Many reasons are put forward for the decline in interest and attainment in mathematics at second level. Issues which have been flagged as contributing to the problem include; an overemphasis on didactic teaching, lack of encouragement to explore possible alternative solutions to problems, an overemphasis on procedure and the separation of mathematical procedures from real world problems education (Goos, 2004).

Mobile technology offer a means whereby at least some of the issues in mathematics education can be addressed. For example (Wijers M., Jonker V., & Kerstens K., 2008) and (Spikol D., Milard M., 2009) describe collaborative, constructivist, contextualised learning scenarios which leverage off the affordances of smartphones to create alternative ways of teaching mathematical concepts.

We argue that for mobile learning to be successfully integrated into the classroom, in any meaningful large scale fashion, “it must not only support learning experiences of the kind just mentioned but the solution must be applicable across a number of elements of the curriculum and come with an appropriate amount of support for the teacher so that they can not only see the benefits of mobile learning but also a clear path to how they can incorporate it into their daily classroom practice” (blinded ref).

Our research aims to develop and validate the efficacy of an integrated toolkit (hardware through to lesson plans) for the teaching of mathematics which follows a collaborative, contextualised, constructivist philosophy. Both generic tools usable in different curriculum areas and dedicated applications focusing on specific aspects of the curriculum are provided. Our initial areas of focus is on Grade 7 of 2006 NCTM Principles and Standards for School Mathematics (NCTM, 2006) and we are looking at the curriculum areas of Data Analysis; Measurement and Geometry; Number, Operations and Algebra. An interdisciplinary design methodology is being followed and experienced teachers are an integral part of the team. To date we have developed tools to measure angles of elevation, angles of rotation, the distance between two points in the open air (from 5m apart upwards), the distance between two points within a classroom (up to 5m), voting and MCQ. We have also developed collaborative applications to manipulate Cuisenaire Rods (for learning fractions) and to engage in mental arithmetic and algebra using a racing game metaphor (blinded ref).

The technical architecture is depicted in figure 1. A four layered architecture separates core middleware functionality from behaviour specific components. A teacher management system enables teachers to manage and monitor learning activities.

User trials are being carried out in a number of local schools with a view to refining the design of the tools and applications while also attempting to gauge the efficacy of the overall approach. While these are ongoing at the time of writing the preliminary data is favourable. For example in a class of 24 students who engaged in an exercise in estimating and measuring the height of structures 62% of the participants said that the activity changed their ideas on trigonometry (in a positive way); 85% reported that the activity made trigonometry easier to understand; 80% said they felt the activity aided in establishing concepts that the teacher had covered in class; 90% reported that they would like to use more of these types of activities in learning about mathematics (blinded ref). In terms of engendering mathematical problems solving skills a comment from one of the students who reported that “the hardest part was working out the way you had to do it...” is most informative as it highlights exactly the difference between much traditional learning of maths and the approach advocated here which we argue can make a significant contribution to the addressing the issues in mathematics education mentioned earlier.
REFERENCES


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