LEARNING DESIGN TOOLKIT (M.ED. IN IDET)

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Learning Design Toolkit

Learning Theories

Behaviorism

Cognitivism

What is behavioral theory?

Behavioral theory focuses on the way humans learn through interaction with their environment. Behaviorism solidifies the fact that behaviors are learned through conditioning. Skinner mentioned that conditioning is a procedure that utilizes punishment and reinforcement. Using the behavioral model, it provides an organized approach to teaching, allowing educators to set clear expectations and provides routines that are consistent.

Cherry believes that teachers can employ behaviorism in the classroom to amplify students' learning and behavior. Here are two examples:

Positive Reinforcement

This is where you implement a reward or incentive system in place to encourage positive behaviors. Some of these include tokens, stickers, verbal recognition or tangible gifts. To make a positive effect, teachers can motivate students to increase the possibility of desired behaviors. For example, I have rewarded students for completing class assignments or for raising his/her hand.

Negative Reinforcement

This is the removal of unpleasant stimulus after achieving the desired behaviour with the possibility of that behaviour being repeated. For example, I have lessened the amount homework for students when they have completed class assignment.

Reference(s)

Skinner, B. F. *About Behaviorism.* 1974. Penguin, 1993

Cherry, k. (2022, November 07). What is behaviorism? https://www.verywellmind.com/behavioral-psychology-4157183

Constructivism

Constructivism involves learners who will actively engage in constructing their own understanding and understanding of the world participation and deliberation. Jean Piaget and Lev Vygotsky, constructivism highlights the role of the learner to construct their own understanding than receiving information passively. Piaget's hypothesis of students developing cognitively emphasizes the importance of developmental stages and discovery, whereas Vygotsky's social constructivism highlights the importance of interacting socially and cultural learning. The constructivist approach usually involves solving problems, engaging actively, collaborating and authentic learning to influence thinking in depth.

Example

Building a Community Garden in a School

In my colleague's middle school science class, students were asked to design and build a community garden. However, instead of reading about plants and ecosystem, the students engage themselves actively in the process of learning by:

1. **They researched how different types of plants develop in their climate locally.**
2. **They collaborate in small groups to plan what the layout should be.**
3. **They applied mathematical skills evaluate the area of the garden and financial plan for materials.**
4. **They experimented with various types of soil and observed the growth of the plant.**
5. **They reflected on the grows and glows of the project.**

In carrying out this procedure, the students constructed their own perception while they interacted through hands-on participation and interacting socially. The students were elated to see how well they were able together information without the use of a textbook.

Reference(s)

Schunk, D. H. (2020). *Learning theories: An educational perspective* (8th ed.). Pearson.

Western Governors University. (2020, May 29). *What is constructivism?* https://www.wgu.edu/blog/what-constructivism2005.html

Connectivism

This a theory that emerged by Stephen Dowes and George Siemens that convey ways in which perception and learning happen in the information age. This theory differs from traditional theories like constructivist, behaviourist and cognitivist theory. Connectivism highlights the importance of technology and acquisition in social learning. Siemens (2005) states that acquiring knowledge happens via the organization and navigation of where (institutions, individuals and instruction) are interrelated. This theory emphasizes that acquiring knowledge is an ongoing procedure which incorporates making decision, as information changes constantly. It is very imperative that learners recognize and have a discernment for the relevancy of information from a wide range of sources.

One important factor is that knowledge have taken up residence across networks and not only in individuals. Siemens (2005) also highlights that the capacity to acquire more is way more that what is know currently, speculating the dynamic of learning in modern environments. Downes (2007) expounds on this by stating the importance of learners participating in compiling knowledge, sharing and creating withing a community that requires networking.

Example

A group of elementary students were given a collaborative project where students learned about different cultures by connecting with classrooms from other countries using digital tools like video conferencing like zoom and Epals.

Engaging in this project, students were asked to research customs and traditions of specific culture by incorporating articles from online, watching videos, and interacting with peers from different countries. The students shared what they have learned through creativity. They created a presentation using multimedia, short videos or posters, which were uploaded on digital platform for feedback from peers.

An example of connectivism:

1. **Learning through networks** – this connection took place with teachers, peers and usage of digital resources from different locations.
2. **Knowledge as distributed** – acquisition of information should come from variety of sources, including connection with students from different countries and online content.
3. **Technology as an enabler** – Tools used electronically should be used to assist acquiring knowledge beyond the traditional classroom setting.
4. **Self-directed and participatory learning** – Students should actively engage in gathering, sharing information and giving contribution to the collaborative understanding of the topic.

In doing this project, it helps students to implement important skills of the 21st-century, such as collaborating, digital literacy and cultural diversity in communication, while incorporating the principles of connectivism.

Reference(s)

Downes, S. (2007). *An introduction to connective knowledge*. Retrieved from http://www.downes.ca/post/33034

Siemens, G. (2005). *Connectivism: A learning theory for the digital age*. International Journal of Instructional Technology and Distance Learning, 2(1). Retrieved from http://www.itdl.org/

Pedagogy vs. Andragogy

TPACK | Technological Pedagogical Content Knowledge

TPACK is a framework for integrating technology into teaching. It emphasizes the intersection of three key areas:

1. **Content Knowledge (CK)**: Understanding
2. the subject matter.
3. **Pedagogical Knowledge (PK)**: Knowing how to teach effectively, including strategies and classroom management.
4. **Technological Knowledge (TK)**: Familiarity with digital tools and technologies.

When these three areas intersect, they form **Technological Pedagogical Content Knowledge**, which represents the ability to integrate technology in ways that are both pedagogically sound and content appropriate.

TPACK helps teachers make informed decisions about how to use technology to enhance teaching and learning. For example, a science teacher might use a simulation (Technology) to teach physics concepts (Content) using inquiry-based methods (Pedagogy

Example

In this **elementary math lesson** on **fractions** for 4th graders, the teacher uses the **TPACK** framework to effectively integrate technology, pedagogy, and content:

1. **Content Knowledge (CK)**: The teacher understands fractions and how to teach them, including visualizing and comparing fractions.
2. **Pedagogical Knowledge (PK)**: The teacher uses hands-on activities, group work, and guided practice to engage students.
3. **Technological Knowledge (TK)**: The teacher incorporates **interactive whiteboards**, **fraction apps**, and **digital games** to help students visualize and practice fractions.

Lesson flow:

- **Introduction**: The teacher demonstrates fractions using a digital whiteboard and an app, helping students visualize the concept.
- **Guided Practice**: Students use virtual manipulatives to match fractions with images.
- **Collaborative Learning**: In small groups, students play a fraction game on tablets for practice.
- **Assessment**: The teacher uses an **online quiz** to check understanding and provide feedback.

By combining these three areas, the teacher enhances student engagement and understanding of fractions.

Reference(s)

- Koehler, M. J., & Mishra, P. (2009). *What is technological pedagogical content knowledge? Contemporary Issues in Technology and Teacher Education*, 9(1), 60–70.
- Koehler, M. J., & Mishra, P. (2017). *TPACK: The seven framework components*. In S. L. Wang et al. (Eds.), *Handbook of research on educational communications and technology* (pp. 13–26).
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6), 1017–1054.TAWOK |

Technology Andragogy Work Content Knowledge

Technology Andragogy Work Content Knowledge is a holistic approach to adult education that combines technological skills, adult learning principles, and specific work knowledge. It emphasizes the integration of learning technologies that are relevant to the adult learner's professional context, and how to best tailor learning experiences to meet adult learners' needs and real-world application.

Example

In the workplace training program, employees are introduced to new project management software using **Technology Andragogy Work Content Knowledge** principles.

- **Technology Knowledge**: Employees are taught how to use the software, with hands-on demonstrations.
- **Andragogy**: The training is self-paced and uses real-life work examples, allowing employees to apply the software to their job-specific tasks.
- **Work Content Knowledge**: The software is tailored to each department, such as finance or marketing, ensuring it's relevant to their daily responsibilities.

This approach helps employees learn how to use the software effectively while connecting the training directly to their work, enhancing engagement and retention.

Reference(s)

Knowles, M. S. (1984). *The adult learner: A neglected species* (3rd ed.). Gulf Publishing.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Learning Process Models

Kolb's Experiential Learning Theory

Kolb's Experiential Learning Theory emphasizes the process of learning through experience. According to David Kolb, learning is a cyclical process where individuals go through four stages to fully grasp new knowledge:

1. **Concrete Experience**: Direct involvement in an activity or experience.
2. **Reflective Observation**: Reflecting on the experience and considering different perspectives.
3. **Abstract Conceptualization**: Developing theories or concepts based on the reflection.
4. **Active Experimentation**: Applying the new ideas to see how they work in practice, leading to new experiences.

Kolb's model suggests that effective learning occurs when individuals actively cycle through all four stages. It is often used in education, training, and personal development.

Example

In this scenario, Kolb's model is applied as students go through the learning cycle:

- **Concrete Experience**: Observing water evaporate on the playground.
- **Reflective Observation**: Discussing what happened to the water and thinking about where it went.
- **Abstract Conceptualization**: Learning the scientific concepts of the water cycle.
- **Active Experimentation**: Creating their own water cycle models and testing their understanding.

This approach helps students connect real-life experiences with theoretical knowledge, enhancing their understanding through hands-on learning.

You said:

Reference(s)

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.

Gagne's Nine Events of Instruction

Gagne's Nine Events of Instruction is a systematic framework for designing effective teaching and learning experiences. Developed by Robert M. Gagne, these nine steps guide instructors in facilitating the learning process. The events are as follows:

1. **Gain Attention**: Capture learners' attention.
2. **Inform Learners of Objectives**: Clarify what learners will achieve.
3. **Stimulate Recall of Prior Learning**: Activate prior knowledge.
4. **Present the Content**: Introduce new information logically.
5. **Provide Learning Guidance**: Offer support and strategies for understanding.
6. **Elicit Performance (Practice)**: Allow learners to practice applying the content.
7. **Provide Feedback**: Give feedback on learners' performance.
8. **Assess Performance**: Evaluate learners' mastery of the content.
9. **Enhance Retention and Transfer**: Help learners apply knowledge in real life and retain it long term.

These steps are designed to ensure that learning is engaging, structured, and effective.

Example

In an elementary school lesson on **multiplication**, a teacher uses **Gagne's Nine Events of Instruction** to guide students through the process:

1. **Gain Attention**: The teacher shows an engaging video about using multiplication in real life.
2. **Inform Learners of Objectives**: The teacher explains that students will learn to multiply numbers and understand its real-world uses.
3. **Stimulate Recall of Prior Learning**: Students recall their knowledge of addition and grouping objects.
4. **Present the Content**: The teacher introduces multiplication as repeated addition, demonstrating with visual aids.
5. **Provide Learning Guidance**: The teacher uses charts and manipulatives to guide students through practice problems.
6. **Elicit Performance (Practice)**: Students practice multiplication in pairs using blocks to solve problems.
7. **Provide Feedback**: The teacher provides immediate feedback while students work, correcting mistakes.
8. **Assess Performance**: Students take a quiz to assess their understanding of multiplication.
9. **Enhance Retention and Transfer**: Homework assignments encourage students to apply multiplication in real-life situations.

This structured approach ensures that students are engaged, practice the skill, and can apply it outside the classroom.

Reference(s)

Gagne, R. M. (1965). *The conditions of learning*. Holt, Rinehart & Winston.

Gagne, R. M. (1985). *The conditions of learning* (4th ed.). Holt, Rinehart & Winston.

Continuous Improvement

PDSA Cycle | Plan Do Study Act Cycle

The **PDSA Cycle** (Plan-Do-Study-Act) is a continuous improvement model used to implement and refine changes. It consists of four phases:

1. **Plan**: highlight a problem and implement a plan for improvement.
2. **Do**: implementing the plan on a very small scale and accumulate data.
3. **Study**: examine the data to test if the change is successful.
4. **Act**: When you get the results, determine whether to adopt, fix or leave the change, then iterate the process.

The cycle helps organizations make gradual improvements by learning from each iteration. It's commonly used in healthcare, business, and education for better outcomes.

Example

In an elementary school, a third-grade teacher uses the **PDSA Cycle** to improve reading comprehension.

Plan: The teacher identifies the challenge the students have with comprehension and had a plan to implement the “think-aloud” strategy, where the teacher displays reading and thinking aloud for a month.

Do: Introducing the strategy in lessons, facilitating students through the process and paying attention to their engagement.

Study: The teacher reviews the test scores and participation after couple weeks, finding out some student’s weaknesses and need more support.

Act: The teacher made changes by adding small group instructions and visual aids, continuing to refine the strategy and monitor the progress.

This process helps the teacher improve reading comprehension over time by making data-driven adjustments.

Reference(s)

Deming, W. E. (1986). *Out of the crisis*. MIT Press.
Hansen, E. T. (2016). *Using the PDSA cycle for quality improvement*. *Journal of Healthcare Management*, 61(4), 284-292.
Tannery, N. H. (2018). *The PDSA cycle: A tool for continuous improvement*. *American Journal of Nursing*, 118(3), 64-69.
Taylor, R. M., Chisholm, C. D., & O'Connor, J. M. (2014). *Implementing the PDSA cycle in healthcare settings: A case study*. *Journal of Nursing Administration*, 44(12), 663-667.

Design Models

Instructional Design (ID) vs. Learning Experience Design (LXD)

ID	LXD
Content-centric	Learner-centric
Focuses on knowing	Focuses on doing
Systematic approach	Design thinking approach

Learning Experience Design (LXD) and Instructional Design (ID) both focus on creating effective learning experiences, but they differ in their approaches and emphasis

Both Instructional Design and Learning Experience Design place emphasis on providing learning experiences that are effective in the classroom. However, the approach taken by both differs.

Instructional Design (ID)

This approach entails:

Focus: This is where constructing and implementing solutions to learning to meet a particular goal.
Key Principles: This is derived from informational hypothesis like Bloom's Taxonomy, ADDIE and Gangne's Nine Events of Instruction.
Approach: Places highlights on outcomes that are measurable, assessments, goals and objectives.
Goal: Making certain that learners effectively obtain skills and knowledge.
Perspective: Often has an interrupted flo and very content focused

Learning Experience Design (LXD)

focus: This focuses on active engagement in learning experiences that are meaningful and catering to holistic development that highlights the needs of the learners.
Key principles: Stem from neurobiology, creative thinking and the experiences of user.
Approach: Has to do with leaners actively engaging, placing importance on empathy and telling stories.
Goal: Fostering delightful and meaningful learning journey designed to cater to diversity
Perspective: This is more cantered around the learners, non-systematic and immersive.
Common Options: Learning experiences are gamified, experiential adaptive, and microlearning

Example

A third-grade teacher wants to teacher wants her students to emotionally make a connection and have clear understanding of how the water cycle impacts the environment and their lives.

Approach - Interactive and experimental learning – Start lesson with an engaging story that incorporates the use of technology so they can feel like active participants.

Personalized exploration – Allow students to explore using an augmented reality app to interactive explore the cycle of water.

Collaboration and Reflection - In small groups students will be given the opportunity to explore their creative side by doing a project creating their own models or videos of the water cycle.

Promote discussion regarding water cycle and conservation relationship.

Goal – To ensure that students actively participate in engaging, meaningful involvements that encourage a depth in thinking critically.

The benefits of LXD

It highlights the creativity, engagement and the how the students personally connect to the material. It also stimulates, working together as a team, exploration and application of the real-world.

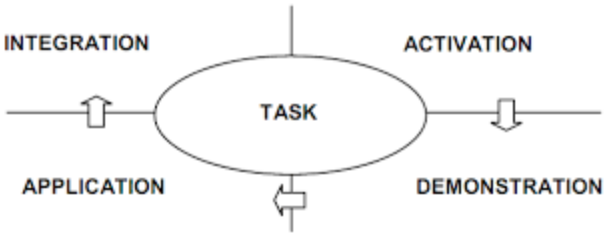
Reference(s)

Reiser, R. A., & Dempsey, J. V. (2017).
Trends and Issues in Instructional Design and Technology (4th ed.). Pearson.
Explores foundational theories and practices of Instructional Design (ID).

Norman, D. A. (2013).
The Design of Everyday Things (Revised and Expanded Edition). Basic Books.

First Principles of Instruction

Merrill's Principles of Instruction



Merril (2002) suggested a set of educational approaches that is rooted in a challenge-driven approach to learning. These educational approaches aim to actively engage students to reinforce effectiveness.

These are the Merril's five principles

1. **Problem-Cantered Learning** – This is where learners are actively engaged in solving authentic problems to promote learning in students.
2. **Activation** – activating new knowledge after facilitating prior knowledge
3. **Demonstration** – Demonstrating the activation of new knowledge after facilitating the learning aspect.
4. **Application** – Applying new knowledge and feedback is being received.
5. **Integration** – Integrating new knowledge into everyday activities of their lives so as to strengthen the learning capacity.

Example

A second-grade teacher is being asked to assist students with grasping the concept of halves and quarters. They should know how to create and identify equal parts in real-world situations.

1. **Problem-centered Learning** – Give children a real-world problem that they is relatable for them to solve. E.g.: You and your friend went to the movies and received a donut. How can you ensure both of you get equal amount? What would you do if two more people joined? What would you do to share the donut now?
   This will allow students grasp the concept of sharing objects equally which would help young learners understand the relevancy of sharing.

2. **Activation** - encourage students to activate prior knowledge by asking them if they have shared anything with a friend and how did they go about doing it? Initiate discussion on the concept of fairness and sharing equally.

3. **Demonstration** – using hand-on visuals to demonstrate the concept of halves and quarters. Display using paper or a sandwich and cut it equally into halves and quarters and the ask the students to observe and describe each part, placing importance that the more parts the item is cut in the smaller it becomes.
4. **Application** – give individual students paper in square or circle and ask them to fold it equally into two equal parts and then quarters. Use questions to ensure students are carrying out the activity e.g. Show me half/quarter. How many parts for each? Teachers should provide feedback to students immediately for clarity and to ensure they are grasping the concepts.

5. **Integration** – Integrating what they have learnt to everyday life. Engaging students in activities to find objects at home or school that are in halves or quarters and encourage them to share what they have found. Place students in groups where they take turns to share objects equally in halves and quarters, explaining their thoughts to the class.

Reference(s)

Merrill, M. D. (2002). First principles of instruction. In C. M. Reigeluth & A. A. Carr-Chellman (Eds.), *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. 2, pp. 41–56). Lawrence Erlbaum Associates.

Merrill's Four-Phase Cycle of Instruction

According to Merril (2002), the model Merrill's Four-Phase Cycle of Instruction is systematic design model that highlights the significance of the engagement learners using real-world experience. This model includes four distinct phases: activation, demonstration, application and integration.

Activation phase – this is where facilitators activate prior knowledge and experiences, assisting to make connections with new knowledge to what they have already known.

Demonstrating Phase – teachers will give clarity or models students should use to demonstrate skills or knowledge required to gain.

Application Phase – using new knowledge to problem solve or complete tasks given.

Integration Phase - integrating what they have learnt and apply it to their daily lives. Using this phase this could be inclusive of presentations, discussions and real-world projects.

Example

A second-grade teacher was asked to help students understand plants and what it needs to grow (air, water, sunlight, and soil)

Activation Phase

Initiate discussion with questions

What do plants need to stay alive? Have you ever watched or seen a plant grow? Encourage students to share their thoughts, and the facilitator clarity what plants need to survive air, water, sunlight and soil to grow.

Demonstration

Demonstrating to students how seeds are planted by placing soil in a pot, put in the seed, add water and put the pot where it can get sunlight. Also, the teacher can display pictures of different plants growing under various situations like with or without sunlight.

Application Phase – Allow each student to plant their seeds in a cup and put water on it. Students will set their plants in different areas where some will be kept in the dark and some without water. They will check their plants daily and record by using a drawing of how they grow.

Integration Phase – Students will give their plants at least two weeks and talk about what they have observed about their plants. They will also give feedback on what plants need to grow and draw picture of a plant that looks healthy and label it with soil, air, water and sunlight.

Reference(s)

Merrill, M. D. (2002). First principles of instruction. *Educational Technology Research and Development, 50*(3), 43–59. https://doi.org/10.1007/BF02505024

Project Management Models

Agile

This model highlights the importance of collaboration, feedback from customers and adaptability. Beck at al (2002), stated that this model breaks work into cycles that are shortened refer to as sprints, facilitating the frequency of delivery of software that is functional. Guided by the Agile Manifesto, it values individuals, working software, customer collaboration, and responsiveness to change over rigid processes (Beck et al., 2001). Highsmith (2009) explained that because it is adaptable it used widely, but for it to be successful, it depends on a team that communicates effectively and has the skills.

Example

Leaders at an elementary school wants to adopt a new program for reading to boost literacy. However, for the implementation to go smoothly, the teachers confirmed in using the Agile model.

Initial planning – this requires the administrators to explain the goal of the project and that is to improve the learners reading comprehension over a nine-week period. They have decided to break this goal into tasks that are manageable when selecting resources, designing the lessons and following the process.

Sprints – the teachers have decided to separate into four sprints that cover four weeks. Each individual sprint will focus on different aspects, such as:

1: setting up groups as well as introducing the program
2. put into practice guided sessions for reading
3. Testing the progress of students and adjusting material used.
4. revise the results and make preparation for broader adoption.

Teacher would meet daily to discuss challenges, progress and give solutions for specific students who are struggling. After each sprint, the team will revise what went well and what didn't. Then they would collaborate with stakeholder to give feedback to make necessary adjustments.
At the end of the nine weeks, teachers will do an evaluation to note how effective the model is, identify are that need improvement and make improvements for future usage.

Reference(s)

Beck, K., et al. (2001). Manifesto for Agile Software Development. Retrieved from https://agilemanifesto.org

Highsmith, J. (2009). Agile project management: Creating innovative products (2nd ed.). Addison-Wesley.SAM | Successive Approximation Model

Successive Approximation Model (SAM)

According to Allen & Sites (2012) Successive Approximation Model is an approach used to design content for educational purposes, programs for training, or curricula. It highlights a process that collaborative and Iterative, making it appropriate for school environments, where adjusting and giving feedback are important to being successful. The SAM Model places emphasis on teamwork, flexibility, iterative phototyping, making sure the materials for learning are aligned closely with the objectives and needs of students.

Example

The reading fluency in an elementary school needs to be improve the fluency of reading in second-grade students. The leaders of the school decided to use the Successive Approximation Model to create and put into practice a program that improves speed, the accuracy of reading, and comprehension skills via activities that are engaging and interactive.

Preparation Phase

Objective: create goals and assemble information for the implanting the program.

Steps: After reviewing data that 60% of the students reading is below grade level, teachers had to ensure that fluency in reading is a priority. Teachers will set a goal to improve the reading fluency by 15% within with nine weeks incorporating activities that were targeted. Identify resources that are age appropriate like reading books and apps that will help enhance reading.

Iterative Design Phase

Implementing and testing phototypes for activities that builds fluency.

Steps – The teachers will create a lesson that involves reading in pairs using age-appropriate text and a timer to improve their speed of reading. Use visual aids to assist with words that are challenging, use additional work cards that has pictures to build vocabulary learning.

Iterative Development state

This the final stage to implement the reading program.

Steps- Lesson that were revised would be shared with all second-grade classroom. Teachers become creative implementing one-minute weekly reading and storytelling in small groups. Collect ongoing data to help track the individual progress of reading.

Reference(s)

Allen, M. W., & Sites, R. (2012). *Leaving ADDIE for SAM: An agile model for developing the best learning experiences*. ASTD Press.

SAMR | Substitution, Augmentation, Modification, and Redefinition

Puentedura (2006) explained that the SAMR Model supplies a framework for technology integration using four levels substitution, Augmentation, Modification and Redefinition. Augmentation and substitution reinforce tasks done traditionally. Redefinition and Modification alter the learning of students by allowing world-wide collaboration, innovative task or projects involving multimedia. This model assists educators' progression for prior practices to developing transformative experiences in learning.

Example

Scenario for the SAMR Model in an Elementary School

Substitution – students will be asked to worksheets that are digitalized on their tables or Chromebook substituted for ones that are printed.
Augmentation – Including on the worksheet are hints for errors and automatic grading

Modification – Encourage students to work as a team to be creative inclusive of using Google Slides.
Redefinition – Allow students to have a meeting with scientists digitally and use insights to integrate into creating their project.

The step-by-step progress demonstrates the change in learning for basic substitution to what is being modified.

Reference(s)

Puentedura, R. R. (2006). *Transformation, technology, and education*. Retrieved from https://hippasus.com/

Waterfall

According to Balaj & Murugaivanq model is a method used for step-by-step development. It goes through phases like planning, designing, building, testing and delivery. Before starting the next step, the previous one must be completed. This model works great for projects that have a fixed requirement but will be less adaptable to changes.

Example

A fifth-grade teacher came up with a idea to us the Waterfall model to do a science fair project.

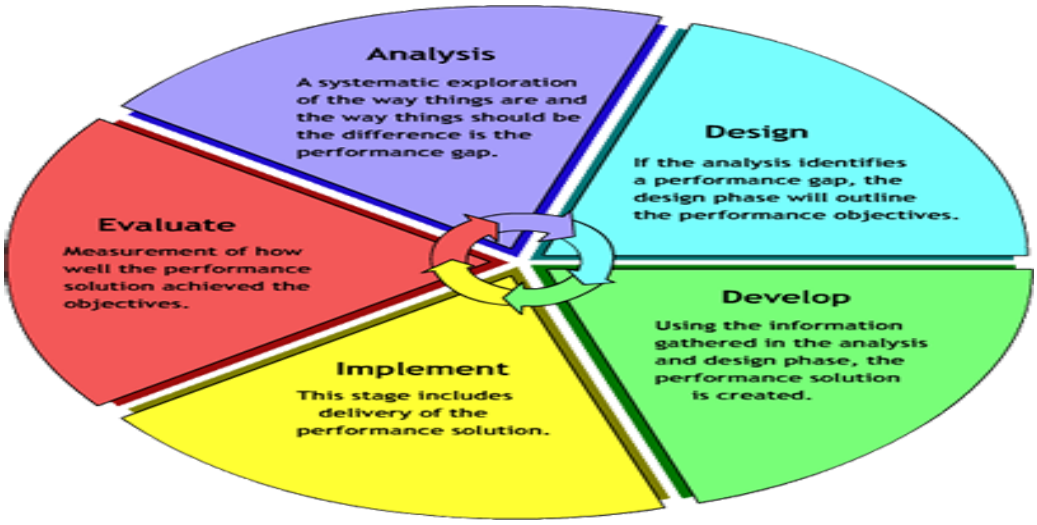
1. **Requirement Phase** – this is where the teacher will have a set of objectives to carry out
2. **Design Phase**- Thus is where plans are put in place for activities and set a timeline.
3. **Implementation Phase** – The plan is followed by students step-by-step.
4. **Testing Phase** – in this phase students practice their presentation, and feedback is provided by the teacher.
5. **Deployment phase** – The final project is being presented by the students.
6. **Maintenance Phase** – the project will be reviewed by the teachers and feedback will be given for improvement in the future.

This model works great for systematic, step-by-step projects that have clear goals.

Reference(s)

Balaji, S., & Murugaiyan, M. S. (2012). Waterfall vs. V-Model vs. Agile: A comparative study on SDLC. *International Journal of Information Technology and Business Management*, 2(1), 26–30.

ADDIE | Analysis, Design, Development, Implementation, and Evaluation



The ADDIE Model is a systematic framework which involves instructional design, comprising of five different stages: Analyse, Design, Develop, Implement and Evaluate.

Analyse – Molenda (2003) stated that this stage is where you need to identify the goals and learning needs and requirements of the audience.
Design – According to Dick et al. (2005) spoke about creating a plan that is detailed with content, tests and the methods of delivery.
Develop – Branch (2009) stated that in this stage materials are produces and tested.
Implement – The is where delivery and managing logistics take place.
Evaluate – Continuously assessing the program to ensure effectiveness (Kemp, Morrison, & Ross, 2007).

The model embodies a great systematic and learning programs that are effective.

Example

A third-grade teacher at an elementary school decided to use the ADDIE Model to create mathematics lesson on fractions.

Analyse – the teacher analyses the needs of students and revise the standards.
Design – The goals are set, and a variety of learning strategies and tests are planned.

Develop – Materials are prepared, which includes hands-on resources and visuals to aid learning
Implement – This is where the lesson is delivered using engaging activities, and the teacher monitors the students' understanding.
Evaluate- at the end of the lesson, the teacher tests student's knowledge using quizzes and revise the lesson's effectiveness to make improvements for lesson in the future.
The ADDIE model aids teachers in planning, delivery and revise lessons to meet the needs of students.

The ADDIE model helps the teacher plan, deliver, and refine lessons to meet student needs.

Reference(s)

Branch, R. M. (2009). *Instructional design: The ADDIE approach*. Springer.
Dick, W., Carey, L., & Carey, J. O. (2005). *The systematic design of instruction* (6th ed.). Pearson.
Google. (n.d.) The ADDIE Model. Retrieved January 19, 2025, from https://www.savannahstate.edu/elearning/addie.shtml
Kemp, J. E., Morrison, G. R., & Ross, S. M. (2007). *Designing effective instruction* (5th ed.). John Wiley & Sons.
Molenda, M. (2003). *In search of the elusive ADDIE model*. Performance Improvement, 42(5), 34-37. https://doi.org/10.1002/pfi.4930420507

Cognitive Load

Cognitive Load Theory

This theory focuses on processing information mentally which incorporates knowing how something is done and having a clear understanding. It also involves how we perceive information, memorize, solving problems, making decisions and the use of language. It highlights how individuals process information and devising the meaning from real life experiences. Cognitive load theory is developed by Jean Piaget and others who view leaning as a process where learners as a life-changing process where individuals collect and absorb information that is with their mental capacity. (Piaget, 1952). Modernized cognitive theory incorporates insights from neuroscience, psychology, and artificial intelligence which gives a comprehensive of how the process of thinking influence behaviour and learning (Neisser, 1967).

Example

Ms. Ashford uses paper to teach fractions to her 2nd Grade students. She told the students to divide the cake into halves, quarters, and eights, assisting them envisioning fractions. Students were asked to make comparison between the slices and gain understanding of terms like numerator and denominator through engaging in hands-on activities. Struggling students got to experience the connection to real life like sharing snacks.

Application of Cognitive Theory

- **Active Engagement**: The manipulation of resources to gain knowledge
-
- Students manipulate materials to construct knowledge.
- **Assimilation/Accommodation**: New information is incorporated into schemas that's already existing.
- **Constructivist Approach**: real hand-on learning assist in building understanding.

This theory is in line with cognitive theory which highlights engagement in meaningful learning.

Reference(s)

[Neisser, U. (1967). *Cognitive psychology*. New York: Appleton-Century-Crofts.
Piaget, J. (1952). *The origins of intelligence in children*. New York: International Universities Press.

Managing Cognitive Load

Multimedia Principle

Multimedia principle focuses on creating multimedia resources that develops learning by lessening mental effort that is unnecessary. Based on Cognitive Load Theory, it emphasizes the significance of managing learners' limitations of effective cognitive resources. The principle is originated from Cognitive Load Theory (Sweller, 1988), proposes that well developed resources for multimedia should include audio, visuals, and information that optimize the process of cognitive learning.

1. **Dual-Channel Processing**: separating channels for visualization and auditory processing to stop overload (Mayer, 2005).
2. **Segmenting**: This is where information is presented in chucks to make learning more manageable (Clark & Mayer, 2016)..
3. **Modality Effect**: Incorporating visuals with spoken text to build comprehension (Mayer, 2009)..
4. **Redundancy Principle**: Eliminate repetition of information across text, visuals and audio to lessen cognitive strain (Sweller, 2010).

Applying these principles, designers can design resources that benefits meaningful learning and lessen cognitive load that is strenuous.

Example

Ms. Payday, a 3rd Grade teacher decides to uses the multimedia principle to manage cognitive load to teach fractions. She pairs verbal explanation with visuals to create better understanding (dual-channel processing), she breaks down the information (segmenting), uses visuals to replace long winded information (modal effect), and eliminates repeating information by pointing out important points to replace reading from the board (redundancy principle). Using this approach will assist students in grasping the concepts of fractions without feeling overwhelmed.

Reference(s)

Clark, R. C., & Mayer, R. E. (2016). *E-learning and the science of instruction*. Wiley.
Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University Press.
Sweller, J. (1988). Cognitive load during problem solving. *Cognitive Science, 12*(2), 257–285.
Sweller, J. (2010). Cognitive load theory: Recent theoretical advances. In J. L. Plass, R. Moreno, & R.

Signaling

Signalling refers to process of using visual cues highlight important that is relevant within a text. This supports the reduction of unnecessary cognitive load and enrich the ability of the learner to remember and process important information. Signalling may appear in various forms, such as bolding, underlining, using arrows, highlighting, or using visual cues. Sweller (2011) suggests

that the effective of signalling is very important in the prevention of cognitive overload, as it relates to the need for students to find or search for relevant information on their own.

Example

Mr. Johnson, a fourth-grade teacher, decided to teach the water cycle to her students and decided to use the signaling technique. She included color coding, bold arrows and highlighted important words in her presentation to highlight important concepts. While she was delivering her lesson, she verbally instructed the students' attention to important features of the diagram and used guided worksheets and interactive whiteboard for reinforcement. Using strategies assisted the students to focus on important information, boosts their understanding, lessen cognitive overload of the water cycle.

Reference(s)

Sweller, J. (2011). *Cognitive load theory*. Psychology of Learning and Motivation, 55, 37-76. https://doi.org/10.1016/B978-0-12-387691-1.00002-8

Chunking

This strategy is used to group information into smaller parts that is more meaningful to students and provides long term memory. It helps to lessen mental load, making it an easier process for their brain to remember and process information. This information is tied closely to George A. Miller's (1956) research, which emphasized the capacity of the brain to handle about six chucks of information at once.

For instructional design, **John Sweller's cognitive load theory** expounds on this by highlighting how chunking helps in learning, especially when solving complex problems or teaching new material.

Example

A third-grade teacher had an objective she wanted to meet with her students. Her goal was to teach her students how to solve basic multiplication problems (e.g., 2 x 4, 3 x 5).

Breaking down the lesson

The teacher introduced the lesson using repeated addition to teach multiplication by explaining 2 x 4 means adding 2 four times (2 + 2+ 2 + 2). She chunked the information on adding repeatedly with small numbers (e.g. 2 x 4, 3 x 5). She the decided to use visual aid, such as dots and an array to demonstrate the information.

Reference(s)

Miller, G. A. (1956). *The magical number seven, plus or minus two: Some limits on our capacity for processing information*.
Sweller, J. (1988). *Cognitive load during problem solving: Effects on learning*.

Visual Cognitive Load/C-R-A-P

Visual cognitive load refers to the cognitive effort that is needed to process information that is visible. It is an element of cognitive load theory, which focuses on the processing of information and how learning can be optimized through instructional design.

Citing information regarding visual load, you should refer academic works discussing it. Here's an example of APA citation and referencing based on foundational and related works:

In-Text Citation Example

- **Parenthetical**: (Sweller, 1988; Chandler & Sweller, 1991)
- **Narrative**: Sweller (1988) and Chandler and Sweller (1991) describe cognitive load theory, including its visual aspects.

Example

Ms. Bailey was teaching her students about the water cycle and noticed that they were overwhelmed with too many visuals and information. The teacher decided to focus on one stage at a time with good clarity, labelled diagrams that were labelled and less text. Breaking the information from the lesson into smaller, achievable parts, she assists her learners have a better understanding of how to remember the information.

Reference(s)

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257–285. https://doi.org/10.1207/s15516709cog1202_4

Chandler, P., & Sweller, J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction, 8*(4), 293–332. https://doi.org/10.1207/s1532690xci0804_2

Strategies for Student Learning

Scaffolding

Cognitive load scaffolding is a teaching method that reduces learners' mental effort by providing support to make learning more manageable. It aligns with Cognitive Load Theory (CLT), which suggests that learners perform best when cognitive load is balanced with their working memory capacity. Scaffolding involves breaking tasks into simpler parts, offering guidance, and using strategies like worked examples to help learners understand complex concepts without overwhelming them.

Example of scaffolding: Using worked examples, where step-by-step solutions are shown, helps reduce cognitive load before learners attempt similar problems independently.

Example

Ms. Johnson, a 3rd-grade teacher, uses cognitive load scaffolding to teach addition with carrying (regrouping). She starts by showing worked examples on the board, breaking the process into manageable steps and explaining each part. As students gain confidence, she gradually reduces support, giving them practice problems with less guidance. This method helps students manage the complexity of the task without becoming overwhelmed.

Reference(s)

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257-285. https://doi.org/10.1207/s15516709cog1202_4

Levels of Challenge

The level of challenge theory refers to the difficulty of activities and how it impacts the student's working memory. The types of mental load are the difficulty to inherent a task (intrinsic load), the irrelevant confusion of how task is being presented extraneous load) and the effort used to mentally to process and comprehend materials, which enhances learning (germane load). Activities provided should be created to match the current abilities of learners to lessen extraneous load while increasing the task gradually to encourage learning that is meaningful.

Example

A fourth-grade teacher uses a step-by-step approach to increase the difficulty of multiplication activities to manage cognitive load. He started with a simple two-digit problems and gave clarity on instruction to eliminate distractions. As the learners achieve confidence, he introduces more complex three-digit problems, stimulating depth of their understanding without feeling overwhelmed. This approach aids balance the levels of challenge for optimal learning.

Reference(s)

Sweller, J., Ayres, P., & Kalyuga, S. (2011). *Cognitive load theory* (1st ed.). Springer. https://doi.org/10.1007/978-1-4419-8126-4

Active Learning

Learning actively in this context of cognitive load refers to using strategies that engage students in tasks requiring them to deeply process information. This aids management in cognitive load by creating a balance between intrinsic load (content complexity), extraneous load (unnecessary cognitive effort), and germane load (effort related to understanding). Optimizing the balance between techniques aids managing cognitive overload. Some techniques are discussions, problem-solving and partner teaching can lessen irrelevant mental load and stimulate meaningful engagement which helps to improve learning outcomes.

Example

Ms. May demonstrates fraction with visual aids and activity that requires hands-on involvement where learners color pizza sections to illustrate fractions. After their engagement, they should explain the concept to a partner, emphasizing understanding. A whole group discussion will follow to provide clarity. This type of approach to learning aids manages mental load and deepen understanding.

Reference(s)

Reference: Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257-285. https://doi.org/10.1207/s15516709cog1202_4

Problem-Solving Tasks

Problem-solving in cognitive load theory refers to cognitive effort that is needed to solve problem-solving, which is impacted by the limits of memory that works. This theory highlights three types of cognitive load: extraneous load (irrelevant information), intrinsic load (how difficult the content is), and germane load (effort that helps learning). Solving problems effectively requires being in control of the loads to eliminate working memory from becoming overwhelming, making sure better that there is better understanding and retention. Incorporating strategies like breaking a task in chunks can assist in lessening the overload of cognitive and improve problem-solving.

Example

Mrs. Taylor a third grade teacher assists her learners manage cognitive load to solve multi-step words problems. She started form a simple step and gradually increased to a more difficult level. To lessen extraneous load, the teachers ensure her explanation and visuals are clear. During guided leaning, she demonstrates a step-by-step process as they solve the problems in pairs. At the end, learners independently were able to solve multi-step problems with minimal cognitive overload.

Reference(s)

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, 12(2), 257-285. https://doi.org/10.1207/s15516709cog1202_4

Sweller, J. (2011). *Cognitive load theory*. Springer Science & Business Media.

Knowing the Learner

Learner and Context Analysis

Dick and Carey Model

The **Dick and Carey Model** is systematic instructional design developed by Walter Dick and Lou Carey. It contains ten steps, which include identifying instructional goals, analyzing

learners, developing instructional strategies, creating assessments, and conducting evaluations. It is generally used in education and training for creating effective instructional resources.

The model consists of the following steps:

1. **Identify Instructional Goals** – explains what students should achieve.
2. **Conduct Instructional Analysis** – highlight skills, knowledge and attitudes needed to reach the goal.
3. **Analyze Learners and Contexts** – test the characteristics of the learner, prior knowledge and their learning environments.
4. **Write Performance Objectives** – improve specific and measurable learning goals.
5. **Develop Assessment Instruments** – Design tests that are in line with the objectives.
6. **Develop Instructional Strategy** – Create different methods of teaching and strategies to facilitate leaning.
7. **Develop and Select Instructional Materials** – design and select appropriate instructional content.
8. **Design and Conduct Formative Evaluation** – use feedback to test and refine the instructional materials.
9. **Revise Instruction** – adjust the instruction based on the results of the evaluation.
10. **Design and Conduct Summative Evaluation** – test the general effectives of the instruction.

Example

A second-grade teacher applies Dick and Carey Model to help her students learn basic fractions. The procedure she decided to begin with was to set objectives and test the student's prior knowledge. She created interactive lessons that come with visual aids, manipulatives, and digital tools while aligning tests with goals. Formative assessments aid in refining instruction, and a final evaluation measures students understanding. This model ensures the continuous effective learning of students.

Reference(s)

Dick, W., & Carey, L. (2015). *The systematic design of instruction* (8th ed.). Pearson. Would you like further details or a comparison with other instructional design models?

Sociocultural Factors

Sociocultural Theory

This theory involves social and cultural influences that shape the behavior of humans, their values and how they interact. The important factors involve cultural norms, social class, religion, family structure, education, language, gender roles, ethnicity, technology, and political systems. These factors play a very important role in influencing the decisions and societal trends made by individuals (Hofstede, 2001). Understanding sociocultural factors is very important for

businesses, policymakers, and educators in adapting to societal changes and addressing diverse needs (Triandis, 1994).

Example

An elementary teacher realizes Amoy, a quiet student, hesitates to engage based on cultural norms she values listening over speaking. The teacher strategies like small group discussion and inclusive teaching to support her. She also incorporates multicultural books and visual aids to accommodate diverse language backgrounds. By recognizing sociocultural factors, she creates an inclusive learning environment that supports all students.

Reference(s)

Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations* (2nd ed.). Sage Publications.

Triandis, H. C. (1994). *Culture and social behavior*. McGraw-Hill.

Universal Design for Learning

This is an education framework that is very effective and accessible for all learners to give flexibility with various teaching methods. It highlights three principles: providing multiple ways to present information (representation), offering different methods for students to express their knowledge (action and expression), and engaging students in diverse ways to maintain motivation (engagement). The objective is to design a diverse leaning environment which caters to all learners.

Example

Mr. Morgan had an idea to about keeping his students motivated and engaged and decided that theses strategies would be best to use:

> Choice: The students were given the opportunity to choose what they wanted to complete the task. Students were given the opportunity to work in small groups, by themselves or with a partner.
>
> Variety f activities: Some learners may be engaged in hands-on activities like acting out parts of a story or designing a poster, while other students maybe engaged using technology (like a Chromebook/tablet with a quiz that is interactive).
>
> Personal Connections: Mr. Morgan encouraged his students to make connections to their own experiences, making the context more engaging and meaningful.

Applying this theory, Mr. Morgan ensure that all his students, regardless of their abilities or preferences in learning, can have access to the content, express their understanding and participate in the lesson in whatever way that works for them.

Reference(s)

CAST. (2018). *Universal design for learning guidelines version 2.2*. CAST. https://www.cast.org/our-work/about-udl