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ABSTRACT

This research used three groups in a quasi-experimental approach to assess the combined impact of teacher teaming and computer technology on student grade point averages (GPAs). Ninth-grade students' academic achievement in each of four different subject areas (algebra, biology, world cultures, and English) was studied. Two separate treatments were investigated. The first treatment exposed one group of students to a teacher-teamed approach for these subjects using a four-period block schedule. The second treatment exposed another group of students to a combination of the same teacher-teamed approach combined with significantly improved access to computer and telecommunications technology in the school and at the participating teachers' and students' homes. A control group received the standard curriculum for these four subjects without any special accommodations for either teacher teaming or technology access. Results showed that students in the team taught group achieved higher GPAs than either the traditional school group or the group having both teacher teams and computer technology. Interviews with participating teachers uncovered impediments to the application of the computer technology. Two tables show mean excused/unexcused absences and mean grades for each subject area. Contains 25 references. (AEF)

Teacher Teams and Computer Technology

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Abstract

Educational innovation occurs in many different ways. One approach uses computer technologies to enhance the learning environment, while another restructures how teachers work with each other and their students. This research used three groups in a quasi-experimental approach to assess the combined impact of teacher teaming and computer technology on student grade point averages. The results show that students in the team taught group achieved higher GPAs than either the traditional school group or the group having both teacher teams and computer technology. Interviews with participating teachers uncovered impediments to the application of the computer technology.

Teacher Teams and Computer Technology

Over the past ten years many governmental, educational, and private sector reports have addressed problems within the educational system in the United States (such as: Boyer, 1985; Carnegie Task Force, 1986; Holmes Group, 1986; National Commission on Excellence in Education, 1983; Task Force on Federal Elementary and Secondary Education Policy, 1983). These studies report that our system of public education is not serving the future needs of our country or our student population, and that the American system of public education is in dire need of revitalization. Various plans have been made to address the nation's educational problems, including: carrying out year-round education, extending the school day, providing more money for education, and developing a nationwide mandatory curriculum.

Suggestions for improving education have also included the integration of computer technology in teaching and learning situations (Riel, 1989), and the restructuring of schools to include the teaming of teachers for interdisciplinary instruction (Whitford & Kyle, 1984). Like many educational innovations, the integration of computer technology and team teaching with interdisciplinary units is being viewed as the newest tools for solving the problems of public elementary and secondary education (Rockman, 1993).

Unfortunately, the evidence is unclear about how well these innovations, especially when used in combinations with each other, work. With ever tightening fiscal resources and increasing public scrutiny local educators, more than ever before, must understand the anticipated outcomes of innovative programs before attempting them, especially when the goal of a program is improved academic achievement.

Computer technology

The use of computers in American public schools has increased steadily since the middle of the 1980s, growing from around 50,000 to over 2,400,000 in just over five years (Becker, 1991). The increasing capabilities and rapidly declining cost of microcomputers, combined with their heightened presence in every sector of our society, have fueled this demand for their presence in schools. Parents perceive that their children will be ill prepared for the future without access to computers in the educational setting (Persell & Cookson, 1987).

What are the real benefits of adding computers to the curriculum? Researchers have reported numerous and varied benefits realized from incorporating computers into the classroom (Brophy & Hannon, 1984; Cuban, 1986; Hecht & Dwyer, 1993; Kosma & Croninger, 1992; Neimiec & Walberg, 1985; and Riel, 1989). Unfortunately, the rapidly changing face of technology, coupled with the slower pace of scholarly communication, means that by the time researchers can disseminate their results improvements in computer hardware and software may have rendered their findings obsolete (Rockman, 1993). Large variations in the kinds of the research completed, and the ways in which computers are used to augment a curriculum, make reproducing any effort, and therefore generalizations from that research, difficult (Becker, 1987; Ryan, 1991).

Teacher teaming

Researchers and educators have documented interest in the idea of a teamed teacher approach since the early 1960s. Chaplain (1964), a pioneer of teacher teaming, saw great merit in teachers working informally together in planning a curriculum, arranging for visitations to each other's classes, exchanging information about students they teach in common, and trading secrets among themselves. Today's concept of teacher teaming has teachers from different subject areas organized into groups of varying numbers with an assigned common area of the school plant, a common schedule, and the responsibility for a common group of students (Meichtry, 1990). The expectation is that the team will work collectively and share resources to provide a broadened range of learning activities and opportunities for children (Schmuck & Runkel, 1985).

How, then, does team teaching influence student learning? One argument put forth as far back as 1969 by James Meyer suggested that team teaching be the potential vehicle for transforming interdisciplinary teaching from the state of theory to one of fact. Extending the teaching competencies of the staff through group interaction and process sharing, it is believed, improves the quality of instruction received by students. Another argument for carrying out teaming suggests that happy and motivated teachers, because of the positive effects that teaming has on them, will foster increased student learning. Costello (1987) supported this claim by suggesting that the single most important influence upon student learning was not a handsomely functional building, a wealth of curriculum materials, or the state of the equipment, but the competence of the classroom teachers and their motivation to act. More recent data (Lundeen & Lundeen, 1993; Boloz & Blessing, 1994) have revealed that team taught students can attain higher grades and standardized test scores than their non-team taught counterparts.

Combining technology and teaming

Unfortunately, no prior research exists describing the interaction between computer technology and teacher teaming. Can teachers effectively integrate these two approaches and what, if any, impediments will stand in their way? Will the benefits of each approach separately interact to produce even higher levels of student achievement, or is there an independent threshold of gain that no amount of innovation can overcome? Before schools can invest their scarce resources on interacting improvement programs educators need to be better informed of the effects of those interactions. This study was a first attempt to measure systematically the blending of computer technology and teacher teaming in one high school setting.

Methods

This research was a quasi-experimental effort studying ninth grade student's academic achievement in each of four different subject areas: Algebra, Biology, World Cultures, and English. One mid-western high school, previously experienced with educational change programs in computer technology and teacher teaming (see Hecht, et. al., 1992 and 1993), was used in this study. Two separate treatments were investigated. The first treatment exposed one group of students to a teacher-teamed approach for these subjects using a four period block schedule. The second treatment exposed another group of students to a combination of the same teacher-teamed approach combined with significantly improved access to computer and telecommunications technology in the school and at the participating teachers' and students' homes. A control group of regular education students received the school's standard curriculum for these four subjects without any special accommodations for either teacher teaming or technology access.

Subjects

The ninth-grade students were quasi-randomly separated into two treatment groups and one control group. Eligibility for selection into a treatment group, due to the block-scheduling nature of the team-taught curriculum, required that each student enroll in all four of the selected courses. Students not meeting these criteria were automatically assigned to the control group. The eligible students were then randomly assigned to one of the two treatment groups. Student and/or parent preferences for non-participation in a treatment group resulted in eleven students being reassigned from their treatment group to the control group.

The first treatment group (Project Schoolroom) received block-scheduled instruction from a team of four cooperating teachers for slightly more than half of their school day, taking elective courses during the remainder. No special computers or technologies beyond those already available within the school were made available. The teachers were allowed one additional period for combined planning and preparation. Fifty-six students were assigned to this group.

The second treatment group (Project Homeroom) also received block-scheduled instruction following the same format as Project Schoolroom but from a second team of four cooperating teachers. This group also had access to a dedicated 25-station computer laboratory throughout the day, and each teacher and student was given a personal computer and modem for their use at home. Project Homeroom consisted of a total of forty-eight students.

The control group consisted of the remaining ninth grade students in the school who were enrolled in one (or more) of the subject courses. The control group teachers were not teamed nor did they have any improved access to computer technologies at the school or at home. Since not all students were required to take each of the four subjects under study the numbers of students in any one subject varied. This resulted in a total of 90 students who took World Cultures, 202 who took English, 238 who took Biology, and 90 who took Algebra. Only 12 of these students enrolled in all four of the subjects under study with 125 taking three of the four subject courses, 105 taking two of the courses, and 132 students only taking one of the four subjects.

To assess the equivalence in distribution of students and abilities the three groups were compared on gender, ethnicity, and beginning of the year criterion referenced test score in Algebra, Biology, and World Cultures (no criterion referenced test was available for English). Male and female students were represented in statistically equal proportions in each of the three groups ($\chi^2 = .049$, df = 2, $\underline{p} = .976$), and the mix of students of different ethnic backgrounds was likewise equivalent ($\chi^2 = 6.10$, df = 8, $\underline{p} = .636$). Analysis of variance revealed slight differences on the beginning of the year criterion referenced tests. Both Project Schoolroom students (· = 28.3% correct) and Project Homeroom students (· = 25.7%) statistically significantly outperformed their control group counterparts (· = 13.5%) on the Algebra test. The same pattern was also seen on the World Cultures test (Project Schoolroom = 42.1%, Project Homeroom = 42.9%, and control group = 38.2%). On the Biology test Project Schoolroom students performed statistically significantly better (· = 42.8% correct) than the Project Homeroom students (· = 37.1%), and both performed significantly better than the control group students (· = 31.3%). While these analyses showed that some differences in ability existed between the groups at the beginning of the year it was felt that these differences were small enough to allow for their accounting as covariates in later analyses.

Instruments

Student academic records served as the primary data source for this study with quarterly grades in each course, grade point averages (overall and for just the four courses under study), and the numbers of excused and unexcused absences examined. These data were supported by occasional classroom observations of selected treatment group classes, periodic in-depth interviews with participating teachers, and an examination of courseware and other curricular artifacts (see Hecht, et. al., 1994, for an in-depth presentation of these data).

Procedures

This research was conducted from August, 1993 through June, 1994, the duration of the 1993-1994 school year. Teachers in both of the treatment groups spent several days during the prior year and summer planning curriculum and activities. Immediately prior to the start of the academic year students in Project Homeroom were required to participate in a short computer orientation camp instructed by the Project Homeroom teachers. The purpose of this camp was to orient those students to the computer hardware, basic operations, and word processing software. Students were required to complete this camp, and show satisfactory skills on an assessment instrument, prior to being allowed to take their computer home.

Results

Both excused and unexcused absences were accumulated for students in all three groups during the first and second semesters in each of the four subject courses (see Table 1). In almost every case the students participating in Project Schoolroom had fewer absences, either excused or unexcused, than their Project Homeroom counterparts. Analysis of Variance, however, revealed that none of these differences were statistically significant (at $\alpha = .05$) except for the first semester of excused absences in English where Project Schoolroom students had statistically significantly fewer absences than both their Project Homeroom and control group counterparts ($F = 3.10$, df = 2,307, $p = .0464$).

Grades were given in each subject at four different quarter points throughout the year (see Table 2). Analysis of Variance, using a Student-Newman-Keuls multiple range test when appropriate, showed that the Project Schoolroom students outperformed both the Project Homeroom and control group students in almost every subject at almost every grading period. In a few cases (second quarter Algebra, third quarter Biology, and the first two quarters of World Cultures) the Project Homeroom students also achieved higher average grades than the control group; in most cases, however, their grades were not statistically different from each other.

Grade point averages, overall for all courses taken and selecting just for the four subject courses, were computed and examined. Project Schoolroom students (· = 2.80) had a statistically significantly ($p < .05$) higher overall GPA than both the Project Homeroom students (· = 2.24) and the control group students (· = 2.41). This difference was even greater when only the four course GPA was considered (Project Schoolroom students = 2.76, Project Homeroom = 2.02, and control group students = 2.27). There was no statistical difference between the average GPAs, either overall or just for the four courses, for the students in the Project Homeroom group and those students in the control group.

Analysis of covariance, using the student's beginning of the year criterion referenced test scores as the covariate, was performed to insure that grade point average differences seen in each of the four quarters could not be explained by ability differences between the groups. The ANCOVAs produced result patterns identical to the one-way ANOVAs without the covariate, with the initial criterion referenced test score accounting for only from two to four percent of the total explained variability.

Interview results

Participating teachers reported that they felt collaboration and sharing among themselves was the most beneficial component in both Project Homeroom and Project Schoolroom. All teachers spoke positively of the team approach, citing several direct benefits including fewer discipline problems than in the past and an ability to spend more time counselling with students. One teacher reported that he spent more than 50% of his day working with individual students. Another teacher considered the team approach a support system for teachers as well as students, since academic and personal feedback were both faster and more frequent. Project Schoolroom and Homeroom teachers reported being able to intervene sooner when problems arose. They said students felt comfortable consulting all teachers about all subjects rather than consulting specific teachers regarding the specific subjects they taught. Teachers reported instances of students continually mixing up teacher names. They interpreted the mixing of names to indicate a feeling on the part of the students that the teachers were truly interchangeable; that talking to one was as good as talking to all. This blurring of group member identities carried over into the curriculum itself. Teachers in both Project Homeroom and Project Schoolroom reported that the working environment encouraged them to give up guarding their individual academic "turf", and to think about education as integrating separate parts of a unified whole.

As the year progressed, however, it appeared that the teachers became less team oriented and began to fall back into the seclusion of their individual disciplines. Teachers from both groups reported an increasing feeling of competition between Project Homeroom and Project Schoolroom. The teachers in both groups indicated that they felt like they "burned-out" during the second semester and that, to some extent, teaming exacerbated that decline.

One issue that was raised consistently in our conversations with the participating teachers centered around the district's criterion referenced tests. Teachers from all three groups continuously stressed the importance of their students performing well on these assessments. The teachers in both the Project Schoolroom and Project Homeroom groups felt that the extra effort they invested in a teamed approach might not be adequately reflected in their student's end-of-year scores. Teachers in the Project Homeroom group were also concerned that their use of the computer required a redirection of classroom time away from the traditional curriculum in order for the students to master and integrate the technology. This was a serious problem for a few of the teachers as there was an expectation, from their peers and academic departments, that the team taught students would progress at the same rates, and on the same materials, as the non-team taught students. Project Homeroom teachers also realized that the CRTs were written for traditional classes taught in traditional ways, and did not reflect what would be taught in a technology-enriched, team taught environment.

While some changes were eventually made by the district in the end of the year CRT, through the addition of specific computer technology questions for the Project Homeroom students, the participating teachers reported that these questions were an addition to the complete test and not a substitution for other material. The district continued to require students to learn the existing curriculum in order to do well on the CRT. Thus, the Project Homeroom teachers reported feeling little to no concession of curricular breadth to accommodate the depth of learning that could be encouraged through the use of the computers. Given the extent of the traditional curriculum, they felt that there was little time or incentive to integrate the use of the computers to their fullest capacity.

Conclusion

These results demonstrate the academic gains that are possible given a restructured, teacher-teamed approach to high school education. Students taught by teacher teams outperformed, in almost all quarterly course grades and overall GPAs, their traditional school counterparts. Students of teacher teams were also absent less frequently, although not at levels great enough to reach statistical significance. Teachers participating in the teamed approach groups attributed these gains to an enhanced familiarity with each student and their particular needs, improved coordination of curriculum delivery and assessment, and a more interdisciplinary approach to the entire ninth grade experience.

The previous literature would lead one to believe that the combination of teacher teaming and computer technology would result in greater gains than either alone. The availability of computer and telecommunications technology, both in the school and at home, should have made this task even easier to accomplish. These results showed, however, that while the Project

Homeroom (combined teaming and technology) approach did promote students to levels greater than their traditional school counterparts these differences were not, in general, statistically significant and were almost always less than what was achieved by the Project Schoolroom (teacher teaming alone) approach. Project Homeroom teachers consistently reported the difficultly of having to integrate new computer technology into an otherwise full curriculum. Furthermore, since the district's criterion references test reflected technology as an addition to what was perceived as an already full Project Homeroom teachers were forced to make a difficult choice between teaching the for and with the technology or teaching with the standard curriculum for the criterion referenced test.

This study points to the need for computer technology to become an inclusive part of regular instruction and assessment, rather than an added feature, if students and teachers are to consider it of value. Districts must learn to value the curricular depth made possible by computer exploration, and must demonstrate this valuation by allowing for modification in both curriculum content, delivery, and assessment. Teacher teaming can provide students with a richer environment that is more responsive to their individual learning needs. If that teamed environment is to be technologically enhanced sufficient planning must be given to the role that technology will play in both the delivery and assessment systems. Time must be allowed within the curriculum for students to learn and explore the technology as a important end in itself. The knowledge embodied in the assessments must include the technical learning as a valued component. Only then will the promise of combined teacher teaming and computer enhancement be realized.

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Table One

Mean Excused and Unexcused Absences

	Excused Absences First Semester	Excused Absences Second Semester	Unexcused Absences First Semester	Unexcused Absences Second Semester
Algebra				
Project	2.05	3.00	0.13	0.22
Schoolroom				
Project Homeroom	3.11	4.75	0.28	0.39
Control	2.66	4.45	0.17	0.14
Biology				
Project	1.95	3.00	0.13	0.24
Schoolroom				
Project Homeroom	3.13	4.75	0.15	0.14
Control	3.11	3.75	0.28	0.42
English				
Project	1.79	2.87	0.09	0.16
Schoolroom				
Project Homeroom	3.23	5.00	0.13	0.27
Control	3.37	4.13	0.36	0.41
World Cultures				
Project	1.82	2.93	0.09	0.13
Schoolroom				
Project Homeroom	3.26	4.95	0.04	0.20
Control	3.09	3.81	0.42	0.49

Table Two

Mean Grades

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Algebra				
Project Schoolroom	3.09[a]	3.09[a]	2.80[a]	2.54[b]
Project Homeroom	2.49	2.32[d]	2.00	1.95
Control	2.21	1.91	2.26	2.28
Biology				
Project Schoolroom	2.73[a]	2.52[a]	2.47[c]	2.47[a]
Project Homeroom	1.85	1.70	2.04[d]	1.61
Control	1.62	1.71	1.58	1.88
English				
Project Schoolroom	2.83[a]	2.68[a]	2.94[a]	2.85[a]
Project Homeroom	2.08	2.04	2.18	2.09
Control	2.23	2.22	2.22	2.22
World Cultures				
Project Schoolroom	3.42[c]	3.21[c]	2.96[a]	2.98[a]
Project Homeroom	3.42[d]	2.87[d]	2.34	2.22
Control	1.93	1.79	2.00	1.90

All analysis evaluated at $\alpha = .05$:

a = Project Schoolroom was statistically significantly different from both Project Homeroom and the control group

b = Project Schoolroom was statistically significantly different from Project Homeroom

c = Project Schoolroom was statistically significantly different from the control group

d = Project Homeroom was statistically significantly different from the control group

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