Chapter 77
The Learning Effect of Using a Blended Learning Design in K12 Science Teaching

Paul-Erik Lillholm Rosenbaum
University of Bergen, Norway & Sjukehusapoteka Vest, Norway

Øyvind Mikalsen
University of Bergen, Norway

Otto Grahl-Nielsen
University of Bergen, Norway

ABSTRACT

In seven experiments, two learning conditions were assessed: a blended learning design against traditional instruction. 135 K12 science students were assigned to either a blended learning approach or to traditional learning instructions in authentic classroom settings. The students participated in one of two topics in the subject field of chemistry. All participants were randomly assigned within each classroom to one of two conditions: 1) an experimental blended learning group having teacher lecture plus Web-based multimedia; 2) a control group with traditional instructions having teacher lecture plus text and diagram. On subsequent retention and transfer tests, the blended learning group performed significantly better on retention in two of seven comparisons, and there was no significant difference in the rest. The challenge that lies ahead is to identify the characteristics of effective blended learning approaches for this type of learning programme. Recommendations for further research are made.

INTRODUCTION

Information and Communication Technologies (ICT) affect many areas where people need more knowledge. Education is one of these fields and ICT has become an inevitable part of modern education mainly because of the opportunities the technologies offers (Mitchell & Forer, 2010; Köse, 2010). For ICT-supported education the most accepted term today is e-learning (Hoic-Bozin, et al., 2009), emphasizing that technology in education should be assisted with appropriate pedagogical methods, design and principles, and particularly with forms that encourage active

DOI: 10.4018/978-1-4666-4502-8.ch077

Copyright © 2014, IGI Global. Copying or distributing in print or electronic forms without written permission of IGI Global is prohibited.

learning (Del Corso, et al., 2005). A suggestive definition for e-learning is made by the Alonso *et al.* (2005): "Using new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchange and collaboration."

By including the advantages of e-learning into traditional learning approaches a new educational model has emerged, which is called "blended learning." Elearnspace (2005) states that "Blended learning takes the best of both worlds and creates an improved learning experience for the students." It seems that blended learning is becoming an increasingly popular form of e-learning particular suitable for the process of transition from traditional forms of learning and teaching towards e-learning (Alonso, et al., 2005; Edginton & Holbrook, 2010; Koohang, 2009; Rush, 2008; Wu, et al., 2010). The literature has many definitions regarding blended learning. Wu (2010) defines it as an educational approach that combines different delivery methods and learning styles. According to Rush (2008) blended learning is a situation which includes students interaction with content while still being in contact with the instructors as well as the project group members as they progress through the task. The most popular definition of blended learning is probably the mix of traditional face-to-face instructions led by teachers and online learning in with the online portion is delivered via a courseware through the Internet (Koohang, 2009; Oliver & Trigwell, 2005). Some of the advantages of blended learning according to the literature are convenience, flexibility, increased retentiveness, enhanced learning, reduced seat time and decreased costs (Young, 2002; Garnham & Kaleta, 2002; Elearnspace, 2005). With emphasis on the two aspects of increased retentiveness and enhanced learning, the aim of this study was to conduct an experiment with the power qualitative to test these certain learning benefits between a blended learning design and a traditional learning activity.

SETTING THE STAGE

Blended learning designs provide a particularly interesting focus for research into the evolution of e-learning. According to the Centre for Educational Research and Innovation (CERI, 2005) ICT is seen rather to compliment than replace forms of learning. In order to contribute with further knowledge within blended learning used in realistic educational settings our study is an initiative. Previous research has generally not produced consistent impacts on cognitive learning benefits. The majority of studies investigate student's attitudes, expectations, satisfaction, and perceived performance by using qualitative approaches. (Edginton, 2010; Köse, 2010; Mitchell & Forer, 2010; Wu, 2010).

In order to produce multimedia content that promotes the learners with understanding certain theoretical criteria for memory and cognition had to be integrated. We have based our analysis of multimedia learning on elements of the Cognitive theory of multimedia learning (Mayer, 2009; Mayer & Moreno, 2002) and the Cognitive load theory that provides a model for how the mind processes multimedia information (Paas, et al., 2003; Sweller, 2005). The Cognitive theory of multimedia learning is based on three ideas (see also Table 1):

Table 1. Three assumptions how the mind works in multimedia learning

Dual Channel	Humans have separate channels for processing information; an auditory/verbal channel and a visual/pictorial channel.
Limited Capacity	There is only a limited amount of processing capacity available to the verbal and the visual channels.
Active Processing	Learning occurs by active cognitive processing in the verbal and the visual channels. Organization and integration of the information is combined with existing knowledge.

16 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:
www.igi-global.com/chapter/the-learning-effect-of-using-a-blended-learning-design-in-k12-science-teaching/88218

Related Content

Using Technology to Teach Gifted Students in a Heterogeneous Classroom
Edward L. Shaw Jr.and Rebecca M. Giles (2015). *Cases on Instructional Technology in Gifted and Talented Education (pp. 31-53).*
www.irma-international.org/chapter/using-technology-to-teach-gifted-students-in-a-heterogeneous-classroom/118317

The Role of the School Library in Empowering Visually Impaired Children With Lifelong Information Literacy Skills
Iwu-James Juliana, Roland Izuagbe, Victoria Itsekor, Michael Opeoluwa Fagbohun, Aderonke Asaoluand Mary Nwanne Nwokeoma (2018). *Instructional Strategies in General Education and Putting the Individuals With Disabilities Act (IDEA) Into Practice (pp. 245-271).*
www.irma-international.org/chapter/the-role-of-the-school-library-in-empowering-visually-impaired-children-with-lifelong-information-literacy-skills/191632

The Confrontation With the Stranger and Intercultural Considerations in the Travel Report: The German Bildungsreise
Isabella Monika Leibrandt (2020). *International Journal of Curriculum Development and Learning Measurement (pp. 66-78).*
www.irma-international.org/article/the-confrontation-with-the-stranger-and-intercultural-considerations-in-the-travel-report/260748

The Effects of Technology Integration in the Classroom for Students With ADHD
Aleen Kojayan, Aubrey L. C. Stattiand Kelly M. Torres (2021). *International Journal of Curriculum Development and Learning Measurement (pp. 1-10).*
www.irma-international.org/article/the-effects-of-technology-integration-in-the-classroom-for-students-with-adhd/269744

Case Study Analysis of a Social Skills Service Delivery Model With Intellectually Disabled Students
(2019). *Cases on Service Delivery in Special Education Programs (pp. 324-352).*
www.irma-international.org/chapter/case-study-analysis-social-skills/221641