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# Virtual collaborative learning environments for music: networked drumsteps

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**Abstract**

This paper focuses on a tool for meaningful, collaborative, interaction in a constructionist music composition environment. In particular, it describes the design and implementation of ''Networked DrumSteps'', an application that allows multiple users in different locations to collaborate in the process of music composition, but without the use of standard notation.

Findings from the testing of Networked DrumSteps in an educational environment show encouraging results. Learners agreed that the piece they made together was ''different'' from something they would have made on their own, and that they made it in different way. From a technical perspective Networked DrumSteps has proven itself to be highly scalable and extendable. Tests done with up to six people collaborating together showed no signs of performance deterioration.


*Keywords:* Music education; Collaborative learning; Interactive learning environments; Computer-mediated communication

## 1. Introduction

This paper is concerned with the use of technology for collaborative music composition.

Composing music is fundamentally different in its nature from performing, or improvising, in that it at least in part consists of a considered reflection on musical materials. In order to make

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this reflection possible, we need a representational system that will allow us to examine the attributes of the material in question. In traditional settings, this role is filled by standard music notation. Yet notation is a hard and non-intuitive concept for any child to learn. For many, it is the point at which interest in learning music ceases due to the difficulty in grasping this concept (Bamberger, 1991). By merging technology with music, we have the ability and opportunity to develop tools that allow a new avenue of exploration that eschews the rote methods of learning notation in favour of novel ways of exploring the music. Multiple representations can lead to a better understanding.

The merits of collaboration and groupwork are manifold and much has been written about their use in various settings. Groupware is the name given to technologies that support and assist collaborative activity. Computer supported co-operative learning (CSCL) is concerned with the use of groupware technology in learning environments. This paper explores collaboration in the area of music composition.

Based largely on Papert's work, DrumSteps (Jennings, 2001) is a microworld designed to allow learners to experiment with various aspects of percussion and rhythm in a musical design space. This experimentation is performed in the absence of standard notation. The basic idea is to allow the learner to build a set of steps and create drum sounds by dropping a ball down the steps. The system has the full range of concepts specific to the domain of rhythm, such as pulse, tempo, timbre, texture, syncopation, accent, etc. In keeping with the underlying constructionist principles, learners have complete control over the learning environment.

In light of what has been said earlier about groupware and collaborative learning, this paper focuses on collaborative music microworlds. In particular, it describes a version of DrumSteps that has been extended to become a networked groupware application designed to support collaborative learning, in effect becoming a distributed musical composition tool. The theory behind the design of a networked version of DrumSteps, hereafter called Networked DrumSteps, stems from findings in educational philosophy and learning theory that make a strong link between learning and social interaction and the idea that knowledge is constructed through interaction with others.

The rest of this paper is structured as follows. Section 2 is a breakdown and review of the theories supporting Networked DrumSteps, such as constructivism and constructionism. Section 3 describes the design process involved in turning DrumSteps into a networked application. It extracts user requirements and focuses on the rationale behind the various design decisions, and under what conditions these decisions were made. Section 4 describes the implementation of Networked DrumSteps. Section 5 presents the findings resulting from tests of the software with a group of learners. An evaluation of the software is also included. Section 6 concludes the paper with a look at future work.

## 2. Background

### *2.1. Information technology and music education*

Most music education software packages designed today fall into one or more of the following categories: tutorial, drill and practise, game, simulation or problem solving, with drill and practice being arguably the most popular or common category (Pellone, 1992). Most of these packages