ABSTRACT

When the original work appeared (Abrahamson, 2006), it spoke of a huge burgeoning sense of excitement surrounding networked classrooms and their growing use throughout universities worldwide. Today, the picture is more complex and substantially more interesting. Driving forces, which include growing acceptance of the evolving nature of teaching and learning, high quality experiments showing what works, and a revolution in the capability, cost, and ease of use of technology itself, are changing the world of education. This is evidenced by the dramatic spread of networked classrooms: today almost every K-12 school and 1 in 6 classrooms in the USA have a system. This evolution, and the interwoven forces that have produced it, make an interesting tale. But, perhaps more significant is the future that these events portend. This paper tries to relate the past in order to look toward that future. Beginning with a brief history of early response systems, it takes up the story from the first author’s own experience leading a team through hardware barriers, misconceptions about pedagogy, and subsequent classroom successes, to summarize the variety of uses of classroom networks, and how they can lead to improved teaching and learning. It then describes the struggles to evolve the technology from 1st to 2nd generation, and a subsequent nationwide randomized control trial in the teaching of Algebra, using this technology, which yielded significant gains in student learning. Finally, imbedded within the narrative, are growing revelations that show why this is such a potentially important area of study for improving education, and why more powerful types of modern systems appear imminent. (Note: This work is an updated and expanded version of an original book chapter written eight years ago (Abrahamson, 2006). The present paper is still written in the first person as a narrative, although a second author has been added. Where not specifically identified, use of the first person in the narrative still refers to the first author. The work of the second author also uses the first person, but his name is identified where his narrative appears.)

Keywords: Classroom Communication Systems, Classroom Teaching, Connected Classrooms, Effective Learning Environments, HPL Centeredness, Networked Classrooms, Pedagogical Tools, Randomized Control Trial (RCT) in Algebra, Response Systems

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INTRODUCTION

Today at every university in the USA, somewhere a faculty member in at least one discipline is using a classroom network in their teaching. This is a phenomenon, which has mushroomed to its present stage mainly within the past decade, from a mere handful of pioneering educators two decades ago. Moreover, the revolution appears not to be limited to higher education. A cursory web search conducted in early 2005, found names of over 3,000 school buildings at the primary and secondary levels in the USA also using networked classroom systems. In 2013 data, provided by a market research company\(^1\), shows that one in six K-12 classrooms throughout the USA have these systems. In other words, almost four hundred thousand classrooms have classroom networks, with one or more in almost every school in the country. On the technology front, a brief survey showed twelve manufacturers of networked classroom systems\(^2\), compared with one or two research outfits, a couple of decades ago. An important point is that the great majority of the networked classrooms, which have gained such wide acceptance, are in fact just simple so-called “Response Systems,” sometimes colloquially known as “Clickers.” In this paper we refer to these simple systems as “Generation 1” (or Gen1) networked classroom systems, and later we will describe what distinguishes them, and what they have in common with more advanced systems.

Amazingly, these generally somewhat primitive tools are being used in just about every discipline currently being taught. An example in 2005 from the author’s own experience, in the process of enquiring about response system usage at the University of Texas at Austin\(^3\) for a letter of recommendation, I was told that response systems were being used that semester in over ten disciplines including physics, chemistry, psychology, biology, mathematics, criminal justice, computer science, library science, pharmacy, and physical education.

In the 2005-2006 academic year a randomized control trial (RCT) in the teaching of Algebra I, with a nationwide sample of 127 teachers from 28 States using an advanced Second Generation (Gen2) system, showed significant gains in student learning (Pape et al, 2013). Randomized control trials are termed a “Gold-Standard Experiment,” and most have shown no effects whatsoever. The fact that this experiment yielded an Effect Size of 0.3, over a full academic year from a nationwide experiment, in the highly problematic mathematics course of Algebra I, was highly unusual.

In education, few things happen this fast or with such a wide and epidemic spread. Arguably, not since the overhead projector has a piece of technology received such pervasive acceptance as an aid to classroom teaching. The purpose of this paper is to give some of the history behind this apparently sudden success story and also to introduce the broader areas of work referenced here, by giving some of the practical and theoretical background upon which the success has been based.

PERSONAL BACKGROUND

It is a salutary exercise for me, because I have spent a good deal of the past thirty years working with some of the predecessors of today’s response systems as well as some more advanced networked classrooms, and have firsthand experience of the history and difficulties behind the current successes. I also believe there is an excellent case to be made that current networked classrooms represent only the first humble steps in an exciting but as yet little explored territory of pedagogical tools that have the power to transform teaching and learning in formal education.

My interest in networked classrooms began almost by accident. From an education in physics and applied mathematics, I was 18 years into a career in aerospace\(^4\) and managing my own research company doing work mostly for NASA, when in 1985 we had a small amount of unbudgeted overhead money that needed to be spent during that year. Within certain limits, as specified on government CPFF\(^5\) contracts,
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