A Summary of Underlying Theory and Research Base for Understanding by Design

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Overview

Understanding by Design (UbD) is a framework for improving student achievement through standards-driven curriculum development, instructional design, assessment, and professional development. Developed by nationally recognized educators Grant Wiggins and Jay McTighe and produced by the Association for Supervision and Curriculum Development (ASCD), Understanding by Design is based on the following key tenets:

1. A primary goal of education is the development and deepening of student understanding.
2. Evidence of student understanding is revealed when students apply knowledge and skills within authentic contexts.
3. Effective curriculum development reflects a three-stage design process called "backward design." This process helps to avoid the twin problems of "textbook coverage" and "activity-oriented" teaching in which no clear priorities and purposes are apparent.
4. Regular reviews of curriculum and assessment designs, based on design standards, are needed for quality control, to avoid the most common design mistakes and disappointing results. A key part of a teacher's job is ongoing action research for continuous improvement. Student and school performance gains are achieved through regular reviews of results (achievement data *and* student work) followed by targeted adjustments to curriculum and instruction.
5. Teachers provide opportunities for students to explain, interpret, apply, shift perspective, empathize, and self-assess. These "six facets" provide conceptual lenses through which students reveal their understanding.
6. Teachers, schools, and districts benefit by "working smarter"—using technology and other approaches to collaboratively design, share, and critique units of study.

In practice, Understanding by Design offers a three-stage "backward planning" curriculum design process, a set of design standards with attendant rubrics, and a comprehensive training package to help teachers design, edit, critique, peer- review, share, and improve their lessons and assessments. Support materials include the original *Understanding by Design* book (Wiggins & McTighe, 1998), which provides an in-depth

look at the Understanding by Design framework, as well as a handbook, a study guide, a three-part videotape series, and a unit builder CD-ROM. The Web site (http://www.ubdexchange.org) provides an intelligent tool for working more effectively and efficiently at the school and district levels and offers an antidote to the isolation so prevalent in the teaching profession. The site features a searchable database of curriculum designs, electronic design tools and templates, and online peer and expert review protocols. These materials provide educators with a powerful set of resources to make their work more focused, engaging, coherent, and effective.

Research Base for Understanding by Design (UbD)

The recently enacted federal statute No Child Left Behind (NCLB) emphasizes the use of research-based programs that have been proven to help most children learn.[1] Yet responsible educators have always investigated the underlying research base for educational programs and practices before employing them. In this regard, two key questions are appropriately asked of UbD:

- What is the research base underlying Understanding by Design?
- How do we know that Understanding by Design, when appropriately applied, will enhance student achievement?

In responding to these questions, it is important to recognize that since Understanding by Design is not a program with an articulated "scope and sequence" of skills or prescribed teaching activities, it is impossible at this time to provide direct, causal evidence of its effect on student achievement. However, the principles and practices of UbD reflect contemporary views of learning based on research in cognitive psychology and are validated by specific studies of factors influencing student achievement. A number of sources providing the underlying research base for UbD are summarized below.

Research Findings from Cognitive Psychology

The Understanding by Design framework is guided by research from cognitive psychology. A readable synthesis of these findings is compiled in the book *How People Learn: Brain, Mind, Experience, and School* (Bransford, Brown, & Cocking, 2002), a recent publication of the National Research Council that summarizes the past 30 years of research in learning and cognition. The book offers new conceptions of the learning

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[1] The *No Child Left Behind* Act (NCLB), signed into law on Jan. 8, 2002, contains the most sweeping changes to the Elementary and Secondary Education Act (ESEA) since its enactment in 1965. The act contains four education reform principles: stronger accountability for results, increased flexibility and local control, expanded options for parents, and an emphasis on teaching methods that have been proven to work.

process and explains how skill and understanding in key subjects are most effectively acquired. Insights from the research are clustered into five areas: (1) memory and structure of knowledge, (2) analysis of problem solving and reasoning, (3) early foundations, (4) metacognitive processes and self-regulatory capabilities, and (5) cultural experience and community participation.

Key findings relevant to Understanding by Design include the following:

- Views on effective learning have shifted from a focus on the benefits of diligent drill and practice to a focus on students' understanding and application of knowledge.

- Learning must be guided by generalized principles in order to be widely applicable. Knowledge learned at the level of rote memory rarely transfers; transfer most likely occurs when the learner knows and understands underlying concepts and principles that can be applied to problems in new contexts. Learning with understanding is more likely to promote transfer than simply memorizing information from a text or a lecture.

- Experts first seek to develop an understanding of problems, and this often involves thinking in terms of core concepts or big ideas. Novices' knowledge is much less likely to be organized around big ideas; novices are more likely to approach problems by searching for correct formulas and pat answers that fit their everyday intuitions.

- Research on expertise suggests that superficial coverage of many topics in the domain may be a poor way to help students develop the competencies that will prepare them for future learning and work. Curricula that emphasize breadth of knowledge may prevent effective organization of knowledge because there is not enough time to learn anything in depth. Curricula that are "a mile wide and an inch deep" run the risk of developing disconnected rather than connected knowledge.

- Feedback is fundamental to learning, but feedback opportunities are often scarce in classrooms. Students may receive grades on tests and essays, but these are summative assessments that occur at the end of projects. What is needed are formative assessments, which provide students with opportunities to revise and improve the quality of their thinking and understanding.

- Many assessments measure only propositional (factual) knowledge and never ask whether students know *when, where,* and *why* to use that knowledge. . . . Given the goal of learning with understanding, assessments and feedback must focus on understanding, and not only on memory for procedures or facts.

- Expert teachers know the structure of their disciplines and this provides them with cognitive roadmaps that guide the assignments they give students, the assessments they use to gauge student progress, and the questions they ask in the give and take of classroom life. . . . The misconception is that teaching consists only of a set of general methods, that a good teacher can teach any subject, and that content knowledge alone is sufficient.

Research on Achievement Related to Understanding by Design

Authentic Pedagogy Study

In the mid-1990s, Newmann et al. (1996) conducted a study of restructured schools at the elementary, middle, and high school levels. This ambitious study measured how well 24 restructured schools implemented authentic pedagogy and authentic academic performance approaches in mathematics and social studies, and whether schools with high levels of authentic pedagogy and academic performance significantly increased achievement over those that measured at low levels. Authentic pedagogy and performance were measured by a set of standards that included higher-order thinking, deep-knowledge approaches, and connections to the world beyond the classroom. Selected classes were observed four times during the school year in each school. The researchers observed 504 lessons and analyzed 234 assessment tasks. They also analyzed student work.

Similar students in classrooms with high and low levels of authentic pedagogy and performance were compared, and the results were striking: students with high levels of authentic pedagogy and performance were helped substantially whether they were high- or low-achieving students. Another significant finding was that the inequalities between high- and low-performing students were greatly decreased when normally low-performing students used authentic pedagogy and performance strategies and assessments.

The study provides strong evidence that authentic pedagogy and assessments pay off in improved academic achievement for all students, but especially for low-performing students. This research supports the Understanding by Design approach, which emphasizes the use of authentic performance assessments and pedagogy that promotes a focus on deep knowledge and understanding, and active and reflective teaching and learning.

Achievement Studies in Chicago Public Schools

Two recent studies of factors influencing student achievement were conducted in Chicago public schools through the Consortium on Chicago School Research. In the first study, Smith, Lee, and Newmann (2001) focused on the link between different forms of instruction and learning in elementary schools. Test scores from more than 100,000

students in grades 2–8 and surveys from more than 5,000 teachers in 384 Chicago elementary schools were examined. The results provide strong empirical support that the nature of the instructional approach teachers use influences how much students learn in reading and mathematics. More specifically, the study found clear and consistent evidence that interactive teaching methods were associated with more learning in both subjects.

For the purposes of the study, Smith, Lee, and Newmann characterized interactive instruction as follows:

> The teacher's role is primarily one of guide or coach. Teachers using this form of instruction create situations in which students . . . ask questions, develop strategies for solving problems, and communicate with one another. . . . Students are often expected to explain their answers and discuss how they arrived at their conclusions. These teachers usually assess students' mastery of knowledge through discussions, projects, or tests that demand explanation and extended writing. Besides content mastery, the process of developing the answer is also viewed as important in assessing the quality of the students' work.
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> In classrooms that emphasize interactive instruction, students discuss ideas and answers by talking, and sometimes arguing, with each other and with the teacher. Students work on applications or interpretations of the material to develop new or deeper understandings of a given topic. Such assignments may take several days to complete. Students in interactive classrooms are often encouraged to choose the questions or topics they wish to study within an instructional unit designed by the teacher. Different students may be working on different tasks during the same class period. (p. 12)

The type of instruction found to enhance student achievement parallels methods advocated by Understanding by Design for developing and assessing student understanding.

Smith, Lee, and Newmann summarize their results as follows:

> The positive effects of interactive teaching should allay fears that it is detrimental to student achievement of basic skills in reading and mathematics. Conversely, the findings call into serious question the assumption that low-achieving, economically disadvantaged students are best served by emphasizing didactic methods and review. Our results suggest precisely the opposite: to elevate mastery of basic skills, interactive instruction should be increased and the use of didactic instruction and review moderated. (p. 33)

A related study (Newmann, Bryk, & Nagaoka, 2001) examined the relationship of the nature of classroom assignments to standardized test performance. Researchers systematically collected and analyzed classroom writing and mathematics assignments in grades 3, 6, and 8 from randomly selected and control schools over the course of three years. In addition, they evaluated student work generated by the various assignments. Finally, the researchers examined correlations among the nature of classroom assignments, the quality of student work, and scores on standardized tests.

Assignments were rated according to the degree to which they required "authentic" intellectual work, which the researchers described as follows:

> Authentic intellectual work involves original application of knowledge and skills, rather than just routine use of facts and procedures. It also entails disciplined inquiry into the details of a particular problem and results in a product or presentation that has meaning or value beyond success in school. We summarize these distinctive characteristics of authentic intellectual work as construction of knowledge, through the use of disciplined inquiry, to produce discourse, products, or performances that have value beyond school. (pp. 14-15)

This study concluded that

> Students who received assignments requiring more challenging intellectual work also achieved greater than average gains on the Iowa Tests of Basic Skills in reading and mathematics, and demonstrated higher performance in reading, mathematics, and writing on the Illinois Goals Assessment Program. Contrary to some expectations, we found high-quality assignments in some very disadvantaged Chicago classrooms and [found] that all students in these classes benefited from exposure to such instruction. We conclude, therefore, [that] assignments calling for more authentic intellectual work actually improve student scores on conventional tests. (p. 29)

Related studies in Chicago confirm these findings. The complete research reports are available online at http://www.consortiumchicago.org/publications/.

Educators familiar with the principles and practices of Understanding by Design will immediately recognize the parallels. The instructional methods that were found to enhance student achievement are basic elements of the pedagogy in the UbD planning model. As in the researchers' conception of "authentic" intellectual work, UbD instructional approaches call for the student to construct meaning through disciplined inquiry. Assessments of understanding call for students to apply their learning in "authentic" contexts and explain or justify their work.

Third International Mathematics and Science Study

The Third International Mathematics and Science Study (TIMSS), conducted in 1995, tested mathematics and science achievement of students in 42 countries at three grade levels (4, 8, and 12) and was the largest and most comprehensive and rigorous assessment of its kind ever undertaken. While the outcomes of TIMSS are well known—American students are outperformed by students in most other industrialized countries (Martin, Mullis, Gregory, Hoyle, & Shen, 2000)—the results of the less publicized companion TIMSS teaching study offer explanatory insights. In an exhaustive analysis of classroom teaching in the U.S., Japan, and Germany using videotapes, surveys, and test data, researchers present striking evidence of the benefits of teaching for understanding in optimizing performance. For example, data from the TIMSS tests and instructional studies clearly show that, although the Japanese teach fewer topics in mathematics, their students achieve better results. Rather than "covering" many discrete skills, Japanese teachers state that their primary aim is to develop conceptual understanding in their students. They emphasize depth vs. superficial coverage; that is, although they cover less ground in terms of discrete topics or pages in a textbook, they emphasize problem-based learning, in which rules and theorems are derived and explained by the students, thus leading to deeper understanding (Stigler & Hiebert, 1999). This approach reflects what UbD describes as "uncovering" the curriculum.

In addition to instructional differences between teachers in Japan and the U.S., the researchers noted another important difference between the two countries' educational approaches. The Japanese utilize a process known as Lesson Study, whereby teachers regularly work in small teams to develop, teach, and refine lessons to improve student performance. They share the results of their action research and concomitant lesson designs in regional "lesson fairs" so that other teachers will benefit from their insights into effective teaching and learning. The process of collaborative unit and lesson design, refinement, and regional sharing parallels the UbD peer review process based on UbD Design Standards.

In summary, nations with higher test scores use teaching and learning strategies that promote understanding rather than "coverage" and rote learning. One nation, Japan, also uses a collaborative design and review process that continually improves teacher performance. Additional information about this significant research may be found on the TIMSS Web site (http://nces.ed.gov/timss/).

High Schools That Work (HSTW)

High Schools That Work (Southern Regional Education Board, 1992), a nationally recognized program for integrating academic and vocational education, grounds its practices in the very principles underlying Understanding by Design:

1. **A challenging curriculum** that "equips students to think analytically, to reason, to judge, and to balance opposing points of view." Such a curriculum "encourages students to use knowledge to solve problems; use academic and technical content and processes to complete tasks typical of those found in the workplace and the community; [and] construct new meanings and understandings from information and ideas."
2. **Teaching for understanding** "creates challenging situations in which students test their knowledge by solving problems, building products, and giving performances or writing reports that synthesize thorough analysis of a topic, a concept, or an idea."
3. **Teaching in a meaningful context** "provides a way to apply academic learning to important 'real-world' problems" and helps students "see meaning and purpose in their studies."
4. **Setting clear performance standards** so that assessments of learning are "based on clearly stated standards that require students to demonstrate their understanding of new knowledge and skills. In this type of assessment . . . students use their knowledge to address a problem or an issue similar to ones encountered in a career field. And they communicate their understandings to teachers and peers." (Bottoms & Sharpe, 1996, pp. 20-24)

[QU: Numbers above should be either bold or regular—but not mixed.]

Research conducted by the National Center for Research in Vocational Education has confirmed the effectiveness of high school programs that embody these principles. For example, one study over a two-year period found that High Schools That Work sites significantly increased the percentages of students in their senior classes who met the HSTW achievement goals in mathematics, science, and reading and the percentages of students in their senior classes who completed the HSTW-recommended program of study" (Frome, 2001).

The American Institutes for Research (AIR) rated a number of Comprehensive School Reform Demonstration (CSRD) programs based on demonstrable evidence of effectiveness. High Schools That Work was one of only three programs receiving a "strong" rating in the AIR study (Coalition for Evidence-Based Policy, 1992).

Research on Mathematics Curricula

In 1989, the National Council of Teachers of Mathematics (NCTM) issued a set of standards for mathematics that reduced the emphasis on rote learning of mathematical formulas and procedures and increased emphasis on conceptual understanding of mathematics. Since this development, a number of new materials based on this approach have been developed. Most of the new curricula have been implemented within the last

six years, and research studies are just beginning to demonstrate the effectiveness of this approach.

Senk and Thompson (2003) summarized the results of 13 studies of "understanding-based" mathematics curricula that follow the NCTM approach. While much of this research is still in the preliminary stages, the results are very promising. For example, studies of children who used a program called *Investigations* in the elementary school "performed better than their counterparts from other curricula with respect to word problems, more complex calculations embedded in word problems, and problems that involved explaining how an operation worked" (p. 127).

Middle school data show the following results:

> The longitudinal data of student performance are rather impressive. In the CMP chapter (Connected Mathematics Curriculum), the authors report significant cumulative gains on the BA test by CMP students over non-CMP students in School R, a school using the CMP materials at grades 6–8. Similarly, data displayed in the MiC (Mathematics in Context) chapter show superior performance by the eighth grade students in Ames, Iowa, who had studied from the MiC curriculum for four years in comparison to a national eighth grade sample on the New Standards Reference Exam. Their achievement is recognized not only in non-routine problem solving but also in the area of mathematical skills. (Senk & Thompson, 2003, p. 288-289)

Finally, a series of studies using high school mathematics reform programs—Core-Plus Mathematics Project, Math Connections, the Interactive Mathematics Program, SIMMS Integrated Mathematics, and the University of Chicago School Mathematics Project (UCSMP)—"offer overwhelming evidence that the reform curriculum can have a positive impact on high school mathematics achievement. It is not that students in these curricula learn traditional content better but that they develop other skills and understandings while not falling behind on traditional content. These evaluations present more solid scientific evidence than has ever before been available about the impact of curriculum materials" (Senk & Thompson, 2003, p. 468).

These studies at the elementary, middle, and high school levels support the movement toward an understanding- and performance-based curriculum. In addition, they demonstrate that students who learn from such a curriculum not only achieve as well on traditional assessments but significantly outperform students who do not use this type of curriculum in areas such as application to new and novel situations, problem-solving skills, and basic understanding of core concepts and principles.

Research on Technology

Wenglinsky (1998) conducted a study of the relationship between the various uses of technology and achievement in mathematics. Achievement data on the 1996 National Assessment of Educational Progress (NAEP) were analyzed and correlated with survey data including the frequency of computer use for mathematics and the kinds of instructional uses of computers in the schools. After factoring out variables such as socio-economic status, class size and teacher qualifications, Wenglinsky found significant achievement relationships in the eighth grade between NAEP test scores and the use of technology that focused on mathematical projects, problems and simulations that promoted application of knowledge and higher order thinking. Surprisingly, using computers in the eighth grade for drill and practice was found to be negatively related to student achievement.

> "The study found that when computers were used for higher-order thinking skills, students performed better…using computers for drill and practice, the lower-order skills, is negatively related to student achievement…the study suggests that teachers should focus on using computers to apply higher-order skills learned elsewhere in class. Computers should be a component of a seamless web of instruction that includes non-technological components. For example, teachers might introduce new topics and convey basic information to their students through general class discussion and lecture, then assign projects and problems that computers as well as other media (books, field trips, etc.) can be used to address."
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> Wenglinsky, 1998, pp. 29, 33-34

This research supports the UbD approach to learning assessment and learning, in which is knowledge and skills are learned in the context of helping students to understand "big ideas" and to thoughtfully apply their knowledge to authentic problems. We contend that applying the principles of *Understanding by Design* can lead to higher levels of achievement on national and state tests, and this data supports this contention.

Research on Instructional Practices

Numerous studies of instruction have confirmed the effectiveness of particular strategies for improving student achievement. Specific teaching strategies emphasized in Understanding by Design are summarized below.

- **Advance Organizers.** Students are confronted on a daily basis with a great deal of unfamiliar material. Teachers can help students make sense out of this material if they take time at the outset of instruction to highlight the organizational and structural patterns of the new material and indicate how it relates to other material already learned. One means of rendering such assistance is the use of advance organizers—short sets of verbal or visual information presented prior to learning a

larger body of content. The intent of advance organizers is to present students with context, not content, and conceptual frameworks, not specific detail. Advance organizers have been described as bridges from students' previous knowledge to whatever is to be learned. They can call forth general organizational patterns and relationships already in mind that students may not necessarily think to use in assimilating the new material.

An advance organizer is always specific to the content and learners with which it is used. Advance organizers may be presented as written text, take a graphic form, utilize audiovisual supports, or be presented orally (e.g., summaries or questions). Research (Weil & Murphy, 1982) has shown all to be effective. For example, Stone (1983) examined 112 studies using a meta-analysis technique. Overall, advance organizers were shown to be associated with increased learning and retention of material at all grade and ability levels, but lower-ability students tended to profit the most. This is not surprising, for these students are usually the most in need of organizational cues and the least able to generate them on their own.

Understanding by Design incorporates advance organizers in several ways. In Stage 1, teachers frame the "big ideas" of the content through the use of "essential questions." These are presented to students at the start of a unit or course and guide learning throughout the unit. In Stage 3, teachers tell students about the required performances that will be used to assess their understanding. Knowledge of the expected performances and the concomitant evaluative criteria serve as advance organizers, provide a purpose for learning, and focus instruction on relevant knowledge and skills.

- **Higher-Order Questioning**

Higher-order questions may be broadly defined as those that require students to go beyond simple recall and engage in more sophisticated thinking. A meta-analysis of 18 experiments by Redfield and Rousseau (1981) concluded that the predominant use of higher-level questions during instruction yielded positive gains on tests of factual recall and application of thinking skills. In a separate study (Andre,1979), researchers investigated the effects of having students respond to higher-order questions that were inserted every few paragraphs in a text; they concluded that such a procedure facilitates better textbook learning than do fact question inserts. Pressley and colleagues (1992) showed that asking students for explanatory responses to higher-level questions *prior* to instruction activates prior knowledge and focuses attention, resulting in better learning. However, despite the demonstrated effectiveness of higher cognitive-level questioning, researchers have shown that the majority of classroom questions are factual in nature. In a review of the research on teacher questioning, Gall (1984) discovered that only about 20 percent of classroom questions required more than simple factual recall.

Similarly, Goodlad (1984) reported that only about one percent of classroom discussion invited students to give their own opinions and reasoning.

This research on questioning is directly applied in the UbD design model. In Stage 1, teachers are explicitly prompted to identify or develop "essential questions" related to the important ideas in the content. These open-ended questions engage students in the very kinds of higher-order thinking shown to enhance learning. In Stage 2, students are asked to demonstrate their understanding by *applying* their knowledge and skills through "authentic" performance assessment tasks and *explaining* their reasoning. In Stage 3, teachers are encouraged to pose higher-order questions based on the six facets of understanding.

- **Feedback**

Research has confirmed that one of the most effective strategies a teacher can use is to provide students with feedback relative to how well they are doing. Hattie (1992) analyzed nearly 8,000 studies and concluded that the most powerful single modification that enhances achievement is feedback. Marzano, Pickering, and Pollock (2001) synthesized the research on feedback to provide the following guidelines for the classroom:

1. Feedback should be "corrective" in nature. This means that it should provide students with an explanation of what they are doing that is correct and what they are doing that is not correct.
2. Feedback should be timely. Feedback provided immediately after assessment enhances learning.
3. Feedback should be specific to a criterion; that is, it should inform students where they stand relative to a specific target of knowledge or skill. Research has consistently indicated that criterion-referenced feedback has a more powerful effect on student learning than norm-referenced feedback.
4. Students can effectively provide some of their own feedback by monitoring their own progress.

Understanding by Design stresses the use of feedback to both learners and teachers. A primary tool for offering such feedback is the rubric, used to evaluate student performance in Stage 2. Teachers are counseled to present the rubrics to students *in advance* of an assessment or task so that that the performance target will be visible. Teachers then use the criteria in the rubric to provide specific feedback to students on their strengths and weaknesses, not just to assign a grade or a score. The WHERETO framework in Stage 3 also emphasizes the use of assessments for feedback, followed by opportunities for students to revise, rehearse, and rethink (R). Students are expected to self-evaluate their work

according to specified criteria (E), so that they will know how to improve their work, rather than waiting for the teacher to tell them how they're doing.

- **Related Strategies**

  Marzano, Pickering, and Pollock (2001) summarized and analyzed multiple research studies in order to show that a number of types of instructional strategies significantly affect student achievement. Several of these strategies explicitly assist students in making connections, conceptualizing knowledge, and explaining and applying knowledge and ideas to new situations.

  The following strategies, all recommended by UbD, enhance students' understanding of, and ability to use, knowledge:
  1. Identifying similarities and differences;
  2. Using "nonlinguistic representations"—primarily graphic organizers, models, mental pictures, artistic expression, and kinesthetic activity;
  3. Generating and testing hypotheses through systems analysis, problem solving, historical investigation, invention, and experimental inquiry; and
  4. Asking students to explain their thinking.

Higher Education

Similar findings emerge from studies in higher education. The National Survey of Student Engagement (NSSE) annually collects information directly from undergraduate students that colleges and universities can use to improve student learning. NSSE (2001) has identified five categories of effective educational practices that research studies show are linked to desired outcomes in college. Three of these five NSSE "benchmarks" align with the principles of Understanding by Design:

Level of Academic Challenge. Challenging intellectual and creative work is central to student learning and collegiate quality. Colleges and universities promote high levels of student achievement by emphasizing the importance of academic effort and setting high expectations for student performance.

Active and Collaborative Learning. Students learn more when they are intensely involved in their education and are asked to think about and apply what they are learning in different settings. Collaborating with others in solving problems or mastering difficult material prepares students to deal with the messy, unscripted problems they will encounter daily during and after college.

Enriching Educational Experiences. Complementary learning opportunities inside and outside classrooms augment academic programs, such as

internships, community service, and senior capstone courses provide opportunities to integrate and apply knowledge.

For example, Texas and Virginia agencies have created social studies frameworks and examples from their standards using the Understanding by Design model. For further information, go to http://socialstudies.tea.tx.us/downloads/toolkits/curriculum-assessment-instruction.htm (Texas)
and http://www.pen.k12.va.us/VDOE/Instruction/History/guide (Virginia)

Future Research Targeted

Although formal research on the efficacy of UbD has not been conducted to date, our users have been doing varying degrees of informal research at the classroom and school levels. Indeed, advanced users are encouraged to set up local action research around persistent achievement problems. Nonetheless, more formal, scientific studies are needed.

Since the UbD program's original book, *Understanding by Design,* was released in the fall of 1998, the work has evolved significantly in light of feedback from users. While it would have been premature to launch formal studies earlier, there now is a plan under way at ASCD to mount a formal, independent research study now that the UbD materials and processes are stable.

Understanding by Design in Action

Numerous schools, districts, regional service agencies, universities, and other educational organizations have recognized the efficacy of the Understanding by Design framework and utilize it in their work. Examples of various uses of UbD are briefly described below.

Programs and Projects

- The Peace Corps has adopted UbD as a framework to guide both its international curriculum development (e.g., Worldwide Schools) and its general training for Peace Corps volunteers.
- The John F. Kennedy Center for the Performing Arts CETA program (Changing Education Through the Arts) coordinates a multi-school and district curriculum project for designing interdisciplinary units featuring infusion of the arts. The resulting products are based on the UbD framework and shared through the UbD Web site (http://www.ubdexchange.org).
- With funding from the Bill and Melinda Gates Foundation, the State of Washington is using the Understanding by Design framework as a cornerstone in its training for teacher leaders on curriculum and assessment design. Over the past three years, more than 3,000 teachers have participated in this systematic statewide training.
- The International Baccalaureate program employed the UbD framework to redesign the template for its Primary Years Program (PYP), a curriculum used worldwide.
- National Science Foundation-funded middle school science and mathematics curriculum projects selected Understanding by Design as the design format.
- The Virginia Department of Education has adopted the Stage 1 format of UbD to define the Standards of Learning Curriculum Framework for Social Studies, K–12. This resource document defines the understandings, essential questions, and knowledge and skills related to the social studies standards. This K–12 sequence is available online at http://www.pen.k12.va.us/VDOE/Instruction/sol.
- The California State Leadership Academy (CSLA) used UbD as the framework for revising its comprehensive statewide leadership-training curriculum.
- The Corporation for Public Broadcasting, in partnership with the Annenberg Foundation, has produced an eight-volume videotape series, *The Arts in Every Classroom*. Programs 5 and 6, "Designing Multi-Arts Curriculum" and "The Role of Assessment in Curriculum Design," illustrate the use of UbD for curriculum and assessment development in the arts.
- Intel's Teach for the Future Program incorporates UbD in its national teacher training program

- The Texas Social Studies Center adopted UbD as its curriculum framework and developed model units for statewide dissemination. Information is available at http://socialstudies.tea.state.tx.us/downloads/toolkits/index.htm.
- The state of Hawaii obtained a statewide membership in the Understanding by Design Exchange Web site to encourage teachers to use UbD in their curriculum planning.

Schools and Districts

A number of schools and districts are using Understanding by Design in systemic ways to guide curriculum, local assessment, staff development, teacher observation, and school improvement. A few examples below reflect the application of UbD in diverse settings.

- Norfolk, Virginia, a large urban district, has been involved in a multiyear curriculum and staff development initiative using UbD. This process has included (1) revision of all systemic curriculum frameworks to include enduring understandings and essential questions; (2) multiyear professional development involving all elementary, middle, and high school sites with follow-up coaching, study groups, and action research; (3) sustained professional development for all central office curriculum specialists and supervisors; (4) extensive work with staff who work with special populations, including gifted and talented and special education with proposed UbD modifications of the district's Individual Education Plan template); and (5) a comprehensive evaluation plan to determine UbD impact upon student and staff performance, using a series of demonstration sites and a randomly controlled experimental evaluation model.

- Georgetown, South Carolina, an economically and racially diverse school district near Myrtle Beach, has used UbD as a catalyst to support its school improvement and student achievement accountability initiatives. Georgetown's implementation process includes (1) comprehensive training for staff at all school sites in UbD learning principles and unit development; (2) restructuring of curriculum in all state-tested content areas (i.e., English, mathematics, science, and social studies) to include "student-friendly" enduring understandings and essential questions; (3) sustained professional development for administrators and central office personnel, emphasizing UbD-based coaching strategies for teacher observation and evaluation; and (4) active integration of UbD Stage 2 assessment principles as part of the district's monitoring of student achievement results.

- The Laredo (Texas) Independent School District is situated on the U.S.-Mexican border and serves a predominantly Hispanic student population. Laredo is using UbD to address its state-mandated accountability plan for both staff evaluation and student achievement. The district has acknowledged the powerful alignment between Understanding by Design and the state's recommendations for using multiple forms of assessment to monitor students' progress as well as the critical need to teach for understanding, not just for knowledge recall. As the new Texas

Essential Knowledge and Skills (TEKS) testing program is being implemented, Laredo is using UbD to train staff in (1) "unpacking" state standards to teach for deep understanding, including incorporation of enduring understandings and essential questions in all TEKS-related content areas; (2) developing representative lessons and units that reflect high standards for all students, particularly English as a second language learners; and (3) observing for student behaviors associated with the six facets of understanding.

- Nanuet, New York, a small suburban district, is mapping its K–12 curriculum around the three stages of UbD to ensure a coherent alignment with state and local standards, a focus on "big ideas," and clearly articulated local assessments for gauging student performance. The maps guide the development of teacher units and courses, promote connections across subject areas and grade levels, and sharpen the scope and sequence to eliminate gaps and repetition.

- The recently chartered Two Rivers Magnet School in East Hartford, Connecticut, used the principles of UbD to develop its mission statement and the "big ideas" that will be central to its curriculum in every classroom. Curriculum will be developed using the UbD template so that curriculum units will be aligned with the state content standards as well as the magnet school mission.

- The Howard School in Atlanta, Georgia, is a progressive, independent school that serves students with a variety of learning styles. The program is grounded in the belief that children construct meaning through authentic learning experiences with the arts playing an integrative role. The Howard School curriculum, explicitly guided by Understanding by Design, includes courses and units of study developed around "enduring understandings" and "essential questions." Classroom assessments are anchored by performance tasks that call for students to apply knowledge and skills to demonstrate understanding. Teachers employ inquiry-oriented instructional methods and personalized teaching to accommodate the particular learning needs of their students.

Regional Collaborations

Regional service agencies and educational consortia have facilitated collaborative curriculum and staff development projects using UbD. For example:

- The Standards in Action project (SIA) is a collaborative project between San Diego County, California, school districts and the San Diego County Office of Education (SDCOE), which serves 42 districts, 590 public schools, and more than 470,000 students. Teacher leaders, along with SDCOE content specialists, work in teams to design and review UbD units in English/language arts, science, mathematics, and English Language Development (ELD) and share them via the

Web. More information is available at the following web site: http://www.sdcoe.k12.ca.us/sia/welcome.html.

- The Bucks County Intermediate Unit, a regional service agency in Bucks County, Pennsylvania, coordinates curriculum and staff development training for teachers and administrators in its 13 school districts. Three of the districts have adopted all or part of Understanding by Design for their curriculum development work. Two districts have conducted UbD training for all or part of their teaching and administrative staffs and are using the underlying premises and assumptions of UbD to redesign curriculum and instructional practices in all K–12 subject areas. One district has made extensive curriculum revisions to its K–12 social studies program and is in the process of redesigning its K–12 science curriculum. Several other districts have conducted training and are in the process of working with UbD to revise curriculum and instructional practices.

- The Capital Region Education Council (CREC), a regional service agency in Hartford, Connecticut, coordinates a UbD curriculum and staff development project for teachers and administrators. Currently, 25 percent of Connecticut's 169 school districts are involved in CREC-sponsored UbD training. UbD curriculum units are collaboratively designed around the Connecticut State Standards and disseminated to the participating districts.

- The New Jersey Curriculum Initiative (NJCI), funded by the Geraldine R. Dodge Foundation, supports UbD training and collaborative curriculum development for 14 public school districts and 5 independent schools. The curriculum products are accessible to all NJCI members through the UbD Web site, as are the results of school-based action research projects.

- The Capital Area Intermediate Unit (CAIU) in Harrisburg, Pennsylvania, received a National History grant to support more rigorous and engaging teaching of United State history at the middle and high school levels. Project participants use the UbD template to design curriculum units, which are then reviewed and shared via the UbD Web site.

Higher Education

- The *Understanding by Design* book is used in more than 150 schools of education as a basic text for curriculum and assessment methods courses at both the undergraduate and graduate levels.

- The College of New Jersey, a state institution in Ewing, is using UbD "backward design" for mapping the curriculum by department and for course and syllabus design.

Additional Information

- More than 255,000 copies of the book *Understanding by Design* have been distributed worldwide.
- More than 55,000 copies of *The Understanding by Design Handbook* are in use.
- Tens of thousands of teachers and administrators have received UbD training.
- More than 28,000 educators have access to the UbD Web site.
- Both the *Understanding by Design* book and *The Understanding by Design Handbook* won the annual Distinguished Achievement Award for Excellence in Educational Publication from EdPress, the education publishing trade association.
- Two major philanthropic organizations (The Pew Charitable Trusts and the Geraldine R. Dodge Foundation) have supported UbD implementation.

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