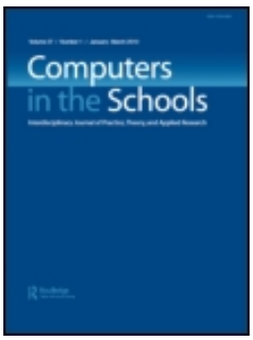

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Examining the Use of the ASSURE Model by K–12 Teachers

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ABSTRACT

Heinich et al. (1999) introduced the ASSURE model to guide teachers in how to plan and deliver lessons that effectively integrate technology into their classroom teaching. Its straightforward, practical approach has made it one of the most widely taught instructional models in the education arena. However, for all of its widespread use, there is very little empirical evidence examining the impact the model has on K–12 learning gains. This study, over a 2-year period, examined 39 separate cases of curriculum being developed using the ASSURE model and the curricula's subsequent effect in promoting student learning. In addition to analyzing scores on student assessments, teachers' perceptions and instructional strategies also were examined as part of this study.

KEYWORDS

ASSURE; instructional design; instructional model; technology integration

Innovations in technology continue to challenge classroom teachers to design new instruction and instructional materials that enhance student engagement and learning activities (Kim, Rueckert, Kim, & Seo, 2013). Although practitioners have training and access to valuable information on creating learning opportunities with instructional design models (see Dick, Carey, & Carey, 2009; Gagne, Wager, Golas, & Keller, 2005; Smith & Ragan, 2005), the effectiveness of these models to create technology-infused lessons that impact student learning remains an on-going narrative, especially when these lessons make use of emerging technologies; for example, mobile devices (Berking, Haag, Archibald, & Birthwhistle, 2012; Junqi, Yumei, & Zhibin, 2010), virtual worlds (Downey, 2011; Soto, 2013), and augmented reality (Ifenthaler & Eseryel, 2013).

In today's classrooms, students are increasingly expecting more technology-facilitated learning activities that are not easily accommodated through traditional instruction. To meet these expectations, K–12 teachers often use already developed curriculum with instructional materials including textbooks and lesson plans that they, in turn, adapt to provide relevant new learning experiences that enhance student engagement and learning with technology. Undoubtedly, teachers often have limited time or support to work on innovation and improvement of teaching with technology and instructional resources as instructional design practices (Laurillard

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et al., 2013). To compensate, teachers rely on models such as ASSURE (Heinich, Molenda, Russell, & Smaldino, 1999).

Heinich et al. (1999) introduced the ASSURE model to guide teachers in how to plan and deliver lessons that effectively integrate technology, media, and materials into classroom teaching (Shelly, Gunter, & Gunter, 2012). This model consists of a six-step instructional system design process:

1. **A**nalyze learners,
2. **S**tate standards, and objectives;
3. **S**elect strategies, technology, media, and materials;
4. **U**tilize technology, media, and material;
5. **R**equire learner participation; and
6. **E**valuate and revise (Smaldino, Lowther, Russell, & Mims, 2015).

Through these six steps, the model demonstrates how to select, use, and evaluate technology and instructional resources as important parts of a systematic design process.

Although many teachers use the ASSURE model to design their lessons or learning activities (Russell & Butcher, 1999; Russell, Sorge, & Brickner, 1994; Smaldino et al., 2015), few researchers have investigated its impact on student learning as new technologies have emerged. This study examines how teachers use the ASSURE model to create technology-integrated lessons and implement these lessons with their students in a variety of settings. The research questions follow:

1. How do teachers use the ASSURE model to integrate technology into their instruction?
2. What impact on student learning resulted from the ASSURE-based instructional lessons?
3. What are the teachers' perceptions of implementing the instruction and of student learning with technology?

Literature review

Over the years, numerous studies have incorporated the ASSURE model into their inquiries. Studies by Kodali (1998) and Sun (2001) examined the frequency of instructional design models used in early Web-based courses but did not examine variances in students' learning levels. Asplund (2006) examined teacher uses and perceived benefits of technology infusion into lessons targeting students with disabilities. Lee and Lee (2014) examined the ASSURE model's influence on teacher efficacy related to technology skills.

Unfortunately, while ASSURE is commonly examined in technology skills and/or design-oriented studies, no studies were found that carried their examination through to the implementation phase of the instructional process and assessed impact on student achievement. To ensure the lack of available literature was not a methodological oversight, one of the ASSURE model authors, Dr. Sharon Smaldino, was contacted directly with the hope that she could provide guidance in finding ASSURE-oriented research that examined the entire process, including

implementation and assessment of student learning gains. As part of her in-depth response, Smaldino (personal communication, September 1, 2015) stated, "You would think that there would be a literature base of some sort related to ASSURE as a model; however, over the years I have not encountered any." This confirmed earlier findings identifying a significant gap in the research literature. Bearing this in mind, this article begins addressing this gap and serves as a prototype for studies examining ASSURE's potential influence on students' learning.

Methods

To address this study's research questions, students enrolled in a graduate-level instructional methods course were tasked with an instructional design project (IDP) in which they created technology-infused instructional units based on the ASSURE model, implemented their individual units, and documented student gains in learning resulting from the units. Data and documents from 39 IDP cases were collected and analyzed; additional information about the IDP and the data procedures is provided below.

A mixed-methods research design with cross-case analysis (Miles, Huberman, & Saldaña, 2014) was employed for collecting and analyzing both quantitative and qualitative data in order to answer the research questions with a more multidimensional approach. As part of the design, unobtrusive measuring techniques were used during the data collection process. These techniques included analyses of documents, personal communications, and group/class communications. The content from these elements was analyzed in keeping with procedures advocated by Patton (2002), and key narratives were extracted to illustrate and emphasize important findings. These narratives are presented throughout this article. Utilizing this mixed-methods approach allowed the researchers to focus on comparative-historical data and avoid biasing respondents' interactions (Trochim & Donnelly, 2006).

Participants

The 39 cases examined during this study were generated by in-service teachers enrolled in an advanced graduate program (i.e., Ed.S. degree) at a regional university located in the southeastern United States. Participants in the study were geographically disbursed in terms of the urban versus rural schools in which the 39 projects were conducted. They also were equally balanced in terms of years of experience. Just under half (48.7%) were new to the profession with 3 or less years of experience while the remaining 51.3% were veteran teachers (see Table 1).

The projects examined in each of the cases were produced as part of their capstone course. The same instructor taught each of the capstone course offerings fall 2013 through fall 2014 from which the projects were taken. The 39 cases and their accompanying IDPs resulted in 874 pages of instructional materials and documentation being analyzed (see Table 2). In addition, learner assessment data from 1,102 students, ranging from elementary through high school grade levels, were gathered

Table 1. Participants' years of teaching experience.

School level	3 or less	4–7	8–11	12–15	More than 15	Total
Elementary	9	2	2	3	1	17
Middle	5	6	2	2	0	15
High	5	0	2	0	0	7
Total	19	8	6	5	1	39

and examined. A breakdown of subjects addressed by the cases, the number of K–12 students affected, and other case-level data are provided later in the article.

Case assignment description—IDP

The goal of the IDP was to aid participants with incorporating technology into their daily teaching and to examine their teaching in order to improve or enhance it. More particularly, the IDP focused on effecting positive educational change in participants' classrooms through instructional practices based on the ASSURE model.

Per the IDP's requirements, participants used the ASSURE model as a guide for designing and developing classroom lessons in K–12 schools. They also were required to implement the lessons in classrooms and gather and report data in their final case report that mirrored the ASSURE lesson plan template. The case report was composed of six elements mirroring the stages of the ASSURE model to ensure that participants were able to demonstrate mastery of individual components of the instructional process (see Table 3). Throughout the semester, participants were required to complete weekly assignments as part of the case report; therefore, they were not able to put off everything until the end of the course.

Data analysis procedures

Because participants' IDPs targeted varying grade levels, disciplines, and topics, common data were not readily available for direct comparison across the 39 cases. To categorize and summarize the instructional diversity observed across the 39 cases, researchers developed a series of summary tables that systematically presented descriptive data with the following categorical groupings: (a) type of school, (b) number of learners, (c) subject of IDP, (d) learner characteristics and needs, (e) instructional strategy, (f) technology and instructional resources, (g) length of instruction, (i) pretest scores, (j) posttest scores, (k) improvement scores, (l)

Table 2. Breakdown of cases.

Course offering	Case report ID	Number of cases	Number of report pages
Fall 2013 Section 1	A1–A7	7	144
Fall 2013 Section 2	B1–B7	7	192
Spring 2014	C1–C10	10	211
Fall 2014	D1–D15	15	327
Total		39	874

Table 3. ASSURE-based IDP case report.

1. Analyze learners
   a. Analyze general characteristics
   b. Analyze specific entry competencies
   c. Analyze learning styles
2. State standards and objectives
   a. State standards (e.g., curriculum standards and technology standards)
   b. Learning objectives
3. Select strategies, technology, and instructional resources
   a. Select strategies
   b. Select technology and instructional resources
   c. Select, modify, or design materials
4. Utilize resources
   a. Preview technology and instructional resources
   b. Prepare technology and instructional resources
   c. Prepare the environment
   d. Prepare the learners
   e. Provide the learning experience
5. Require learner participation
   a. Practice
   b. Feedback
6. Evaluate and revise
   a. Evaluate impact on student learning
   1) Pre-assessment
   2) Post-assessment
   b. Evaluate and revise strategies, technology, and instructional resources
   1) Were the instructional strategies effective?
   2) Could they be improved?
   3) Did the technology and instructional resources assist students in meeting the learning objectives?
   4) Did they support meaningful student participation?

instructional effectiveness, (m) areas for improvement, (n) technology/media influence on students' learning mastery, and (o) effect on students' interest.

From this data set, a series of analyses were done on the individual assessment instruments used in each of the 39 cases (e.g., Cohen's *d* to assess each instrument's internal reliability, as well as resulting pretest and posttest scores; that is, items (i) and (j). The Appendix provides a summary for many of these items.

With regard to qualitative data (e.g., participants' responses to open-ended questions), a content analysis was conducted. Following Patton's (2002) protocols, narratives were analyzed and coded for recurring themes; these codes, in turn, were categorized into broader themes that occurred throughout participants' statements. Through this process, all the information was systematically condensed and made comparable across cases.

Results

Key elements from the raw data as well as findings resulting from the series of quantitative and qualitative analyses are presented hereafter, beginning with a descriptive summary of the cases contextualizing the school settings, subject areas addressed, number of K–12 students affected, etc. Following the summary information, findings specific to each research question are presented with a final discussion appearing at the end of this section.

Summary of cases

As illustrated in Table 4, the cases examined within this study demonstrate the ASSURE model's adaptability to a variety of school settings and subject areas. Classroom teachers from elementary through secondary schools (variable *v*1) embraced the ASSURE model to design and implement their instruction with students across a wide range of ages and in a variety of subjects. Although the preponderance of cases focused on language arts and middle school settings, it should not be inferred that ASSURE is best applied to these areas. As discussed later, student learning gains between pretest and posttest measures were consistently observed across all age ranges and subject areas.

Question 1: How do teachers use the ASSURE model to integrate technology into their instruction?

One of the key stages of the ASSURE model focuses on the selection of strategies, technologies, media, and materials for use in instruction. These elements were examined along three factors: learner characteristics and needs (*v*4), instructional strategies (*v*5), and technology and instructional resources (*v*6). The information in the table for each variable was organized into major categories that emerged when analyzing content of the cases during the coding process. For instance, the

Table 4. School settings and subjects addressed in IDP cases.

Instructional settings		Elementary (K–5th grades)	Middle (6th–8th grades)	High (9th–12th grades)
School type (*v*1)		A1, A2, A3, A7, B5, C2, C3, C5, C6, C7, C8, D2, D6, D11, D12, D13, D15 (17/39)	A4, A5, A6, B2, B3, B4, B7, C1, C4, C10, D1, D3, D5, D8, D14 (15/39)	B1, B6, C9, D4, D7, D9, D10 (7/39)
Number of learners (*v*2)		290	652	160
Subject of IDP (*v*3)	Language arts (e.g., reading fluency, persuasive writing)	A1, B5, C2, C3, C5, C7, C8, D2, D6, D11, D12, D15 (12/39)	A4, A6, B2, B3, C1, D3 (6/39)	B1, C9, D7, D9, D10 (5/39)
	Social studies (e.g., voting and citizenship)	A2, A7, D13 (3/39)	B7, D1 (2/39)	
	Science (e.g., electricity and magnetism)	A3 (1/39)	B4, C10, D5 (3/39)	
	Special education (e.g., functional grocery word identification)	C6 (1/39)	C4 (1/39)	
	Research/library media (e.g., how to use primary and secondary sources in research)		D8, D14 (2/39)	
	Math (e.g., working with exponents)		A5 (1/39)	
	Character (e.g., character in real life)			B6 (1/39)
	Business tech (e.g., mail merge in Word)			D4 (1/39)

information on learner characteristics and needs (*v4*) was organized by six major categories that emerged from the teachers' responses on what they described as their students' perceptual preferences and strengths for learning: variety of learning styles; hands-on, cooperative grouping; technology; motivation needed; and so forth (e.g., special needs and independence). The following excerpts exemplify the comments made by participants when analyzing the characteristics of learners in their individual case studies.

> With respect to learning styles, the students enjoy participating in collaborative activities (A5, Cooperative grouping).

> The majority of the students appear to experience more success when information is presented using technology and media (B1, Technology [e.g., computers, iPads, etc.]).

> They are beginning to work well independently of direct teacher supervision, but still need redirection and motivation (A3, Motivation needed).

> The majority of the class have a moderate intellectual disability (C4, Etc. [e.g., special needs and independence]).

Once the teachers analyzed their students' learner characteristics and needs (*v4*), the teachers engaged in the critical step of selecting the appropriate instructional strategies (*v5*), technologies, and instructional resources (*v6*) to achieve the learning objectives. In terms of defining their instructional strategies (*v5*), the following strategy statements from participants' case studies demonstrate the unique and varied approaches used.

> The teacher will use the interactive whiteboard to teach students how to apply exponent rules to various numerical and algebraic expressions. Presentation was selected as the instructional strategy because this material is new for all students in the class (A5, Presentation with technology).

> Student-centered activities will include students working collaboratively to construct a front page news article or a mini–documentary (B7, Group activities/Cooperative grouping).

> This will be followed by a discussion (student-centered) ensuring that students have fully grasped the basic knowledge provided by the text on the topic of Great Depression, the Crash of the Stock Market, New Deal (D1, Discussion).

In terms of technology and instructional resources (*v6*), there were few categories, as noted in Table 5, but within those categories the actual resources used varied widely.

> Students enjoy using the mini whiteboards, working on IXL , and using the iPads. The whiteboards and IXL provide students with instant feedback, which they like. The iPads add a level of technical sophistication and "cool" factor to their work, which promotes student engagement (A5, Instructional tools).

> Throughout the course of this unit, various forms of technology will be utilized, such as PowerPoint (PPT), YouTube videos, Senteo response systems, digital cameras, Web-based resources, and publishing software (B7, Instructional tools).

Table 5. Learner characteristics and needs, instructional strategies, and technology and instructional resources.

Variable/category			Report ID
Learner characteristics and needs (*v*4)		Variety of learning styles (e.g., visual, auditory, kinesthetic, etc.)	A4, A6, A7, B3, B4, B6, C1, C2, C7, C10, D2, D3, D6, D13 (14/39)
		Hands-on	A2, B1, B2, B3, B4, B5, C3, C4, C8, D4, D8, D12, D13 (13/39)
		Cooperative grouping	A4, A5, A6, B2, B3, C8, D1, D4, D11, D12, D15 (11/39)
		Technology (e.g., computers, iPads, etc.)	A2, A4, A7, B1, B7, D5, D9, D14 (8/39)
		Motivation needed	A1, A3, C5, D7, D10 (5/39)
		Etc. (e.g., special needs and independence)	A3, C6, C4, C9, D4 (5/39)
Instructional strategies (*v*5)	Teacher-centered	Presentation with technology (e.g., smartboard, projector, etc.)	A1, A2, A3, A4, A5, A6, A7, B1, B2, B3, B4, B5, B6, B7, C1, C2, C3, C4, C5, C9, C10, D1, D2, D3, D4, D5, D7, D8, D9, D10, D11, D12, D13, D14, D15 (35/39)
		Demonstration with technology	A1, A5, A6, B5, B6, C3, C4, C6, C7, C10, D1, D5, D6, D8, D12, D14 (16/39)
		Etc. (e.g., drill-and-practice)	C5, D11 (2/39)
	Student-centered	Learning activities with technology (e.g., iPad, Web sites, games, etc.)	A1, A2, A3, A4, A5, A6, A7, B1, B2, B3, B4, B5, B6, B7, C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D15, D14 (39/39)
		Group activities (Cooperative grouping)	A1, A3, A5, B2, B3, B6, B7, C1, C2, C3, C4, C5, C10, D1, D3, D2, D8, D11, D14, D15 (20/39)
		Discussion	A2, A3, A4, A6, A7, B1, B3, B5, B7, C1, C2, C3, C5, C9, D1, D3, D7, D10, D11 (19/39)
		Miscellaneous (e.g., discovery, role-play, simulation)	A1, A2, A4, B4, B5, B6, C5, D1, D6, D9, D12, D14, D15 (13/39)
Technology and instructional resources (*v*6)		Instructional tools (e.g., Kidblog, wiki, Edmodo, games, etc.)	A1, A2, A3, A4, A5, A6, A7, B1, B2, B3, B4, B5, B6, B7, C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15 (39/39)
		Computer/projector	A1, A2, A3, A4, A6, A7, B1, B2, B3, B4, B5, B6, B7, C1, C2, C3, C5, C6, C7, C8, C9, C10, D1, D3, D4, D5, D7, D8, D9, D10, D11, D12, D13, D14, D15 (35/39)
		Tablet (e.g., iPad)	A5, C3, C4, D2, D3, D6, D11, D12, D15 (9/39)
		Recorder/camera	A4, B5, C2, C3 (4/39)
		BYOD	C5 (1/39)

The results demonstrate that all teachers were successful in making technology a central component of their instruction (100%) and instructional tools (100%) in their lessons to support student learning as a part of the ASSURE model.

Table 6. Length of instruction, pretest score, posttest score, and improved score by school type.

Variables	Elementary (K–5th grade)	Middle (6th–8th grade)	High (9th–12th grade)
Length of instruction including assessments (*v*7; hours)	8.02	10.23	10
Pretest score (*v*8)	56.0	48.0	58.9
Posttest score (*v*9)	81.0	80.2	88.1
Improved score (*v*10)	25.0	32.2	29.2

It was particularly interesting to note the frequent use of technology-supported active learning strategies employed in each of the cases. Although ASSURE was not conceived with the primary intent of serving as an active learning model, it readily lends itself to facilitating active learning strategies. As noted in Table 5, the majority of cases employed technology-supported learning activities that were student-centered (e.g., student-driven inquiry, discovery and information gathering, simulations, etc.). In addition to student-centered learning, more than half of the cases (20/39) utilized some form of collaborative learning. In terms of the activities themselves, Web-based resources, games, and activities were used. A few cases employed tablets; and in unique cases involving elementary school students, the students were allowed to "bring your own device" (BYOD) to help them learn.

Noting that only two cases used technologies for drill-and-practice and other non-active learning strategies, it is clear that participants used the ASSURE model to seek out and employ technologies that engaged their learners in an active, hands-on, collaborative manner. This approach could be a paramount reason why so many cases posted strong learning gains for their students.

Question 2: What impact on student learning resulted from the ASSURE-based instructional lessons?

As part of the Evaluate and Revise phase of the ASSURE model, participants measured student learning gains through the use of pre/posttest measures. These measures, in turn, were reported as part of the participants' IDP case report. Table 6 provides a summary of students' instructional time and the learning gains that resulted from the instruction. Case-by-case details are provided in the Appendix.

Paired, two-tailed, t tests were calculated using the pretest and posttest means from each of the 39 cases. When looking across all of the cases, the average pretest value was 53.45 ($SD = 20.24$) and the average posttest value was 82.14 ($SD = 17.04$), resulting in a significant increase in student learning ($t(38) = -10.299$, $p < .001$; Cohen's $d = 1.54$). This is not surprising when one examines the student learning gains at the individual case level. At the individual case level, only one of the 39 cases produced learning gains that were not statistically significant (see the Appendix for case level details). Case C6 did observe an increase in student learning but not at significant levels. It further should be noted that C6 is an outlier in that there were only two students in the special education classroom using the ASSURE-based instructional content.

Given the manner in which K–12 students consistently achieved statistically significant learning gains regardless of grade levels or subject matter, it is difficult to discount the pedagogical potential of the ASSURE model. By employing ASSURE in their instructional design practices, 38 out of 39 participants (97.4%) produced instructional modules resulting in large learning gains for their 1,102 K–12 students.

Table 7. Summary of IDP reports by variables 11, 13, and 14.

Variable/category		Report ID
Were the instructional strategies effective? (*v*11)	Positive	A1, A2, A3, A4, A5, A6, A7, B1, B2, B3, B4, B5, B6, B7, C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, D2, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15 (37/39)
	Required minor change	D3 (1/39)
	Required major change	D1 (1/39)
Did the technology and media assist students in meeting the learning objectives? (*v*13)	Positive	A1, A2, A3, A4, A5, A6, A7, B1, B2, B3, B4, B5, B6, B7, C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, D2, D4, D5, D6, D7, D8, D9, D10, D12, D13, D14, D15 (36/39)
	Required minor change	D3, D11 (2/39)
	Required major change	D1 (1/39)
Were they effective in arousing student interest? (*v*14)	Positive	A1, A2, A3, A4, A5, A6, A7, B1, B2, B3, B4, B5, B6, B7, C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, D2, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15 (37/39)
	Required minor change	D3 (1/39)
	Required major change	D1 (1/39)

Question 3: What are the teachers' perceptions of implementing the instruction and of student learning with technology?

The final step of the project focused on the teachers' reflections on assessing the instructional strategies, technology, and instructional resources used to support student learning. The reflection questions were prepared based on recommendations by Smaldino et al. (2015, p. 56): Were the instructional strategies effective? (*v*11), Could they be improved? (*v*12), Did the technology and media assist students in meeting the learning objectives? (*v*13), and Were they effective in arousing student interest? (*v*14). The findings of the reflections regarding those categorical variables were analyzed and the results presented in Table 7.

Overall, the teachers had mostly positive comments on implementing the instruction. However, the teachers also addressed areas of improvement after implementing the instruction and evaluating its impact on student learning, as shown in Table 8. Not surprising to anyone who has taught in a classroom before, the most common issue was time, with just over half of the cases reporting issues with time management. Frequent comments ranged from implementation timelines (e.g., "Future improvement could begin with a longer implementation period") to pacing (e.g.,

Table 8. List of recommendations for improvement.

Could they be improved? (*v*12)	Report ID
Time	A2, A4, A6, B1, B2, B4, B5, B6, B7, C3, C7, C9, D1, D3, D4, D8, D11, D12, D14, D15 (20/39)
Hands-on	A4, A6, B1, B5, B7, C10, D1, D2, D13, D15 (10/39)
Tools/applications	A1, A7, B3, C4, C6, C5, D5, D14 (8/39)
Grouping (e.g., size of group)	A3, C2, C4, C5, C8, D7, D13 (7/39)
Assistance (technical)	A7, B6, C3, C8, D5, D12 (6/39)
Level of content (e.g., reduce lesson)	A3, A7, B4, B5, C1, C3 (6/39)
Assessment (e.g., pre and peer-review)	B3, C9, D9 (3/39)
Demonstrations/examples	D3, D6 (2/39)
Etc. (assessment tool, physical place, the print on the worksheet bigger)	A5, C6, D10, D11 (4/39)

"strategies used could likely be improved somewhat by switching back and forth more quickly between teacher- and student-centered strategies to make the lesson feel more quickly paced" to balancing time spent on one activity versus another (e.g., "I believe the students would have been better off if they had more practice scanning codes before this assignment").

Similarly, the teachers had mostly positive comments about the implementation of the instruction and students learning with technology. About 95% of the teachers responded that their instructional strategies were effective ($v11$) and that technology and instructional resources assist their students in meeting learning goals ($v13$) and assist in arousing student interest ($v14$). Positive statements about the effectiveness of instructional strategies ($v11$) included

> This increase in assessment results indicates the instruction was effective in teaching students how to accurately use exponent rules to solve mathematical problems (A5, Positive).

> After implementing the project in Mrs. Johnson's third-grade class, we found the IDP to be very effective. The results were very encouraging. Students had an average of 34% gains between the pretest and posttest (B5, Positive).

Equally positive observations were found in participants' case studies in the area of technology and learning objectives ($v13$).

> In talking with the students, the practice on IXL was the most beneficial in helping students learn the content. The students liked receiving instant feedback and raising their "SmartScore" within the program (A5, Positive).

> Yes, the use of the Bitsboard App assisted students in learning the functional vocabulary and words. Students were very focused while using the Bitsboard App and stayed on task while participating in the various activities it provided with the functional vocabulary (C4, Positive).

Similarly, participants observed positive effects on students' engagement and interest in learning during their projects.

> Students were engaged and excited when they used the technology. Students loved doing the research on the laptops and desktop computers and printing out the images to add to the storyboard. Students also loved using the Flips to record their stories (B5, Positive).

> They especially enjoyed working in groups of two to play the activities and see who could obtain the most matches in a memory game with the functional vocabulary (C4, Positive).

Although many teachers had a positive outlook and positive teaching experiences with the lessons, it did not mean that the instruction based on the ASSURE model was effective for all students (see Table 9).

Overall, teachers were very happy with the ASSURE-facilitated projects they developed as well as with the results posted by the students. However, as several teachers wrote, "There is always room for improvement." The changes that were recommended were minor in nature and ones that are typical of instructional units being implemented for the first time (e.g., better time management). In those cases where major changes were identified, the changes related to students' preparedness

Table 9. Participants' comments on recommended minor or major changes.

Variable	Required minor change (from the report D3)	Required major change (from the report D1)
Were the instructional strategies effective? (*v*11)	"Several students admitted that they do not like to write regardless of the medium or the topic, and those were the same students who did not show progress."	"The instructional strategies utilized within this project had to be modified a great deal from my original plan to what the students were able to do. As well, the strategies, technology, and media were more of a burden on the learning process rather than helpful and effective."
Did the technology and media assist students in meeting the learning objectives? (*v*13)	"Many students learned quickly to add images to their blog posts, realizing the added aesthetic touch that they provide. Others never embraced this."	"The media and technology also caused distractions with the students staying focused on their work. The students didn't do detailed research due to their trying to rush through the projects."
Were they effective in arousing student interest? (v14)	"When this unit was first introduced, many students were excited to get started and continued to blog enthusiastically, growing in their writing gradually. Even those students who were least interested in reading and discussing books showed some interest."	"Surprisingly, the students were not aroused by the project at all. … Again, I feel that the students were initially intimidated and overwhelmed by the project. This is because the students have not been challenged to this capacity before and allowed to 'think outside the box.'"

(e.g., having the skills to use the technology or being able to stay focused and not distracted by the technology being used).

Discussion

Depending on the instructional resources available for use, there are a variety of general instructional design frameworks (e.g., Dick, Carey, & Carey, 2009; Gagne et al., 2005; Smith & Ragan, 2005), as well as technology-specific models (e.g., Berking, Haag, Archibald, & Birthwhistle, 2012; Downey, 2011; Ifenthaler & Eseryel, 2013). Heinich et al.'s (1999) ASSURE model is a generic model that has stood the test of time. However, for all of its long-term stamina, there is comparatively little empirical evidence examining its effect on student learning gains.

Based upon the findings from this study, it appears that the ASSURE model definitely has a positive influence on learners who receive instruction developed using this framework. As the data in Tables 4 and 5 illustrate, the six stages of the ASSURE model support, and potentially encourage, the creation of student-centered, active learning lessons. Admittedly, the ASSURE model does not preclude the creation of lessons that are wholly teacher-centered or lessons that rely on passive learning strategies. There were cases of this nature; however, these cases were very few in number and each of them still used some level of student-centered instruction and/or active learning. As a whole, the strategies used in the 39 cases were active, engaging, and highly effective.

With regard to their effect on student learning, the ASSURE-facilitated lessons proved to be highly effective. Thirty-eight (38) out of the 39 cases reported statistically significant learning gains. Given that these gains spanned over 1,100 students across a broad spectrum of disciplines in elementary, middle, and high school settings, the consistent reporting of such large learning gains is remarkable in and of itself. The one common element across all of these cases was the use of the ASSURE model to guide, plan, and develop lessons systematically and symmetrically to effectively integrate the use of appropriate instructional strategies, technology, and media for learning. In doing so, it appears that the teachers successfully developed instructional strategies (*v*5) with technology and instructional resources (*v*6) in their lessons to support learner differences and special needs (*v*4) as a part of the ASSURE model.

With an eye toward sustaining the learning gains, the data, and comments in Tables 7, 8, and 9 reflect the important step of evaluation and revision (*v*12). In nearly every case, the teachers' perceptions of the lesson and its effectiveness were positive. Granted, revisions typically are necessary but those revisions were relatively minor in nature for the majority of the cases.

In conclusion, from a practitioner standpoint, it is acknowledged that the ASSURE model is a practical, easy-to-implement approach for integrating technology into classroom instruction. Beyond its ability to facilitate the development of new lessons, it remains to be seen if, and to what degree, it may affect student learning gains. Consequently, it was with much surprise that such large learning gains were so consistently reported across nearly every case analyzed in the study. Admittedly, it is unlikely that such large and sweeping gains will occur in all future studies. That being said, such positive and overwhelming results encourage the need for additional studies examining the potential influences of the ASSURE model to determine more precisely to what degree and in what areas the ASSURE model has the greatest impact on instruction and learning.

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Appendix
Summary of IDP Reports

Case	Pages	Title of IDP	School	Student	Number of students	Cohen's *d*	Length	Pre	Post	Difference	*p*	*t*
A1	13	Language arts	Elementary	First grade	21	0.51	7.5	47.62	57.5	9.88	0.0021	3.559
B5	34	Language arts	Elementary	Third grade	23	2.18	7.5	56.17	90.61	34.44	0.0001	7.196
C2	46	Language arts	Elementary	Fourth grade	28	1.19	3	82.33	90.46	8.13	0.0001	14.0607
C3	22	Language arts	Elementary	K	25	0.43	6.3	12.6	16.5	3.9	0.0001	6.3049
C5	16	Language arts	Elementary	Second grade	15	2.45	8	58.66	80.08	21.42	0.0001	10.2007
C7	17	Language arts	Elementary	First grade	20	0.5	13.3	70.01	83.3	13.29	0.0001	6.4466
C8	14	Language arts	Elementary	First grade	12	1.02	4	68.33	88.33	20	0.0152	2.8723
D2	15	Language arts	Elementary	First grade/English for Speakers of Other Languages (ESOL)	6	1.89	15	24.8	48	23.2	0.0187	2.9407
D6	31	Language arts	Elementary	Fifth grade	22	2.14	7.25	73.23	93.48	20.25	0.0001	8.6358
D11	17	Language arts	Elementary	Third grade	6	3.28	5	39.4	82	42.6	0.0231	4.3015
D12	24	Language arts	Elementary	Fifth grade	39	2.65	9	58.46	95.95	37.49	0.0001	12.5782
D15	21	Language arts	Elementary	Fourth grade/gifted	4	2.55	8	75	94	19	0.0421	3.4125
A2	28	Social studies	Elementary	Third grade	19	2.29	8	65.79	85.16	19.37	0.0001	9.4706
A7	28	Social studies	Elementary	Fourth grade/risk	21	2.07	4.5	42.14	84.76	42.62	0.0001	9.042
Case	Pages	Title of IDP	School	Student	No. of students	Cohen's *d*	Length	Pre	Post	Diff.	*p*	*t*
D13	24	Social studies	Elementary	Third grade	19	3.68	5	41.05	95.89	54.84	0.0001	9.9176
A3	17	Science	Elementary	Third grade	8	3.77	4	57.5	90.25	32.75	0.0002	7.0218
C6	18	Special ed	Elementary	Fourth and third grade/Attention Deficit Hyperactivity Disorder (ADHD)	2	2.97	21	79	100	21	0.2829	2.1
A4	15	Language Arts	Middle	Eighth grade	135	2.02	10	57.14	92.35	35.21	0.0001	9.5743

(*Continued on next page*)

Appendix

Summary of IDP Reports (Continued)

Case	Pages	Title of IDP	School	Student	No. of students	Cohen's *d*	Length	Pre	Post	Diff.	*p*	*t*
A6	19	Language arts	Middle	Eighth grade	47	1.8	5	70.23	86.05	15.82	0.0001	8.564733
B2	20	Language arts	Middle	Seventh grade	16	1.99	5	69.69	85.07	15.38	0.0001	5.5365
B3	26	Language arts	Middle	Eighth grade	30	0.91	12	25.9	30.47	4.57	0.0001	9.5879
C1	11	Language arts	Middle	Seventh grade	101	1.56	6	52.57	73.57	21	0.0001	10.6927
D3	23	Language arts	Middle	Sixth grade	59	3.48	8	52.19	84.66	32.47	0.0001	23.682
B7	22	Social studies	Middle	Seventh grade	54	4.47	13	33.6	90.32	56.72	0.0001	19.959
D1	28	Social studies	Middle	Fifth grade	11	1.65	10	26.55	68.91	42.36	0.0002	5.8238
B4	36	Science	Middle	Eighth grade/English Language Learning (ELL)	28	2.53	11	46.57	84.86	38.29	0.0001	13.2756
C10	30	Science	Middle	Sixth grade	22	1.78	40.5	60.91	80.45	19.54	0.0001	5.8614
D5	30	Science	Middle	Fifth grade	53	6.11	5	23.58	84.64	61.06	0.0001	29.6626
A5	24	Math	Middle	Eighth grade	19	11.93	12	15.89	75.61	59.72	0.0001	36.2887
Case	Pages	Title of IDP	School	Student	No. students	Cohen's *d*	Length	Pre	Post	Diff.	*p*	*t*
C4	22	Special ed	Middle	Seventh–eighth grade/intellectually disabled	5	3.11	8	47.4	88.6	41.2	0.0036	6.1052
D8	21	Library	Middle	Sixth grade	48	1.33	4	66.25	88.7	22.45	0.0001	5.1897
D14	21	Library	Middle	Seventh–eighth grade	24	0.97	4	71.25	88.26	17.01	0.0010	3.7905
C9	15	Language arts	High	Ninth grade	56	0.79	7.5	71.4	82.79	11.39	0.0635	1.9349
B1	28	Language arts	High	10th grade	21	3.67	11.25	30.71	89.86	59.15	0.0001	19.8126
D7	16	Language arts	High	11th grade	15	1.02	7.5	70.94	85	14.06	0.0006	4.3653
D9	24	Language arts	High	10th grade	15	2.17	6	90.2	97.21	7.01	0.0001	9.0226
D10	15	Language arts	High	Ninth grade/English and Language Arts (ELA)	6	1.04	0.75	59	84.8	25.8	0.0108	4.5009
B6	26	Character education	High	10th—12th grade	30	1.07	30	72.2	89.27	17.07	0.0001	4.4783
D4	17	Technology	High	11th–12th grade	17	9.45	7	18.06	87.59	69.53	0.0001	33.9778