Facilitating Student Learning Through Contextualization: A Review of Evidence

Dolores Perin[1]

Abstract

This is a review of evidence for contextualization, defined here as an instructional approach connecting foundational skills and college-level content. Two forms of contextualization are identified, *contextualized* and *integrated* instruction. Despite methodological limitations, the available studies suggest that contextualization has the potential to accelerate the progress of academically underprepared college students.

Proficiency in reading, writing, and mathematics is key to academic learning, but courses in these foundational skills[1] are conventionally taught separately from the disciplines to which the skills must be applied. For example, students may be taught writing skills in a developmental English class and then be expected to apply them in a college-level history class. Several problems arise with this structure. First, for reasons still to be determined, learners, even the most proficient, often do not readily transfer newly learned skills to novel settings (Barnett & Ceci, 2002). Second, students may not be motivated to learn the skills taught in developmental education courses because they do not perceive them to be directly connected to their personal educational goals (Cavazos, Johnson, & Sparrow, 2010). Third, weaknesses in academic skills may not be addressed by the disciplinary instructor whose objective is to teach the subject matter, not basic skills (Fisher & Ivy, 2005).

[1]Columbia University, New York, NY, USA

Corresponding Author:
Dolores Perin, Teachers College, Columbia University, 525 W. 120th Street, Box 70,
New York, NY 10027, USA
Email: perin@tc.edu

   This situation has serious implications for the academic trajectory of the many students who enter community colleges without the ability to read, write, or solve mathematics problems at the college level. However, bringing basic skills and content area instruction closer together may increase proficiency in reading, writing, and mathematics skills as well as the capacity of students to apply those skills in meaningful ways to academic tasks (Baker, Hope, & Karandjeff, 2009; Heller & Greenleaf, 2007; Lee & Spratley, 2010). In particular, developmental educators have suggested that basic skills instruction should use "authentic materials like the textbooks used in college courses such as psychology or biology" (Simpson, Hynd, Nist, & Burrell, 1997, p. 41). Simpson et al. (1997) contrasted such "embedded" instruction with the predominant "generic" approach (p. 42), in which technical aspects of literacy or mathematics are taught apart from content. Embedding developmental education instruction in disciplinary content may be helpful because basic-skill demands differ considerably across disciplines (Goldman & Bisanz, 2002; Stahl & Shanahan, 2004). Furthermore, generic instruction has been criticized as uninteresting and ineffective (Grubb et al., 1999). In contrast, "people learn when they have a need that is meaningful and real" (Goode, 2000, p. 270). For many students, what is real is their career goals, which are furthered by the completion of a specific degree or certificate program. Thus, using authentic materials may result in more active, generalizable learning (Simpson & Nist, 2002). The purpose of this article is to examine evidence for the embedding of basic skills instruction through *contextualization*.

   Contextualization has been defined as "a diverse family of instructional strategies designed to more seamlessly link the learning of foundational skills and academic or occupational content by focusing teaching and learning squarely on concrete applications in a specific context that is of interest to the student" (Mazzeo, Rab, & Alssid, 2003, pp. 3-4). As passing the disciplinary courses needed to earn a desired college credential is assumed to be of considerable interest to students, the specific content of these courses can create a context for the learning of reading, writing, and mathematics skills that are authentic and personally meaningful to them (Kalchik & Oertle, 2010). The alignment and integration of developmental and disciplinary courses has been associated with positive student outcomes (Levin, Cox, Cerven, & Haberler, 2010; Weiss, Visher, & Wathington, 2010) and connections between basic skills and disciplinary learning are highlighted in the national literacy standards for career and college readiness (National Governors' Association and Council of Chief State School Officers, 2010).

Identification of Studies

Literature was sought that focused on contextualization as a form of instruction in reading, writing, or mathematics. A keyword search for sources (journal articles, books, and technical reports) dated 1990 to 2010 was conducted using the ERIC, JSTOR, and Education Full Text databases, augmented by searches of the Web of Science Social Science Citation Index, Google Scholar, and bibliographies in identified references as

well as by a hand search of the journals relevant to the purpose of the study, including *Community College Review, Community College Journal of Research and Practice*, and *Journal of Developmental Education*. Works were selected if they reported instructional procedures for the contextualization of basic academic skills or measured student outcomes associated with the approach. The contextualization of English as a second language (e.g., Song, 2006) and content area instruction (e.g., Reisman & Wineburg, 2008) was beyond the scope of this review. The initial intention was to confine the search to work in community colleges, but because a shortage of research on contextualization in this setting was immediately apparent, the search also screened in reports on contextualization in adult literacy and K-12 education. The search identified 61 sources, of which 34 were descriptive and 27 were quantitative reports. Later in this article, selected studies with quantitative evidence are discussed. A full bibliography, listing both the descriptive and quantitative work, is available from the author.

Terminology

Numerous terms are used in the literature for contextualization, both of basic skills and other areas, including *contextual teaching and learning* (Baker et al., 2009; Johnson, 2002), *contextualized instruction* (Parr, Edwards, & Leising, 2008; Wisely, 2009), *content area literacy* (McKenna & Robinson, 2009), *embedded instruction* (Simpson et al., 1997), *writing-to-learn* (Klein, 1999; McDermott, 2010), *integrative curriculum* (Dowden, 2007), *situated cognition* (Hattie, Biggs, & Purdie, 1996; Stone, Alfeld, Pearson, Lewis, & Jensen, 2006), *problem-based learning* (Gijbels, Dochy, Van den Bossche, & Segers, 2005), *theme-based instruction* (Dirkx & Prenger, 1997), *anchored instruction* (Bottge, Rueda, Serlin, Hung, & Jung, 2007), *curriculum integration* (Badway & Grubb, 1997), *academic-occupation integration* (Bragg, Reger, & Thomas, 1997; Grubb & Kraskouskas, 1992; Perin, 2001; Prentice, 2001), *work-based learning* (Raelin, 2008), and *functional context education* (Sticht, 2005). Furthermore, contextualization is an important component of learning communities involving developmental education and college English courses (Fallon, Lahar, & Susman, 2009; Tai & Rochford, 2007; Weiss et al., 2010) as well as workplace literacy (Mikulecky & Lloyd, 1997). Regardless of the term used, all of these applications center on the practice of systematically connecting basic skills instruction to a specific content that is meaningful and useful to students.

Extent of Use of Contextualization in Basic Skills Instruction

Estimating the extent of contextualization of basic skills instruction in community colleges is difficult, but the use of contextualization seems rare. A study in one state found the practice to be infrequent and confined mostly to mathematics instruction (Wisely, 2009). A search for contextualization in the form of academic integration at community colleges in several states also found low usage (Perin, 2001). Although

learning communities connecting developmental and college-level content courses have been described (Weiss et al., 2010), it is not known whether these efforts last only when external funding is available or whether they are becoming regular practice. If contextualization is rare, it may be because it is expensive; Jenkins, Zeidenberg, and Kienzl (2009) reported that a program integrating adult basic education and college-credit occupational courses in the state of Washington received 75% more funds per student than did traditional basic skills and vocational courses. Other reasons for the low use of contextualization may be a lack of awareness of its existence and benefits, the effort required to modify curriculum, and general resistance to moving toward an interdisciplinary focus. If the research indicates positive outcomes and colleges wish to implement contextualization, these barriers will need to be overcome.

Two Forms of Contextualization of Basic Skills Instruction

An examination of the literature indicates that contextualization is implemented in two distinct forms, *contextualized* and *integrated* instruction. This distinction has not been made explicit in previous literature, but it is an important contrast for instructional design because each form of contextualization involves different teaching staff and instructional emphases. Contextualized instruction is employed by instructors of reading, writing, and mathematics, whereas integrated instruction is the province of discipline-area instructors.[2] To maintain consistency with previous literature, the umbrella term *contextualization* is used here to refer collectively to the two forms of instruction.

Contextualized basic skills instruction involves the teaching of reading, writing, or mathematics skills against a backdrop of specific subject matter such as philosophy (Snyder, 2002), statistical process control (Baker et al., 2009), allied health (Shore, Shore, & Boggs, 2004), business (Weiss et al., 2010), history (De La Paz, 2005), and science. The primary objective is to teach the academic skills rather than the subject matter, although there may be some implicit learning of the content as students are exposed systematically to material in the same discipline as they practice the basic skills over time. Although many developmental reading instructors routinely use passages from content area textbooks, what is different about contextualized instruction is the systematic use of text from a single college-credit subject area.

Whereas the venue for contextualized basic skills instruction is the basic skills classroom, *integrated basic skills instruction* occurs in content area classrooms. Examples have been reported for college courses in business and allied health (Artis, 2008; Badway & Grubb, 1997; Cox, Bobrowski, & Spector, 2004; Perin, 2001) and in K-12 science, social studies, and career and technical education (Barton, Heidema, & Jordan, 2002; Bulgren, Marquis, Lenz, Schumaker, & Deshler, 2009; De La Paz & Felton, 2010; Krajcik & Sutherland, 2010; Massey & Heafner, 2004; McDermott, 2010; Nokes, 2008; Parr et al., 2008; Stone et al., 2006; Tilson, Castek, & Goss, 2010). Integrated instruction may be needed when a content instructor observes that many

students are having difficulty with the basic skills needed to learn the material, such as, in one example, when teachers found it necessary to "sneak in" reading comprehension strategies in a college course on symbolic logic (Higbee, Lundell, & Arendale, 2005, p. 328).

While contextualized instruction aims to teach basic skills for the purpose of meaningful application, the goal of integrated instruction is to teach the disciplinary content, not basic skills; however, teaching basic skills is a necessary step toward critical thinking about the content (Pearson, 2010). As instruction must be customized for specific contexts, both approaches can require considerable effort on the part of instructors. However, given the serious difficulties with basic academic skills seen in both secondary and postsecondary classrooms in the United States (Bailey, Jeong, & Cho, 2009; Grigg, Donahue, & Dion, 2007; Salahu-Din, Persky, & Miller, 2008), it is important to find instructional methods that can promote improved outcomes. Theories of the transfer of learning as well as theories of learner motivation suggest that contextualization may serve this purpose.

Theoretical Framework: Underlying Mechanisms

The goal of contextualization is to create conditions for more effective learning, expressed, for example, in better skills, higher grades and rates of retention in courses, and progression to more advanced course work. Whether instruction is contextualized or integrated, the connection of basic skills instruction to applications and life goals is consistent with constructivism, which places students' interests and needs at the center of education (Dewey, 1916/1966; Dowden, 2007).

From a cognitive perspective, contextualization is thought to promote transfer of learning and the retention of information (Boroch et al., 2007; Dirkx & Prenger, 1997; Karweit, 1998; Stone et al., 2006; Weinbaum & Rogers, 1995). Stone et al. (2006) hypothesized that "the creation of explicit connections between situations is critical if students are to transfer their knowledge and skills outside the classroom, whether it is to another context or to an abstract testing situation" (p. 11). However, knowing when and where one should apply a previously learned skill requires metacognitive and self-regulation abilities that low-skilled students may lack (Bailer, 2006; Fox, 2009; Mayer & Wittrock, 1996; Nash-Ditzel, 2010). Linking basic skills instruction directly to authentic content area applications that students will encounter in a disciplinary course may increase the likelihood that skills will be transferred to that particular setting[3].

Barnett and Ceci (2002) proposed that the extent to which the transfer of skills occurs will vary according to the type of skill being targeted, how transfer is measured, the demands placed on memory of the skill to be transferred, and the distance between learning and transfer. According to this framework, the distance between original learning and eventual transfer can be measured in terms of the similarity of the two domains; the physical, temporal, functional, and social contexts also come into play, as does the modality for expressing transfer. In the present context, modality is the application of a

skill, such as verbalizing how a mathematics problem is solved in an accounting class or writing a summary in a history class.

In addition to the cognitive mechanism of transfer of learning, possible benefits of contextualization may be explained by the affective mechanism of intrinsic motivation, where a learner is drawn to engage in a task because it is perceived as interesting, enjoyable, or useful (Baker & Wigfield, 1999; Becker, McElvany, & Kortenbruck, 2010; Ryan & Deci, 2000). Academically underprepared college students may not be drawn to learn basic skills that they should have learned much earlier in their academic history (Cavazos et al., 2010; Dean & Dagostino, 2007; Gardenshire-Crooks, Collado, Martin, & Castro, 2010). Having graduated from high school, they may not realize that their academic skills are not at college standard, and they may resist the need yet again to sit in classrooms that teach basic skills. Levin and Calcagno (2008) summarized students' low motivation to learn from generic basic skills instruction:

> [Skill and drill] pedagogy has many drawbacks, including the fact that many remedial students face serious attitudinal obstacles that prevent them from learning in this way. Often it is the same style that the students were exposed to in high school and that may have contributed to their difficulties in the first place. Beyond that, its abstract and isolated nature may prevent students from seeing the usefulness of what is being taught in real-world situations and from applying the skills that are learned to later academic and vocational coursework. (Levin & Calcagno, 2008, p. 185)

Furthermore, underprepared students may not be motivated to attend class regularly and apply themselves to learning because they dislike appearing incompetent (Dean & Dagostino, 2007) or because of competing job and family responsibilities (Caverly, Nicholson, & Radcliffe, 2004; Kozeracki, 2005). Extrapolating from research on motivation, it is possible that students may be more inclined to try to overcome such obstacles if explicit connections are made in class between basic skills and personally meaningful content applications (Berns & Erickson, 2001; Bond, 2004; Boroch et al., 2007; Guthrie, Anderson, Alao, & Rinehart, 1999; Johnson, 2002; National Council for Workforce Education & Jobs for the Future, 2010; Shore et al., 2004; Sticht, 2005)[4]. Similarly, workplace literacy students, who may not generally see the appeal of basic skills instruction, may be more motivated to learn the skills when instruction is connected to job-specific applications (Jenkins et al., 2009; Sticht, Armstrong, Hickey, & Caylor, 1987; Washington State Board for Community and Technical Colleges, 2005).

Evidence on Contextualization

Twenty-seven studies provided evidence on contextualization. Sixteen of the studies were on contextualized instruction, 10 were on integrated instruction, and a further study, by Wisely (2009), reported on both contextualized and integrated instruction.

Quantitative studies of contextualized instruction were conducted with college academic programs (six studies), adult basic education (six studies), and K-12 academic education (four studies of each), but no studies involving career and technical education (CTE) students were found for this form of contextualization. Five of the six studies on contextualized instruction in college involved developmental education (Caverly et al., 2004; Perin & Hare, 2010; Shore et al., 2004; Snyder, 2002; Wisely, 2009), and one (Martino, Norris, & Hoffman, 2001) focused on low-achieving students in a college-level content course. Among the six studies involving adult basic education students, five were conducted with workplace literacy programs (Ekkens & Winke, 2009; Lazar, Bean, & Van Horn, 1998; Mikulecky & Lloyd, 1997; Perin, 1997; Sticht, 1995) and one was conducted with a prison sample (Dirkx & Crawford, 1993). Three of four studies of K-12 contextualized instruction focused solely on mathematics (Bottge, 1999; Bottge & Hasselbring, 1993; Brenner et al., 1997), and one dealt with writing instruction (De La Paz, 2005).

Four of the 10 studies on integrated instruction were conducted with CTE programs, two in college (Cox et al., 2004; Jenkins et al., 2009) and two in secondary education (Parr et al., 2008; Stone et al., 2006). The other six studies were in academic programs in elementary (Guthrie et al., 1999; Tilson et al., 2010) and secondary education (Bulgren et al., 2009; De La Paz & Felton, 2010; Greenleaf et al., 2010; Vaughn et al., 2009). No studies of integrated instruction at the college level were identified.

Many of the studies had methodological weaknesses that limited conclusions that could be drawn about the effectiveness of contextualization. A table summarizing the studies and their limitations is available from the author. Twelve studies (six on contextualized and six on integrated instruction) that offer the best evidence for the impact of contextualization on basic skills are summarized in the next section[5].

Contextualized Instruction

College settings. Perin and Hare (2010) created a curricular supplement to provide developmental education students with weekly practice in selected reading and writing skills to complement their work in the classroom. The practice focused on written summarization, question generation, vocabulary, and persuasive writing skills. Students in 12 developmental reading and English classrooms in two community colleges were randomly assigned to two conditions. Both conditions practiced the same skills but used different text. In one condition called "science," the skills practice was contextualized in passages from biology textbooks. In the other condition called "generic," the students engaged in the same practice but instead of using science text, read passages on a wide assortment of topics taken from developmental education textbooks. A third group was a purposive sample of four classrooms that served as a business-as-usual comparison group. Both the science and generic groups showed statistically significant higher gain on three variables on a researcher-developed written summarization measure (the proportion of main ideas from source text, accuracy of information, and word count) than the comparison group, and the science group showed greater gain than the

generic group on two summarization variables (proportion of main ideas and accuracy), with effect sizes of 0.33 to 0.62 *SD* units. However, pre-post gain on a generic standardized test of reading was not associated with participation in the instruction. The findings for the summarization measure suggest that systematic practice contextualized in content-specific text helps students learn to summarize the type of material they need to read to learn in college-credit courses. At the same time, the study is limited by the fact that it involved independent practice rather than direct instruction, and students received only a small amount of feedback, raising the possibility that results were perhaps due at least in part to student-related variables. Also, because randomization occurred within classrooms, there may have been contamination between conditions.

Caverly et al. (2004) investigated the use of a contextualized reading comprehension strategy with first-semester students in developmental reading classrooms in a 4-year college. Instruction was anchored in chapters from textbooks used in core curriculum courses that the students would have to pass to complete their degree. A strategy was taught based on the mnemonic "PLAN" (Predict, Locate, Add, and Note). Students first predicted what would be in the textbook chapters and examined the title, introduction, subtitles, pictures, graphs, summaries, and the use of boldface and italics. From the predictions and examination of the text, the students created a concept map (visual display of the information) and ascertained how they would approach the reading task. Next, they checked items in the concept map that they already knew and marked unfamiliar information with a question mark. They then read the text and expanded the concept map using new information. In the last step of the strategy, students reflected on what they had learned and estimated how well they thought they could now satisfy the task demands they had identified before reading. The students applied the strategy to both well- and poorly written textbook passages. Also, to promote transfer of learning, they were asked to apply it in other classes and were required to summarize this in writing.

Statistically significant differences were found between students ($n = 56$) who took the contextualized reading course and students in a random sample ($n = 72$) who had the same pretest reading levels but did not take developmental education. Measures used in the analysis were scores on a statewide standardized reading test as well as grades in a subsequent college-level history course with high reading demands. This study suggests that the strategy of contextualized instruction promoted achievement in college-credit courses, but the conclusions are tentative because the comparison group did not take developmental education, leaving a question as to what, specifically, was responsible for the improved performance: the developmental education course in general, the instructional strategy, or a combination of the two. Also, students who choose to take developmental education may differ from those who do not on variables (e.g., motivation) that may explain the group difference.

Similar to Caverly et al. (2004), Shore et al. (2004) contextualized basic skills instruction in college course content. Community college developmental mathematics students who were preparing for degrees in various health professions were taught problems

based on topics from allied health (respiratory therapy, radiology, occupational therapy, medical laboratory, and physical therapy) and nursing curricula. The problems were developed collaboratively by a group of health and developmental education instructors who observed each other's classes. For example, a problem was developed to teach students to interpret a graph illustrating the relationship between the percentage of normal glomerular filtration, as measured by creatine clearance, and blood urea nitrogen; this information is used to yield a function needed by nurses when analyzing a patient's kidney function. Data were collected for cohorts over a 3-year period.

Compared with a comparison group made up of sections of a traditional developmental mathematics course, students receiving the contextualized instruction in the first 2 years of the study earned better mathematics scores and were more likely to respond on a questionnaire that they found the instruction useful. The proportion of contextualized problems on the mathematics test increased each year over the 3-year project period, increasing to 70% in the third year. The contextualization group participating in the third year did not show an advantage over the comparison group, which was attributed by the researchers to a larger number of seriously underprepared students than in previous years and to the fact that the contextualized problems were harder than the traditional problems. The positive findings for contextualization in the first 2 years of the study are encouraging, but firm conclusions cannot be drawn because it was not stated how classrooms were assigned to conditions or whether the groups had equivalent mathematics scores at the pretest stage. Furthermore, the authors referred to pre- and posttests but neither the specific amount of gain nor the statistics were reported.

Adult basic education. Based on a program evaluation, Mikulecky and Lloyd (1997) reported outcomes of contextualized instruction for 180 incumbent workers in six companies who participated in work-related literacy classes. The instruction was provided in five of the companies for 20 to 60 hours and for 200 hours in another—equivalent, as the authors pointed out, to 6 or 7 weeks of high school. Participants' initial reading levels ranged from high elementary school grades to college level. The industries in which the instruction was contextualized included automobile and other manufacturers, a prison, an insurance company, and a hospital. For example, hospital workers and correctional officers were taught writing skills needed to improve the quality of written reports and memoranda, and gasket makers were taught reading skills using company newsletter articles, procedure manuals, and productivity graphs. Some of the participants were taught skills to prepare for promotion tests.

Literacy gains were measured using pre and post self-reports on literacy practices, beliefs, and plans as well as self-reports on strategies used to read a workplace newsletter and on performance on a work-related reading scenario. The researchers created scores from the self-reports, compared the pre and post scores using t tests, and, finally, expressed the amount of gain on a 3-point scale (positive, neutral, and negative gain). Statistically significant gain was found on the reading scenario, reading strategies, literacy beliefs, and plans, and the gains in one company were higher than those for a waiting-list comparison group from the same company. Overall, increases in skill were found for students in classrooms in which more than 70% of instructional time was spent

on reading and writing activities and in which students discussed and received feedback on reading and writing processes. Although encouraging, this is tentative because it is based on self-reports, which can be subjective.

Secondary education. De La Paz (2005) contextualized writing instruction in social studies content in eighth-grade English language arts classrooms. This instruction took place after students had learned an approach to historical reasoning in the social studies class. In the language arts class, the students were taught self-regulation strategies to set and monitor progress toward reading and writing goals and to write persuasive essays on controversies related to westward expansion. The essay-writing instruction was contextualized in textbook passages, primary documents, and secondary sources from the social studies class based on two mnemonics, STOP (Suspend judgment; Take a side, Organize ideas; Plan as you write) and DARE (Develop a topic sentence; Add supporting ideas; Reject an argument for the other side; End with a conclusion). Students engaged in essay-writing practice using the self-regulation and mnemonic strategies until they were able to plan and compose an essay of at least five paragraphs within one class period after reading a set of social studies documents. Compared with a group receiving traditional instruction (no historical reasoning or contextualized writing instruction), the contextualized strategy group showed greater gain on measures of essay length, persuasive quality, the number of arguments included in the essay, and historical accuracy (effect sizes $d = 0.57$ to $d = 1.23$), providing some support for contextualization. Furthermore, the effects were seen for learners over a range of ability levels, from students with learning disabilities to average- and high-achieving learners. However, a post-only design was used, and although group pretest achievement scores did not differ, the comparison group was made up of English language learners, raising the possibility that there may have been unmeasured pretest differences between groups. Furthermore, the experimental condition consisted of both contextualization and strategy instruction, clouding attribution of results.

Brenner et al. (1997) conducted a contextualized mathematics intervention using an everyday life scenario. Seventh and eighth graders in a pre-algebra class were taught problem-solving skills including the manipulation of symbols in equations. Specifically, students learned to produce and represent functions such as $y = mx + b$. The problems were cast in a hypothetical scenario involving the selection of a pizza company as a vendor for the school cafeteria. Lessons included taste tests with data collection on student preferences, a computer malfunction scenario in which students searched for errors in the pizza maker's order forms and invoices, a pizza delivery game in which students had to determine the correct destination, formulas related to advertising the pizza, and tables about profit and loss in the pizza business. Students frequently worked in cooperative groups to discuss and solve the problems. Three teachers taught two sections each, one contextualized and one traditional; the classes were randomly assigned among teachers to treatment and control conditions, and the classrooms for each teacher were randomly assigned to conditions. Several curriculum-based and transfer measures were administered to test students' ability to represent and solve word problems. Participants in the intervention showed greater gain than the control group in the

representation of problems, such as depicting the word problems in the form of tables and graphs. Both fluent speakers and English language learners showed this benefit.

The design of the study did not permit a clear attribution of the findings to contextualization. The intervention and control conditions differed not only in the use of contextualized materials but also in whether cooperative learning was used. Furthermore, because the materials were contextualized, the treatment focused more on problem representation than the symbol manipulation that, according to the researchers, is characteristic of traditional mathematics instruction at this level. In fact, the performance of the control group was better on symbol manipulation.

Integrated Instruction

CTE (college). Jenkins et al. (2009) studied student outcomes in the Integrated Basic Education and Skills Training (I-BEST) program, a special initiative that combines CTE and adult basic education in community colleges throughout the state of Washington[6]. Students in this program are enrolled in noncredit adult basic education and simultaneously take a college-credit occupational course that integrates instruction in occupationally related reading, writing, and mathematics. Instruction lasts one college quarter, in accordance with the statewide community college calendar. Although the content and number of hours of instruction varies across sites, there is a stipulation that both an occupational and a basic skills instructor must be present in the classroom for at least half of the total instructional time. (It is not reported how this time is distributed across class sessions.)

Two-year outcomes were compared between a cohort of 900 I-BEST students and two other samples of adult basic education students: one group that did and another group that did not enroll in a traditional, college-level CTE course at the same time as the I-BEST students. The comparisons controlled for age, gender, intent (vocational or academic), enrollment status (full- or part-time) when first enrolled, and educational history. Net of controls, I-BEST students were more likely than the traditional group to take subsequent credit-bearing courses, earn credits toward a certificate or degree, persist to the next college year, and show gain in basic skills. I-BEST students' basic skills improvement was 18% higher than adult basic education students who did not enroll in a traditional occupational course and 9% higher than adult basic education students who took an occupational course. Thus, the major advantage of I-BEST was seen when the comparison group took only adult basic education but not an occupational course. These results provide encouraging evidence for integrated instruction, but conclusions remain tentative as the sample was self-selected, raising the possibility that results could be attributed at least partially to student motivation. As the authors noted, I-BEST correlated with, but did not necessarily cause, the positive outcomes.

CTE (secondary education). Stone et al. (2006) investigated the effects of integrating mathematics instruction into five CTE areas (agriculture, auto technology, business and marketing, health, and information technology) using a "Math-in-CTE" model. The purpose of the instruction was to broaden students' knowledge of mathematics concepts

they learned in CTE and have students "recognize how to solve practical problems by using mathematics in their occupational area; recognize math occurring in other contexts; and do so without diminishing the acquisition of technical knowledge in the course" (p. 5). However, it was not explained why technical knowledge might diminish by a broadened approach to mathematics instruction, which assumed prior knowledge of algebra. Initially, highly contextualized mathematics problems were taught, along with more abstract examples. For instance, when students used a *T*-square during instruction in agricultural mechanics, the teacher presented the Pythagorean theorem by showing the formula $a^2 + b^2 = c^2$. However, ultimately, the goal was that "students would see the math as an essential component of the CTE content, a tool—like a saw, wrench, or thermometer—needed to successfully solve workplace problems" (p. 6).

Teachers in 12 states were recruited on a volunteer basis and randomly assigned to conditions (57 experimental and 74 control). The CTE teachers in the experimental condition collaborated with mathematics teachers to identify mathematics problems embedded in the existing CTE curricula and to create lessons highlighting mathematical operations. The math-enhanced CTE lessons constituted 10% of instructional time over one academic year. The mathematics lessons contained seven elements: introduce the CTE lesson; assess mathematics skills relating to the CTE lesson; work through a mathematics problem embedded in the CTE lesson; work through related, contextualized examples; work through traditional mathematics examples; have students demonstrate their understanding; and mathematics questions in formal assessment at the end of the CTE unit or course (Stone et al., 2006, p. 12).

Pre- and posttests on two standardized mathematics tests, the TerraNova and Accuplacer, showed significantly greater gain for the experimental group (effect sizes 0.42 and 0.55). When occupational tests used in each participating classroom were administered at posttest, no significant differences were found between the experimental and control groups. The authors interpreted this to mean that the mathematics instruction was not detrimental to a growth of knowledge in the CTE field, but because the mathematics enhancement was presumably in the interest of an increase in occupational knowledge, the findings can also be interpreted to mean that the mathematics enhancement did not advance CTE performance.

Academic programs (K-12). Building on De La Paz's (2005) eighth-grade study of contextualized instruction described earlier, De La Paz and Felton (2010) investigated the effects of instruction that focused on both historical reasoning and persuasive writing in an 11th-grade 20th century history course. Whereas in the earlier study, the writing skills were taught by language arts teachers, in the De La Paz and Felton study, history teachers provided this instruction.

Participants were students ($n = 79$) in experimental classrooms and students ($n = 81$) in business-as-usual comparison classrooms in two schools. In the experimental (integrated instruction) condition, the history teachers introduced and modeled steps in the writing of persuasive essays on historical topics and then taught the content using the historical reasoning strategy. Then, the students were given guided practice in the writing of two persuasive essays on the history topics using the STOP and DARE

mnemonics from De La Paz's 2005 study. Instruction and guided practice focused on writing a topic sentence stating a position on a historical controversy, providing reasons, using evidence to support claims, presenting a counterargument (with evidence), and refuting the opposing point of view, presenting new evidence.

Pre- and posttest persuasive essays were analyzed for length, persuasive quality, and historical accuracy. At posttest, the essays written by the experimental group were longer ($d = 0.66$), approximately one third more likely to include elaborated claims, and three times more likely to include elaborated rebuttals than the essays written by the comparison group (controlling for essay length); in addition, the experimental group's essays cited historical documents in support of claims more often (effect size 1.42 SD units). These results support the practice of integrated instruction, although, as with the De La Paz (2005) study, it is not possible to determine whether the positive outcome was attributable to contextualization or the instructional strategies.

A study of integrated instruction was conducted by Vaughn et al. (2009) with low-income seventh-grade social studies students, approximately one third of whom spoke Spanish as a native language and were not proficient speakers of English. Assignment to condition was unusually rigorous; first, students were randomly assigned to classrooms and then classrooms were randomly assigned to an intervention or business-as-usual control condition. The social studies material was identical in both conditions. The intervention involved explicit reading comprehension and vocabulary instruction; the control group did not receive any literacy instruction but only focused on the social studies content. The integrated instruction was delivered for 50 minutes per day, 5 days per week for 9 to 12 weeks. Four new vocabulary words were taught per day. All vocabulary was drawn directly from the social studies text.

To teach vocabulary after giving an overview of a "big idea" relating to the historical topic, the teacher pronounced each vocabulary word, identified a Spanish cognate or translated the word into Spanish, provided a definition in everyday language, showed a visual representation of the word, and put each word into two sentences, one in historical context from the class reading and the other relating to students' everyday life experience. The students then discussed each word in pairs. A 2-to-4-minute video clip on the topic was then shown and discussed. Then a graphic organizer was used to support silent and oral reading comprehension, and students worked in pairs to read the text and answer questions. In the paired reading, one student read while the other followed along, with the first student interrupting to correct the reader as needed. The teacher then led a whole-class discussion of the answers to the questions and, as a writing activity, worked with students to summarize information on the topic using the graphic organizer.

On researcher-developed measures of vocabulary matching and reading comprehension, the experimental group showed greater gain than the control group, with effect sizes of $g = 1.12$ for reading comprehension and $g = 0.53$ for vocabulary. Importantly, the integrated instruction was equally effective with proficient and less proficient speakers of English.

Bulgren et al. (2009) used a short-term "content-enhancement routine" (CER, p. 274) with typically developing and learning disabled (LD) students ($n = 36$) in Grades 9 to 12. Students were randomly assigned to CER and control groups, using stratification to ensure equal representation of LD and non-LD students. The CER group learned a strategy for taking notes and learning vocabulary based on a 30-minute film on ozone depletion as the basis of an essay on climate change. The note-taking process was taught using a "question exploration guide," an organizational structure for recording important information in the film. Sections of the guide listed several questions that students had to answer, including "What is the critical question?" "What are they key terms and explanations?" "What are the supporting questions and answers?" and "What is the main idea answer?" Other questions related to experiments that could be conducted as well as to how knowledge about ozone depletion could be applied to individual lives. The control group viewed the film twice and was asked to take notes with no further instruction.

Outcome measures were writing quality and content knowledge exhibited in posttest essays on a topic related to ozone depletion. Writing quality referred to the ideas expressed in the essay as well as organization, voice, word choice, sentence construction, and the use of written English conventions. The content score measured identification of the problem, cause, effect, solution, and the writer's conclusion on the issue. At posttest, the essay quality of the experimental group was 25% better than that of the control group ($d = 1.32$). Superior gains for the treatment group were seen for every writing quality variable except writing conventions. The CER group also showed greater gain than the control group on content knowledge ($d = 0.74$). However, when the scores for the LD and typically developing students were disaggregated, only the typically developing students showed greater gain than the control group ($d = 2.0$). The results of this integrated instruction approach are encouraging, but conclusions are limited by the fact that the activity in the control condition seems considerably less compelling. Other methodological limitations are that instruction was delivered by researchers rather than classroom teachers and the intervention was very short, lasting only two sessions.

Similar to Bulgren et al. (2009), Tilson et al. (2010) taught an experimental science unit that integrated literacy instruction. Whereas the study conducted by Bulgren et al. was a small-scale experiment in secondary education, participants in the study conducted by Tilson et al. were fourth graders in 94 classrooms in 48 elementary schools. Students were randomly assigned to experimental classrooms ($n = 217$ students) or control classrooms ($n = 241$ students). The science unit taught concepts on physical science (light and energy), with 40% of instructional time spent on science, 40% on literacy (reading, writing, speaking, and listening), and 20% on formative assessment.

Several types of science-related writing were embedded in the science instruction, including the recording of data, written responses to informational text, and reports on what students learned in group discussions. Instruction was provided on constructing topic sentences, including supporting evidence, and using scientific vocabulary in

precise ways. The teacher modeled the entire writing process at the beginning of the unit. Moreover, the students were taught to use graphic organizers and worked in pairs to plan writing tasks. As an example of the integrated instruction, one of the lessons involved testing various materials to investigate the phenomenon of reflection. Students created a data table and read a text on the topic, after which they wrote explanations on the nature of reflection.

In the control condition, students used the same text and experiential activities but, instead of explicit strategy instruction, they only engaged in reading and writing practice. All students were tested pre and post on writing skills using an experimenter-designed instrument. The quality of students' writing was scored on the accuracy of the science content, the use of evidence, the quality of the introduction and conclusion, the clarity of expression, vocabulary usage, and vocabulary count (defined as how many of 32 science terms targeted during instruction were included in the writing sample). The treatment group showed greater gain from pre to post than the control group on all of the writing measures except vocabulary usage and quality of conclusion ($d = 0.69$ on a composite score of all of the writing dimensions). As with De La Paz (2005) and De La Paz and Felton (2010), a clear attribution cannot be made to contextualization in itself because the treatment was confounded with strategy instruction.

Trends in the Research

The studies identified in this review suggest that contextualization of basic skills instruction, especially when coupled with explicit strategy instruction, is a promising approach for academically underprepared community college students. Conclusions are tentative, however, because of the shortage of rigorous studies with college populations. Research with K-12 samples was included in the review because there was relatively little information on the use of contextualization with students in college or adult education settings, but there does not seem to be any reason why findings from elementary and secondary education cannot be extrapolated to older adolescent and adult learners.

Outcome measures for almost all of the studies focused exclusively on and found gains for specific basic skills outcomes, such as reading, writing, or mathematics scores. All of the outcomes of contextualization for basic skills achievement were positive, although there was minor variation in outcomes for subskills and different measures. It is also of note that most of the studies compared contextualization with a business-as-usual comparison group, indicating that contextualization is more effective than standard, noncontextualized practice. This is a good start in examining the potential of contextualization, but more definitive conclusions can only be made when contextualization is compared with other instruction in addition to conventional approaches so that effects of attention and novelty can be ruled out.

An assumption underlying integrated instruction is that when basic skills instruction is incorporated in disciplinary instruction, ability in both academic skills and content knowledge should increase. However, in five studies of integrated instruction that

measured outcomes on knowledge development in a content area (Bulgren et al., 2009; De La Paz & Felton, 2010; Parr et al., 2008; Stone et al., 2006; Tilson et al., 2010), two found no improvement in content knowledge (Parr et al., 2008; Stone et al., 2006). Both of these studies embedded mathematics in occupational courses in high school CTE. As strong claims are made for the advantages of combining literacy with subject-area instruction, these mixed findings are disappointing and warrant further research.

Only two studies, Wisely (2009) and Jenkins et al. (2009), provided data on college advancement. Wisely found that participation in contextualization was associated with completion of developmental education courses and the speed of entry into, as well as the performance and completion of, college-level courses. However, these positive effects were limited to non-White students; no effect of contextualization was found for White students. Jenkins et al. found that adult education students who attended occupational classes that integrated basic skills and content area instruction were more likely than adult education students who either did or did not enroll in a traditional occupational course to take subsequent credit-bearing courses, earn credits toward a college credential, persist to the next college year, and show greater gain in basic skills. Given practitioners' enthusiasm about the value of contextualization (see program descriptions in Baker et al., 2009; Boroch et al., 2007; California Community Colleges, 2008), it is unfortunate that more evidence is not available.

Practical Implications

The presence of large numbers of low-skilled students in colleges, especially community colleges, along with low rates of retention and progress in course work (Bailey et al., 2009) and recent findings that traditionally low graduation rates are not increasing (Radford, Berkner, Wheeless, & Shepherd, 2010) suggest that instruction of academically underprepared college students needs to be reformed. Among the many different innovations underway that attempt to promote the learning of low-skilled college students (Perin & Charron, 2006), contextualization seems to have the strongest theoretical base and perhaps the strongest empirical support. (There is a striking lack of evidence for most instructional approaches used to teach foundational skills in community colleges; see Levin & Calcagno, 2008.) Both forms of contextualization (i.e., contextualized and integrated instruction) are supported by quantitative studies that include control or comparison groups. There are more studies on contextualized than integrated instruction, but both forms of contextualization appear potentially valuable.

Moving toward contextualization in general, and contextualized or integrated instruction in particular, will depend on practical conditions internal to the colleges. Most important among these conditions are instructors' willingness to modify their instruction and colleges' ability to provide incentives and support for this change. Many developmental education instructors are not highly aware of the day-to-day reading and writing requirements that students find so difficult in college-credit disciplinary courses. Furthermore, instructors tend to be strongly committed to the generic, decontextualized

instruction in reading, writing, and mathematics that predominates in developmental education (Grubb et al., 1999). However, disciplinary instructors may be equally unwilling to consider contextualization because they feel that basic skills instruction is beyond their range of responsibility or competence. Strong college leaders will need to provide ongoing direction and support for either version of contextualization.

The following recommendations are offered to support the implementation of contextualization in community colleges to promote improved student outcomes.

1. Carefully select the context for basic skills instruction. Indeed, the selection of this context is perhaps the greatest challenge to contextualization. Instructors understandably do not wish to teach academic skills too narrowly. It may be most effective to segment basic skills instruction according to students' career goals so that different developmental education courses are contextualized in content from course work needed for a given degree or certificate. Selection of college-credit courses with high enrollments but low success rates may be a useful direction. Block scheduling of developmental education students to provide appropriate contextualization will be needed. These reforms will initially take much effort but may be more effective than current developmental education practice.

2. Create conditions for interdisciplinary collaboration so that basic skills and content area instructors can familiarize each other with their curricula, assessment approaches, standards, and teaching techniques (Baker et al., 2009; Greenleaf et al., 2010; Kalchik & Oertle, 2010; Perin, 2005; Shore et al., 2004; Stone et al., 2006). It is important that instructors visit each other's classrooms, discuss their educational philosophy and instructional techniques, jointly analyze the literacy and mathematics demands of content instruction, look for intersects between their instructional topics, and collaborate to align curricula so that students can be taught reading, writing, or mathematics skills that are directly applicable to the subject areas they are learning. Substantial time is required for this effort. Although salary and time constraints are a major challenge, part-time instructors should be integral to this effort because they form a large proportion of the developmental education faculty.

3. Provide ongoing professional development led by experienced trainers, coaches and mentors to initiate and support contextualization. Professional development leaders should be experts from within the institution rather than outsiders (Kozeracki, 2005). Formal professional development should be conducted with interdisciplinary groups of instructors and should be designed to meet tangible targets for implementing contextualized or integrated courses. Evidence-based professional development methods should be used, such as interdisciplinary inquiry-based approaches that involve coaching and intensive institutes (Greenleaf et al., 2010). Furthermore, professional development should be guided by common cross-discipline agreement on

desired learning outcomes for contextualization and the means of achieving them (Baker et al., 2009). Follow-up activities and supportive monitoring should be provided after the conclusion of formal training sessions to maintain instructors' interest and ability to contextualize or integrate basic skills instruction. Greenleaf et al. (2010) noted that "a long history of research in reading has demonstrated that reading comprehension strategies are not often taught in subject-area classes, even when teachers are trained to use these strategies during subject-area teaching" (p. 15). To avoid this situation, follow-up support by respected instructional leaders will be needed.

4. Develop assessment procedures that incorporate both basic skills and content area knowledge to evaluate the effects of contextualization. For example, in the study conducted by Shore et al. (2004), developmental mathematics and allied health instructors collaborated to create allied health mathematics problems. Both De La Paz and Felton (2010) and Perin and Hare (2010) included measures of content accuracy in instruments to measure contextualized writing, and Guthrie et al. (1999) developed fine-grained assessment methods that simultaneously measured reading comprehension strategies and science knowledge. It appears that such measures will need to be locally developed because disciplinary curricula tend to change, and conventional standardized tests do not capture students' progress in contextualized basic skills (Greenleaf et al., 2010), although customized subject-specific basic skills tests can be developed and normed (Lazar et al., 1998).

5. As the basis of contextualization of basic skills instruction in community colleges, select discipline-area courses that are needed for graduation by large numbers of students but have high failure rates. As contextualization is a labor-intensive initiative, it will be necessary to select courses for implementation. Initial attempts should focus on courses that have the highest need, represented by failure rates. Anecdotal evidence suggests that introductory science courses such as anatomy and physiology, required for graduation in popular majors such as allied health, may be a useful place to start because these courses display high failure rates, and studies are available on the contextualization of basic skills in science (Bulgren et al., 2009; Guthrie et al., 1999; McDermott, 2010; Shore et al., 2004).

6. When contextualized courses are established, collect outcome data for examination by instructors and administrators. Instructors who implement contextualization and administrators who support this effort should be made aware of both short- and longer term outcomes such as the rate of passing basic skills and disciplinary courses, grade point average, semester-to-semester retention, and degree or certificate attainment. Evaluating contextualization in this way will indicate whether the effort is worthwhile and may point to the need for modification of teaching techniques.

Future Research Directions

Many approaches to the instruction of academically underprepared students have been tried, but their level of effectiveness is often unknown (Perin & Charron, 2006). Furthermore, it is not clear that improving instruction is itself high on the community college educational reform agenda. For example, a study of a well-funded reform effort, "Achieving the Dream," reported that only 27% of a set of student achievement–oriented reform strategies implemented by 26 community colleges focused on changes in classroom instruction (Rutschow et al., 2011, Figure 5.2, p. 76). Colleges might be more likely to reform instruction if there were more evidence on which to base such efforts.

The lack of rigorous research suggests that it is currently premature to invest substantial funds in contextualization. However, practitioners have been enthusiastic about it for many years, trends in the available research are positive, and the approach is consistent with theories of learning and motivation. For these reasons, it would be worthwhile to mount a rigorous research and development effort to gather information about the potential efficacy of this approach, specifically with low-skilled adult learners, whether in community college degree and certificate programs or adult basic education programs.

A premise underlying the practice of contextualization of basic skills is that students are more likely to transfer the skills to subject-area learning when the instruction is connected to these subject areas rather than taught abstractly. A topic that has not been addressed in studying the effects of contextualization on transfer of learning is possible interactions between student ability, student motivation, type of skill to be learned, and amount of contextualization. Thus, in either research and development studies or basic research investigations, moderators of the possible effects of contextualization should be identified. Experiments investigating contextualization should include a comparison of performance on alternate approaches as well as business-as-usual comparison groups to ensure that effects of contextualization are not attributable simply to novelty or increased attention.

Anecdotal evidence from practitioners (e.g., Baker et al., 2009; Boroch et al., 2007; Johnson, 2002) suggests that lower skilled students benefit from contextualization, not because it helps them become flexible learners but only because it increases their mastery of basic skills as well as the likelihood of transfer of basic skills to content courses that is not occurring in traditional, decontextualized learning environments. There is very little research on the relationship between contextualization of basic skills instruction and subsequent course work, and based on the small number of available studies, it is not possible to attribute the gains exclusively to contextualization. Future research paradigms should control for variables such as the nature of the course, teacher expertise, and cognitive and affective characteristics of learners.

The issue of dosage of contextualization should also be studied in light of claims that instruction can be overcontextualized and as such can be counterproductive

(e.g., see Bransford, Brown, & Cocking, 2000). Another area that needs attention is the nature of the dependent variable used in studies of contextualization. The studies in this review varied on whether they measured both basic skills and subject-area gain or just the former. Dependent variables in future research on contextualization of basic skills should include both basic skills and content knowledge because the intent is to bring the two areas closer together and increase learning in both.

Conclusion

The contextualization of basic skills in disciplinary content is used in elementary, secondary, adult and postsecondary education as a way to engage students, deepen content learning, and promote transfer of skill. The approach is well grounded in psychological theories of transfer and motivation. There is support in the literature for two forms of contextualization identified in this review: contextualized instruction, which is taught by developmental education instructors and English language arts teachers, and integrated instruction, which is provided by discipline-area instructors.

There is more descriptive than evaluative literature, but the 27 quantitative studies found in this review, taken together, suggest that contextualization has the potential to promote short-term academic achievement and longer term college advancement of low-skilled students. However, the studies suggest that considerable effort is needed to implement contextualization because instructors need to learn from each other and collaborate across disciplines, a practice that is not common in college settings. Furthermore, there is very little information on cost or what would be needed to scale up contextualization. However, the available evidence, taken in combination with practitioners' considerable enthusiasm for contextualization, suggests that this approach is a useful step toward improving the outcomes of academically underprepared college students.

Notes

1. The terms *foundational skills*, *basic skills*, and *developmental education* are used interchangeably in this article to refer to preparation in reading, writing, and mathematics that aims to bring underprepared students' skills to the college level. A further point is to

recognize that all of these terms imply assumptions about the nature of learning. It is possible to interpret the word *skill* as implying a behaviorist framework, which is at odds with a view of learning as essentially sociocultural. The term *skill* is used here as shorthand for ability to engage in the reading, writing, and mathematics activities that undergird and are necessary for learning from the postsecondary curriculum. Also, the current intent is to be neutral with regard to explanations for the term *low skills*; no negative connotation should be inferred.

2. In rare cases, contextualization of reading, writing, or mathematics has been used in learning communities that link upper-division college courses, such as advanced composition and abnormal psychology (Cargill & Kalikoff, 2007).

3. Cognitive theory on transfer has a long history of unresolved debates (Anderson, Reder, & Simon, 1996; Barnett & Ceci, 2002; Billing, 2007; Bransford et al., 2000; Detterman & Sternberg, 1993; Greeno, 2009; Mikulecky, 1994; Perkins & Salomon, 1989; Smagorinsky & Smith, 1992; Son & Goldstone, 2009). One problem is the lack of a commonly agreed-on definition of transfer (Barnett & Ceci, 2002), but a more pressing question is that of "dosage," that is, how much contextualization is required to facilitate the transfer of learning. More specifically, the debate has focused on creating flexible learners who will apply knowledge and skill to diverse situations. It has been theorized that overcontextualization limits learners' flexibility in applying new knowledge and skill (Bransford et al., 2000). The debate has a slightly different focus from that in the current review, which is narrower in its concern with the learning and application of basic literacy and mathematics skills by low-achieving students. From a pragmatic point of view, although too much contextualization may inhibit flexibility in the application of skills, the simple application of basic skills to a subject area would be an improvement over the current situation in which many low-skilled students do not apply basic skills they have learned in remedial settings once in the content classroom. Furthermore, it appears that transfer is difficult to discern even when explicit instruction in transfer is provided (Hendricks, 2001).

4. The hypothesis here is that level of intrinsic motivation predicts level of future engagement in course work. However, it is noted that intrinsic motivation to read has not been found to be a statistically significant predictor of future reading ability. Rather, level of intrinsic motivation to read loses its independent predictiveness once prior reading ability is accounted for (Becker et al., 2010). The same may be true for intrinsic motivation as a predictor of students' engagement in learning, with the result that motivation may be confounded with prior academic achievement in predicting future course engagement.

5. Most of the studies of contextualization in college settings have serious limitations. However, all of the studies of contextualization in college identified in the search for this review are included in the following section because we are most concerned with this particular sector.

6. In the state of Washington, adult basic education serves students based on tested skill levels and, consequently, overlaps with developmental education courses.

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Bio

Dolores Perin is professor of psychology and education and senior research associate with the Community College Research Center, Teachers College, Columbia University, New York.