environment that provides information and allows opinion sharing between team members to make rich connections when co– creating content (Kearney, Schuck, Burden, & Aubusson, 2012).

Strategies for Use

Strategy 1 – Creating Infographics

[Creating Infographics (2:04)](#)

Piktochart can be used to create infographics for elementary, middle, and high school students to showcase their understanding of activity or learning material.

Strategy 2 – Team Template

[Team Template: Staying Connected (3:32)](#)

Piktochart is a way for individuals to collaborate with each other to share ideas and perspectives. It also contains a blog and video tutorials for different templates.

Helpful Resources

Resource 1 – <u>How to use Piktochart to Make Effective Infographic Content</u>

This blog post provides a detailed breakdown of how to create an infographic with Piktochart using the various functions that are offered.

Resource 2 – <u>Piktochart Tutorials</u>

This web page contains video tutorials that are easy to follow when creating infographics, publishing infographics, designing templates, presentations depending on user preference.

Resource 3 – <u>Piktochart Applications and Learning Activities</u>

This blog post includes a brief overview of how the SAMR model of learning can be adapted by Piktochart in the classroom.

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Author

Submitted by:	Riya Patel
Email:	riya.patel1@ontariotechu.net
Twitter	@riya_08
Bio:	Riya Patel has been teaching in an elementary school setting for over three years and is passionate about bringing to light many of the digital tools present today to increase student engagement and achievement.

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PIXTON

Overview

[Introduction to Pixton](#) (3:14)

Description

[Pixton](#) is a web-based learning tool (WBLT) that allows students and educators to create comics. There are various templates/themes (content packs) that educators can choose from to help their students get a better understanding of the topic they are learning and to help them develop their writing skills. Pixton is student-friendly as it allows them to take charge of their learning

as they process and create their knowledge in ways that makes sense to them.

Justification for Using this Tool

Since the basic concept of a comic strip is to place events in sequential order, it must follow some of the guidelines outlined by the elaboration theory. Elaboration theory emphasizes the fact that steps must be placed in a sequential order that makes sense and that must be accomplished by strategically organizing them (Reigeluth, 1999). It also emphasizes that learners can make sense of their understanding of the content that students would be able to do as they are creating their comic strips (David, 2014).

When creating the individual panels of a comic strip, there is not a lot of information the creator can place in each panel. Therefore, it is imperative that the comic strip creator carefully divide the information they want to display in small sections that make sense as a whole. This is in-line with the segmenting principle which states that providing too much information to students at once may lead to cognitive overload and it is recommended to break down the information into smaller, easier to manage chunks or segments (Clark & Mayer, 2011).

Strategies for Use

Strategy 1 – Self-Portrait

[Creating a Self-Portrait](#) (0:57)

As an introduction to using Pixton, teachers can ask the students to create a comic-strip about themselves.

Strategy 2 – Real World Math

[Real World Math Examples](#) (0:44)

Pixton can be used for subjects such as math to help students understand concepts better by asking them to create a comic strip incorporating math in a real-life scenario.

Helpful Resources

Resource 1 – [Pixton EDU: Intro for Educators](#)

This YouTube video showcases briefly how educators and students can benefit from using Pixton in their classrooms by giving examples of the different components of the tool.

Resource 2 – <u>How to Effortlessly Use Pixton for Tomorrow's No-Prep Lesson Plan</u>

This blog post gives a step-by-step guideline on how a new Pixton user can introduce the tool in their classroom.

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Author

Submitted by:	Roohi Jawad
Email:	roohi.jawad@ontariotechu.net
Twitter:	@RooJ33
Bio:	I am a grade 5 homeroom teacher and I have been an Ontario certified teacher (OCT) since 2009. I am currently pursuing a Master's of Education degree at Ontario Tech University. I am always looking for new ways to engage and educate my students, and often it is through some form of technology.

47

POWTOON

Overview

[Powtoon Overview](#) (04:20)

Description

[Powtoon](#) allows users to access a vast array of templates and publish their creations directly to a wide range of platforms, including social media plugins like Facebook and YouTube. Powtoon users also have the option to convert presentations from PowerPoint into a video by uploading it into the Powtoon ecosystem.

Justification for Using this Tool

A great feature of Powtoon is the ability to collaborate with peers or colleges. Learning by modelling, feedback and reinforcement is a crucial feature in Bandura's Social Learning theory. By allowing people to collaborate in the creation of the videos and presentations, they have the opportunity to work through ideas, and share how they would execute their own vision. Also, collaboration allows for team members to provide constructive criticism, and offer additional input and solutions (Bandura, 1988).

The nature of Powtoon is to create and present engagingly. Having templates provided ensures that users are not overloading the audience with too much information. Powtoon is also very accessible with features such as audio and closed caption. Powtoon is more beneficial than a tool that lacks multimedia sources, or on that allows for an abundance of information on each slide. The templates allow users to focus on the content of the presentation rather than the esthetic of it. If the user is a beginner, templates decrease the mental load of the user by allowing them to only focus on the sequence of information as opposed to figuring out how the presentation should look. Cognitive overload, therefore, maybe decreased (De Jong, 2010).

Strategies for Use

Strategy 1 – Powtoon Strategies for Teachers

[Powtoon Strategies for Teachers](#) (02:12)

Powtoon allows teachers to create organized and engaging presentations at a controlled pace.

Strategy 2 – Powtoon Strategies for Students

[Powtoon Strategies for Students](#) (01:56)

Powtoon allows students to create content-focused presentations, to collaborate and to share ideas.

Helpful Resources

Resource 1 – [How to Create a Powtoon for Free](#)

- This video walks you through how to create a free Powtoon. It reviews the templates and shows you different options on how to create your own template.

Resource 2 – [How to Create a Cool Animated Presentation in Five](#)

Easy Steps

- Learn how to create an animated and engaging presentation in five steps. Instructions are broken down and easy to read.

Resource 3 – Tutorials, Tutorials, Tutorials

- This link will connect you to a multitude of video tutorials addressing the "how- to'" in becoming a master Powtoonist. You will find tutorials such as "How to create a script" and "before you start making your Powtoon". Think of this link as the "outline" of your presentation.

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Author

Submitted by:	Jessica Hunter
Email:	jessica.hunter1@uoit.ca
Bio:	Creating presentations since 2010. Actively pursuing my Master of Education, and passionate about creating a positive and intuitive space for learners.

48

QUIZLET

Overview

[Quizlet Overview](#) (3:36)

Description

Quizlet is an interactive game-based learning tool used to study information. This tool uses a variety of engaging studying techniques including interactive digital flashcards, matching, and multiple-choice activities. Quizlet is compatible and accessible using most devices and can be accessed on the website or using the apps. Teachers and Students can easily upload information to

create study sets by adding terms and definitions using a combination of words and pictures. Quizlet would then create a study section and play section for the set. This tool is easy to navigate and provides feedback to the learners as they engage in the different modes of learning.

Justification for Using this Tool

Quizlet employs gamification techniques. Students and teachers can use Quizlet to gamify content that would be otherwise boring or difficult to learn. According to Huang, & Soman, (2013) gamification is the addition of game elements to nongame settings. Many game-like-elements or game mechanics are used to make this tool appealing and interactive. For example, students are timed while playing the gravity and matching games, and while completing the write, spell, test or learn sections learners can see their progress including the number of correct and incorrect answers given. These game elements according to Huang & Soman (2013) help to motivate students to continue learning as well as social aspects such as the Quizlet live features where students work in randomly selected teams motivate students in a community setting and improves the social-elements.

Quizlet is in line with many of the principles of design for e-learning. The practice principle (Clark & Mayer, 2011a) forms the foundation on which Quizlet operates. This principle involves incorporating sufficient questions in the learning process that fosters interactions and improves student learning.

Quizlet also uses a good balance between words, audio,

and graphics that are also aligned with the coherence principle of design. Extraneous materials can be avoided such as advertisements when teachers upgrade their accounts. Students also have the option of reading the questions as well as using audio. Graphics such as pictures and graphs are presented where needed making this tool also in accordance with the Modality Principle (Clark and Mayer, 2011 and Oberfoell & Correia,2016) as multiple cognitive pathways are used.

Strategies for Use

Strategy 1 – Using Quizlet Live in the Classroom

[Using Quizlet Live in the Classroom](#) (1:44)

This is an interactive feature in Quizlet where students can collaborate to find the correct answers to questions and teachers can get feedback on students' knowledge.

Strategy 2 – Quizlet for Assessment

[Quizlet as an assessment Strategy (2:09)](#)

In Quizlet teachers can select a set and Quizlet would

generate random customized tests which would include (written, multiple-choice, matching or true or false questions that can be used as formative assessment or self-assessment for students.

Helpful Resources

Resource 1 – Pros & Cons of Using Quizlet in Your Classroom

This blog outlines the pros and cons of using Quizlet for both students and teachers

Resource 2 – Learn about Quizlet using Quizlet

This resource is a Quizlet study set created by one of its members that is publicly available and give a quick review of the various features of Quizlet

Resource 3 – Webinar: Organizing content and tracking progress with Quizlet

This Webinar gives step by step instructions on how to organize content and track students' progress on Quizlet.

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Author

Submitted by:	Melissa Hippolyte
Email:	Melissahippolyte2@gmail.com
Web Page:	www.younglearnersedutech.weebly.com
Bio:	I am currently a Master of Education student at Ontario tech University. I am also an Ontario Certified Teachers and Registered Early Childhood Educator

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SEESAW

Overview

 [Seesaw Overview](#) (2:34)

Description

[Seesaw](#) is a free web-based application that can be accessed using any mobile device or laptop. It has been used to engage students and provide accountability to parents as a digital learning portfolio. Seesaw empowers students to create, reflect, collaborate and share their learning with others, including peers, teachers, and parents. Using this app, students can use creative tools to

take photos, draw, record videos, or any other form of media to document their learning in a digital portfolio to share with others, as well as. receive feedback.

Justification for Using this Tool

One of the most important features of the Seesaw application is its ability to engage student learning by leveraging their digital technology skills. Seesaw aligns well with the Engagement Theory, which is a framework for technology-based teaching and learning. This theory is based on the underlying premise that when students are motivated and meaningfully engaged in the lesson task(s), they learn more effectively, tend to retain the information, and can transfer their learning to other contexts (Kearsley & Shneiderman, 1998).

Another justification for using the Seesaw app as a communication and collaboration tool, especially at the elementary school level, is its ease of use. Seesaw is very easy to learn for young students and without a strong technological background. It does not require students to have an established e-mail or Google account. Seesaw has been used as a simple way for teachers to teach their students to develop their own digital learning portfolios, and then share with others, such as their parents, (Toner, 2017).

Using Seesaw, students can create artifacts such as drawings, photos, videos, notes, etc. or they can add files from their devices. With the built-in audio and video recording features, they can easily provide reflections of their work to communicate and collaborate with others. Likewise, they can easily share their thoughts regarding

their learning as they post their artifact(s) to their Seesaw digital learning portfolio, (MacLean, 2016).

Strategies for Use

Strategy 1 – Strategies for Using Seesaw

[Strategies for Using Seesaw](#) (1:44)

This video provides strategies for students, teachers and parents to use Seesaw as a digital learning tool to provide classroom and home connections.

Strategy 2 – Additional Tips for Teachers

[Additional Tips for Teachers When Using Seesaw](#) (2:12)

This video provides additional tips for teachers when using Seesaw as a digital tool for student engagement and learning. The information has been summarized from the [Seesaw](#) website.

Helpful Resources

Resource 1 – [Creating Digital Learning Portfolios with Seesaw](#)

This blog provides a rationale for the benefits of using the Seesaw application to enable teachers to collaborate with students in creating digital learning portfolios using mobile devices or laptops. Students can add artifacts to the digital portfolio through Seesaw, and then, teachers can review student assignments and provide feedback. Likewise, students can provide their reflections on their work or the lesson to the teacher.

Resource 2 – [How to Use the Seesaw App in the Classroom](#)

While Seesaw has been used mainly as a student-driven digital portfolio to engage learners to create, reflect, collaborate and share information with others, it also facilitates effective home-school communication between teachers and parents. Other suggested uses for Seesaw in the classroom include, using the drawing tool to lessen the need for printing off worksheets; providing teaching and learning through the flipped classroom approach; applying the app as a reading and fluency tool; or providing opportunities for peer collaboration and feedback of student work.

Resource 3 – [Tips for Using Seesaw](#)

This website blog provides additional tips and strategies for using Seesaw as a digital tool for student engagement and learning. The information has been gathered from the [Seesaw](#) website and placed into one conveniently

accessible location for teachers to easily find the basic information for this web-based learning tool.

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Author

Submitted by:	Gary Lew
Email:	gary.lew@ontariotechu.net
Bio:	Gary Lew has been in the educational field for the past 25 years and is currently an elementary school principal within the Durham District School Board. He is completing the Master of Education program, with an interest in instructional design and leadership in educational technology.

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SOCRATIVE

Overview

[Socrative – quick review for teachers](#) (4:04)

Description

[Socrative](#) is a simple web-based, mobile friendly, assessment tool that allows teachers to create quiz-type content and engage students through quick formative assessment questions or team competitions. Students who may be unlikely to raise their hands in class have an opportunity to respond digitally and anonymously.

Teachers have options in what students can see such as percentages on the screen instead of individual responses.

Justification for Using this Tool

Socrative can provide a teacher instant feedback and engagement from students. From the constructivist theory of learning, students engage actively in the learning process and build understanding based on their prior knowledge. Reliable just-in-time assessments are the foundation of informed teaching and learning (Irving 2020). The multimedia principle is used well in the design of this platform. On-the-fly online assessments can provide the teacher with important info such as what percentage of students understood the previous lesson outcome. In a recent study, (Lim 2017), the majority of students using Socrative were in agreement that their focus in the class improved which greatly enhanced the learning experience.

Strategies for Use

Strategy 1 – Teacher Use Case #1

[Socrative – Teacher Use Case #1](#) (1:23)

Have you ever had students that don't want to put their hand up in class? Here is a fun and engaging way of getting them active through team based competition.

Strategy 2 – Teacher User Case #2

[Socrative – Teacher Use Case #2](#) (1:29)

Have you ever finished teaching a topic and your students look like they are lost? Try doing a socrative exit ticket (survey) and find out in real time what percentage of students understood the lesson.

Helpful Resources

Resource 1 – [How to Get Started With Socrative](#)

From the Socrative website a collection of 25 help articles to learn how to get started with your account and help students login.

Resource 2 – [What Activities Can You Launch](#)

From the Socrative website a collection of 11 help articles about the types of activities you can launch in Socrative.

Resource 3 – [Socrative for Teachers: A Brief Introduction](#)

From YouTube, Aimee Shattock takes you through a basic overview of Socrative and how to use it for formative assessment with students.

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Author

Submitted by:	Jory Basso
Email:	jory@hybriddrj.com
Web Page:	www.hybriddrj.com
Bio:	Dr. Jory Basso is an Associate Professor of Biology and has been educating students in health sciences since 2013.

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THINGLINK

Overview

ThingLink – <u>An Overview</u> (3:11)

Description

<u>ThingLink</u> is a Finnish-American developer and pioneer of interactive image and video technology that lets users create and share dynamic rich media images, videos, and virtual tours containing various media or 3rd party web content. The purpose of ThingLink is to allow photos and videos to be made into interactive navigation spaces,

mainly for the purpose of education and online publishing.

Justification for Using this Tool

There are at least 3 good reasons why ThingLink should be used in educational contexts. Firstly, from an Elaboration Theory perspective (introduced by Charles Reigeluth), instruction should be delivered by starting with simple foundational concepts and then followed by more specific and complex ideas. Information should also be chunked and sequenced to allow learners to connect the content. ThingLink creates conditions for this to happen by presenting an overall view of the information and providing learners with the choice to zoom in on more specific information related to the topic, image, etc. to acquire a deeper understanding of the subject.

Secondly, ThingLink is a good example of the multimedia principle in action. The multimedia principle states that text and images are superior to just text or graphics in isolation. Research consistently demonstrates that courses with words and graphics are better received and people learn more deeply than just words alone. By tagging images with links to further resources (webpages, pop-up boxes, and maps for e.g.) learners are able to tap into a rich variety of information.

Finally, ThingLink provides learners with Learner Control. As mentioned by Clark & Mayer (2008) "Given the high levels of control inherent on the Internet, it is likely that learners will expect the same kind of freedom in e-learning courses." In the process of linking images

to other resources, students are making decisions and exercising judgment. This provides them with a sense of authorship and they will subsequently be more engaged in the learning process.

Strategies for Use

Strategy 1 – Projects

[ThingLink for Projects](#) (2:15)

ThingLink can be used by middle and high school students collaboratively when working on projects.

Strategy 2 – Adult Education

[ThingLink for Adult Education](#) (2:59)

ThingLink can be used in online adult training modules to explore work spaces.

Helpful Resources

Resource 1 – [ThingLink Education Blog](#)

This blog encourages both educators and students to sign

up and take advantage of the different insights from contributors as well as to share information and participate in webinars etc.

Resource 2 – [5+ Ways to Use ThingLink for Teaching and Learning](#)

An online article providing readers with a list of useful ways to integrate ThingLink into your teaching practice.

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Author

Submitted by:	Tobie Pilloy
Email:	tobie.pilloy@ontariotechu.net
Twitter:	@PilloyTobie
Bio:	Professional working in the adult educational industry for over a decade. Specialising in online education and professional development.

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TRELLO

Overview

[An Overview of Trello](#) (1:49)

Description

[Trello](#) is a simple-to-use web and mobile task tracking application that allows users to easily collaborate on projects. The free version provides robust functionality, with additional features available to paying users. Trello also offers educational institutions a 30% pricing discount on paid subscriptions.

Leveraging the [Kanban board](#) concept of the Agile Project Management methodology, Trello allows users to create separate task lists or "boards", which include three default lists inside – To Do, Doing, and Done. Users can add tasks within these default lists; add custom lists; assign task due dates, categories, and responsibilities; and track task progress.

Justification for Using this Tool

Trello provides an elegant online collaboration interface for project-based learning. Users can break a large assignment into individual tasks, assign responsibilities and due dates, and manage progress in real-time. Trello's visual Kanban boards allow users to view the overall project status at glance and also attach files or have discussions concerning individual tasks. This visual overview also promotes accountability within group projects.

Strategies for Use

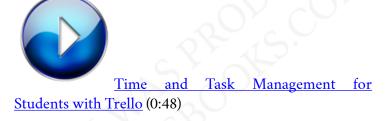### Strategy 1 – Trello for Group Projects

[Trello for Group Projects](#) (1:12)

Trello provides an excellent framework for managing project-based learning initiatives, especially for group projects. Students can create boards and customize task

lists to suit their own needs or use one of Trello's board templates to get them started.

Strategy 2 – Time and Task Management for Students with Trello

[Time and Task Management for Students with Trello](#) (0:48)

Trello is a fantastic time management tool for anyone, including students. Unlike calendar applications, which don't monitor progress and typically can only display 1 month of data at a time, a Trello board works beautifully as a semester planning for any student.

Helpful Resources

Resource 1 – What is Kanban?

This article explains the origins of Kanban boards and users can implement them for effective project management. While the article situates Kanban in a software development context, other types of projects can also effectively use these boards.

Resource 2 – Trello Essential Training

This tutorial from LinkedIn Learning (formerly Lynda.com) outlines the basic use of Trello boards including setup, task management, user administration,

progress tracking, and integration with third-party applications such as cloud storage services and calendars.

Resource 3 – <u>Trello For Students</u>

This blog post explains a student perspective on how one could use Trello both for specific projects as well as general task management at school.

Resource 4 – <u>Trello – Online Tools for Teaching & Learning</u>

This article outlines several ways teachers can integrate Trello into their learning environments. It suggests usages at each level from elementary school through higher education.

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Author

Submitted by:	Richard Freeman
Email:	richard.freeman@ontariotechu.net
Web Page:	https://twitter.com/sofun22843747
Bio:	Rich Freeman is a Professor of Computer Studies at Georgian College in Barrie, Ontario and a Master of Education candidate at Ontario Tech University.

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WEB KNOWLEDGE FORUM (WEB KF)

Overview

[Knowledge Forum](#) (2:35)

Description

Web KF is an educational software that had its nascent

stages at York University in Toronto. It was later adopted by the Ontario Institute for Studies in Education at University of Toronto, (OISE)and developed to support knowledge building pedagogies. This software encourages users to work jointly, or on their own to contribute information to a communal database, creating a resource for an entire community. Ideas can be revisited, critiqued, and reworked in a variety of ways. As students build on each other's work, their efforts result in an increasingly elaborated network of ideas.

Justification for Using this Tool

Web KF is ideal for designing a WBLT in that it facilitates group work, knowledge sharing, problem-solving, on-line collaboration and distance education. Some learning theories and design principles that are supported by Web KF are outlined below.

In terms of design principles, Web KF reduces cognitive load through the segmenting principle (Halpern et al. 2007). Complex information is broken down into smaller chunks that the learner can navigate at their own pace. In addition, the informal nature of Web KF aligns with the personalization principle (Clark et. al, 2011). An atmosphere of trust is created as participants build knowledge that is based on mutual interests and experience. There is a teacher presence, however the teacher acts as more of a participant.

Web KF is aligned with the following learning theories: Problem-based Learning (PBL) (Barrows, 1983), Collaborative Learning Theory, and Social Development Theory (Vygotsky, 1978). It is aligned with PBL in the

sense that the instructor is able to post an ambiguous trigger, and the rest of the community is invited to opine and share their thoughts and experience with respect to the trigger. In terms of Collaborative Learning, all of the work in Web KF is based on sharing. Students participate in on-line collaboration,ask questions, solve problems, and provide feedback. Social Development theory plays a role in learning in that more knowledgeable participants provide scaffolding to other learners, which helps them reach their Zone of Proximal Development (ZPD).

Strategies for Use

Strategy 1 – Engagement and Participation

[Engagement and Participation](#) (2:17)

Analytics such as graphs and matrices are embedded in Web KF which allow the user and the instructor to get a clear visual snapshot of the level of participation in the group over time.

Strategy 2 – Thought Development and Leadership

[Thought Development and Leadership](#) (2:16)

The ability to analyze and reflect on the communication dynamics of the group has the potential to shape both leaders and influencers within the network.

Useful Resources

Resource 1- [How to Use Web KF](#)

This is a short and easy to understand video on how to use Web KF.

Resource 2 – [Using Scaffolds in Web KF](#)

Here is a useful link on ideas of how to use Knowledge Forum scaffolds.

Resource 3 – [Student Views of Web KF](#)

This link discusses student views of collaboration and on-line participation in Knowledge Forum.

Research

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Author

Submitted by:	Deborah McDavid-Pesikan
Email:	Deborah.mcdavidpesikan@ontariotechu.net
Bio:	Deborah is an English as a Second Language instructor and M.Ed. candidate with an interest in technology to enhance the teaching and learning experience.

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WEEBLY

Overview

[Weebly Overview](#) (3:37)

Description

[Weebly](#) is a free web hosting service. It is recognized for its easy-to-use "drag and drop" website design. Although Weebly offers advanced tools through its paid plans, users are able to create functional and interactive websites with the free version without technical expertise. Weebly offers hundreds of professional-looking website templates that can be easily customized

by adding, editing, and arranging various multimedia. Teachers have the option of registering for Weebly for Education, an extension of Weebly, that is tailored specifically for classroom use. However, teachers may prefer to use Weebly, as Weebly for Education does not yet offer the same range of tools, such as third-party application integration.

Justification for Using this Tool

Weebly as a web-based learning tool has various opportunities to maximize student learning. First, Weebly presents opportunities to integrate multimedia on webpages. Multimedia presentation is important for e-learning as it engages students in active and meaningful learning (Clark and Mayer, 2011). Weebly users can present a diverse array of multimedia on their websites, including text and graphics, including video, photo, and illustration.

Weebly also possesses the ability to achieve the coherence principle, which Mayer and Fiorella (2014) define as removing extraneous content from multimedia to reduce cognitive overload and improve student learning. Weebly accomplishes this by eliminating webpage advertisements and limiting the use of distracting embellishments – such as unnecessary transitions and animations – by offering fixed editing functions that promote webpage minimalism.

Further, Weebly's App Centre offers various third-party applications that creators can integrate into their website to promote student interactivity that also facilitates meaningful learning. For example, creators can

incorporate quizzes, surveys, social media links, and collaborative discussion boards to engage students with the website.

Weebly also offers collaboration opportunities, which Clark and Mayer (2011) propose have great potential to improve individual learning. For instance, students may work together on a Weebly domain to engage in website development using various design principles. Weebly for Education also promotes student collaboration by allowing students to insert comments and feedback to other users' webpages.

Although Weebly promotes student learning through different design features, a criticism of this web-based learning tool is that it does not readily respect the modality principle, which states that learning is improved through the verbal narration of content (Moreno & Mayer, 1999). Weebly offers audio integration options, however; this is only available through the paid plans.

Strategies for Use

Strategy 1 – For Teachers

[Weebly For Teachers](#) (3:08)

This video provides strategies to help teachers integrate Weebly into their classrooms, such as through web-based

lessons, classroom blogs, and collaborative student projects.

Strategy 2 – For Students

 Weebly For Students (1:32)

This video provides strategies for students to use Weebly as an educational resource, such as for projects or e-portfolios.

Helpful Resources

Resource 1 – Weebly Review

This article presents an informative review of integrating Weebly into the classroom. It explains what Weebly offers, its pros and cons, multimedia tutorials, and suggestions on how teachers can use it in the classroom.

Resource 2 – How to use Weebly (for teachers)

This is a video tutorial for teachers on how to use Weebly. It explains how teachers can use this design tool to create a classroom blog, however; the same steps and principles can be applied to create a class website or lesson.

Resource 3 – How to use Weebly (for students)

This is a video tutorial for students on how to use

Weebly. It explains how to access your account, add pages, text, and images.

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Author

Submitted by:	Amareen Brar
Email:	amareen.brar@ontariotechu.net
Twitter:	@AmareenBrar
Bio:	I have a background in Education administration and Marketing. I am a Master of Arts (Education) student pursing my thesis and assisting with research regarding multiliteracy and curriculum development.

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YOUTUBE

Overview

 [YouTube in the Classroom (1:42)](#)

Description

YouTube is a WBLT that allows educators and students to create educational videos. There are various uses of these videos, it can either be used to upload and share your own content or you can also access videos from others who are experts in the topic.

Justification for Using this Tool

This tool allows students to have learner control. Learner control means that students can control the rate in which they work through the video and information being presented. With YouTube videos, you can pause and rewind at any point during viewing. The multimedia principle states that students understand the content presented in video or images more than content only in text.

Strategies for Use

Strategy 1 – For Teachers

[How to use YouTube in the Classroom 1 (2:00)](#)

Why teachers should use YouTube in the classroom. Teachers can use youtube to create and share content with their students. If they use youtube it allows students to pause and rewatch lectures at any time.

Strategy 2 – For Students

How to use Youtube in the Classroom 2 (1:10)

Students can turn to YouTube to help grasp a concept because videos are a great method to learn concepts. It can help students build on prior knowledge from their lectures. As well YouTube can be used when students are creating assignments to creatively organize their work to present to their classmates and teacher.

Helpful Resources

Resource 1 – 21st Century Classroom: YouTube

- How YouTube in a classroom transforms the classroom into a 21st-century learning environment.

Resource 2 – How to upload a video to YouTube

- How to upload your video to YouTube and share it with your students.

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Author

Submitted by:	Delaney Jones
Email:	delaney.jones@ontariotechu.net
Bio:	Delaney Jones works with children who have been diagnosed with learning disabilities or ADHD.

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ZOOM

Overview

[Zoom Overview](#) (2:04)

Description

Despite the availability of enterprise-level "telepresence" systems for decades now, they were initially both cost-inefficient and exceedingly inconvenient from a user perspective (LaFollette, 2018, p. 76). [Zoom](#) was designed "from the ground up" in response to increasing demands for platforms that are capable with respect to performance, stability, and features (LaFollette, 2018,

p.76). Zoom is an enterprise video conferencing tool with several real-time messaging and content sharing capabilities. Zoom facilitates the processes of starting, joining, and collaborating with others across various devices through its comprehensive communications platform. Zoom's integrated messaging features effectively streamline workspace collaboration, leading to perceptible increases in performance, trust, and engagement.

Justification for Using this Tool

A well-designed web-based learning tool (WBLT) often incorporates elements from one or more web-based technological tools as part of the effort to support learning in an environment focused on interaction and knowledge acquisition. The process of knowledge retention and eventual transference is both expedited and reinforced through the development of a social community of learners, a notion that is supported by the theoretical framework of constructivism. This model describes the learning process as "an active development of personal meaning through the interaction of current conceptions and ongoing experiences," in which learners are active participants collaborating in the construction of knowledge (Yakimovicz & Murphy, 1995, p. 203). When learning takes place within a community, even the continual introduction of newcomers enhances the learning process (Lim, 2010). The newcomers not only have access to the knowledge that veterans possess, but their inexperience also encourages reflection (Lim, 2010), which is particularly valuable in virtual learning communities (Clark & Mayer, 2011).

Furthermore, introducing elements characteristic of problem solving can promote further collaboration among learners in such communities (Jahng, 2012). Problem-based learning (PBL) comprises a type of collaborative instruction, whereby groups are tasked with defining and researching issues based on given case problems (Clark & Mayer, 2011). Zoom's platform is inclusive of these elements, and as such, its integration within a WBLT is significantly beneficial. Zoom's convenient web interface and apps are not only convenient to use, but are ideal for videoconferencing, demos, webinars, online courses, and even training (LaFollette, 2018). The dynamism afforded through Zoom's high-quality audio, video, screen-sharing, and recording functionalities are also conducive to group collaboration (LaFollette, 2018). In particular, this platform allows users to share text, image, or audio files to group members instantaneously, who can then annotate shared files (LaFollete, 2018). Users are able to clearly indicate when they have a question or comment, and taking turns is a relatively easy process (Moore, 2018).

Strategies for Use

Strategy 1 – Using Zoom as a Tool for Collaboration

[Using Zoom as a Tool for Collaboration](#)
(1:52)

Learners can use Zoom as a way to remotely collaborate with colleagues and/or peers in real-time. They can utilize the platform's capabilities, including the sharing of text, image, or audio files, in the process of gathering input from one another.

Strategy 2 – Using Zoom for Problem-Based Learning

Using Zoom for Problem-Based Learning (1:40)

A contextualized, real-world problem or issue can be presented to learners, who are then able to capitalize on Zoom's various features conducive to promoting collaboration as they search for a solution.

Helpful Resources

Resource 1 – Zoom How-To Videos

Zoom has created a Resource Center with links to quick how-to videos on using this tool. These videos are structured on a per topic basis, so users are easily able to find the video relating to the feature and/or functionality they wish to learn more about.

Resource 2 – Zoom For Education

This webpage outlines how Zoom's video communications capabilities are beneficial in an

educational environment, particularly with respect to enriching teaching and learning, maximizing school resources, improving learner outcomes.

Resource 3 – Using Video Conferencing to Improve Remote Collaboration

This article examines the extent to which video conferencing works to improve collaboration, and also identifies remaining impediments for such tools. The conditions and factors necessary for remote collaboration to succeed are also highlighted.

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Author

Submitted by:	Zahra Harbi
Email:	zahra.harbi@ontariotechu.net
Twitter:	https://twitter.com/ZahraHarbi1
Bio:	Zahra Harbi is a current Masters student at the Faculty of Education, Ontario Tech University. She received her Honours Bachelor of Science at the University of Toronto. Her research interests include translanguaging, technology-assisted language acquisition, eLearning and in particular mobile-assisted language learning.