

Literatursammlung Fachbereich Mathematik

Mathematics and outdoor photography experience – exploration of an approach to mathematical education, based on the theory of Dewey’s aesthetics

Meier, A., Hannula, M. S., & Toivanen, M. (2018). Mathematics and outdoor photography experience – exploration of an approach to mathematical education, based on the theory of Dewey’s aesthetics. LUMAT: International Journal on Math, Science and Technology Education, 6(2), 146–166.

Abstract

Based on Dewey's theory of art, aesthetics, and experiences and photographer Barnbaums' writing about expanded perception through photography, we conducted a one-day experimental mathematics education unit. Using photography in outdoor conditions had a positive impact on teacher students' perception of the use of photography for teaching mathematics. To study the changes in students' visual attention deeper, we used gaze-tracking to analyse one student's visual attention when walking outdoors after the activity. The gaze data indicated that more visual attention was given to objects he had photographed or discussed during the group activity in comparison to other objects.

[Zum Artikel](#)

Supporting Elementary Pre-Service Teachers to Teach STEM Through Place-Based Teaching and Learning Experiences

Adams, A. E., Miller, B. G., Saul, M., & Pegg, J. (2014). Supporting elementary pre-service teachers to teach STEM through place-based teaching and learning experiences. The Electronic Journal for Research in Science & Mathematics Education, 18(5).

Abstract

Although recent educational reforms emphasize the importance of Science, Technology, Engineering, and Mathematics (STEM), many elementary teachers feel less knowledgeable about STEM content and less comfortable teaching STEM than other subjects. This study examined a teacher education program that utilized place-based pedagogies within an integrated block of science, mathematics and social studies methods courses to support elementary preservice teachers' development as teachers of STEM. Data were collected on elementary preservice teachers' perceptions of their experiences as they participated in, planned, and enacted integrated place-based STEM education lessons. Findings indicate that experiences with STEM learning and teaching through integrated, place-based activities had a positive impact on preservice teachers' understanding of place-based approaches, their perceived ability, and projected intent to design and implement place-based STEM learning activities.

[Zum Artikel](#)

Challenges in Seeing Data as Useful Evidence in Making Predictions of the Probability of a Real-World Phenomenon

Nilsson, P. (2013). Challenges in Seeing Data as Useful Evidence in Making Predictions of the Probability of a Real-World Phenomenon. *Statistics Education Research Journal*, v12 n2 p71-83 Nov 2013.

Abstract

This study investigates the relationship between deterministic and probabilistic reasoning when students experiment on a real-world situation involving uncertainty. Twelve students, aged eight to nine years, participated in an outdoor teaching activity that called for reflection on the growth of sunflowers within the frame of a sunflower lottery, where students were involved in the process of creating their own empirical data of the growth. However, the study shows not only that the students do not make use of data for predicting the outcome of an uncertain event, but also how this can be explained by students' attention to deterministic features of the situation, brought to the fore within an ecology context and connected to a conceptual principle of 'sharing'.

[Zum Artikel](#)

Geocaching: finding mathematics in a global treasure hunt

Bragg, L. A. (2014). Geocaching: finding mathematics in a global treasure hunt. *Australian Primary Mathematics Classroom*, 19(4), 9+.

Abstract

The article discusses the concept of geocaching, a mathematical lesson outdoor type of teaching that combines technology, treasure hunting and mathematics leading to purposeful, authentic and engaging mathematics. It describes a geocaching educational program that was designed for primary students to increase their conceptual understanding of mathematics. It also notes the knowledge and skills of pre-geocaching including experiences with distance, direction and compass points.

[Zum Artikel](#)

Learning arithmetic outdoors in junior high school – influence on performance and self-regulating skills

Fägerstam, E., Samuelsson, J. (2014). Learning arithmetic outdoors in junior high school – influence on performance and self-regulating skills, *Education 3-13*, 42:4, 419-431, DOI: 10.1080/03004279.2012.713374

Abstract

This study aims to explore the influence of outdoor teaching among students, aged 13, on arithmetic performance and self-regulation skills as previous research concerning outdoor mathematics learning is limited. This study had a quasi-experimental design. An outdoor and a traditional group answered a test and a self-regulation skills questionnaire before and after a 10 weeks unit in arithmetic. Findings suggest differences in changes in academic performance between the groups in favour of the outdoor group and no significant

changes in self-regulation skills, apart from a decrease in intrinsic motivation in the traditional group.
(PsycINFO Database Record (c) 2016 APA, all rights reserved)

[Zum Artikel](#)

Taking Math Outdoors: A Natural Learning Environment

Payne, Milton R. & ERIC Clearinghouse on Rural Education and Small Schools. & National Institute of Education (U.S.). (1985). Using the outdoors to enrich the teaching of mathematics. Las Cruces, N.M : Educational Resources Information Center, Clearinghouse on Rural Education and Small Schools, New Mexico State University

Abstract

Written for teachers in elementary and middle schools and for personnel at outdoor education centers, this publication is the second in an ERIC/CRESS series on utilizing outdoor education methodologies to enhance the academic curriculum. The resource guide suggests ways of getting students interested in arithmetic and mathematics and how to make teaching math fun. Fifteen outdoor activities are keyed to the basic mathematics skills which the National Council of Teachers of Mathematics (NCTM) advocates each student acquire before completing high school. The skills include problem solving; applying mathematics in everyday situations; alertness to reasonableness of results; estimation and approximation; appropriate computational skills; geometry; measurement; reading, interpreting, and constructing tables, charts, and graphs; using mathematics to predict; and computer literacy. Each lesson is presented as an "idea" and contains descriptions of the NCTM skill, purpose, materials required, specific activity, and procedures. The lesson titles are: "Outdoor Shapes," "Hull Gull," "Arithmetic Treasure Hunt," "Cricket Thermometers," "Popcorn Scramble," "Seesaw Equations," "Practice with Dimensions of Circular Objects," "Outdoor Sets," "Ant and People Race," "Can You Locate the Center of an Acre?" "How Many Deer and Moose," "How Tall Is That Tree?" "Lumberjack Lesson," "Hunting Buried Treasure," and "Building and Using a Measuring Wheel." (NEC)

[Zum Artikel](#)

Developing an 'outdoor inspired' indoor experiential mathematics activity

Burell, A., McCreedy, J., Munshi, Z. & Penazzi, D. (2017). Developing an 'outdoor inspired' indoor experiential mathematics activity. MSOR Connections. 16. 26. 10.21100/msor.v16i1.351.

Abstract

The issue of poor retention and achievement rates is one that plagues many British universities. While well documented and researched, there is still need for innovative practices to address this problem. This article outlines the theoretical underpinning of the Activity Guide, a tool the authors developed to support mathematics departments in order to make the transition to university easier for students and thus increase retention and attainment. Some of the topics covered here include reflective practise, experiential learning and independence; topics adapted from an outdoor frontier education course that had been specifically tailored by the authors to target and develop study skills particularly important for mathematics subjects. To allow for transferability and use by the entire higher education mathematics community the Activity Guide was produced to bring a similar course

on university campuses, or even in classrooms, to better cater for resources and the scale the institutions' facilities allow. The Activity Guide contains all that lecturers will need to plan, set up and deliver a range of activities to their students."

[Zum Artikel](#)

Nature-based education: using nature trails as a tool to promote inquiry-based science and math learning in young children

Lee, C.K., Ensel Bailie, P. (2019). Nature-based education: using nature trails as a tool to promote inquiry-based science and math learning in young children, *Science Activities*, 56:4, 147-158, DOI: 10.1080/00368121.2020.1742641

Abstract

Nature trails can be used as a tool for young children to learn about inquiry-based science and math in an open and natural environment. A nature trail provides the opportunity for children to develop their gross motor skills by walking, hiking or playing on the trail and enhance social skills by doing outdoor activities with their friends. The nature trail activities described in this paper are geared toward pre-K to grade 3 children and created by the pre-service early childhood teachers (PSECTs) who attended a five-week nature-based education course held in late spring/early summer term. The nature-based activities supported not only the Maine's Early Learning and Development Standards (MELDS) but also the Next Generation Science Standards (NGSS), and Common Core Math Standards (CCMS). The PSECTs enjoyed creating the activities and appreciated the positive feedback from their classmates when they were trying out the activities on the trail. Creating a nature trail for young children was a new and eye-opening learning experience for all the PSECTs and they were encouraged as teachers to build new nature-based activities that would benefit their future students.

[Zum Artikel](#)

Resourcing Maths and Science from Nature -- and the Recycling Bin!

Clark, M. (2020). Resourcing Maths and Science from Nature -- and the Recycling Bin! *Primary Science*, n162 p24-27.

Abstract

In this article, the author describes how nature can link maths and science to develop skills in both subjects. Experiencing maths, seeing maths, touching maths, playing with maths is a great start, giving children the opportunity to learn maths in the way that science is often experienced. This article does not aim to provide an answer for fully overcoming the social, economic, locational and cultural barriers for many children in the United Kingdom to access nature. However, if a few sticks and stones help to develop curiosity, questioning and confidence in number and shape, and inspire others to show how this can be done, then it is a very natural start.

[Zum Artikel](#)

Teaching maths outside the classroom: does it make a difference?

Otte, C.R., Bøling, M., Elsborg, P., Nielsen, G., & Bentsen, P. (2019). Teaching maths outside the classroom: does it make a difference?, *Educational Research*, 61:1, 38-52, DOI: 10.1080/00131881.2019.1567270.

Abstract

Background: An emerging field of research indicates that the use of learning environments other than the classroom can improve pupils' academic achievement in several subjects, including their skills in mathematics.

Purpose: The aim of this study was to investigate the association between Education Outside the Classroom (EOtC) and pupils' skills in mathematics. Methods: This explorative, quasi-experimental study involved schoolchildren (aged 9-13 years) from 15 Danish public schools who participated in EOtC over the course of a school year. The mathematical skills of pupils from 23 EOtC maths intervention classes (n=421) and 12 EOtC non-maths comparison classes (n=198) were measured at the start and end of the 2014-2015 school year.

Results: Both groups showed improved maths skills; however, we found no significant difference between the EOtC maths and the comparison groups. Conclusion: The results indicate that, in this explorative study, moving maths teaching outside the classroom neither harmed nor improved pupils' mathematical skills. These results and implications for research are discussed.

[Zum Artikel](#)

Finding the Math in the Mountains: Place-based Learning in the Mountains of Southwest Virginia

Askea, H. (2019). Finding the Math in the Mountains: Place-based Learning in the Mountains of Southwest Virginia.

Abstract

The purpose of this article is to provide key aspects and learning outcomes associated with the Math of the Mountains Project. Math of the Mountains was a year long grant project that engaged 60 K12 mathematics teachers in the key concepts and applications of place-based learning and mathematics instruction. Through online coursework and peer support, a four-day immersive field experience, and teacher led field experiences, participants applied elements of PBL to create lesson activities that support real-world learning and problem solving scenarios.

[Zum Artikel](#)

An Outdoor Project-Based Learning Program: Strategic Support and the Roles of Students with Visual Impairments Interested in STEM

Tsinajinie, G., Kirboyun, S. & Hong, S. (2021). An Outdoor Project-Based Learning Program: Strategic Support and the Roles of Students with Visual Impairments Interested in STEM. *J Sci Educ Technol* 30, 74–86.

Abstract

A qualitative study was conducted to understand how middle and high school students with visual impairments (VI) engage in Science, Technology, Engineering and Mathematics (STEM). The Readiness Academy, a Project-Based Learning (PBL) intervention, was designed to provide a week-long, immersive, outdoor, and inquiry-based science education program to students with VI. We analyzed 187 photographs, camp associate intern notes, and researcher memos first using emotion coding, followed by process coding to structure initial codes and categories into seven research activities. We used axial coding as a secondary cycle coding method to determine four consistent themes across all research activities: apprenticeship, collaboration, accessibility, and independence. We found that the inclusion of purposeful accessibility, such as assistive technology and multisensory experiences, supported how students with VI engaged in STEM education. The findings reflect how students dynamically fulfilled roles as apprentices, collaborative members, and independent researchers within the program's context of PBL and outdoor science education.

[Zum Artikel](#)

Outdoor mathematics trails: an evaluation of one training partnership

Moffett, P. (2011). Outdoor mathematics trails: an evaluation of one training partnership, *Education 3-13*, 39:3, 277-287, DOI: 10.1080/03004270903508462

Abstract

Outdoor education has received greater attention in the United Kingdom with the launch of the Learning Outside the Classroom Manifesto. However, teachers' lack of confidence and competence appear to be key factors underpinning the extent of outdoor learning provision in schools. This paper reports on a partnership project in which student teachers worked alongside classroom teachers to create outdoor activities in primary mathematics. Findings suggest that such a partnership provides a supporting framework for both teachers and student teachers to develop confidence, competence and enthusiasm for the provision of future outdoor learning experiences.

[Zum Artikel](#)

Learning biology and mathematics outdoors: effects and attitudes in a Swedish high school context

Fägerstam, E., Blom, J. (2013). Learning biology and mathematics outdoors: effects and attitudes in a Swedish high school context, *Journal of Adventure Education and Outdoor Learning*, 13:1, 56-75, DOI: 10.1080/14729679.2011.647432

Abstract

This research suggests that learning biology in an outdoor environment has a positive cognitive and affective impact on 13–15-year-old, Swedish high school pupils. Eighty-five pupils in four classes participated in a quasi-experimental design. Half the pupils, taking a biology course in ecology or diversity of life, had several lessons outdoors and the other half were taught indoors. All of the classes, but one, also had mathematics lessons outdoors once a week. Twenty-one pupils were interviewed five months after the course and all were positive towards the new learning environment they had experienced outdoors in biology

and/or mathematics. They also valued the higher degree of interaction among the pupils. Other findings from the interviews were that the pupils from the outdoor classes showed a higher degree of long-term knowledge retention. They remembered both activities and contents better than the pupils in the indoor classes. An essay-type question assessing their biological understanding qualitatively according to the Structure of Observed Learning Outcome taxonomy revealed no differences between the groups. The results are discussed in the light of neurocognitive models of long-term memory.

[Zum Artikel](#)

Characteristics of middle school students learning actions in outdoor mathematical activities with the cellular phone

Daher, W., Baya'a, N. (2012). Characteristics of middle school students learning actions in outdoor mathematical activities with the cellular phone, *Teaching Mathematics and its Applications: An International Journal of the IMA*, Volume 31, Issue 3, September 2012, Pages 133–152.

Abstract

Learning in the cellular phone environment enables utilizing the multiple functions of the cellular phone, such as mobility, availability, interactivity, verbal and voice communication, taking pictures or recording audio and video, measuring time and transferring information. These functions together with mathematics-designated cellular phone applications facilitate authentic learning based on real-life phenomena, and widen the range of mathematical activities possible to carry out. This research shows that the cellular phone provides the mathematics students with rich, diverse and colourful learning environment in and out of the classroom. The participating students worked with the cellular phone to carry out activities involving formal mathematical phenomena and at the same time authentic real-life phenomena which they modelled mathematically. Doing so, they worked individually and collaboratively with diverse, specific and general mathematical concepts and at the same time practiced specific and general mathematical procedures, which expanded their mathematical knowledge and meta-knowledge. The cellular phone enabled the students to work with various representations of mathematical objects which encouraged them to investigate these objects independently or with the guidance of their teacher. The students also could tackle advanced mathematical objects intuitively based on their visual representation and actual realization in real-life situations.

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