

20th International Conference on
Multimedia in Physics Teaching and Learning

Program and Book of Abstracts

MPTL 2015 International Conference

September 9–11, 2015
at LMU Munich, Germany

Organized by:
Multimedia in Physics Teaching and Learning (MPTL)
Chair of Physics Education, Faculty of Physics, LMU Munich

With the support of:
German Research Foundation (DFG)
European Physical Society (EPS) – Physics Education Division
German Physical Society (DPG)
Wilhelm und Else Heraeus-Stiftung
Ludwig-Maximilians-Universität München (LMU)
The city of Munich

COMMITTEES

Scientific Advisory Board

Wolfgang Christian, Davidson College, USA
Ton Ellermeijer, CMA, Amsterdam, Netherlands
Francisco Esquembre, University of Murcia, Spain
Raimund Girwidz, LMU Munich, Germany
Tomasz Greczyło, University of Wrocław, Poland
Bruce Mason, University of Oklahoma, USA
Marisa Michelini, University of Udine, Italy

Program Committee

Nick Braithwaite, The Open University, UK
André Bresges, University of Cologne, Germany
Wolfgang Christian, Davidson College, USA
Sebastián Dormido, UNED, Spain
Ton Ellermeijer, CMA, Netherlands
Francisco Esquembre, Universidad de Murcia, Spain
Raimund Girwidz, LMU Munich, Germany
Tomasz Greczyło, University of Wrocław, Poland
Jochen Kuhn, University of Kaiserslautern, Germany
Bruce Mason, University of Oklahoma, USA
Marisa Michelini, University of Udine, Italy
Dean Zollman, Kansas State University, USA

Local Organizing Committee

Raimund Girwidz, LMU Munich, Germany
Stefan Richtberg, LMU Munich, Germany
Lars-Jochen Thoms, LMU Munich, Germany
Bianca Watzka, LMU Munich, Germany

MPTL 2015 Program and Book of Abstracts

© 2015 Ludwig-Maximilians-Universität München, Chair of Physics Education
Back cover image: Rudolf Sterflinger, München Tourismus, Nr. 0711-2

Volume editor: Lars-Jochen Thoms, Raimund Girwidz
Volume number: 39 B

Published by the European Physical Society
Managing editor: P. Helfenstein, Mulhouse

Printed in Münster by Verlagshaus Monsenstein & Vannerdat in cooperation with
Ludwig-Maximilians-Universität München, University Library

The electronic version of this publication is available via
<http://nbn-resolving.de/urn:nbn:de:bvb:19-epub-25097-8>

ISBN: 978-2-914771-92-4 (print) ISBN: 978-2-914771-93-1 (electronic)

Learning Mediated by Educational Hypermedia on the Phases of the Moon

Adriano Luiz Fagundes¹, Tatiana da Silva¹ and Marta Feijó Barroso²

¹Federal University of Santa Catarina, Brazil, ²Federal University of Rio de Janeiro, Brazil

Introduction and Theory

Phases of the Moon is a digital educational material designed adopting the theory of cognitive load (CLT), reflections about the role of visualization in science education and the concept of digital learning object. This theoretical framework allows the assumption that both the characteristics of the visual resources as well as individual differences can influence computer-mediated learning.

Concept and Implementation

Hypermedia as a whole constitutes a learning object divided in smaller ones: “The Moon”, “The Phases”, “Synchronous Rotation” and “The Hemispheres”. Each one of them was designed with multimedia resources in accordance with the instructional principles of CLT to provide visual support and aid learning. The first one discusses features of the Moon, a subject considered to be simple and familiar to most individuals. The second addresses lunar phases, a phenomenon that requires the understanding of the relative motion of Sun, Earth and Moon, the perception of how the Moon is illuminated by the Sun and how this enlightening is perceived on Earth to be fully understood, creating a great demand of intrinsic cognitive load and with a higher degree of reasoning complexity. The hypermedia provides some idealizations that provides some ease to the comprehension on the subject. The third learning object discusses the synchronous rotation of the Moon, a phenomenon that requires visualization and understanding of simultaneous rotational and translational motion. A model decoupling the two components can provide reduction on the complexity.

Objectives and Assessment

The hypermedia was assessed as a product, by science peers, with use of an online questionnaire, and it was considered of good educational quality.

It was also assessed by users, college students, by using it in an introductory undergraduate physics discipline of an STEM course; 77 students participated in the assessment process. Each learning object was evaluated separately. It is understood that one of the best ways to analyze whether individuals internalized the representations and models presented is by asking them to draw schemes or diagrams. Questionnaires and tests were used during a two month period.

The learning outcomes of the object “The Moon” assessed the knowledge of the Moon as a natural satellite of the Earth without proper light; a learning gain of 8% was obtained, confirming the hypothesis that it is already known by majority of students. The second learning object “The Phases” was assessed by asking students to represent a schematic diagram with lunar phase’s sequences and to answer about the possibility of observing the Sun and the Moon according to the time of day, with an average percent gain of 40%, providing a strong evidence on the instructional capacity of the interactive animation. The assessment on students’ comprehension about the synchronous rotation of the Moon requested the explanation and the representation of motion dynamics, with an average gain of 50%. A qualitative analysis allowed the identification of the effectiveness of the material. It is inferred that the characteristics of the hypermedia may have contributed effectively to the results, in accordance with previous results that points to the effectiveness of science learning materials supported by computational resources using interactive resources, an spatial organization of information and use of visual aspects as guides to the elaboration of materials.