A SOAR-Fired Method for Teaching Synthesis Writing

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Linlin Luo • *University of Regensburg*
Kenneth A. Kiewra • *University of Nebraska*

Abstract

Students often fail to write effective synthesis essays that compare multiple sources across common intersecting categories. Instead, they compose flawed essays that focus primarily on one source and then add a few ideas from other sources (patchwriting); report ideas from all sources in a disjointed fashion (tag-all writing); or draw from one source after another without comparison (separate-representation writing). Effective synthesis writing depends on three strategies: selecting important information from each source, arranging the selected information in a graphic organizer for easy comparison, and connecting information from the various sources in a comparative way. The authors report on an established teaching and learning system called SOAR (Select, Organize, Associate, and Regulate) and its newly investigated impact on synthesis writing in the two studies that they conducted. In the first study, students provided with SOAR supplements (a graphic organizer, association prompts, and a regulation checklist) composed essays that contained more information, better synthesis organization, and more intertextual relationships than did essays from students who were not using SOAR supplements. In the second study, SOAR-trained students composed better organized synthesis essays than students who used their own preferred strategies. Across studies, students found SOAR helpful for synthesis writing and reported that they would be likely to use SOAR for future writing assignments. The authors conclude with an example of how to teach students to use SOAR when they write.

Keywords: synthesis writing, SOAR strategies, graphic organizers

As an instructor, what is your impression of students' writing, particularly synthesis writing, which requires them to compare multiple topics? In the course of your career, you have probably witnessed one or more types of flawed synthesis writing from your students. Most students need strategies to help them write effectively.

The three types of creativity described in Figure 1 are an example of material that students might be asked to read and analyze through synthesis writing. What follows are descriptions of flawed student approaches to an essay on this material.

Adaptive Creativity	Innovative Creativity	Emergent Creativity
Adaptive creativity is the ability to bring past knowledge and strategies to bear on current situations. Examples include any of the day-to-day problems that a homemaker or a skilled person in a profession or vocation would have to solve. For example, a homemaker might have to use adaptive creativity to plan and execute a new house-cleaning and meal-preparation strategy when he or she learns that unexpected guests will soon be arriving. The motivation of the adaptively creative person is to maintain the status quo or to slightly improve the status quo. Adaptive creativity can be mastered over 3–5 years.	Innovative creativity refers to a person's ability to significantly change or adapt a major process, product, or paradigm. Quite often an innovator's motivation stems from dissatisfaction with current conditions, which results in a desire to make a significant change. The time demand for developing innovative creativity is 5–10 years. Examples of innovatively creative people include inventors who significantly improve products or produce new products, such as Steve Jobs, the founder of Apple Inc.	Throughout history, exceptional individuals have launched intellectual, social, or political revolutions. For example, Einstein's groundbreaking theory of relativity, along with his contributions to the development of quantum theory, laid the foundation of modern physics. Emergent creativity refers to the person's ability to fundamentally change existing ideas, beliefs, or styles. The change is so profound that the whole direction of a discipline is reshaped. Obviously, such a significant change involves a lifetime of experience and analysis in a particular field. Emergently creative people's motivation stems from their drive to challenge basic assumptions: they are more concerned with their own new ideas than with the underlying assumptions of a discipline.

Figure 1. Creativity texts.

Flawed Synthesis Writing

Writing experts have characterized flawed synthesis writing as either *patchwriting, tag-all writing,* or *separate-representation writing*. Patchwriting (Barks & Watts, 2001) occurs when writers craft an essay based mainly on one source and add cursory mentions of only one or two ideas from other sources. For example, an essay on the material in Figure 1 might extensively describe adaptive creativity and only mention the definitions of the other two types of creativity at the end.

Tag-all writing (Britt, Perfetti, Sandak, & Rouet, 1999) occurs when writers include all important source ideas but report them in a disjointed fashion. For example, an essay might include all the information about the three types of creativity but without any organizing principle or connection among these ideas.

Separate-representation writing (Britt et al., 1999) occurs when writers summarize each source consecutively but never synthesize them. For example, an essay might consist of three separate summaries of adaptive, innovative, and emergent creativity, respectively, but without any discussion of how these types of creativity compare to one another.

None of these essays would represent effective synthesis writing. According to Spivey and King (1989), synthesis writing involves the processes of selecting, organizing, and connecting information from multiple source texts to construct a new text. The first process, selecting, involves the writer deciding what information about each topic should be included. The second process, organizing, involves the writer arranging the selected information based on logical categories (Spivey, 1991). The third process, connecting, involves linking and integrating information from multiple topics to produce a new text. Table 1's first three columns show why patchwriting, tag-all writing, and separate-representation writing are ineffective: They fail to engage all three processes. Patchwriting engages none of the processes; tag-all writing engages only the selecting process; and separate-representation writing engages the selecting and organizing processes but not the connecting process.

Table 1
Types of Synthesis Writing Regarding Writing Processes

	Patchwriting	Tag-All writing	Separate-Representation writing	Effective synthesis writing
Selecting	—	+	+	+
Organizing	—	—	+	+
Connecting	—	—	—	+

Effective Synthesis Writing

An example of an effective synthesis essay about the three types of creativity is shown in Figure 2. As indicated in Table 1's right-most column, effective synthesis writing incorporates all three writing processes. The sample essay selects all relevant information about each type of creativity and organizes and connects that information across categories, thereby showing the similarities and differences among the three types.

> The three types of creativity—adaptive, innovative, and emergent—differ with respect to outcomes, time demands, and motivation. Regarding outcomes, the three types—progressing from adaptive to innovative to emergent—increase in sophistication. Adaptive creativity involves solving a common problem in a new way, such as an efficient plan to get a house and meal ready for unexpected guests. Innovative creativity is more sophisticated. It involves inventing or improving something, such as Steve Jobs's Apple products. Emergent creativity is the most sophisticated. It involves reshaping an entire discipline. When Einstein proposed the theory of relativity and developed quantum theory, he laid the foundation of modern physics.
>
> In line with this progression of outcomes is the progression of time demands necessary to achieve those outcomes. As the type of creativity grows in sophistication, so does the number of years necessary to attain results: adaptive, 3–5 years; innovative, 5–10 years; and emergent, a lifetime.
>
> The motivation for each type of creativity stems from either internal or external sources. The source of motivation is external for adaptive and innovative creativity, but internal for emergent. The source of motivation is consistent with the outcome. Adaptively creative people and innovatively creative people are concerned with solving problems that arise from their environment—an external source. Emergently creative people, in contrast, are driven by their own thoughts and ideas about a discipline—an internal source.

Figure 2. An example of effective synthesis writing.

Synthesis writing is a common requirement in secondary schools and colleges (Addison & McGee, 2010; Cumming, Lai, & Cho, 2016; Massengill, 2015). It is a reading-to-write task, requiring students to synthesize information from several sources to gain a comprehensive understanding of a topic. In the simplest form of synthesis writing, students might read two or more source documents and compose a comparative essay. Teachers often assign this type of synthesis writing to help them evaluate students' understanding of a topic (Boscolo, Arfé, & Quarisa, 2007). For example, students in a high-school history class might be asked to write a synthesis essay comparing three historical periods. In a more complicated form of synthesis writing, such as a literature review for a college thesis, students might need to search for and determine the most relevant source documents for a thesis (i.e., sourcing) before they could select, organize, and connect information from these source documents. Sourcing requires students to survey and read multiple documents, evaluate each document, and make decisions about whether and how to use it. This type of synthesis writing is more challenging, because it involves additional complex cognitive processes, and thus is more likely to be required in college classes.

Whether students are given source documents to write a comparative essay or search for source documents to write an in-depth literature review, the key processes for synthesizing information are selecting, organizing, and connecting. Unfortunately, students often synthesize information ineffectively (e.g., Dovey, 2010; Krishnan & Kathpalia, 2002; Segev-Miller, 2004; Smit, 2010) because they fail to engage these processes (Dovey, 2010; Kennedy, 1985; Mateos & Solé, 2009; Segev-Miller, 2004). Therefore, it is imperative to teach students strategies for synthesis writing.

Strategies for Synthesis Writing

Although synthesis writing is a common academic requirement (Addison & McGee, 2010; Cumming et al., 2016; Massengill, 2015) and a fundamental academic literacy skill (Cumming et al., 2016), it has not been studied extensively (Kirkpatrick & Klein, 2009; Mateos & Solé, 2009). Among the limited studies that examined the synthesis-writing strategies that students commonly use (e.g., Anmarkrud, Bråten, & Strømsø, 2014; Barzilai, Tzadok, & Eshet-Alkalai, 2015; Dovey, 2010; Mateos & Solé, 2009; McGinley, 1992; O'Hara, Taylor, Newman, & Sellen, 2002; Segev-Miller, 2007; Spivey, 1991), five relevant findings emerged.

First, most students used some type of selecting strategy, such as note taking, to extract information from texts. However, students who simply selected information without further organizing and connecting it produced synthesis essays that were no better than the essays of students who did not take notes (e.g., Gil, Vidal-Abarca, & Martínez, 2008). Second, students rarely used organizing and connecting strategies without prompting; when prompted, however, they produced effective synthesis writing. Third, graphic organizers, such as matrices, enhance students' synthesis writing. Students trained to use graphic organizers for writing produced higher-quality synthesis essays than those who did not receive such training (Risemberg, 1993). Fourth, relationship prompts, such as "look across sources for commonalities," helped students connect information from multiple sources and compose effective synthesis essays (De La Paz & Felton, 2010). Fifth, no single study has examined the means to impact all three processes critical to effective synthesis writing: selecting, organizing, and connecting.

An integrated strategy system called SOAR (Kiewra, 2005, 2009), which is commonly associated with improving text learning, also seemingly has the potential to improve synthesis writing.

SOAR

The SOAR strategy system was developed to help students study (Kiewra, 2005) and help instructors teach (Kiewra, 2009). *SOAR* is an acronym for the system's four integrated components: Select, Organize, Associate, and Regulate. The first component, Select, refers to selecting and recording complete notes from texts. Returning to the sample creativity materials (Figure 1), a complete set of notes might look like those in Figure 3. Research shows that note taking during reading leads to higher achievement than simple reading alone (e.g., Kiewra, 1985; Kobayashi, 2009; Peverly, Brobst, Graham, & Shaw, 2003) and that note completeness is positively correlated with achievement (Baker & Lombardi, 1985; Kiewra, 1987).

Adaptive Creativity
Outcome: solving a common problem in a new way
Example: a homemaker uses new meal-preparation strategies for unexpected guests
Motivation: to maintain or slightly improve the status quo
Time demands: 3–5 years

Innovative Creativity
Outcome: creating a new product or altering a major paradigm
Motivation: to make a significant improvement due to dissatisfaction with current conditions
Time demands: 5–10 years
Example: Steve Jobs's Apple products

Emergent Creativity
Outcome: intellectual, social, or political revolutions
Example: Einstein's groundbreaking theory of relativity
Time demands: lifetime
Motivation: to reshape a field based on one's own vision or revelation

Figure 3. Complete notes from sample creativity materials.

The second component, Organize, refers to arranging selected notes in graphic organizers. Figure 4 shows a matrix organizer for the creativity materials, where information about the three types is presented in one place, organized by categories (e.g., outcome and motivation) and ready for comparison. The matrix localizes related information better than the linear notes in Figure 3. The matrix displays information in economical and spatial ways that allow relationships to be quickly identified, whereas linear notes obscure relationships (Kiewra, 2012). Research confirms that studying graphic organizers such as matrices leads to higher achievement than does studying linear displays such as traditional texts or outlines (e.g., Kauffman & Kiewra, 2010; Robinson & Kiewra, 1995).

	Adaptive Creativity	Innovative Creativity	Emergent Creativity
Outcome	Solving a common problem in a new way	Creating a new product or altering a major paradigm	Intellectual, social, or political revolutions
Motivation	To maintain or slightly improve the status quo	To make a significant improvement due to dissatisfaction with current conditions	To reshape a field based on one's own vision or revelation
Time Demands	3–5 years	5–10 years	Lifetime
Example	Homemaker uses new meal strategies for unexpected guests	Steve Jobs's Apple products	Einstein's groundbreaking theory of relativity

Figure 4. Matrix organizer for sample creativity materials.

The third component, Associate, refers to connecting multiple ideas to discern meaningful relationships among them, rather than examining one idea at a time in a piecemeal fashion. For example, examining Figure 4's first row, it is easy to see that the creative outcomes appear progressively more sophisticated, from adaptive (solving a common problem) to innovative (creating a new product) to emergent (starting an intellectual revolution). Examining the first and third rows, one can see that as the types of creativity increase in sophistication, time demands for achieving results increase as well. Association strategies, such as prompting students to identify relationships and asking elaborative questions (e.g., "How do the motivations for creativity change across the three types?"), improve learning compared to piecemeal techniques (e.g., Atkinson et al., 1999; Kobayashi, 2009; Pressley, McDaniel, Turnure, Wood, & Ahmad, 1987).

The fourth component, Regulate, refers to monitoring and assessing learning using metacognitive strategies such as self-testing, rather than rote learning strategies such as restudying, rereading, and recopying notes. Regarding the creativity materials, students might monitor and assess their own learning by asking these questions: (a) Which type of creativity is used most in day-to-day problem solving? and (b) What is the motivation for emergent creativity? Research confirms that retrieval practices (e.g., self-testing) lead to higher achievement than repeated learning opportunities such as rereading notes (e.g., Frase & Schwartz, 1975; Karpicke, 2012; Roediger & Butler, 2011).

Thus far, four studies (Daher & Kiewra, 2016; Jairam & Kiewra, 2009, 2010; Jairam, Kiewra, Rogers-Kasson, Patterson-Hazley, & Marxhausen, 2014) have investigated the integrated SOAR system. These studies compared SOAR-aided students and non-SOAR-aided students and found that SOAR-aided students learned prose materials better, especially regarding relationships—usually between 30 and 40% better. One SOAR study (Daher & Kiewra, 2016) is particularly relevant to synthesis writing, because it extended SOAR investigations into multiple-text learning and tested the trainability of SOAR.

College students were assigned randomly to either the SOAR group or the preferred-strategy group. First, both groups participated in a 30-minute training session: The SOAR group received SOAR training and practiced SOAR using three texts. The preferred-strategy group received the same practice texts but was instructed to use their own preferred strategies to study them. Following training, participants studied five texts—each about a type of ape and each appearing on a separate website—and created their own study materials on a provided notepad. Following information acquisition, an achievement test covering fact, relationship, and concept learning was administered.

The SOAR group recorded more notes (selection), created more graphic organizers (organization), and generated more associations (association) and practice questions (regulation) than the preferred-strategy group. Therefore, the brief SOAR training positively impacted study behaviors. The SOAR group also outperformed the preferred-strategy group on all three tests: fact (74% vs. 65%), concept (57% vs. 46%), and relationship (70% vs. 39%), with the largest effect seen for relationship learning.

SOAR and Synthesis Writing

Although previous SOAR studies examined SOAR as a study method (Daher & Kiewra, 2016; Jairam & Kiewra, 2009, 2010), it is reasonable to propose that SOAR might also be effective for synthesis writing. Empirically, SOAR was especially robust for relationship learning, which is the crux of synthesis writing (Spivey, 1991). Theoretically, SOAR supports all three key processes necessary for good synthesis writing (shown in Table 1). SOAR's first two components, Select and Organize, aid synthesis writing's selecting and organizing processes, respectively. SOAR's third component, Associate, aids synthesis writing's connecting process. SOAR's fourth component, Regulate, can help writers monitor their other writing processes (as writers compose and follow a writing plan and raise and answer regulation questions such as "Am I selecting important information from texts?"; "Am I organizing it?"). Although Spivey and King (1989) did not specify regulating as a key synthesis-writing process, self-regulatory strategies, such as planning, monitoring, and self-evaluation, are related to successful synthesis writing (e.g., Dovey, 2010; Segev-Miller, 2007).

With support from an IDEA Impact Grant, we conducted two studies to examine SOAR's impact on synthesis writing. Study 1 examined the efficacy of providing SOAR supplemental materials to writers as an aid for synthesis writing. Study 2 examined the trainability of SOAR to help writers use SOAR strategies for synthesis writing on their own.

Study 1

The research question was, Does providing SOAR supplements improve synthesis writing? To answer this question, we assigned college students randomly to study four texts about creativity (similar to those in Figure 1 but longer and more detailed), either with provided SOAR supplements or without them, in preparation for writing a synthesis essay that compared the four types of creativity. We predicted that the students receiving SOAR supplements would write better essays than the students not receiving SOAR supplements, regarding essay information selection, organization, and intertextual connections.

The SOAR supplements contained a matrix that listed the four creativity topics across the top (labeled A–D) and the 10 common categories (e.g., definition, goal, means to reach goal) down the left side (labeled 1–10), and the 80 idea units within the 40 matrix cells, thus covering SOAR's Select and Organize components. Also included was a list of 10

association prompts that identified matrix cells from which writers could derive comparative associations, thus covering SOAR's Associate component. Also included was a self-regulation planning outline and checklist, thus covering SOAR's Regulate component (e.g., "Did I include important information from all four texts?"; "Did I write about how the creativity types are alike and how they are different?").

Analyses of essays indicated group differences in line with predictions, all favoring SOAR-aided writers over non-SOAR-aided writers. Regarding information selection, SOAR-aided writers included more text ideas in essays (40% versus 29%). Regarding essay organization, SOAR-aided writers used a more comparative categorical organization (comparing creativity topics by categories, such as definition and goal, instead of a topic-by-topic organization). Sixty-three percent of SOAR-aided writers used categorical organization, compared to just 13% of non-SOAR-aided writers. Regarding intertextual connections, SOAR-aided writers included more accurate and complete intertextual relationships (e.g., "The goal of creativity becomes progressively more profound going from expressive [creating a momentary brilliance] to adaptive [solving a day-to-day problem] to innovative [creating or improving a product] to emergent [reshaping a discipline], as the creativity appears progressively more sophisticated") in essays than did non-SOAR-aided writers (4 versus 2).

Study 1 confirmed that students left to their own devices compose inadequate synthesis essays. Meanwhile, students provided with SOAR supplements compose essays that include more ideas, better categorical organization, and more intertextual relationships. Students also reported that SOAR supplements are helpful and that they would like to use them for future writing tasks. Unfortunately, instructors are unlikely to provide SOAR supplements with every synthesis-writing task. Therefore, Study 2 investigated whether students can be trained to use SOAR writing strategies on their own.

Study 2

The research question was, Does SOAR training improve synthesis writing? To answer this question, college students first completed a baseline synthesis-writing task on Day 1. On Day 2, one week later, students were assigned randomly to receive either SOAR training or no training. The no-training control group practiced their own preferred strategies. Both groups then performed another synthesis-writing task. We predicted that SOAR training would facilitate synthesis writing, so that students who received SOAR training would write better synthesis essays than students who did not receive SOAR training on Day 2 but not on Day 1.

SOAR-trained students were presented with three practice texts. For the first text, they were simply shown how to apply SOAR strategies—jotting notes for Select, creating a matrix for Organize, generating relationships for Associate, and completing a writing plan and checklist to guide and evaluate writing for Regulate. For the second text, practice was guided such that students were prompted to apply each SOAR strategy, in turn, on their own. Following each SOAR component, feedback was provided as to what optimal materials might look like. For the third text, students practiced all four strategies uninterruptedly and were then given complete SOAR feedback at the end. Control-group students did not receive SOAR training. Instead they practiced their preferred learning strategies for each of the three practice texts. Practice time was 27 minutes for each group.

On Day 1, half the students from each group (SOAR and control) studied creativity texts (modified from Study 1) and half studied comparably designed texts on the topic of temperament. Participants were allotted 25 minutes to study. They were permitted to take notes on the texts and on provided notepaper. They were told that they could use these notes when writing. Following the study period, participants were allotted 30 minutes to write a comparative essay with the use of notes about the topic that they studied (creativity or temperament), before completing a survey about their study and writing experiences. On Day 2, a week later, students completed the 27-minute training (SOAR or control) and then studied

either the creativity or temperament texts (whichever one they had not studied on Day 1) for 25 minutes, using either SOAR or their preferred strategies, knowing that they could later use their notes to write a comparative essay. Following the study period, students wrote their essay with the use of notes and then completed a survey about their training, studying, and writing experiences.

As predicted, essays were comparable on Day 1, before training occurred, for the SOAR and control groups. Unexpectedly, group differences were also not observed for information selection or intertextual connections on Day 2, following training. These Day 2 findings indicate that SOAR training did not boost the number of ideas or intertextual connections recorded in essays compared to control training, counter to predictions. Regarding essay organization, however, predicted group differences were found. On Day 1, both SOAR and control writers composed essays that were largely inadequate and comparable. Only 14% of writers in each group organized their essay categorically. On Day 2, however, following training, about 50% of SOAR writers composed essays organized categorically, whereas only about 16% of control writers composed categorically organized essays. Figure 5 highlights these organization findings.

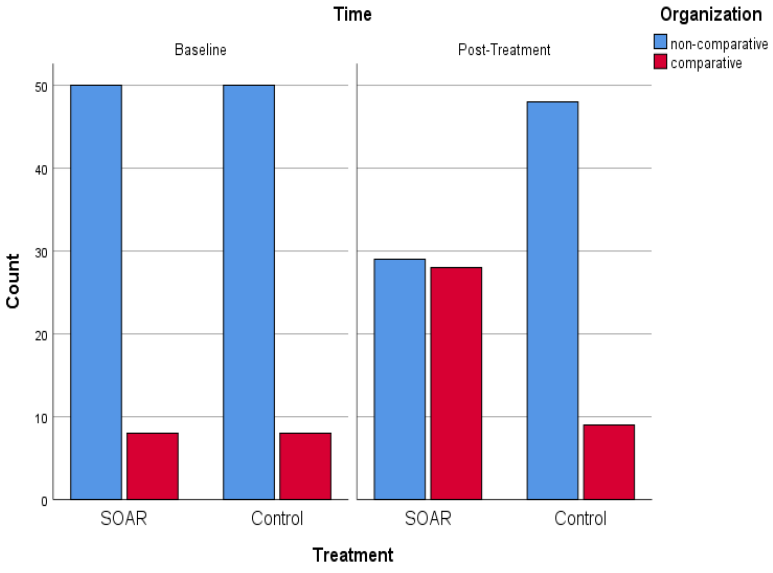

Figure 5. Bar graph for organization results.

Both groups created minimal study materials prior to training on Day 1. Following training, control and SOAR participants differed markedly in terms of study behaviors used to prepare for essay writing. In terms of selecting information, 56% of control participants took notes, compared to 96% of SOAR participants. SOAR notes were also more complete (35% of text ideas compared to 26%). In terms of organizing, 7% of control participants constructed a matrix, compared to 90% of SOAR participants. In terms of associating information, only 3% of control participants wrote association statements, compared to 26% of SOAR participants. Among those who wrote associations, on average, those in the control group wrote just one association, whereas those in the SOAR group wrote four. Finally, regarding regulation, only 5% of control participants constructed a planning outline or checklist, versus 47% of SOAR participants.

Regarding survey responses, students' reported strategy use mirrored observed strategy behaviors. In general, both groups reported using minimal and incomplete strategies, such as underlining and note taking, for Day 1 writing. For Day 2 writing, the control group reported using much the same strategies, whereas the SOAR group reported widespread use of SOAR strategies. In fact, 72% of SOAR participants reported using all four SOAR strategies, and 84% found SOAR's organizing component the most helpful for composing a synthesis essay. Many believed that the matrix alone was sufficient to help them spot and report intertextual relationships. Finally, SOAR-trained students reported that SOAR was effective for essay writing and that they would use SOAR for future writing tasks.

Study 2 confirmed that brief SOAR training is effective at encouraging students to apply SOAR strategies as they prepare for a synthesis-writing task. More important, such training results in better organized essays (across categories rather than topic by topic), compared to untrained students using their preferred study and writing strategies. In addition, SOAR-trained students find SOAR methods effective—especially organizing text ideas in a matrix—and plan to use SOAR methods for future writing tasks.

Conclusions and Implications

Synthesis writing reflects many key goals for college student writing development, such as reading across texts to discern relationships and patterns, and using strategies, such as organizing and connecting, to compose texts that integrate the writer's ideas with those from appropriate sources (Framework for Success in Postsecondary Writing, 2011; WPA Outcomes Statement for First-Year Composition, 2014). [SLB1]A recent review on writing in secondary education and college settings (Cumming et al., 2016) concluded that "to write effectively from sources is a fundamental academic literacy skill normally acquired during secondary and higher education" (p. 47). Not only is synthesis writing a key to academic success, but it is also an essential skill identified by professionals. Two thirds of employees in major American corporations and in government agencies reported performing some type of synthesis writing on a regular basis (e.g., gathering information about existing products to propose a new business idea, or collecting evidence from several people to evaluate a case) and agreed that these writing skills impact promotion decisions (National Commission on Writing, 2004, 2005).

Although synthesis writing is important in school and in the workplace, students struggle with it (Addison & McGee, 2010; Dovey, 2010; Solé, Miras, Castells, Espino, & Minguela, 2013). They routinely compose flawed essays that involve patchwriting, tag-all writing, or separate-representation writing. Composing effective synthesis essays depends on three processes: selecting (identifying important ideas from source texts), organizing (placing selected ideas in a graphic organizer in which intertextual relationships are easily observed), and connecting (building intertextual relationships). Previous research has investigated ways to boost these processes, but, until recently, no study had examined ways to make all these writing processes fire.

The two studies reported here were the first to plug this research gap by investigating the applicability of the SOAR system to synthesis writing. Previous SOAR studies confirmed that provided SOAR materials aided text learning and that SOAR strategies could be taught and proven effective for learning from multiple texts—especially concerning intertextual relationships. Based on previous research, SOAR seemed a worthy means of improving synthesis writing.

Based on the two SOAR studies we conducted, instructors should be aware of the following conclusions:

- Students left to their own devices produce ineffective synthesis essays.
- Providing students with SOAR materials aids synthesis writing. SOAR supplements help writers produce more complete essays, better categorically organized essays, and essays containing more intertextual relationships.
- Students would like to receive SOAR supplements for future writing tasks.
- Students can be trained to use SOAR strategies for writing in about 30 minutes.
- SOAR-trained students use SOAR methods when they prepare to write. They record notes and create organizers to a large degree, and they build intertextual relationships and create planning outlines to a lesser degree.
- SOAR-trained students find SOAR, especially the matrices, an effective strategy for synthesis writing and are likely to use SOAR strategies in the future.
- SOAR-trained students compose better categorically organized synthesis essays than students using their own preferred strategies.

Based on these conclusions, instructors should provide SOAR supplements or train students in SOAR methods (see Kiewra, 2009) to improve their synthesis writing. We conclude with an example of SOAR supplements that instructors might provide to students who are asked to write a synthesis essay from a multiple-slide lesson on schedules of reinforcement, shown in Figure 6.

Figure 6. A multiple-slide lesson on schedules of reinforcement.

To help students select and organize this information, instructors could provide the completed matrix organizer shown in Figure 7.

	Schedules of Reinforcement			
	Interval		Ratio	
	Fixed	Variable	Fixed	Variable
Definition	Reinforce first response after fixed time interval	Reinforce first response after predetermined but variable time interval	Reinforce after fixed number of responses	Reinforce after predetermined but variable number of responses
Example	Food for first key peck after 10 seconds	Food for first key peck after 5, 15, 2, and 18 seconds	Food after every 10 key pecks	Food after 5, 15, 2, and 18 key pecks
Response Rate	Slow, pauses	Slow, steady	Rapid, pauses	Rapid, steady
Extinction	Relatively easy	Difficult	Relatively easy	Difficult

Figure 7. A complete matrix of schedules of reinforcement.

To help students make associations, instructors can encourage students to examine the matrix categorically, across topics, and find associations, such as the following:

- Interval schedules produce slow responses, whereas ratio schedules produce rapid responses.
- Fixed schedules produce pauses between responses, whereas variable schedules produce steady responses.
- Fixed schedules are easy to extinguish, whereas variable schedules are difficult to extinguish.

Finally, to help students regulate their writing, instructors can help students form a writing plan, such as the following:

1. Compare the definitions showing that interval schedules are based on time and ratio schedules are based on number. Also point out that fixed schedules are unchanging and that variable schedules change.
2. Show how examples fit with definitions.
3. Point out that interval schedules produce slow responses but that ratio schedules produce rapid responses.
4. Point out that fixed schedules produce pauses following reinforcement, whereas variable schedules produce steady responses.
5. Point out that fixed schedules are easy to extinguish but that variable schedules are difficult to extinguish.

By using SOAR, as either a writing supplement or following training, students can compose higher quality synthesis essays than when they use their preferred strategies. SOAR materials are not difficult for instructors or students to generate. These books will help teachers (Kiewra, 2009) and students (Kiewra, 2005) learn and apply SOAR strategies.

Author Biographies

Linlin Luo is a postdoctoral research fellow in the Department of School Research, School Development, and Evaluation at the University of Regensburg, Germany. Her research interests include cognitive strategies for learning and writing, talent development, and online coaching and mentoring in STEM education. She holds a master's degree in statistics and a PhD in educational psychology from the University of Nebraska–Lincoln.

Kenneth A. Kiewra is professor of educational psychology at the University of Nebraska–Lincoln. He earned his PhD in educational psychology and instructional design from Florida State University and was also on the faculty at Kansas State University and Utah State University. Kiewra's research pertains to teaching and learning. He has investigated the SOAR teaching and study method he developed and world-class talent development. He is the former director of the University of Nebraska's Academic Success Center and the former editor of Educational Psychology Review.

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T: 785.320.2400
T: 800.255.2757

301 South Fourth St., Ste. 200
Manhattan, KS 66502

Email: info@IDEAedu.org
IDEAedu.org