Effects of a 21st-Century Curriculum on Students’ Information Technology and Transition Skills

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Abstract

A pretest–posttest control group experimental design was used to evaluate the effectiveness of EnvisionIT, a 10-unit web-based curriculum designed to teach secondary students information technology (IT) skills in the context of transition-planning activities. Fifteen high schools were stratified by socioeconomic status and randomly assigned to the EnvisionIT experimental condition or a control condition in which students received traditional instruction. Pre- and posttest data for 287 students—119 (41%) of whom had disabilities—were analyzed using hierarchical linear modeling. Findings indicated that students in the experimental group made significantly greater gains in IT literacy than students in the control group. Students in the experimental group also showed greater gains in several transition skills, including goal setting, knowledge of how to find jobs, and information about college. Results support the conclusion that the EnvisionIT curriculum produces improvements in students’ acquisition of the 21st-century skills needed for success in today’s high tech world.

Keywords

transition, information technology literacy, curriculum intervention, students with disabilities, 21st-century skills

The growing emphasis on academic proficiency, standards-based reform, and high-stakes testing for an increasingly technologically driven world has become the guiding force of recent legislation and educational trends. Although No Child Left Behind (NCLB, 2002) emphasizes standards-based instruction for all students, the Individuals With Disabilities Education Act (IDEA, 2004) mandates that schools provide individualized education programs that prepare students with disabilities for college, employment, and independent living. The divergent underlying assumptions of IDEA and NCLB create a conceptual and logistical challenge for educators: How do they align transition with standards-based education? IDEA requires that schools deliver transition services based on measurable postsecondary goals and provides for accommodations and transition services based on individual student needs, interests, and abilities. In contrast, NCLB assumes uniform learning standards for all students in the context of standards-based curriculum, with outcomes measured through statistically valid standardized assessment techniques (Kochhar-Bryant & Bassett, 2002). In short, the individual educational and transition needs of students with disabilities are often at odds with the push for higher standards for all students. For many students with disabilities, an undifferentiated curriculum has led to a lack of student motivation and poor postsecondary outcomes.

According to the National Longitudinal Transition Study–2 (NLTS2), 47% of high school students with disabilities reported that their primary transition goal was to attend college (Cameto, Levine, & Wagner, 2004). However, only 19% of youth with disabilities who had been out of high school for up to two years were currently enrolled in postsecondary education, as compared to 40% of their peers in the general population (Wagner, Newman, Cameto, Garza, & Levine, 2005). Regarding employment, although 53% reported that their primary transition goal was to enter employment (Cameto et al., 2004), only 41% were employed, as compared to 63% of youth in the general population (Wagner, Newman, Cameto, & Levine, 2005). Clearly, students need additional transition planning and preparation to assist them to achieve their primary transition goals.
Twenty-First Century Skills

Legislators and business leaders are demanding that today’s students be prepared with 21st-century skills needed to succeed in college, work, and life—including core subjects such as English, mathematics, sciences, history, and foreign languages; life and career skills such as self-direction, productivity, and social and cross-cultural skills; and information, media, and technology skills (Partnership for 21st Century Skills, 2008). Information technology (IT) is defined as the set of skills needed to find, retrieve, analyze, and use information (Association of College and Research Libraries, 2000). The Partnership for 21st Century Skills recommends that educators (a) emphasize core subjects that incorporate 21st-century tools and skills; (b) use 21st-century tools to develop learning skills in current standards, curricula, and assessments of core subjects; (c) teach and learn in a 21st-century context and content (i.e., real-world applications and examples); and (d) use 21st-century assessments to measure 21st-century skills (Partnership for 21st Century Skills, 2004). The implications of being technologically illiterate became apparent to education leaders and policy makers, producing a national initiative to integrate 21st-century skills into existing standards and assessments required by NCLB (2002) and IDEA (2004).

Although technological skills were not a prerequisite for many jobs in the past, the increasing use of computers to automate simple tasks and a technologically driven world require IT skills. According to the U.S. Department of Labor employment projections for 2002 through 2012, eight of the ten fastest growing occupations require technological fluency (National Higher Education ICT Initiative, 2004; U.S. Bureau of Labor Statistics, 2004). NCLB requires students to be technologically fluent by the end of eighth grade. The implications of being IT illiterate are vast. For example, students who lack the ability to navigate the computer and Internet in the classroom do not benefit from the use of technologies to access, manage, integrate, and evaluate information.

Research shows that 98% of students with and without disabilities in general education classrooms have computers in at least some academic classes; however, they rarely or never use them (Wagner, Newman, Cameto, Levine, & Marder, 2003). In addition, students with disabilities use computers 33.9% in seventh- or eighth-grade general education classrooms as compared to 13.2% in the tenth-grade classrooms and 16.8% in the eleventh- and twelfth-grade classrooms. The NLTS2 reported that 83% of students with disabilities attend general education classes where the most frequently used instructional materials are paper based. In a National Center for Education Statistics (2005) publication, teachers reported that access to the Internet, digital encyclopedias, and presentation software was essential classroom technology. Because IT literacy is such an integral part of the postsecondary experience and the workforce, why are students with disabilities using technology at nearly half the rate at the secondary level than at the intermediate level? Students with disabilities are less likely to graduate from high school or go on to college, have lower employment rates, and earn lower wages than students in the general population (Brolin & Loyd, 2004; Stodden & Johnson, 2004). With 38% of people with disabilities employed as compared to 78% of people without disabilities (National Council on Disability, 2009), it is imperative that students with disabilities acquire information technology skills.

Integrating Academic, Transition, and Information Technology Skills

According to the American Youth Policy Forum and Center for Workforce Development,

Integrating academic and career skills in the classroom nurtures and enhances students’ ability to understand and retain content because it is relevant and meaningful to their lives. Gaining IT skills in the context of exploring careers through the Internet facilitates the development of other fundamental learning skills. For example, finding information about careers of interest by comparing and contrasting information found on the Occupational Outlook and Career Voyages websites meets both English and technology academic standards. Finally, as students use the Internet to explore the nature of work, salary, and educational requirements of careers, they are better prepared to develop realistic postsecondary employment and education and training goals. (Brand, 2004)

Students need comprehensive instruction integrated into core classes on both essential academic standards (English/language arts and technology) and career development and transition skills that culminate in the development of a self-directed transition portfolio to guide their transition from high school to employment and college. Educational curricula must be developed that meet academic standards, prepare students to succeed on mandated assessments, and prepare students to transition to college and careers with the 21st-century skills needed to succeed.

EnvisionIT is a 21st-century online curriculum developed for students with and without disabilities with funding from the Office of Special Education Programs. The EnvisionIT curriculum integrates reading, writing, and technology content; teaches IT literacy skills; and assists students to use the Internet to explore careers, complete age-appropriate transition assessments, and develop self-directed transition plans. In addition, EnvisionIT teaches students how to complete online job and college applications. Providing
students with comprehensive transition curricula is essential to empowering students to establish realistic goals and transition plans. Providing teachers with a curriculum that integrates academic, technology, and transition skills will better prepare students to navigate college and the workforce.

The purpose of this study is to test the effects of the EnvisionIT curriculum on students’ IT literacy and transition skills. Through a pretest–posttest control group design, we assessed the effects of EnvisionIT for students with and without disabilities. The following hypotheses were investigated:

1. Students with and without disabilities who participate in EnvisionIT will score significantly higher on information technology skills, as measured by the IT Literacy Survey.
2. Students with and without disabilities who participate in EnvisionIT will score significantly higher in transition skills, as measured by the Ohio State University Career Survey.

Additionally, we were interested in exploring the types of students who benefit most from the EnvisionIT curriculum. Therefore, we assessed the differential effects of the curriculum across grade level, reading level, and disability classification.

Method

School Recruitment

We recruited schools across Ohio through conference presentations and local meetings with school personnel. Schools were invited to participate if they had one or more classes that met the following criteria: (a) high school English, technology, or career class; (b) inclusive classroom or resource room; (c) student access to individual desktop computers, the Internet, and the course server; and (d) 40 hours of class time to implement the curriculum. The resulting sample included 15 schools representing nine rural schools, five suburban schools, and one small urban school district. Despite extensive recruitment efforts with several large urban districts, administrators from those districts chose not to participate, citing the complexity of the randomized control group design. Specifically, schools and classroom teachers were required to commit to participation prior to learning whether they were randomly assigned to the experimental or control group.

Randomization Procedure

To ensure equivalence between the experimental and control groups, schools were stratified into three categories based on socioeconomic status (SES): high, middle, and low. Next, the four highest SES schools were randomly assigned to the experimental or control condition and the four lowest SES schools were randomly assigned to the experimental or control condition. The remaining seven schools were then randomly assigned to conditions. This process yielded a total of seven experimental schools (two high-SES, two mid-SES, and three low-SES) and eight control schools (two high-SES, two mid-SES, and four low-SES). Fisher exact and Pearson chi-square tests found no significant differences between the experimental and control groups on gender, school setting, disability, and reading ability classifications.

Sample

Following assignment of schools to experimental and control conditions, students within participating classrooms were asked to complete informed assent/consent forms and gain signatures from their parents, if the student was a minor. Informed consent was obtained from 256 of the 310 students recruited across the seven experimental classrooms and from 185 of the 237 students recruited across the eight control classrooms. This yielded enrollment rates of 82.6% and 78.1% for the experimental and control groups, respectively. The final analytic sample, however, was considerably smaller because of several attrition factors. Students were removed from the sample if they did not have at least a 70% completion rate (finished unit 7 of the 10-unit curriculum) or if they moved or dropped out of school. Classrooms were removed from the sample because of poor adherence to protocol (i.e., lack of treatment fidelity), resulting in the final analytic sample of 153 students in the experimental condition and 134 students in the control condition (see Table 1).

The experimental group was comprised of 56% male (n = 86) and 44% female (n = 67) students. In terms of race, 93% of the sample was White (n = 139) and 7% (n = 11) reported some minority status (e.g., African American, Latino/Latina). Students in suburban schools totaled 17% (n = 26) and 83% (n = 127) were from rural areas. Student disability status, broken into the largest categories, yielded 59% (n = 91) with no disability and 41% (n = 62) with some disability. Of those reporting a disability, 42% (n = 26) were diagnosed with an intellectual disability (ID), 24% (n = 15) were identified as having a learning disability (LD), and the remaining 34% (n = 21) reported having some disability other than LD or ID. The AIMSweb eighth-grade reading classification at pretest showed that 33% (n = 50) of the experimental sample was at benchmark, 35% (n = 54) was strategic, and 32% (n = 49) was intensive. Because of incomplete reporting, some estimates may not total 100%.

The control group was comprised of 55% (n = 71) male and 45% (n = 59) female students. The sample was 82% White (n = 108) and 17% (n = 23) reported some minority
status. Approximately 25% \((n = 33)\) were enrolled in a suburban setting and 75% \((n = 101)\) were in a rural setting. In terms of disability status, 57% \((n = 77)\) of students in the control group reported having no disability, whereas 43% \((n = 57)\) did report a disability. Of that 43%, approximately 60% \((n = 34)\) were diagnosed with a LD and 23% \((n = 13)\) had ID. Other disabilities accounted for the remaining 34%. The AIMSweb reading classification at pretest showed that 31% \((n = 42)\) of the control sample was at benchmark, 47% \((n = 63)\) was strategic, and 22% \((n = 29)\) was intensive.

### Instruments

**Information Technology Literacy Survey.** The Information Technology Literacy Survey (IT-Lit) is a 35-item curriculum-based multiple-choice questionnaire administered pre- and posttest. The IT-Lit addresses the three domains covered in EnvisionIT: (a) tools/mechanics of the Internet (e.g., how to access and use the Internet, how the Internet is organized); (b) research processes (e.g., how to properly cite sources, how to most effectively search the Internet for information); and (c) application to career research (e.g., how to search career databases). A pilot was conducted on the instrument using 40 subjects. A Cronbach’s alpha close to or above .800 and an intraclass correlation coefficient (ICC) above .600 suggests a reliable and valid measurement. This survey was found to have a Cronbach's alpha of .822 and an ICC of .676. Of the available 35 items, 21 items were found to be valid and reliable items for use in this study, resulting in a possible score of 21 points.

**The Ohio State University Career Survey.** The Ohio State University Career Survey (OSU-CS) is a 23-item curriculum-based multiple-choice questionnaire collected pre- and posttest. The OSU-CS collects student demographic information (grade and age), current work and benefit status, and perceived comfort and knowledge of important transition skills such as looking for a job, applying to college, and setting and achieving career goals. In its first year pilot, a test–retest reliability assessment was completed with an \(N\) of 40. This survey was found to have a Cronbach’s alpha of .767 and an ICC of .767.

### Table 1. Descriptive Characteristics of Participants by Group.

| Subgroup                  | Experimental \((n = 153)\) | Control \((n = 134)\) | \(p\) Value |
|---------------------------|----------------------------|-----------------------|-------------|
| Gender                    |                            |                       |             |
| Male                      | 86                         | 71                    | .8111\(^a\) |
| Female                    | 67                         | 59                    |             |
| Race                      |                            |                       |             |
| White                     | 139                        | 108                   | .0102\(^a\) |
| Minority                  | 11                         | 23                    | .1428\(^a\) |
| School setting            |                            |                       |             |
| Suburban                  | 26                         | 33                    | <.0001\(^b\) |
| Rural                     | 127                        | 101                   |             |
| Class grade               |                            |                       |             |
| Senior                    | 17                         | 4                     |             |
| Junior                    | 18                         | 4                     |             |
| Sophomore                 | 16                         | 92                    |             |
| Freshman                  | 98                         | 34                    |             |
| Disability classification  |                            |                       | .8103\(^a\) |
| No disability             | 91                         | 77                    |             |
| With disability           | 62                         | 57                    |             |
| Disability category       |                            |                       | .0004\(^b\) |
| ID                        | 26                         | 13                    |             |
| LD                        | 15                         | 34                    |             |
| Other                     | 21                         | 10                    |             |
| AIMSweb classification (pretest) |                  |                       | .0713\(^b\) |
| Benchmark                 | 50                         | 42                    |             |
| Strategic                 | 54                         | 35                    |             |
| Intensive                 | 49                         | 32                    |             |

Some categories do not total 100% because of missing data. ID = intellectual disability; LD = learning disability.

\(^a\)Based on two-tailed Fisher exact test. \(^b\)Based on Pearson chi-square test.
The AIMSweb Maze Reading Assessment. Two eighth-grade AIMSweb® MAZE passages were used pre- and posttest to assess students’ reading skills. The MAZE is a multiple-choice cloze task that students complete while reading silently. The first sentence of a 150- to 400-word passage is left intact. Thereafter, every seventh word is replaced with three words inside parentheses. One of the words is the exact one from the original passage, the other two are distracters. Research has shown that this instrument provides a reliable and valid measure of reading comprehension (Shinn & Shinn, 2006). Compared to norms of more than 30,000 subjects, students were placed in one of three categories: benchmark, strategic intervention, or intensive intervention. Students categorized as benchmark either met or exceeded the normed mean and were considered to be reading independently at the eighth grade reading level. Students categorized as needing strategic intervention fell one standard deviation below the normed mean and were considered to be reading instructionally, but not independently, at the eighth grade reading level. Students categorized as needing intensive intervention fell two standard deviations below the normed mean and were considered not able to read at the eighth grade reading level, either instructionally or independently.

Procedures

Once schools were randomly assigned to conditions, experimental teachers participated in a full-day workshop on the purpose and use of the EnvisionIT curriculum; logon and navigation procedures; and data collection, grading, and fidelity protocols. After training, baseline demographic and reading achievement data were collected on all students to describe the sample, identify learning supports such as text-to-speech software, and identify possible covariates. Further pretest data were collected on IT literacy skills and transition knowledge. Once these data were collected, teachers began implementing EnvisionIT. Implementation varied across schools, with some teachers implementing the curriculum every day for a 48-minute period in semester-long classes and others using an integrated schedule of a full week per month or a few days per week in full-year classes. On-site monitoring, observation, and technical assistance were provided to teachers by researchers throughout the study period.

Fidelity

A fidelity checklist was constructed for use during site observations to determine the internal validity and accuracy of interpretation of the intervention effects. The checklist was structured in a dichotomous yes/no format with the observer rating the following intervention elements: (a) data collection measurements and procedures were completed according to protocol; (b) appropriate technology was available to support the curriculum; (c) teacher communicated classroom expectations, grading procedures, and other behavior specified in the teacher’s guide; and (d) students were instructionally engaged with the curriculum, asked for assistance if necessary, and followed the teacher’s instructions. The experimental fidelity checklist determined the level of adherence to treatment protocols. The control fidelity checklist described the use of technology, classroom expectations, and teaching strategies. At the teacher workshop, the fidelity checklist and proposed observation schedule were reviewed. Fidelity observations were conducted in each class between units 2 and 4, between units 5 and 7, and between units 9 and 10. One point was given for every appropriate behavior observed, with total points possible being 29. Higher scores reflected a more faithful adherence to protocol. If teachers fell below 60% adherence (17.4 points or below), technical assistance was provided and a follow-up observation was conducted. If the teacher again did not meet the fidelity criteria, the class’s data were removed from the analytic sample.

Analysis

We used a hierarchical linear model (HLM) to test the effects of the EnvisionIT curriculum on dependent measures of students’ IT literacy scores, perceived goal-setting knowledge and abilities, and perceived knowledge of how to find jobs and information about colleges. We used the change in scores from pretest to posttest to measure the effect of the intervention, controlling for the student’s pretest score on the dependent measure, school setting (rural, suburban), disability class (with or without disabilities), grade level (freshman vs. upperclassman), baseline AIMSweb classification (intensive, strategic, benchmark), and teacher. Interaction effects needed for the comparison of the two groups within subsamples formed by the covariates were included in the model.

Results

The HLM analyses detected differences between the experimental and control groups’ scores on IT literacy and transition skills after controlling for the effect of disability, grade, reading level, school setting, and teacher effects. For the IT literacy score change, the model explained 42% of the variation in the data (N = 286 after removing one outlier whose IT literacy score dropped from 16 to 0). The main effects of pretest score, \( p < .0001 \); disability class, \( p < .0001 \); AIMSweb classification, \( p = .0017 \); group, \( p = .005 \); and school setting, \( p = .048 \), were significant. Teacher effect was nested within group and school setting, as different teachers did not contribute across school settings and we assumed that
all the effects of the school on the student performance was expressed by the teacher effect. It was significant, $p = .0174$. In other words, the model, after controlling for the stated covariates, indicated that 42% of the change in the data set could be attributed to the independent variable and this effect was significant. Model diagnostics for outliers and normality check of the residuals were conducted. Table 2 provides the least squares estimates of the mean changes for the various subgroups using our statistical model. It assumes that the baseline IT literacy score is 12.1 (the mean of the baseline scores). Next, results will be discussed according to our stated hypotheses.

**IT Literacy**

Overall, experimental students made statistically greater gains in IT literacy ($M = 3.493$) than control students ($M = 0.571$), $t = 3.5446$, $p = .0005$. Students with disabilities in the experimental group outperformed students with disabilities in the control groups with means of 1.241 and $-0.125$, respectively, although this increase was not statistically significant, $t = 1.4265$, $p = .1549$. The results for students without disabilities were more dramatic with a mean increase of 5.745 for experimental students and 1.268 for control. This change was significant, $t = 3.6013$, $p = .0004$. Uppercrassen experimental students made significantly greater gains ($M = 4.103$) than uppercrassen control students ($M = -0.043$), $t = 3.7989$, $p = .0002$. Freshman experimental students also gained more than freshman control students, with means of 2.883 and 1.186, respectively, $t = 0.9573$, $p = .3393$, although this difference was not statistically significant.

To examine whether gains in IT literacy were related to student reading ability, change in IT literacy scores were analyzed by AIMSweb reading classification. Students are classified as either (a) benchmark, which indicates the student is reading independently at the eighth-grade level and does not need intervention to read EnvisionIT; (b) strategic, an indicator of moderate intervention needs; or (c) intensive, which identifies that the student is below level and needs intensive intervention such as text-to-speech assistive technology. Experimental students who were reading at the eighth-grade reading level and identified as benchmark readers by the AIMSweb had the most significant gains ($M = 5.518$) when compared to control benchmark readers ($M = 2.5605$, $p = .0110$). Experimental students needing strategic reading intervention made greater gains ($M = 3.666$) than control strategic readers ($M = 3.4553$, $p = .0006$). Experimental students who were identified as intensive readers made gains of 1.294 compared to intensive control readers who actually decreased $-0.573$, but this finding was not significant, $t = 1.6787$, $p = .0944$. Taken together, these findings suggest that students with greater reading proficiency obtain greater benefits from the curriculum.

Finally, regardless of the school setting, experimental students continued to have greater gains in IT literacy than control students. Suburban experimental students had larger gains ($M = 4.506$) than suburban control students ($M = 1.013$, $t = 2.5605$, $p = .0110$); and rural experimental students had larger gains ($M = 2.480$) than rural control students ($M = 0.130$) $t = 3.1184$, $p = .0020$. Both of these findings were statistically significant.

**Transition Results**

Using paired $t$ tests, we examined changes in transition scores (post–pre) for students with and without disabilities...
for the experimental and control groups. Mean scores regarding how to set goals, knowledge about finding jobs, and finding information about colleges significantly improved for students with disabilities in the experimental group, but not for those in the control group. For students without disabilities, the experimental group showed a significant increase for knowledge of finding jobs, whereas the control group showed no significant change in any of the measured scores. Table 3 reports 95% confidence intervals for the mean change in various scores.

Goal-setting subscale. Four questions from the OSU-CS asked students their knowledge or perceived abilities in goal setting. Students were asked to rate their knowledge of how to set career goals and how to create a step-by-step plan. Students were also asked how strongly they agree that they believe they can achieve goals and how much others believe they can achieve goals. Experimental students with disabilities improved their knowledge and comfort in setting and achieving goals. Control students did not.

Finding jobs. Students were asked in the OSU-CS to rate their knowledge of how to find paying jobs on a 5-point Likert-type scale: 1 (not knowledgeable), 2 (a little knowledgeable), 3 (somewhat knowledgeable), 4 (moderately knowledgeable), or 5 (extremely knowledgeable). Experimental students with and without disabilities had significant gains in knowledge posttest compared to control students with and without disabilities (see Table 3).

Finding colleges. Students were asked in the OSU-CS to rate their knowledge of how to find information about colleges as a little, somewhat, moderately, or extremely knowledgeable. Experimental students with disabilities had significant gains in knowledge posttest compared to control students with disabilities. Experimental students without disabilities did not have significant gains in knowledge posttest compared to control students without disabilities.

Discussion
Test and Algozzine (2009) identify a need for more experimental research studies in secondary transition that follow the recommendations for conducting high-quality group experimental research described by Gersten, Fuchs, Compton, Coyne, Greenwood, and Innocenti (2005). Specifically, more research is needed in the area of employment skill instruction, including teaching skills such as completing a job application (Nelson, Smith, & Dodd, 1994) and using computer-assisted instruction to teach employment skills (Mechling & Ortega-Hurdon, 2007). This experimental

| Table 3. Comparison of Mean Increase in Knowledge of Transition Skills by Group |
|---------------------------------|-----------------|-----------------|
|                                | Mean Change in Score | 95% CI          |
|                                | Goal setting       |                 |
| **Students without disabilities** |                   |                 |
| Experimental                    | .3626             | −0.1862         | 0.9115          |
| Control                         | .4805             | −0.2826         | 1.2437          |
| **Students with disabilities**  |                   |                 |
| Experimental                    | .7581             | 0.0536          | 1.4625          |
| Control                         | .5965             | −0.2394         | 1.4320          |
| **Knowledge of finding jobs**   |                   |                 |
| **Students without disabilities** |                   |                 |
| Experimental                    | .2747             | 0.0402          | 0.5093          |
| Control                         | .1558             | −0.1073         | 0.4190          |
| **Students with disabilities**  |                   |                 |
| Experimental                    | .3226             | 0.0149          | 0.6303          |
| Control                         | .2632             | −0.1105         | 0.6368          |
| **Knowledge of finding information about colleges** | | |
| **Students without disabilities** |                   |                 |
| Experimental                    | .2308             | −0.0291         | 0.4907          |
| Control                         | .1558             | −0.1198         | 0.4315          |
| **Students with disabilities**  |                   |                 |
| Experimental                    | .4677             | 0.1307          | 0.8048          |
| Control                         | .3333             | −0.0594         | 0.7260          |

CI = confidence interval; LL = lower limit, UL = upper limit.
*aIndicates significant increase at 5% level of (two-tailed) significance.
study demonstrates that the EnvisionIT curriculum increases students’ IT literacy and transition skills, as compared to students’ in the control group.

**Information Technology Literacy**

Overall, students who completed the EnvisionIT curriculum made significantly greater gains in IT literacy than control students. On the IT-Lit assessment, students with disabilities who completed EnvisionIT outperformed students with disabilities in the control group. More proficient readers demonstrated greater increases in IT knowledge, as evidenced by significantly greater gains for experimental benchmark readers, as compared to control benchmark readers. Those students with lower reading levels also had lower IT literacy gains. This finding suggests an underlying positive relationship between students’ reading levels and achievement in content-related subject areas, thus strengthening the notion that reading instruction and supports may need to be considered for students in advanced grade levels. Although project staff identified students whose instructional reading levels were below sixth grade and recommended that these students use text-to-speech assistive technology, very few students used these supports even when software programs and training were provided for teachers. During fidelity visits, teachers reported that they were not using the recommended software for several reasons: (a) their districts’ IT specialists had difficulty with the installation of text-to-speech software, (b) teachers themselves were uncomfortable with assisting students to use the supports, and (c) students did not want to use headphones to listen to the screen reader.

Despite the fact that a number of students in the experimental classrooms did not use text-to-speech support, students who were classified as both benchmark and strategic readers performed significantly better on the IT-Lit. These students gained skills in understanding how the Internet is organized, how to determine the purpose of a web site, and how to find and complete online job and college applications. In addition, these students became proficient in using a course management system and submitting work electronically. These 21st-century skills are essential in many college and job settings.

**Transition**

The EnvisionIT curriculum provided transition and employment skill instruction for students in three areas: (a) goal setting, including how to develop measurable employment and education and training goals and to how to create transition plans to meet these goals; (b) finding jobs, including instruction on how to complete job applications and prepare for job interviews; and (c) finding information about colleges, including how to select colleges that provide degrees that match the student’s career goal and how to complete online college applications. Students with disabilities who completed EnvisionIT reported increased transition knowledge in all three areas: goal setting, finding jobs, and finding information about college. Students without disabilities reported increased knowledge for finding jobs, but not for goal setting or for finding information about college. Students without disabilities may be expected to set goals and find information about colleges at pretest. However, students with disabilities made significant gains in their knowledge in all three areas.

**Setting career goals.** Students with disabilities who completed the EnvisionIT curriculum significantly increased their knowledge of how to set and achieve transition goals. For the first time, IDEA (2004) requires individualized education program teams to develop measurable postsecondary goals based on age-appropriate transition assessments. Within the EnvisionIT curriculum, students complete learning and personality style assessments and interest inventories. Based on the results of these assessments, students explore a number of high interest careers using a variety of web sites, such as the Bureau of Labor Statistics, Career Voyages, and Occupational Outlook Handbook. Once they narrow their employment goal, they interview workers within their chosen career field. Students develop their postsecondary employment and education goals using the information gained from EnvisionIT.

**Employment.** After students established valid employment goals by completing transition assessments, they learned to complete online job applications. Both students with and without disabilities who completed the EnvisionIT curriculum reported a significant increase in their knowledge of finding jobs and completing online job applications, as compared to students who did not receive the EnvisionIT curriculum. As stated previously, 53% of students with disabilities planned to enter employment (Cameto et al., 2004), yet only 41% were employed, as compared to 63% of youth in the general population (Wagner, Newman, Cameto & Levine, 2005). Would providing instruction on how to search for jobs and complete job applications improve post-school outcomes? Although this study was not long enough to determine the impact on actual employment rates, we recommend providing direct employment skill instruction as part of students’ course of study.

**Postsecondary education.** Students with disabilities reported significantly increased knowledge on posttests on how to find information about college, as compared to control students and students without disabilities. Approximately half of students with disabilities have a primary transition goal of attending college, but only 19% are enrolled one year after graduation (Cameto et al., 2004). Perhaps the reason students with disabilities are enrolled in college at less than half the rate of their stated transition goal is due, in part, to the fact that these students have not learned how to search
for information about colleges, complete online college applications, and gain adequate IT literacy skills. Students require direct instruction on how to establish postsecondary measurable goals, complete college applications, use course management systems, and find accurate information using the Internet if they are to be successful in college.

Integrate Transition Planning Into Academic Courses of Study

A positive relationship exists between quality transition planning and postschool results for students with disabilities (Blackorby & Wagner, 1996; Wagner et al., 2003). Follow-up studies consistently document that postschool employment is less likely to materialize when youth with disabilities lack meaningful transition planning experiences prior to exiting the schools (Rylance, 1998; Test, Mustian, Mazzotti, & White, 2009). The literature indicates that teachers are not implementing effective transition planning because of educators’ lack of knowledge, competence, or time to deliver transition services (Carlson, Chen, Schroll, & Klein, 2003; Wandy, Webb, Williams, Bassett, Asselin, & Hutchinson, 2008).

The above findings underline the importance of implementing curricula that deliver transition services that include both age-appropriate transition assessments that lead to self-directed postsecondary goals and instruction on completing job and/or college applications. Teachers who have not had the opportunity to learn how to teach transition skills can use EnvisionIT to equip their students with these essential skills. This 21st-century EnvisionIT curriculum is correlated to academic standards and uses a course management system that is prevalent at many colleges and work sites. Students must be prepared with the knowledge, skills, and competencies to successfully transition to self-directed colleges and careers.

Limitations and Future Research

Two issues limit the generalizability of our study results. First, no students from urban schools were involved in the study. Despite efforts to recruit urban districts, a number of barriers were encountered including lack of administrative support, inadequate computer capacity within districts’ high schools, or low expectations of students. Second, assistive technology (AT) software programs to assist students with below-grade-level reading skills were not used systematically. Although pretests were administered to identify students who might benefit from text-to-speech AT, neither commercial nor open-source AT applications were integrated into either treatment or control classrooms, despite the fact that several types of AT and training were provided to teachers. We anticipate that the integration of such resources will enhance the effectiveness of the intervention.

Further investigation is needed to determine the effectiveness of text-to-speech screen readers to assist poor readers to gain access to the general curriculum. Students with disabilities might have improved their performance if text-to-speech supports had been provided, as recommended by project staff. Solutions to system barriers, such as the inadequate training and support of teachers to implement text-to-speech, must continue to be a priority for researchers, administrators, and teachers.

The results of this study also suggest that subsequent replications focus on urban schools, where students’ academic and transition outcomes are ranked among the lowest on state report cards. Because of poor reading proficiency of urban students, accommodating digitized content with text-to-speech screen readers must be researched to determine the effects of digitized content with and without text-to-speech support on academic and transition outcomes of urban students.

Finally, improving academic achievement and knowledge of how to find information about jobs and colleges are laudable goals. However, how these gains in student skills are correlated with improved postschool outcomes is unknown. Research is needed to link teaching 21st-century transition curricula, gains in academic and transition skills, and postschool outcomes, such as hours worked and hourly wage in employment and success in college, as measured by retention and grade point average indicators.

Conclusion

We must develop curricula that meet required academic standards, include instruction on IT literacy and transition planning, and ultimately prepare students to transition to the 21st-century workforce. Researchers, legislators, and practitioners agree that if students with disabilities are to attain the skills, knowledge, and behaviors that will equip them for the workforce, we must deliver curricula that compensate for the lack of time and competence our educators report regarding delivering transition services and that prepare students to successfully transition to the 21st century.

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