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BENCHMARKING INSTRUCTIONAL DESIGN MODELS - ADDIE WINS

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BENCHMARKING INSTRUCTIONAL DESIGN MODELS - ADDIE WINS

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Abstract: The rapid development of learning and instructional design technology has resulted in the creation of numerous instructional design models. These models are often used as the basis for instructional design courses, providing students with an introduction to the field. The abundance of models can be overwhelming, especially for beginners in the field. This prompts the question - which model is the best to use? The objective of this paper was to review the comparative advantages of selected models and to assist instructors in choosing the most appropriate one. Desk research was conducted to establish a list of qualitative indicators that can be used to evaluate and benchmark selected models. The models (such as ADDIE, SAMR etc.) were examined, and a benchmarking table was created. The paper provided insight into the most important characteristics of the selected models and presented arguments on their advantages and disadvantages. Based on the results of analysis and benchmarking indicators, the ADDIE model demonstrated slight advantages over other models. This paper compares four important models and recommends the ADDIE model as the most complete, structured, flexible, and easy to implement.

Keywords: instructional design, ADDIE, SAMR, teaching, education

JEL Classification: I29.

INTRODUCTION

E-learning today demands substantial financial support, particularly in the initial investments required for setting up the e-learning infrastructure, encompassing both hardware and software. While open solutions are available, the primary costs lie in developing high-quality educational content and teaching materials. It's essential to consider the time and potential expenses for training educational system users, ensuring that resources are optimally utilized by applying appropriate pedagogical and me-

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thodical principles in the selection and creation of teaching content and the e-learning system.

In the early stages of integrating the Internet and Web into e-learning, the delivery of teaching materials was restricted to online provision. This led to low-quality materials due to the lack of supportive technologies available today. Despite these limitations, they marked the initial pioneering steps in e-learning. It is now imperative to anticipate and precisely define the teaching conditions, learning objectives, and target student groups for any course or materials to maximize learning outcomes.

In the recent period marked by the global COVID-19 pandemic, teaching and learning methods have heavily relied on modern information and communication applications. These applications facilitated the teaching and learning processes with varying degrees of success. Problems arose for those educators who, in their daily work, relied on traditional teaching methods without using information and communication technology (ICT) tools. Teaching materials prepared for traditional methods showed significant shortcomings during this period. There was a need to transform these materials into formats suitable for remote teaching and learning. Instructional design models, which provided recommendations and guidelines for adapting to the new situation, once again became the focus of teachers' work. This paper aims to highlight the importance and flexibility of the ADDIE model compared to other alternative instructional design models.

THE INSTRUCTIONAL DESIGN MODELS – BRIEF LITERATURE REVIEW

Learning theories are the foundation for choosing instructional strategies and help predict their effectiveness accurately. To achieve successful learning outcomes, the science of instruction and instructional design models guide the development of strategies that encourage proper cognitive processes. This paper examines the major learning theories and provides detailed explanations of selected examples of instructional design models. The primary aim of this article is to present the science of learning and instruction as theoretical evidence for the design and delivery of instructional materials. Furthermore, this article furnishes a practical framework for implementing these theories in the classroom and laboratory settings. (Khalil & Elkhider, 2016)

The instructional design models provide recommendations for the planning of the learning process in e-learning systems, as well as precise steps that should be followed during the process of electronic course creation. It is possible to distinguish three general phases in the process of preparation for an e-course: the creation of the e-course, implementation and evaluation of the created e-course. (Popović & Naumović, 2009)

For instance, constructivism emphasizes the importance of students taking responsibility for their learning. This is because the transfer of knowledge is complex, and active student involvement significantly enhances the construction of knowledge within the student's mind. As a result, students are motivated to generate new ideas when they are actively engaged in the learning process. Additionally, collaborative group work facilitates the exchange of experiences among students, leading to a deeper comprehension of the learning material. The constructivist learning model encompasses students' investigative activities and establishing of social and educational communication channels. Embracing an investigative approach allows students to view

mistakes as integral to the learning process. Throughout this journey, students cultivate their own educational culture, ultimately fostering an increase in their learning autonomy. (Mušanović, 2000; Reighlut & An, 2021)

According to Merrill et al (1996), the instructional design presents the practice of creating "*instructional experiences which make the acquisition of knowledge and skills more efficient, effective, and appealing.*" (Merrill et al, 1996)

Some researchers argue that behavioural strategies and recommendations for instructional design are primarily used for studying facts, cognitive strategies are used to study processes and principles, and constructivist strategies are used to support advanced thinking that promotes personal knowledge and contextualized learning. (Milosavljević, 2007)

Wagner in its essay argues some critical points for consideration by the instructional designers when engaging in digital experiences. Instructional designers are responsible for creating engaging digital learning experiences. They have to be proficient in writing, clearly presenting ideas, develop moderate technological proficiency, and have an appreciation for design. For the advancement of our profession, instructional designers need to find common ground that unites and facilitates collaboration, regardless of their professional training or work settings. (Wagner, 2011)

Allen and Sites (2012) claim that the instruction provided by companies and organizations is often overloaded with text and lacks engaging learning experiences. Boring instruction is costly, ineffective, and leads to negative attitudes and disrespect from learners. (Allen & Sites, 2012)

This can result in a lack of attention, aversion to the subject, and hindered learning opportunities. It's perplexing that so much boring instruction exists, given its recognized ineffectiveness. Organizations settle for boring and ineffective learning programs due to ineffective management of project risks, excessive focus on upfront analysis, inadequate exploration of alternative design options, excessive emphasis on content presentation over the learning experience, lack of involvement of sponsors, stakeholders, and learners, reliance on design by committee, and the use of outdated methods.

Based on desk research of available literature, we found that practitioners often use the following four models in practice:
- Merrill's Principles of Instruction (MPI),
- Dick & Carey model,
- SAMR model, and
- ADDIE model.

Naturally, this is not an exhaustive list. Other instruction design models in use, mentioned in literature are, for example, Kirkpatrick's Four Levels of Evaluation, Gagné's Nine Events of Instruction, Bloom's Taxonomy and TECH, etc. In this paper, these models were not taken into consideration. (Reise, Carr-Chellman, & Dempsey, 2024)

The ADDIE model was first created by Florida State University to explain the processes involved in developing an instructional systems development (ISD) program for military inter-service training. The name is an acronym of the phrase - Analyze, Design, Develop, Implement, Evaluate. This model was designed to train individuals

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effectively for a specific role and could be used for any intra-service curriculum development activity. The steps of the model were revised over the years, and the model became more dynamic and interactive than its original version. The most popular version of the model emerged in the mid-80s. Considering the educational aspects of learning and their effect on the development of online courses, the ADDIE model is perhaps the most widely used model for developing learning materials.(Abernathy, 2019; Branch, 2009; Reiser & Dempsey, 2012)

The Dick and Carey model is an instructional systems design model that emphasizes a systematic approach to designing instructional materials. It includes components such as instructional goals, instructional analysis, and formative evaluation. This model asserts a systems view of instruction, highlighting the interconnectedness of its various elements, such as context, content, learning, and instruction. According to this model, instructors, learners, materials, instructional activities, delivery systems, and learning all collaborate to achieve the desired outcomes. The components of this model are executed iteratively and in parallel with each other, as demonstrated in the illustration. The Dick and Carey model emphasizes a systems approach, viewing instruction as an interconnected process rather than a linear one. (Dick, Carey & Carey, 2015)

The SAMR model (Substitution, Augmentation, Modification, Redefinition) categorizes levels of technology integration in education. It guides educators in moving from basic enhancements using technology to more transformative and innovative practices. SAMR is a model created to assist educators in integrating technology into teaching and learning. Developed by Dr. Ruben Puentedura, the model enables and supports teachers in developing and integrating digital learning experiences with technology. The aim is to transform learning experiences to achieve higher levels of student success. (Blundell, Mukherjee & Nykvist, 2022)

M. David Merrill, a renowned educational researcher and teacher, developed Merrill's Principles of Instruction (MPI), known as Merrill's First Principles of Instruction. These five core principles revolve around task-based learning, emphasizing that effective learning experiences stem from problem-solving. For online learners to comprehensively grasp and apply information in real-world scenarios, active engagement with eLearning content is essential. This engagement encompasses a multi-phase process, including activation, demonstration, integration, and other vital components. Merrill's instructional design model is a set of guidelines to enhance the effectiveness and efficiency of instructional materials. The model emphasizes real-world problem-solving and is structured around five core principles. Merrill's model is based on five core principles: problem-centred, activation, demonstration, application, and integration. (Merrill, 2002)

COMPARISON OF THE INSTRUCTIONAL DESIGN MODELS

Analysing different sources of literature, we decided to select the following key indicators for comparison, ensuring equal representation of models' capacities:

- **Number of phases or steps in implementation** – to understand and evaluate the complexity of the model and needed realisation efforts,
- **Scope of the model** - to understand the scope of the model's applicability to different topics and subjects of teaching,
- **Goals and objectives of the model** – to understand the proposed purpose of

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the model relevant from the aspect of the implementation,
- **Instructional strategies** – to understand how flexible the model is towards different instructional strategies,
- **Learner analysis examination** – to understand how and where the analysis of learners' needs happens,
- **Content analysis examination** – to understand how to adapt the content to the learners' needs,
- **Assessment and evaluation topic** – to understand assessment and evaluation within the model,
- **Implementation and delivery issues** – to understand implementation cycle complexity and delivery of the model,
- **Development process** – to understand the complexity of the model development cycle and constraints,
- **Role of instructor/teacher** – to understand the role of the instructor/teacher in all phases of the model.

Table 1 shows the comparative review of indicators for selected instructional design models.

Table 1. Comparative review of indicators for selected instructional design models

	ADDIE	SAMR	Dick&Carey	Merrill's Principles of Instruction (MPI)
Number of phases/steps	5	4	10	5
Scope	Broadly applicable, often underpinned by behavioural and cognitive theories	Broadly applicable to enhance and transform learning with education technologies.	Based on systems theory and behavioural principles.	A broad, constructivist approach emphasizing problem-solving.
Goals and Objectives	Clearly defined at the outset in the Analysis phase	To transform learning experiences so they result in higher levels of achievement for students.	Specific and measurable, developed in the initial stages.	Focused on real-world tasks and problems.
Instructional strategies	Flexible and adaptable to various strategies	Emphasis on education technologies	Detailed and aligned with objectives.	Emphasizes active learning and real-world application.
Learner analysis	Conducted during the Analysis phase to understand learner needs and characteristics	Analysis in the Substitution phase to understand what benefits will come with new education technology	In-depth analysis of learners' needs, entry behaviours, and characteristics	Analysis and understanding of learners' prior knowledge and experiences.
Content Analysis	Systematic and thorough development during the Design phase	Content organised around tasks to be implemented	A systematic approach to breaking down content into smaller units	Organized around real-world problems and tasks.

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	ADDIE	SAMR	Dick&Carey	Merrill's Principles of Instruction (MPI)
Assessment and Evaluation	An integral part of each phase, especially in Evaluation	Assessment is present in all four phases	Emphasizes criterion-referenced testing and formative evaluation	Integrated with instructional activities and tasks.
Implementation and Delivery	Iterative, structured and planned in the Implementation phase.	Linear and structural implementation through enhancement and transformation	Iterative and cyclical, allowing for continuous improvement.	Flexible, with a focus on authentic tasks.
Development Process	Linear in nature, but allows for iterative cycles.	Linear in nature, but allows improvements and iteration	Iterative and cyclical, allowing for continuous improvement.	Iterative, with ongoing adjustments based on learner feedback.
Role of the Instructor	Different roles are defined throughout phases, from design to implementation	Role to transform learning experience with educational technologies	A central role in facilitating and evaluating learning.	Facilitator and guide in the learning process.

Source: Authors

RESULTS AND DISCUSSION

Based on the data collected, it is evident that the models have a similar number of phases. The Dick&Carey model differs in that its processes are not grouped into phases. However, this distinction is not critical as the phases in other models consist of multiple steps or processes. Essentially, all models follow a similar structural approach, with minor differences that do not have a significant impact. The ADDIE model's clear and structured approach provides an easy roadmap and follow-up during the implementation of the entire project, making it the preferred model based on this indicator.

The main goal of instructional models is to be widely accepted and implemented universally. The Dick & Carey model is based on systems theory and behavioural principles that are suitable for educational environments at all levels (primary, secondary, and higher education). The ADDIE model builds on this by incorporating cognitive aspects and theories, making it more widely applicable in various professional development settings. On the other hand, the SAMR model focuses more on technology and its impact, and less on cognitive aspects. The MPI model prioritizes problem-solving and takes a more practical approach, less influenced by behavioural and cognitive theories. In summary, the ADDIE model is more general and comprehensive, allowing for a tailored approach similar to the MPI model, which is specifically focused on problem-solving.

The objectives and goals of the models differ slightly. The SAMR model aims to transform the learning experience using various educational technologies based on modern information and communication technologies, while MPI is focused on problem-solving. On the other hand, the ADDIE and Dick&Carey models are more general.

In the case of ADDIE and Dick&Carey, goals and objectives are defined and developed in the initial phase and aligned with the specifics of the individual project. This means that their objectives are more flexible and can incorporate SAMR and MPI objectives. These characteristics give ADDIE and Dick&Carey an advantage in this regard.

If you want to implement strategies that promote active learning and real-world application, the MPI model is the one to choose. The SAMR model is suitable for situations where there is a stronger reliance on technology and a higher level of knowledge in using it. On the other hand, the ADDIE and Dick & Carey models are more flexible, allowing the application of nearly all instructional strategies. This flexibility enables the development and use of technologies and corresponding strategies, as well as the ability to apply a tailored approach to projects with different outcomes and objectives. The advantage of the ADDIE and Dick & Carey models is that they can implement both cognitive and behavioural principles, thereby improving the overall acceptance of the designed or transformed educational materials.

This is a crucial step in instructional design. The capability of models can be a critical factor here. SAMR focuses on the benefits for learners from modern learning technologies. Dick&Carey take a more psychological approach to analysing learners, considering entry behaviours, personal characteristics, and more. MPI aims to understand learners' previous knowledge and experiences for enhancements. In the Analysis phase, ADDIE identifies real learners' needs comprehensively, encompassing all aspects targeted by other models, giving it an advantage compared to others.

The primary focus for each model is the content. Content should be initially introduced into the model and then transformed to align with the objectives of the chosen model. The SAMR model, being more technical, looks for content that can be easily digitized and adapted for various types of presentations using modern technologies. The MPI model requires a customized approach for selecting and processing content due to its focus on learner behaviours. The Dick & Carey model emphasizes content that is easily understandable and can be further developed to meet learner needs. In the Analysis phase of the ADDIE model, precise information on the required content and its sources is obtained. During the Design phase, this content is refined to align with objectives and identified needs. ADDIE's structured content analysis offers detailed insights in advance, streamlining processes by eliminating redundancies and time-consuming tasks that could impede project timelines. Hence, the advantage lies with this structured approach.

Assessments and evaluations are well represented and implemented in all models, almost equally. Even though it is the final phase in the ADDIE model, assessments are integrated in some way in all phases. Other models also follow this approach of evaluating individual phases to guarantee quality and timely project completion. No model has a clear advantage with this indicator.

All models present clear and structured paths for implementation. Typically, the implementation follows a linear form but possesses iterative capabilities to enhance the outcomes. It bears similarities to the waterfall model in software engineering and shares the same strengths and weaknesses. From a project management standpoint, a structured approach ensures proper follow-up, aids in monitoring the tasks executed, and guarantees the achievement of the project's objectives. A slight advantage is given to the ADDIE model, which allows for testing and potential enhancements in the eval-

uation phase. Before project completion, the project manager or instructor can assess whether further improvements are necessary. While other models offer similar functionality to some extent, they are not as effectively developed as the ADDIE model.

Excluding the Dick&Carey model with a cyclic structure, other models exhibit a linear structure in development. However, this linear structure can easily transition into a cyclic and iterative. It is evident across all models that iterations are crucial for achieving optimal results and project objectives. While ADDIE and SAMR receive feedback from the project manager and/or instructors, MPI relies on learners' feedback. Considering the structural and systemic approaches present in all models, there is no clear "winner" in this aspect. All models aim to streamline the development process and yield results promptly. Delving deeper into specifics, this aspect remains subjective, revolving around personal preference.

Instructors play a vital role in designing and implementing projects. It is crucial to embrace the chosen model, grasp its strengths and weaknesses, customize it to suit their requirements, and deliver outcomes that align with project goals and learners' needs. Among the three models discussed (SAMR, MPI, and Dick&Carey), the instructor holds a central position, overseeing all facets of design and implementation. In the ADDIE model, instructors have a pivotal role but can delegate certain tasks to individuals with specialized skills or knowledge. In the Evaluation phase of the ADDIE model, instructors are often distinct from project managers to ensure an impartial assessment of outcomes.

ADVANTAGES OF THE ADDIE MODEL

Comparative strengths and weaknesses are given in Table 2. The ADDIE model follows a clear and sequential five-step process. A structured and systematic approach facilitates the early identification and resolution of issues, reducing the chances of major revisions later. Models like Merrill's Principles of Instruction may lack the comprehensive, step-by-step process that ADDIE offers, focusing more on task-centred strategies. The distinct phases of the ADDIE model facilitate simple project management, allowing instructional designers to allocate resources, timelines, and responsibilities. This clarity and division of tasks help in maintaining consistency and quality throughout the instructional design process. Despite its sequential nature, the ADDIE model is highly flexible and has a high level of adaptability allowing for iterative improvements. This adaptability is crucial for projects where requirements may evolve. ADDIE can be tailored to various instructional contexts, from traditional classroom settings to e-learning and corporate training environments. The Evaluation phase of the ADDIE model ensures continuous improvement through formative and summative assessments. This comprehensive evaluation helps refine the instructional material and delivery methods for maximum effectiveness. The ADDIE model is widely accepted across various sectors, including education, corporate training, and the military. Its broad applicability and recognition make it a trusted framework for instructional designers. These advantages make the ADDIE model applicable to different fields. The recent literature argues implementation of the ADDIE model in health (Said & Schwartz, 2021) and software development (Aydin, Gürsoy & Karal, 2023; (Lameras & Arnab, 2022), education (Damopolli, Nunaki, Jeni, Rampheri et al, 2024), online teaching (Awajan, 2022), sport (Destriana, Destriani & Yusfi, 2021) etc.

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The ADDIE model aids in identifying best-practice principles for instructional programs and ensures the design of courses according to proven methodologies and industry standards. This model facilitates the design of clear and specific learning objectives and materials aligned with overall instructional goals and objectives. (Spatioti, Kazanidis, & Pange, 2022) Through formative and summative evaluations, designers can assess the effectiveness of the training program and make necessary improvements. In summary, the ADDIE model offers advantages such as identifying best-practice principles, facilitating high-quality course design, and the ability to measure the outcomes of the training program. By following this systematic approach, instructional designers can create effective and engaging instructional materials that meet the needs of learners. (ADDIE-model, 2024; Drljača, Latinović, Stanković & Cvetković, 2017)

Table 2. Strengths and weaknesses of selected instructional design models

	ADDIE	**SAMR**	**Dick&Carey**	**Merrill's Principles of Instruction (MPI)**
Strengths	Comprehensive and structured. Uses clear phases that make it easy to follow.	Has the capacity to improve lessons and amplify learning through the use of technology Provides shared language to discuss the role of technology in the classroom	Emphasizes detailed analysis and systematic design. Focuses on achieving specific, measurable outcomes	Focuses on real-world application and problem-solving. Encourages active learning and learner engagement.
Weaknesses	Can be time-consuming and in some cases may be too rigid for some dynamic environments.	Emphasize technology over learning goals and heavily rely on technology	Can be complex and resource-intensive. - May require significant expertise to implement effectively.	May be challenging to implement without sufficient resources or expertise. - Less structured than models like ADDIE, which can be a drawback in some contexts.
SUMMARY	Highly structured and versatile Suitable for a wide range of instructional contexts but can be rigid and time-consuming.	A structured approach to enhance and strengthen learning with increased use of technology	A systematic, detailed approach that is effective for achieving specific learning outcomes Can be complex and resource-intensive.	A robust framework for designing effective instruction by focusing on real-world problems and actively engaging learners in the learning process

Source: authors

DISADVANTAGES OF THE ADDIE MODEL

Although widely respected and used in instructional design, the ADDIE model has several disadvantages that can impact its effectiveness and efficiency.

Some researchers saw ADDIE's sequential phases as too rigid, as each phase must be completed before moving to the next. This can slow down the whole process and adapt to changes more difficult and less flexible. It can be deduced that lack of agility makes the model less adaptable to dynamic and rapidly changing learning environments.

On the other side, due to the detailed and structured approach, the model can be time-consuming. Time-consuming projects usually suffer from increased resource demand that can make such projects irrelevant and less interesting for smaller projects and institutions. Each project has to be documented, and this model requires extensive documentation and evidenting in each phase. This administrative problem is a common challenge for designers and educators, presenting a notable disadvantage.

The model with its rigid structure can prevent further innovative and creative solutions. This also may lead to slow adaptation and delayed evaluation of the final result. Instructional designers must consider these limitations and choose models or adapt the ADDIE framework to meet the specific needs of their projects and organizational contexts.

CONCLUSION

This paper presents the results of a comparison of four, most represented and different instructional design models. Other less popular and used methods were not analysed in this paper. We elaborated on ten indicators for comparison on a qualitative basis. All models apply to different educational materials, while SAMR is exclusively used to amplify the use of modern technologies to create advanced educational materials. We also discussed the strengths and weaknesses of the proposed models. We concluded that the ADDIE model showed the most comprehensive and complete model solution among the four models selected. The ADDIE model's advantages stand out for its structured, systematic approach, flexibility, comprehensive evaluation process, wide applicability, and clear phases for project management. These advantages make it a robust framework ideal for various instructional design projects, ensuring effective and efficient learning outcomes across different contexts.

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