

A Cognitive Approach to Instructional Design for Multimedia Learning

*Stephen D. Sorden
Northern Arizona University
Flagstaff, AZ, USA*

steve.sorden@nau.edu

Abstract

Aimed at both newcomers to online learning as well as experienced multimedia developers, this paper addresses the issue of how to avoid unproductive multimedia instructional practices and employ more effective cognitive strategies. Baddeley's model of working memory and Paivio's dual coding theory suggest that humans process information through dual channels, one auditory and the other visual. This, combined with Sweller's Theory of Cognitive Load and Anderson's ACT-R cognitive architecture, provides a convincing argument for how humans learn, which leads to the question of how multimedia instruction can be designed to maximize learning. Cognitive theory and frameworks like Mayer's Cognitive Theory of Multimedia Learning provide empirical guidelines that may help us to design multimedia instruction more effectively. Mayer argues that the best way to present multimedia instruction is through visual graphics and informal voice narration, which takes advantage of both verbal and visual working memories without overloading one or the other.

Keywords: working memory, multimedia, cognitive load, act-r, production system, dual coding.

Introduction

Cognitive theory is borne from the relatively new interdisciplinary field of cognitive science. Cognitive science studies the nature of the mind by drawing from research in a number of areas including psychology, neuroscience, artificial intelligence, computer science, linguistics, philosophy, and biology. The term **cognitive** refers to perceiving and knowing, and cognitive scientists seek to understand mental processes such as perceiving, thinking, remembering, understanding language, and learning (Stillings, Weisler, Chase, Feinstein, Garfield, & Risland, 1995). As such, cognitive science can provide powerful insight into human nature, and, more importantly, the potential of humans to develop increasingly powerful information technologies.

This paper addresses the problem that much of what we are currently seeing in multimedia in-

struction may actually hinder the learning that it claims to promote and then discusses possible ways to improve it. I introduce several well-known assumptions of cognitive science, which provide a framework for applying empirical theories of cognition and learning that improve multimedia instruction and assist humans in learning more effectively. The cognitive theories discussed in the paper

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**de Miranda, Guilhermina Maria Lobato
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4C-ID Model and Cognitive Approaches to Instructional Design and Technology: Emerging Research and Opportunities de Miranda, Guilhermina Maria Lobato Ferreira, Rafael, Manuel Joaquim Henriques, Melo, Mário Marcelino Luis de, Costa Pardal, Joana Martinho de Almeida, Pontes, Thiago Bessa, 2020-12-18 There has been an evolution of the explanations on the results of research on human learning and how digital technologies have supported the design of more efficient learning environments Previous theories such as Richard Mayer's cognitive theory of multimedia learning and John Sweller's cognitive load theory have gained significant attention and remain the two main theories within the multimedia learning field However there has not yet been a book compiled of several investigations on the specific 4C ID model that covers different domains of knowledge The 4C ID model combines the two main theories of Richard Mayer and John Sweller to advance the field of learning and instruction 4C ID Model and Cognitive Approaches to Instructional Design and Technology Emerging Research and Opportunities explores the behavioral and constructivist approaches to learning and instruction and focuses mainly on the particular cognitive approach and resulting theories and insights of the 4C ID model The chapters present the results of three experimental studies applied to the teaching of electrical circuits initiation to computer programming using the Alice microworld and computer programming using Python textual language This book is a valuable resource tool for computer programmers computer scientists teachers educational psychologists practitioners researchers academicians and students interested in the various approaches to learning and instruction in terms of the 4C ID instructional model

Handbook of Improving Performance in the Workplace, Instructional Design and Training Delivery Kenneth H. Silber, Wellesley R. Foshay, 2009-11-19 With the contributions from leading national and international scholars and practitioners this volume provides a state of the art look at ID addressing the major changes that have occurred in nearly every aspect of ID in the past decade and provides both theory and how to information for ID and performance improvement practitioners practitioners who must stay current in their field This volume goes beyond other ID references in its approach it is useful to students and practitioners at all levels it is grounded in the most current research and theory and it provides up to the minute coverage of topics not found in any other ID book It addresses timely topics such as cognitive task analysis instructional strategies based on cognitive research data collection methods games higher order problem solving and expertise psychomotor learning project management partnering with clients and managing a training function It also provides a new way of looking at what ID is and the most comprehensive history of ID ever published Sponsored by International Society for Performance Improvement ISPI the Handbook of Improving Performance in the Workplace three volume reference covers three core areas of interest including Instructional Design and Training Delivery Selecting and Implementing Performance Interventions and Measurement and Evaluation **Learning Science for Instructional Designers** Clark N. Quinn, 2021-04-13 Ensure Your Instructional Design Stands Up to Learning Science Learning science is a

professional imperative for instructional designers In fact instructional design is applied learning science To create effective learning experiences that engage we need to know how learning works and what facilitates and hinders it We need to track the underlying research and articulate how our designs reflect what is known Otherwise how can we claim to be scrutable in our approaches Learning Science for Instructional Designers From Cognition to Application distills the current scope of learning science into an easy to read primer Good instructional design makes learning as simple as possible by removing distractions minimizing the cognitive load and chunking necessary information into digestible bits But our aim must go beyond enabling learners to recite facts to empowering them to make better decisions decisions about what to do when and how This book prepares you to design learning experiences that ensure retention over time and transfer to the appropriate situations Gain insights into Providing spaced practice and reflection Tapping into motivation and challenge to build learner confidence Using performance support tools social learning and humor appropriately Prompts at the end of each chapter will spark your thinking about how to use these concepts and more in your daily work Written by Clark N Quinn author of Millennials Goldfish Other Training Misconceptions Debunking Learning Myths and Superstitions this book is perfect for anyone who strives for their instruction to stand up to learning science

Handbook of Research on Managing and Designing Online Courses in Synchronous and Asynchronous Environments Durak, Gürhan,Çankaya, Serkan,2021-12-17 In order to be successful online learning should be planned systematically It can be said that offering distance education courses without preparation and knowledge about the theoretical background can cause drawbacks While distance education has become widespread and popular it is observed that there could be problems in its application Such problems can include technical problems inability to meet the learning needs at the learners own speeds lack of communication among learners and between learners and teachers and lack of quality materials appropriate for online learning or the inclusion of materials used in traditional methods directly into online learning For successful online courses these critical aspects of distance education are important and they should be taken into account by the institutions and the instructors offering online courses The Handbook of Research on Managing and Designing Online Courses in Synchronous and Asynchronous Environments provides up to date knowledge and experiences regarding technologies processes and environments for online course design in distance education systems and covers topics related to the aspects of successful distance education systems with a focus on teaching and learning in online environments Focusing on topics such as instructional design and integrated systems it is an ideal guide for online course designers instructional designers curricula developers administrators educators researchers trainers and students

Motivation, Volition, and Engagement in Online Distance Learning Ucar, Hasan,Kumtepe, Alper Tolga,2021-06-25 Motivation is an important factor in and for all education levels However as learners in online distance education milieus are away from both teachers other learners and the learning environments physically this concept becomes more important for online education Motivating learners in

distance education and keeping their motivation alive throughout the learning process is an issue that should be emphasized and taken care of for teachers and instructional designers. At this point, although there are many approaches, models, and theories regarding enhancing and sustaining motivation and engagement in the education processes, it is seen that there is not enough work on or effective and efficient strategies that can be applied in online distance learning environments. *Motivation, Volition, and Engagement in Online Distance Learning* evaluates motivational obstacles in online distance education, both theoretically and practically, identifies the strengths and weaknesses of the online education environments regarding motivation, and provides actionable motivational and volitional strategies for online educators. This book offers coverage of topics such as learning theories, motivation research, and synchronous online learning environments, making it a valuable resource for researchers, professionals, decision makers, institutions in all education levels, academicians, pre-service teachers, and most importantly, online educators from various disciplines and learners from all educational landscapes.

Instructional Design: Case Studies in Communities of Practice Keppell, Michael J., 2007-03-31. Instructional designers hold the responsibility of selecting, sequencing, synthesizing, and summarizing unfamiliar content to subject matter experts. To successfully achieve legitimate participation in communities of practice, instructional designers need to utilize a number of communication strategies to optimize the interaction with the subject matter expert. *Instructional Design Case Studies in Communities of Practice* documents real-world experiences of instructional designers and staff developers who work in communities of practice. *Instructional Design Case Studies in Communities of Practice* explains the strategies and heuristics used by instructional designers when working in different settings, articulates the sophistication of communication strategies when working with subject matter experts, and provides insight into the range of knowledge, skills, and personal characteristics required to complete the tasks expected of them.

The Evolution of American Educational Technology Paul Saettler, 2004-09-30. This book traces the theoretical and methodological foundations of American educational technology, focusing on the historical process rather than devices or media. It emphasizes the importance of past heritage in current practices and provides a selective survey of research relevant to American public schools.

The Design of Instruction and Evaluation Mitchell Rabinowitz, Fran C. Blumberg, Howard T. Everson, 2004-09-22. This book is about empirically tested knowledge and principles that inform the design of instructional and evaluation systems and the use and promise of media and technology within such systems. Historically, psychology has informed the design of instructional and evaluation systems in different ways. A behavioral perspective emphasizes the role of the environment in determining behavior, a factor external to the learner. A cognitive perspective focuses on the role of cognitive processing and constraints in determining learning factors that are internal to the learner. This volume presents the affordances approach, which addresses how the environment and the affordances within it interact with cognitive processes to determine learning. Insights into this interaction are presented. It is the book's contention that the affordance approach represents an advancement over

the behavioral and cognitive perspectives it is an evolution within the cognitive approach not an alternative to it The Design of Instruction and Evaluation Affordances of Using Media and Technology is intended for education practitioners responsible for the implementation of media and technology in classrooms for researchers and faculty and for use as a text in courses on media and technology use in educational settings instructional design and psychology of learning The ASTD Handbook of Instructional Technology American Society for Training and Development,1993 This handbook aims to provide trainers and managers with the information they need to select the most effective instructive technology for their training and development needs It provides a practitioner s view of each area of instructional technology analyzing the job and task analyzing performance designing instruction identifying selecting and training instructors evaluating programs Readers will find hundreds of basic techniques valuable hints checklists graphic illustrations and practical real life examples to help them deal with the myriad of choices available and maximize training effectiveness Cognitive Load Factors in Instructional Design for Advanced Learners Slava Kalyuga,2009 The empirical evidence described in this book indicates that instructional designs and procedures that are cognitively optimal for less knowledgeable learners may not be optimal for more advanced learners Instructional designers or instructors need to evaluate accurately the learner levels of expertise to design or select optimal instructional procedures and formats Frequently learners need to be assessed in real time during an instructional session in order to adjust the design of further instruction appropriately Traditional testing procedures may not be suitable for this purpose The following chapters describe a cognitive load approach to the development of rapid schema based tests of learner expertise The proposed methods of cognitive diagnosis will be based on contemporary knowledge of human cognitive architecture and will be further used as means of optimising cognitive load in learner tailored computer based learning environments **Journal of Computer-based Instruction** ,1984 **Instructional Guidance** Slava Kalyuga,2015-05-13 This book explores cognitive load theory in instructional design aiming to reduce cognitive overload by providing appropriate information It balances direct instruction and inquiry learning applying human cognitive architecture to develop an integrated approach **The Theoretical and Conceptual Bases of Instructional Design** Rita Richey,1986 **Journal of Education for Library and Information Science** ,1990 **Designing Effective Instruction** Gary R. Morrison,Steven M. Ross,Jerrold E. Kemp,2007 This valuable resource provides instructional designers with the guidance they need to meet the challenge of creating effective and efficient instruction Maintaining a careful balance between theory and application the Fourth Edition presents a practical easy to follow approach to instructional design that can be applied to K 12 classrooms higher education distance education and business programs The authors incorporate behavioral and cognitive approaches into their model so that readers can reap the benefits of both **Designing Effective Instruction** Jerrold E. Kemp,1998-01-15 With an emphasis on practical application this book presents future educators with an instructional design model applicable to a number of situations that can mature with the instructional designer Cognitive and behavioral

approaches have been incorporated in a ten element model so readers can reap the benefits of both **Instructional Media and the New Technologies of Instruction** Robert Heinich, Michael Molenda, James D. Russell, 1993 Grade level 1 2 3 4 5 6 7 8 9 10 11 12 e i s t *Instructional Design* R. Neal Shambaugh, Susan Magliaro, 2006 This book guides students through the Instructional Design process using a systematic approach to developing instruction through a cycle of teaching questions familiar to teachers This text is meant for pre service and in service teachers and presents Instructional Design as a systematic tool to help teachers make clear teaching decisions in terms of learning outcomes assessment teaching and technology and to reflect on these decisions Teachers using this text will actively design units of instruction in an organized fashion aided by structured tasks Design Activities numerous examples and sample lesson plans This text includes coverage of key topics such as designing instruction for classes that include exceptional students diverse populations and increased use of technology Specific discussion of Needs Assessment and Program Evaluation in a way that makes sense for teachers is also included Instructional Design Charles K. West, James A. Farmer, Phillip M. Wolff, 1991 This guide to the teaching of design presents ways in which recent and established aspects of cognitive science can be utilized by teachers Teaching and learning aids as well as exercises are included The book can be used across a wide age range and with any size of group

Proceedings of Selected Research Paper Presentations at the ... Convention of the Association for Educational Communications and Technology Association for Educational Communications and Technology. Convention, 1988

Decoding **A Cognitive Approach To Instructional Design For**: Revealing the Captivating Potential of Verbal Expression

In an era characterized by interconnectedness and an insatiable thirst for knowledge, the captivating potential of verbal expression has emerged as a formidable force. Its capability to evoke sentiments, stimulate introspection, and incite profound transformations is genuinely awe-inspiring. Within the pages of "**A Cognitive Approach To Instructional Design For**," a mesmerizing literary creation penned with a celebrated wordsmith, readers attempt an enlightening odyssey, unraveling the intricate significance of language and its enduring effect on our lives. In this appraisal, we shall explore the book's central themes, evaluate its distinctive writing style, and gauge its pervasive influence on the hearts and minds of its readership.

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