



Scaffolding Understanding of Scholarly Educational Research Through Teacher/Student Conferencing and Differentiated Instruction

ABSTRACT

This article reports the results of a qualitative study of the effectiveness of a critical reading instructional intervention based on teacher/student conferencing (TSC) and differentiated instruction (DI) in improving the participants' understanding and evaluation of published educational research. TSC and DI entailed using a subset of teaching strategies including pre-teaching, self-selection of critiqued articles, cooperative learning, embedded instruction, extended instruction, reflection to scaffold students' challenges, providing constructive feedback, enabling students to describe their feelings, assessing own learning, and setting goals and plans for further development. A cohort of 11 ($n = 11$) novice graduate students took part in a 15-week course during which they critiqued several published journal articles and reflected on their experience. Results of a thematic analysis of the participants' reflection logs revealed that their initial feelings of apprehension and anxiety transformed into growth in their self-efficacy as consumers and designers of educational research. Likewise, the participants benefitted from the instructional intervention under study in becoming more proficient readers and in developing supportive relationships. The study implications, limitations, and suggestions for further research that would explicate what specific teaching strategies categorized under TSC and DI were most effective in achieving the study outcomes are discussed.

KEYWORDS

educational research, differentiated instruction, teacher/student conferencing

INTRODUCTION

Critiquing journal articles has been a common instructional strategy in graduate and honor degree undergraduate courses at the institutions of higher learning in various international educational contexts. This practice is premised on the assumption that reading research articles effectively and efficiently is a form of scientific literacy (Norris and Phillips 2003). As such, reading and writing are not simply perceived as tools for the storage and transmission of scientific knowledge. Rather, reading and writing are considered central to science as they allow critical examination, analysis, and reflection on published research.

In the same vein, applying research into practice has been endorsed as an effective approach to the preparation and continuous professional development of teachers (Bailey, Curtis, and Nunan 1998; Macalister 2018; Nation 2018). Novice graduate students in teacher education programs need to be

socialized into the academic literacy and discourse norms of their fields of specialization (Duff 2010). They are also required to achieve their targeted program competencies and intended learning outcomes. More specifically, they need to build their knowledge base for teaching in terms of content, pedagogical, and curricular knowledge. In addition, they also ought to develop the requisite skills for conceptualizing, conducting, and reporting their thesis research.

Similarly, in-service teachers frequently resort to reading journal articles, among other means such as attending conferences and participating in workshops, to raise awareness about their strengths and weaknesses, acquire new knowledge, solve problems, upgrade skills, advance their careers, and prevent burnout (Wong 2011). Along similar lines, Macalister (2018) concluded in a recent survey that reading a book or article about language teaching was the most frequently reported practice of professional development followed by attending conferences, taking courses, and joining online professional groups and discussions. Likewise, in a recent reflection on his long personal experience as a language teacher and researcher, Nation (2018) emphasized the importance of the theme that teaching “practice must be based as far as possible in research” given that “. . . this represents the APPLIED in applied linguistics” (138).

Yet, despite its popularity as an instructional strategy, reading and critiquing research articles is, often, a daunting and challenging experience for novice graduate students. This is because such articles tend to be laden with unfamiliar vocabulary, include discipline-specific concepts, and require background knowledge in research design and in the procedures and techniques of quantitative and qualitative data collection, analysis, and reporting. Additionally, SoTL scholars have documented other challenges that face students in understanding and conducting research (Ciarocco, Strohmets, and Lewandowski 2017; Nind, Kilburn, and Luff 2015). Based on a synthesis of 89 international studies from various countries, Earley (2014) reported that students tend to question the relevance of a research methods course and are anxious or nervous about it. As such, students may lack the interest or motivation to learn the material and may have misconceptions and negative attitudes about research. Similarly, Kingsley and Robertson (2017) stated that students in the social sciences may perceive data collection and analysis to be a difficult undertaking that is irrelevant to everyday life. Furthermore, these researchers highlighted students’ diversity in terms of research background knowledge and suggested that teachers’ styles, the provision of constructive feedback, and the empowerment of students are important factors in building their self-confidence, motivation, and competencies to understand and do research.

Scholars have also highlighted the challenges that face teachers as well as underscored the scarcity of studies to surmount these challenges and mitigate negative effects. For instance, Ciarocco, Lewandowski, and Van Volkom (2013) emphasized that teachers need to carefully plan their instruction and practices to scaffold and guide their students. Likewise, teachers need to overcome the difficulties of explaining and contextualizing research-related content and practices, closely monitor students’ levels of understanding, and adjust their teaching approaches according to the specific learning needs of students (Earley 2014; Veilleux and Chapman 2017). Meanwhile, other scholars highlighted the lack of systematic research and discussion of teaching methods to develop students’ understanding and abilities to understand, conduct, and communicate research (Earley 2014; Nind, Kilburn, and Luff 2015; Wagner, Garner, and Kawulich 2011). This indicates that it is important to design and utilize instructional strategies that would enable graduate students to understand and evaluate published

research articles and benefit from reading them in designing their own research and in improving their teaching (Fang 2005; Gillen 2006).

In the present study, we address this gap by describing the procedures and reporting the results of a SoTL intervention for critiquing published research that we have applied on a cohort of novice graduate students. This intervention is based on teacher/student conferencing (TSC) and differentiated instruction (DI) and entails using the instructional strategies of pre-teaching, self-selection of critiqued articles, cooperative learning, embedded instruction, extended instruction, and reflection (Miller, 2016). The intervention aims to improve the participants' understanding and evaluation of published educational research and to enhance their sense of efficacy as young consumers and designers of educational research.

BACKGROUND

Teacher/student conferencing

Teacher/student conferencing (TSC) has been recognized for quite some time now as a proven and beneficial practice in composition studies. According to Arbur (1977), TSC is conceptualized as a way of providing feedback to writers through conversational dialogues to construct and negotiate meaning with emphasis on two-way communication between the teacher and learner (Freedman 1985; Freedman and Sperling 1985; Hyland and Hyland 2006). This conferencing is considered beneficial because it encourages autonomous learning and allows learners to construct their revision plans independently (Hyland and Hyland 2006). It also allows writers to reflect on their writing and to notice any issues that may arise in their written drafts (Freedman and Sperling 1985).

TSC assumes that not all types of feedback lead to the achievement of desired and positive curricular outcomes (Hattie 2009; Loudon et al. 2005). Because whole class monologic classroom discourse may discount and even ignore the individual schemas, life experiences, and perspectives of learners, it is important to engage them in dialogic, individualized, and cognitively challenging and interactive exchanges of dialogues (Galton et al. 1999; Gillies and Khan 2008; Nystrand et al. 2003). Empirical evidence reported by Mercer (2000) indicates that dialogue exchanges through teacher-student conferences are highly effective as learners work within their "Intermental Developmental Zone" and engage in reflection, analysis, and synthesis independently (140). Furthermore, Nicholas and Paatsch (2014) maintain that conferences allow teachers to monitor understanding and provide learners with opportunities to receive, understand, and respond to feedback. Teachers also understand what influences learners' thinking and get insights to scaffold learners' challenges and support them given that "understanding happens between people" and is not "attributed to one person or the other in communication" (Rogoff 1990, 67).

Differentiated instruction

Differentiated instruction (DI) has been widely accepted as a teaching philosophy and practiced as a mechanism to accommodate students' learning needs and address differences in their profiles that could mediate learning and academic achievement (Smets, De Neve, and Struyven 2020). These profile differences can be broad and entail cognitive, affective, and readiness factors that should be taken into consideration in responsive instructional designs. Examples of factors that are important to consider include variations in background knowledge, interests, learning styles, types of intelligences, and levels of

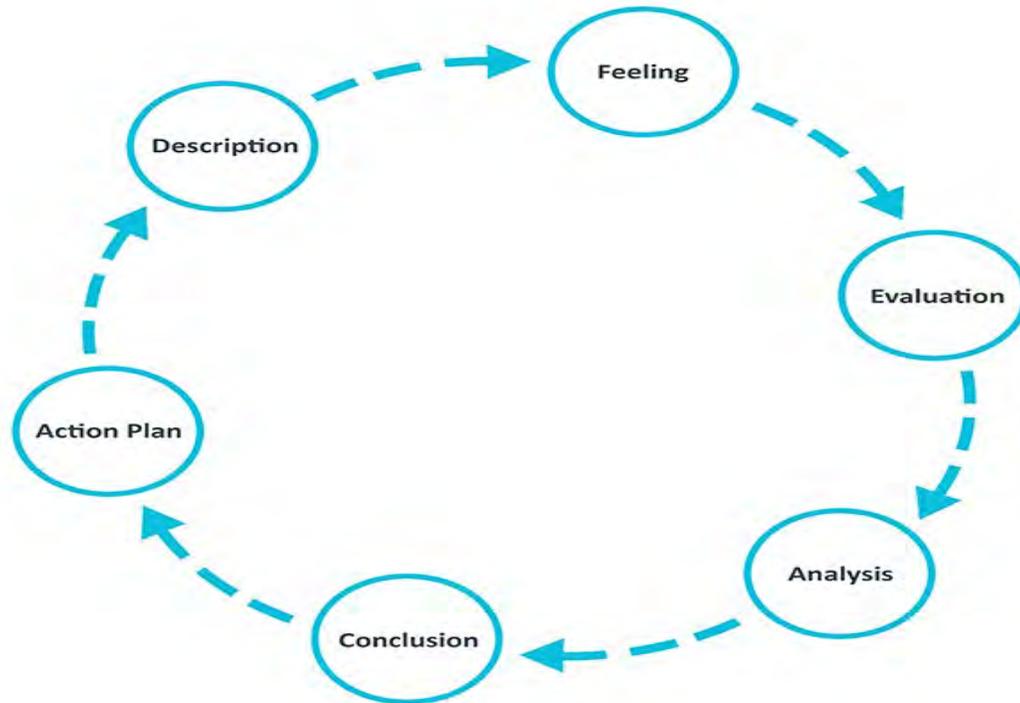
motivation and preparedness to perform certain academic tasks. However, differences in profiles “are not seen as fixed student traits, but rather as malleable” (Smets, De Neve, and Struyven 2020, 2). Consequently, DI utilizes flexible grouping of students as they work together in cooperative learning (CL) groups formed based on the principles of a situated, dynamic, and changing teaching and learning process (Coubergs et al. 2017).

According to Tomlinson (2015), DI can be done in terms of the content, process, and product of teaching and learning. As such, DI is perceived as “a paradigm that proposes the rethinking of the structure, management, and content of the classroom” (Subban 2006, 935). It should also be noted that “a diverse range of teaching strategies are used to practice DI” (Smets, De Neve, and Struyven 2020, 2). These researchers maintain that various CL activities, enrichment strategies, scaffolded learning, and tiered instruction can be used to implement DI. Specifically, CL is generally defined as a learner-centered approach to organizing classroom activities into academic and social learning experiences in which learners work in groups to complete tasks collectively. Unlike individual and competitive learning, students support each other’s learning as they cooperatively capitalize on their resources and skills. Furthermore, teachers facilitate and support students’ socially constructed knowledge and change their roles from giving information to aiding and coaching learning. CL encompasses several concrete and more conceptual approaches, methods, and procedures (Ghaith 2018). These include: The Structural Approach (Kagan 1992), Complex Instruction (Cohen and Lotan 1997), Group Investigation (Sharan and Sharan 1992), Learning Together (Johnson, Johnson, and Holubec 1993), and Student Team Learning (Slavin 1995).

Along similar lines, the enrichment strategies of pre-teaching, extended instruction, and embedded instruction can be used to scaffold students’ learning and to enable them to carry out tasks that they would not be able to do independently (Rakap and Parlak-Rakap 2011). Specifically, pre-teaching is used as a useful strategy to introduce vocabulary, explain new concepts, and activate or build relevant background knowledge. This strategy relies on the advance organizer theory (Ausubel 1978) and aims to facilitate meaningful learning through the provision of relevant introductory materials during the initial phase of instruction. Examples of representative pre-teaching activities include discussion, previews, semantic mapping, and purpose questions as well as using CL structures such as Think-Pair-Share, Stand-N-Share, Round Robin, Talking Tokens, and many other structures that are explained in Kagan (1992). Similarly, extended instruction is intended for students who need to receive extra instruction beyond initial general instruction provided to all students. Individual students or small groups of students get tiered and tailored scaffolds to support their learning based on the results of diagnostic and formative assessments (Noda and Tanaka-Matsumi 2014). Finally, embedded instruction provides written, visual, or auditive support to carry out challenging tasks that may not be possible to perform without the provision of responsive learning prompts and incidental and contextualized exposure to needed information (Argelagos and Pifarre 2012).

Theoretical and instructional framework

The present study is framed within Gibbs's (1988) reflective cycle intended to give structure to learning from experience as shown in figure 1 below:

Figure 1: Gibbs reflective cycle

This cycle is based on the proposition that learners can benefit from reflection on either a single learning experience or on a series of repeated learning situations. The cycle consists of six stages that include description of the learning experience, learners' feelings, evaluation, analysis, conclusion, and an action plan. Each of the stages also includes several helpful questions and sample reflections to support learners. More specifically, in the description stage, learners describe the learning situation in some detail and may answer questions such as what happened? When and where did it happen? And who was present? Likewise, learners can describe their feelings before, during, and after the learning experience as well as express their own and others' thoughts about the situation. Additionally, learners evaluate objectively and honestly what worked and what did not work. They also analyze the situation and extract meaning from it, including academic literature to explain their extracted meaning. Finally, learners write conclusions about what happened, summarize their learning, and develop a future action plan that indicates what they would do differently in a similar or related situation.

In addition, we synthesized and implemented an instructional framework based on TSC (Shrum 2019) and DI (Tomlinson and Imbeau 2013). The purpose behind this framework is to provide the study participants with relevant feedback, scaffold their challenges, and support them. Specifically, we reasoned that the participants may differ in terms of their motivations, learning styles, research skills, and background knowledge. Consequently, we differentiated the process of instruction in terms of the frequency and duration of the individual conferences and the nature of scaffolding and support needed

by different participants. However, we did not differentiate by the product of instruction and required all participants to complete the critique assignments. The objective was to brace all efforts and create a welcoming and supportive environment that would facilitate learning, create motivation, and minimize frustration and anxiety. Likewise, we wanted to clarify course expectations, negotiate the teaching-learning process, provide timely and useful feedback, and build deeper and more genuine relations with the participants.

METHOD

Study context

The study context is a graduate-level course on the principles and practices of writing instruction. The course is research-oriented and aims at building the participants' competencies in understanding, designing, and reporting educational research as well as developing a mature model of the composing process. The course also intends to build the participants' knowledge and enable them to generate and gain insights into contemporary core understandings as well as current vexing issues, particularly in literacy research, and in subject matter educational research more generally.

One of the researchers was the instructor of the course in which the study participants were enrolled. Consequently, a series of measures were taken to control for any potential conflict of interest given that one of the researchers had a supervisory role over the study participants. Specifically, all participants were informed about the purpose of the study, consented to participate, and were ensured anonymity and confidentiality of data collection and analysis according to approved Institutional Review Board (IRB) regulations and ethical research standards. The participants were also informed about the potential benefits and duration of the study and were ensured the freedom to participate.

Sample

The study participants were 11 ($n = 11$) female graduate students enrolled in their first semester of a two-year master's degree education program offered at the American University of Beirut (AUB), Lebanon. AUB is an English-medium university that follows the American model of liberal arts education. Nine students ($n = 9$) were Lebanese, one ($n = 1$) Kenyan, and one ($n = 1$) German. All of the participants are highly proficient in English given that they had completed their undergraduate degrees at institutions of higher learning that use English as an instructional language. The age of the participants ranged from 21 to 29 years with an average of 23.4 years ($SD = 4.1$).

The concentration specialization areas of the participants varied within the discipline of education. Specifically, three students were majoring in teaching English as a foreign language (TEFL), three in educational guidance and counselling, two in educational administration, two in tests and measurement, and one in science education.

Procedure

The course was designed and implemented based on the premise that incoming graduate students need to build their requisite knowledge base and skills for understanding and conducting educational research. Specifically, they need to know the types of research studies and their various quantitative, mixed methods, and qualitative designs. In addition, they need to develop competencies in interpreting and applying descriptive and inferential statistics as well as qualitative data collection, analysis, and reporting techniques and procedures. It is also important to learn how to generate research

problems, rationalize investigations, and understand and take measures to address threats to internal and external validity, establishing dependability, and ensuring the trustworthiness of reported results. Consequently, we reasoned that it is important to implement a systematic instructional intervention to enable incoming graduate students to read journal articles critically and to develop their skills in understanding published research and prepare them for conducting their own research.

Specifically, we applied the instructional procedure presented in appendix A to pre-teach needed concepts and build the necessary background knowledge to engage the study participants in critiquing and understanding published research. The procedure utilized three fact sheets about the types of quantitative and qualitative research, descriptive and inferential statistics, and generating research problems. Next we requested participants choose their own journal articles and critique them according to the rubric presented in appendix B. Specifically, the participants were requested to submit two critiques of self-selected articles and structure them to determine the type of the critiqued study, indicate the journal quartile rank and impact factor according to Scimago Journal Rank (SJR) as well as report the Information Matrix for the Analysis of Journals (MIAR) Secondary Index Broadcasting (ICD), if available, figure out the study rationale according to the Principal Proposition (PP), Interacting Proposition (IP), and Speculative Proposition (SP) format; discuss the study design; specify conceptual and operational definitions of independent, dependent, and moderator variables; state the null and alternative hypotheses if any; describe the procedures and techniques of data collection and analysis; and report the study findings. The participants were also requested to comment on the strengths and limitations of the study under review and write a reflection on their experience using the Gibbs (1988) reflective cycle.

Throughout the semester, we focused on understanding the learning needs of the study participants as well as on scaffolding their challenges through individual conferencing, flexible grouping, and differentiation of instruction. This was made possible as we adopted an open-door policy and encouraged all participants to inform us of any conceptual and methodological challenges faced in comprehending the course content or encountered in the process of writing their critiques. Additionally, we used the “Stand N Share” and the “Talking Tokens” CL structures of Kagan (1992) at the beginning of each session of the course to provide equal opportunities for all participants to share their questions and discuss solutions to what they found unclear or challenging. Likewise, we conducted formative assessments of written critiques and used the outcomes to identify and gain further insights into the learning needs of all participants.

Each participant took part in a minimum of five individual conferences to discuss their concerns and get their questions answered regarding the content of the provided fact sheets and the critiques they wrote. Participants who needed extended support received DI in three flexible groups formed based on the identified learning needs to (1) enhance ability to figure out the study rationales according to the PP, IP, SP format, (2) increase knowledge of research designs and related concepts, and (3) develop the skills of quantitative and qualitative data analysis, including descriptive and inferential statistics as well as content analysis and thematic coding. Likewise, additional extended support was provided via individual conferences requested by the participants who needed individualized support to develop their knowledge and enhance their skills to understand and critique research. Furthermore, we provided embedded instruction to build and increase students’ knowledge of emerging issues as well as extended instruction to introduce and explicate new concepts and show resources to support learning as needed.

Data collection and analysis

The present study employed a qualitative research design. The reflection logs of the participants on their experience critiquing journal articles constituted the primary data source. These reflections were written upon completion of the article critique assignments and were structured according to the reflective cycle of Gibbs (1988):

- Description of the experience.
- Feelings and thoughts about the experience.
- Evaluation of the experience, both good and bad.
- Analysis to make sense of the situation.
- Conclusion about what you learned and what you could have done differently.
- Action plan for how you would deal with similar situations in the future, or general changes you might find appropriate.

Data analysis entailed initial inductive data coding given the exploratory nature of the present study, following which we performed line-by-line data coding, categorization, and theme generation to report the study results as suggested by Yi (2018). Specifically, each of the 11 respondents was given the codes of “R 1 for respondent 1” through “R 11 for respondent 11” to maintain anonymity. Then we read through the reflection logs of the study participants twice to get familiar with the data and assign initial broad codes for the statements that seemed important and related and highlight the statements with different colors. We also wrote down notes in the margin for future reference. Finally, we combed through the data to make the codes more detailed, following which we analyzed and sorted similar codes into the same categories and determined the overarching themes for reporting the study findings.

FINDINGS

Data analysis led to the following themes:

Theme 1: Initial feelings of anxiety and uncertainty

This theme captures the participants’ initial feelings of heightened anxiety and uncertainty about how to complete their assignment to critique published research. Specifically, a total of eight out of the 11 respondents (72.72 %) expressed feelings of anxiety and uncertainty when they first attempted to do their first journal article critiques, despite attempts to build their requisite background knowledge through the provision and discussion of factsheets. For instance, R 1 and R 2 respectively remarked that “I admit the engagement in this task was novel and unique at the same time. No doubt it was a challenging mental activity” and “when we were given the first assignment to write our own critique, I felt overwhelmed.” R 5 also expressed similar feelings and reported that “as with any new type of writing, the first attempt to write a research critique was frustrating. I felt confused and could not figure out what exactly should go under each subheading in the critique assignment.” Likewise, several other respondents echoed the same feelings of their peers as illustrated in the following excerpts:

R 3: “I felt wholly inadequate and uncertain.”

R 7: “I felt extremely anxious at the time and even considered leaving the course.”

R 8: “At first, I felt a bit apprehensive about writing the first critique.”

R 9: “I felt like I know nothing, and I should know everything.”

R 11: “I felt challenged at first, since it is something novel.”

Theme 2: Sources of difficulties

This theme explicates the participants' perceptions of the sources of difficulties they experienced in understanding and critiquing published research. Specifically, a total of six out of the 11 respondents (54.54 %) specified the sources of difficulties that they had experienced in completing their journal article critique assignments. For instance, R1 indicated that "It seemed she (classmate) was facing the same difficulty analyzing the statistical data and discussing the design of the study. The study's methodology, its design, type, and the statistical data were the areas of complexity which aroused my confusion mainly." Similarly, R 5 wrote "I also struggled to understand the type of statistical analysis used in the studies." R 9 also considered that the "most confusing section was critiquing the statistical methods and data analyses. I felt as I was reading a foreign language." Likewise, other respondents identified additional difficulty sources pertaining to figuring out the study rationale and the methodology of conducting research as illustrated in the following excerpts:

R 10: "In my first critique, trying to figure out the rationale in terms of the propositions (PP, IP, SP), was quite a challenge."

R 11: "It took me a lot of time to understand the guidelines and how to begin with each part and go deeper with the method and the data analysis parts."

Theme 3: Strategies used to complete critiques

This theme illustrates the strategies used by four (36.36%) of the 11 participants to complete their critique assignments. For instance, R1 reported that she "started planning and followed the guidelines in the rubric. Then, I (she) communicated with one of my colleagues to discuss with her the procedure of accomplishing this task. Browsing through the net helped me get some descriptions for certain designs and methodology." Similarly, R 2 explained that "writing notes while reading the article is very important." Likewise, R 3 said that she "researched what I (she) did not know as I went." Finally, R 6 stated that she "spent several days trying to select a well-written journal article."

Theme 4: Helpful teaching practices

This theme pertains to the participants' perceptions of practices that they consider helpful. Specifically, eight out of the 11 respondents (72.72%) identified a number of practices that they thought helped them understand and critique published research. For instance, R1 considered individual conferences and differentiating instruction to be useful. She reported that "the professor kindly assigned individual conferences which took into consideration the individual differences of each of us." R 2 valued receiving feedback and stated that "the fact that we could send a first draft and receive the professor's feedback eased the stress and anxiety." R9 agreed and expressed that "receiving feedback is what I consider to have (having) played a major role in enhancing my learning throughout the semester." R 5 also agreed and indicated that "I (she) found the track changes approach paired with individual conferencing a great way to teach writing in this course." Meanwhile, R 4 appreciated the freedom of article choice and said that "having the freedom to choose the topic of our choice was the start of a positive impression towards it." Other respondents further underscored the value of individual conferencing, teacher support, and clarifying task expectations as useful teaching practices as illustrated in the following excerpts:

R 7: “Things went well since I was given the opportunity to engage in an individual conference.”

R 10: “The chances that the professor provided through the flexibility of due dates and the use of various tools of communication reduced my anxiety and stimulated my confidence.”

R 11: “The factors that helped with this assignment are the rubric provided, the feedback supplied as well as the ability to redo the assignment, and the open environment to be able to discuss the assignment with our peers and the professor.”

Theme 5: Procrastination

This theme shows that students who have initially perceived themselves to be competent and adept at performing certain tasks procrastinated when they encountered novel and challenging other tasks. Specifically, four out of the 11 participants (36.36 %) did well on their first critiques because they selected familiar studies and managed to utilize their prior knowledge of qualitative research designs in writing their critiques. Yet, when they attempted to critique quantitative studies, they seem to have experienced some sense of uncertainty and procrastination as shown in the following excerpts:

R 4: “I felt wholly inadequate and uncertain. I recognized this feeling as familiar, as the beginning of a cycle of inaction for me, and I thought that if I downloaded the article right away, skimmed it, and did some small act of work, I could push past those feelings before they became an entity in their own right. I did just that, but it did not help.”

R 6: “While the article sat in my tablet for weeks, I oscillated between feeling guilty and lacking confidence.”

R 9: “Only the fear produced by an imminent deadline made me begin working on it.”

R 11: “Once I started, I had to confront what I had been avoiding, my shaky knowledge of quantitative research methodology.”

Theme 6: Transformation in self efficacy to understand and design research

This theme demonstrates the positive transformative effects of the study intervention in terms of growth in the participants’ sense of efficacy as critical consumers and designers of educational research. Specifically, all the participants (100%) reported that critiquing journal articles according to the instructional approach described in this study has increased their research competencies. For instance, R 1 indicated that “overall, the experience of doing the critique was unique and amazing despite its complexity. I can now read any study and know the proposition and the rationale of the researcher/s.” R 2 agreed and reported that “the ability to analyze certain topics and express my comments widened my knowledge as well as my way of writing and understanding.” Likewise, all other respondents reiterated the positive transformative effects expressed by their peers as illustrated in the following excerpts:

R 3: “I feel I have a firmer understanding and I am pleasantly surprised to say that I am concluding this experience with a feeling of hope and purpose, something that I have not felt toward my academic work in quite some time.”

R 4: “Critiquing various articles has dramatically opened my mind.”

R 5: “It was a way to improve my critical analysis skills and helped me build a relationship of trust with my professor.”

R 6: “I was surprised when I started writing my second critique how smooth the process was.”

R 7: "I feel more confident as a reader and researcher."

R 8: "I realized the importance of building up a relationship with the professor."

R 9: "Now, I am able to understand and analyze the studies."

R 10: "The impact of this exercise has changed my reading perception and how I view or approach every single article or study."

R 11: "Critiques helped in adding to my knowledge about research methods."

DISCUSSION

The findings of the present study revealed that novice graduate students may experience many challenges and initial feelings of heightened anxiety and uncertainty upon reading published research. These findings can be explained in terms of Kegan's (1980) constructive development theory given that the challenges and feelings of the study participants seem to be caused by awareness of their "inadequacy" to meet the expectations of critiquing published research due the "poorness of fit" between the participants' technical knowledge of research and the demands of understanding and critiquing journal articles (275). The participants, however, were able to cultivate and utilize strategies to achieve "goodness of fit" through seeking assistance from instructor and their colleagues to better manage the task complexity and grow as consumers and designers of research through cultivating "inter-individual" ways of knowing and recognizing the need for interference from others. In this sense, the journal article critique assignment implemented in the present study could be considered as characterized by some "desirable difficulty" (Bjork and Bjork 2011, 60) and labeled as a feature that enhances learning.

The initial feelings of the study participants can also be explained as a state of "cognitive dissonance" described as a condition created by the tension writers feel because they sense a gap between who they are and who they want to be (Ballenger and Myers 2019). As aspiring novice researchers, the study participants may have hoped to write good critiques and earn high scores on their course assignments. This hope, however, seems to have been associated with a feeling of inadequacy and anxiety coming from lack of experience in this type of academic writing. Ballenger and Myers (2019) describe this learning situation as the state of "aspiring writers who have a sense of hope and that hope creates a precarious teetering between optimism and self-doubt" (591). This lurching situation may have created a benign effect of positive tension to prompt some of the study participants to come up with and utilize strategies and ways such as developing supportive relationships with others (instructor and peers), seeking feedback, and researching and resolving unclear issues on their own in order to complete their assigned tasks.

It should also be noted that some of the study participants who did well on their first critique procrastinated in submitting their second assignment perhaps as a mechanism of regulating their emotions, rather than time or productivity, to complete assignments in a timely manner (Pychyl and Sirois 2016). These researchers explain that procrastination is an emotional response to tasks which learners find aversive for reasons that may include feelings of self-doubt or insecurity. Along similar lines, Flett et al. (2012) reported that graduate students' procrastination is associated with feelings of self-criticism, a sense of failing on important tasks, general negative thoughts about the self, and writing apprehension. Students who actually procrastinated seem to have done well at the beginning of the course given that they self-selected their articles and did their first critiques drawing on their prior knowledge of the principles and practices of qualitative research. However, they procrastinated when

they encountered novel tasks entailed in critiquing quantitative studies. This underscores the importance and need for flexibility in teaching practices, conducting individual conferencing, and scaffolding learners' challenges in order to mitigate the negative feelings of anxiety and procrastination and enhance learners' self-awareness and efficacy, motivate them to become more proactive to complete assignments, and promote academic growth.

The results of the present study also revealed that the participants benefitted from individual conferences, differentiating instruction, scaffolding challenges, providing feedback, and allowing participants to choose their own articles to complete the critique assignments. These results corroborate those of other researchers regarding the proven efficacy of TSC (Bell 2002; Lain, Fink, and Frey 2007), DI (Parsons et al. 2018; Steenbergen-Hu, Makel, and Olszewski-Kubilius 2016), scaffolding (Simons and Klein 2007), constructive feedback (Vollmeyer and Rheinberg 2005), and choice of individual topics (Bonyadi 2014). The findings can also be explained in terms of Kolb's (2014) experiential learning theory given that the study participants seem to have gone through the four stages of the concrete new experience of critiquing published research, reflective observation on their new experience, abstract conceptualization of new ideas, and active experimentation with critiquing research and applying their new ideas. This combination of the stages seems to have enabled the study participants to acquire knowledge and transform challenging experiences into new learning opportunities and attaining desired competencies.

IMPLICATIONS, LIMITATIONS, AND SUGGESTIONS FOR FURTHER RESEARCH

The pedagogical implications call for considering using the instructional intervention described in the present study as a mechanism for enhancing students' understanding and skills of critiquing and designing educational research, taking into consideration contextual factors that may impact the teaching-learning process in diverse educational programs and settings. It should also be noted that the present study has some limitations that should be addressed in future research. Specifically, all study participants were female learners, and the data sources were self-reported. Additionally, there was no testing of growth in students' sense of efficacy, confidence, and skills as consumers and designers of research. As such, further research with larger and mixed-gender samples and varied tests and measures of desired outcomes based on rubric scores is needed to examine the validity of the exploratory findings of the present study. Likewise, further research is needed to determine the generalizability of the findings into other cross-cultural and international contexts. Of particular importance in this regard would be conducting further experimental and longitudinal studies to determine what specific instructional strategies categorized under TSC and DI were most effective and which learning environments can enhance students' critical reading abilities of various specialized text types and thereby contribute to their academic and professional development. It would be also interesting to conduct longitudinal studies to examine the development of students' feelings of self-criticism and procrastination after receiving support to scaffold their challenges and address their emerging learning needs and desired competencies.

ACKNOWLEDGMENTS

We are grateful to Associate Editor Ketevan Kupatadze, to the three anonymous reviewers, to Allie Loughry, and to the *TLI* editorial team for their accurate and illuminating comments.

Ghazi M. Ghaith is professor of language education. Department of Education, American University of Beirut, Lebanon.

Ghada M. Awada is post-doctoral fellow and researcher. Graduate Research Studies, Lebanese American University, Beirut, Lebanon.

REFERENCES

- Argelagos, Esther, and Manoli Pifarre. 2012. "Improving Information Problem Solving Skills in Secondary Education through Embedded Instruction." *Computers in Human Behavior* 28, no. 2: 515–26. <https://doi.org/10.1016/j.chb.2011.10.024>.
- Arbur, Rosemarie. 1977. "The Student-Teacher Conference." *College Composition and Communication* 28, no. 4: 338–42. <https://doi.org/10.2307/356726>.
- Ausubel, David P. 1978. "In Defense of Advance Organizers: A Reply to the Critics." *Review of Educational Research* 48, no. 2: 251–257. <https://doi.org/10.3102/00346543048002251>.
- Bailey, Kathleen M., Andy Curtis, and David Nunan. 1998. *Pursuing Professional Development: The Self as Source*. Boston: Heinle & Heinle.
- Ballenger, Bruce, and Kelly Myers. 2019. "The Emotional Work of Revision." *College Composition and Communication* 70, no. 4: 590–614. https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=g590-614-Jun19-CCC.indd&btnG=.
- Bell, James H. 2002. "Research Report: Better Writers: Writing Center Tutoring and the Revision of Rough Drafts." *Journal of College Reading and Learning* 33, no. 1: 5–20. <https://doi.org/10.1080/10790195.2002.10850133>.
- Bjork, Elizabeth L., and Robert A. Bjork. 2011. "Making Things Hard on Yourself, but in a Good Way: Creating Desirable Difficulties to Enhance Learning." In *Psychology and the Real World: Essays Illustrating Fundamental Contributions to Society*, edited by Gernsbacher, Morton Ann Ed, Richard W. Pew, Leaetta M. Hough, and James R. Pomerantz, 59–68. New York: Worth Publishers.
- Bonyadi, Alireza. 2014. "The Effect of Topic Selection on EFL Students' Writing Performance." *SAGE Open* 4, no. 3: 1–9. <https://doi.org/10.1177/2158244014547176>.
- Ciarocco, Natalie J., Gary W. Lewandowski, and Michele Van Volkom. 2013. "The Impact of a Multifaceted Approach to Teaching Research Methods on Students' Attitudes." *Teaching of Psychology* 40, no. 1: 20–25. <https://doi.org/10.1177/0098628312465859>.
- Ciarocco, Natalie J., David B. Strohmets, and Gary W. Lewandowski Jr. 2017. "What's the Point? Faculty Perceptions of Research Methods Courses." *Scholarship of Teaching and Learning in Psychology* 3, no. 2: 116–31. <https://doi.org/10.1037/stl0000085>.
- Cohen, Elizabeth and Rachel Lotan. 1997. *Working for equity in heterogeneous classrooms: Sociological theory in practice*. New York: Teachers College Press.
- Coubergs, Catherine, Katrien Struyven, Gert Vanthournout, and Nadine Engels. 2017. "Measuring Teachers' Perceptions About Differentiated Instruction: The DI-Quest Instrument and Model." *Studies in Educational Evaluation* 53: 41–54. <https://doi.org/10.1016/j.stueduc.2017.02.004>.
- Duff, Patricia A. 2010. "Language Socialization into Academic Discourse Communities." *Annual Review of Applied Linguistics* 30: 169–92. <https://doi.org/10.1017/S0267190510000048>.
- Earley, Mark. A. 2014. "A Synthesis of the Literature on Research Methods Education." *Teaching in Higher Education* 19, no. 3: 242–53. <https://doi.org/10.1080/13562517.2013.860105>.
- Fang, Zhihui. 2005. "Scientific Literacy: A Systemic Functional Linguistics Perspective." *Science Education* 89, no. 2: 335–47. <https://doi.org/10.1002/sce.20050>.
- Flett, Gordon L., Murray Stainton, Paul L. Hewitt, Simon B. Sherry, and Clarry Lay. 2012. "Procrastination Automatic Thoughts as a Personality Construct: An Analysis of the Procrastinatory Cognitions Inventory." *Journal of Rational-Emotive & Cognitive-Behavior Therapy* 30, no. 4: 223–36. <https://doi.org/10.1007/s10942-012-0150-z>.
- Freedman, Sarah Warshauer. 1985. *The Acquisition of Written Language: Response and Revision. Writing Research: Multidisciplinary Inquiries into the Nature of Writing Series*. New Jersey: Ablex Publishing Corporation.
- Freedman, Sarah Warshauer, and Melanie Sperling. 1985. "Written Language Acquisition: The Role of Response and the Writing Conference." In *The Acquisition of Written Language: Response and Revision. Writing Research:*

- Multidisciplinary Inquiries into the Nature of Writing Series*, edited by Sarah Warshauer Freedman, 106–30. New Jersey: Ablex Publishing Corporation.
- Galton, Maurice, Linda Hargreaves, Chris Comber, Debbie Wall, and Tony Pell. 1999. "Changes in Patterns of Teacher Interaction in Primary Classrooms: 1976-96." *British Educational Research Journal* 25, no. 1: 23–37. <https://doi.org/10.1080/0141192990250103>.
- Ghaith, Ghazi. 2018. "Teacher Perceptions of the Challenges of Implementing Concrete and Conceptual Cooperative Learning." *Issues in Educational Research* 28, no 2: 385–404. <http://www.iier.org.au/iier28/ghaith.pdf>.
- Gibbs, Graham. 1988. *Learning by Doing: A Guide to Teaching and Learning Methods*. Oxford: Oxford Polytechnic Further Education Unit.
- Gillen, Christopher M. 2006. "Criticism and Interpretation: Teaching the Persuasive Aspects of Research Articles." *CBE—Life Sciences Education* 5, no. 1: 34–38. <https://doi.org/10.1187/cbe.05-08-0101>.
- Gillies, Robyn M., and Asaduzzaman Khan. 2008. "The Effects of Teacher Discourse on Students' Discourse, Problem-Solving and Reasoning During Cooperative Learning." *International Journal of Educational Research* 47, no. 6: 323–40. <https://doi.org/10.1016/j.ijer.2008.06.001>.
- Hattie, John A. C. 2009. *Visible Learning: A Synthesis of over 800 Meta-Analyses Relating to Achievement*. London: Routledge.
- Hyland, Ken, and Fiona Hyland. 2006. "Contexts and Issues in Feedback on L2 Writing: An Introduction." In *Feedback in Second Language Writing: Contexts and Issues*, edited by Ken Hyland, and Fiona Hyland, 1–19. New York: Cambridge University Press.
- Johnson, David, W., Roger, Johnson, T., and Holubec, Edythe. 2013. *Cooperation in the Classroom* (9th ed.). Edina, MN, Interaction Book Company.
- Kagan, Spencer. 1992. "Cooperative learning. San Juan Capistrano, CA: Resources for Teachers."
- Kegan, Robert. 1980. "Making Meaning: The Constructive-Developmental Approach to Persons and Practice." *The Personnel and Guidance Journal* 58, no. 5: 373–80. <https://doi.org/10.1002/j.2164-4918.1980.tb00416.x>.
- Kingsley, Barbara. E., and Julia M. Robertson. 2017. "Exploring Reticence in Research Methods: The Experience of Studying Psychological Research Methods in Higher Education." *Psychology Teaching Review* 23, no. 2: 4–19. <https://files.eric.ed.gov/fulltext/EJ1160268.pdf>.
- Kolb, David A. 2014. *Experiential Learning: Experience as the Source of Learning and Development*. Pearson FT Press.
- Lain, Sheryl, Lisa Fink, and Nancy Frey. 2007. "Reaffirming the Writing Workshop for Young Adolescents." *Voices from the Middle* 14, no. 3: 20–28. <https://search-proquest-com.ezproxy.aub.edu.lb/scholarly-journals/reaffirming-writing-workshop-young-adolescents/docview/213930397/se-2?accountid=8555>.
- Louden, William, Mary Rohl, Caroline Barratt Pugh, Claire Brown, Trevor Cairney, Jess Elderfield, Helen House, Marion Meiers, Judith Rivalland, and Ken Rowe. 2005. *In Teachers' Hands: Effective Literacy Teaching Practices in the Early Years of Schooling*. Australia: Edith Cowan University.
- Macalister, John. 2018. "Professional Development and the Place of Journals in ELT." *RELC Journal* 49, no. 2: 238–56. <https://doi.org/10.1177/0033688218771385>.
- Mercer, Neil. 2000. *Words and Minds: How We Use Language to Think Together and Get Things Done*. London: Routledge.
- Miller, Andrew. 2016. "6 Strategies for Differentiated Instruction in Project Based Learning." (blog). 8 January 2016. <https://www.edutopia.org/blog/differentiated-instruction-strategies-pbl-andrew-miller>.
- Nation, Paul. 2018. "Keeping it Practical and Keeping it Simple." *Language Teaching* 51, no. 1: 138–46. <https://doi.org/10.1017/S0261444817000349>.
- Nicholas, Maria, and Louise Paatsch. 2014. "Teacher Practice: A Spotlight on the Use of Feedback and Conferencing in the First Year of Schooling." *Australian Journal of Teacher Education* 39, no. 9: 130–52. <https://search.informit.org/doi/10.3316/ielapa.693324044152229>.
- Nind, Melanie, Daniel Kilburn, and Rebekah Luff. 2015. "The Teaching and Learning of Social Research Methods: Developments in Pedagogical Knowledge." *International Journal of Social Research Methodology* 18, no. 5: 455–61. <https://doi.org/10.1080/13645579.2015.1062631>.
- Noda, Wataru, and Junko Tanaka-Matsumi. 2014. "Application of a Three-Tiered Instruction Model for Japanese Second-Grade Students to Improve Accuracy and Fluency of Multiplication Facts." *Journal of Special Education Research* 2, no. 2: 71–79. <https://doi.org/10.6033/specialeducation.2.71>.

- Norris, Stephen, and Linda M. Phillips. 2003. "How Literacy in its Fundamental Sense is Central to Scientific Literacy." *Science Education* 87, no. 2: 224–40. <https://doi.org/10.1002/sce.10066>.
- Nystrand, Martin, Lawrence L. Wu, Adam Gamoran, Susie Zeiser, and Daniel A. Long. 2003. "Questions in Time: Investigating the Structure and Dynamics of Unfolding Classroom Discourse." *Discourse Processes* 35, no. 2: 135–98. https://doi.org/10.1207/S15326950DP3502_3.
- Parsons, Seth A., Margaret Vaughn, Roya Qualls Scales, Melissa A. Gallagher, Allison Ward Parsons, Stephanie G. Davis, Melissa Pierczynski, and Melony Allen. 2018. "Teachers' Instructional Adaptations: A Research Synthesis." *Review of Educational Research* 88, no. 2: 205–42. <https://doi.org/10.3102/0034654317743198>.
- Pychyl, Timothy A. and Fuschia M. Sirois. 2016. "Procrastination, Emotion Regulation, and Well-Being." In *Procrastination, Health, and Well-being*, edited by Timothy A. Pychyl and Fuschia M. Sirois, 163–88. New York: Academic Press.
- Rakap, Salih, and Asiye Parlak-Rakap. 2011. "Effectiveness of Embedded Instruction in Early Childhood Special Education: A Literature Review." *European Early Childhood Education Research Journal* 19, no. 1: 79–96. <https://doi.org/10.1080/1350293X.2011.548946>.
- Rogoff, Barbara. 1990. *Apprenticeship in Thinking: Cognitive Development in Social Context*. New York: Oxford University Press.
- Sharan, Yael, and Shlomo Sharan. 1992. *Expanding Cooperative Learning Through Group Investigation*. New York: Teachers College Press.
- Shrum, Donna L. 2019. "Empower Students Through Individual Conferences." *ASCD Express* 14 (22). Advance Online Publication. <http://www.ascd.org/ascd-express/vol14/num22/empower-students-through-individual-conferences.aspx>.
- Simons, Krista D., and James D. Klein. 2007. "The Impact of Scaffolding and Student Achievement Levels in a Problem-Based Learning Environment." *Instructional Science* 35, no. 1: 41–72. <https://doi.org/10.1007/s11251-006-9002-5>.
- Slavin, Robert, E. 1995. *Cooperative Learning: Theory, Research, and Practice*. Boston: Allyn and Bacon.
- Smets, Wouter, Debbie De Neve, and Katrien Struyven. 2020. "Responding to Students' Learning Needs: How Secondary Education Teachers Learn to Implement Differentiated Instruction." *Educational Action Research*: 1–18. <https://doi.org/10.1080/09650792.2020.1848604>.
- Steenbergen-Hu, Saiying, Matthew C. Makel, and Paula Olszewski-Kubilius. 2016. "What One Hundred Years of Research Says about The Effects of Ability Grouping and Acceleration on K-12 Students' Academic Achievement: Findings of Two Second-Order Meta-Analyses." *Review of Educational Research*. 86, no. 4: 849–99. <https://doi.org/10.3102/0034654316675417>.
- Subban, Pearl. 2006. "Differentiated Instruction: A Research Basis." *International Education Journal* 7, no. 7: 935–47. <https://eric.ed.gov/?id=EJ854351>.
- Tomlinson, Carol Ann. 2015. "Teaching for Excellence in Academically Diverse Classrooms." *Society* 52, no. 3: 203–09. <https://doi.org/10.1007/s12115-015-9888-0>.
- Tomlinson, Carol Ann, and Marcia B. Imbeau. 2013. "Differentiated Instruction: An Integration of Theory and Practice." In *Handbook of Educational Theories*, edited by Beverly Irby, Genevieve H. Brown, Rafael Lara-Alecio, and Shirley A. Jackson, 1081–101. North Carolina: Information Age Publishing.
- Veilleux, Jennifer C., and Kate M. Chapman. 2017. "Development of a Research Methods and Statistics Concept Inventory." *Teaching of Psychology* 44, no. 3: 203–11. <https://doi.org/10.1177/0098628317711287>.
- Vollmeyer, Regina, and Falko Rheinberg. 2005. "A Surprising Effect of Feedback on Learning." *Learning and Instruction* 15, no. 6: 589–602. <https://doi.org/10.1016/j.learninstruc.2005.08.001>.
- Wagner, Claire, Mark, Garner, and Barbara, Kawulich. 2011. "The State of the Research Methods in Social Sciences: Towards a Pedagogical Culture." *Studies in Higher Education* 36, no. 1: 75–88. <https://doi.org/10.1080/03075070903452594>.
- Wong, Mary Shepard. 2011. "Fifty Ways to Develop Professionally: What Language Educators Need to Succeed." *Language Education in Asia* 2, no. 1: 142–55. <https://doi.org/10.5746/LEIA%2F11%2FV2%2FI1%2FA12%2FWONG>.
- Yi, Erika. 2018. "Themes Don't Just Emerge-Coding the Qualitative Data." Project UX, November 10, 2020. <https://medium.com/@projectux/themes-dont-just-emerge-coding-the-qualitative-data-95aff874fdce>.

APPENDICES

Appendix A: Instructional Procedure to pre-teach concepts and build background knowledge.

Step 1. We provided and discussed a fact sheet about the various types of quantitative and qualitative research study designs including experimental, correlational, case study, survey, descriptive, mixed-methods, and ethnographic designs. The fact sheet also included definitions of a number of research discipline-specific concepts and terminology such as independent, dependent, and moderator variables; null and alternative hypotheses; internal and external validity; random sampling; descriptive and inferential statistics; and unitizing and categorizing data.

Step 2. We provided and discussed a fact sheet about descriptive and inferential statistics. This included the measures of central tendency (mean, mode, median), frequency, percentage, standard deviation, range, pair and independent sample t-tests, correlational analysis (Pearson r , Spearman Rho), Chi Square, Analysis of Variance and Covariance (ANOVA and ANCOVA), Multivariate Analysis of Variance and Covariance (MANOVA and MANCOVA), Regression Analysis, Path Analysis, and Structural Equation Modeling.

Step 3: We provided and discussed a worksheet for generating research problems according to the principal proposition, interacting proposition, and speculative proposition format (Clark, n.d.). This format is based on the definition of a research problem as “a situation resulting from the interaction of two or more factors (e.g., givens, constraints, assertions, beliefs, conditions) which reveals an anomaly or contradiction which, in turn, yields (1) a perplexing or enigmatic state, (2) an undesirable consequence, or (3) ambiguous preferences or choices from among courses of action.” (Clark, n.d., 1). As such, the statement of the research problem is not conceived in the context of the present study just as an interrogative sentence or statement that asks a question such as what is the effect of an independent variable on dependent variable(s), or what relation exists between two or more variables? (Kerlinger 1973) Rather, we adopted the following format for generating research problems:

- Principal Proposition – ordinarily stated in the form of a given; a generalization; a generally accepted proposition; an accurate description of a condition; an approved policy; a widely accepted theory; ordinary knowledge about practice.
- Interacting Proposition – stated in the same terms as the principal proposition but it contradicts, contravenes, notes exceptions to, challenges, or casts doubt upon the principal proposition.
- Speculative Proposition(s) – examine or speculate about the most likely causes of the apparent anomaly or contradiction; set the direction for the inquiry; complete the sentence, “The principal and interacting propositions, co-exist in my best judgment because...”
 - Provocation exception
 - Conflicting evidence
 - Knowledge void – incomplete knowledge for the present or future
 - Action-knowledge or knowledge-action conflict
 - Action-action conflict
 - Formal knowledge-experiential knowledge conflict

- Action-theory or theory-action conflict
- Knowledge-theory or theory-knowledge conflict
- Theoretical conflict
- Policy-knowledge or knowledge-policy conflict
- Policy-action or action-policy conflict
- Policy-theory or theory-policy conflict
- Policy-policy conflict at the same or different policy levels
(Clark, n.d., 1).

Clark, David L. (n. d.). "Worksheet A: Statement of the Problem." Advance online publication.

<https://www.gallaudet.edu/documents/Research-Support-and-International-Affairs/research-design-worksheets.pdf>.

Kerlinger, Frederick Nichols. 1973. *Foundations of Behavioral Research* (2nd ed.). New York: Holt, Rinehart, and Winston.

Appendix B: Article Critique Rubric

Assessment dimension	Descriptor
Study Source	Bibliographic Information. Check if journal is Indexed in "Scimago" and report H score, Quartile Rank (Q), JCR or JIF, if available. Report, if indexed in MIAR and the IDC Value
Study Type	Experimental, Correlational, Survey, Case Study, Descriptive, Mixed Methods, Meta-analysis, Ethnography, etc.
Study Rationale	Apply the PP, IP, SP format discussed in "Worksheet A" (available through Moodle). Discuss the strength of the rationale. Are the propositions (PP, IP, SP) convincing and supported by credible citations?
Study Design	Is the study research design appropriate to the research questions under investigation?
Study Theoretical Framework	What is the study theoretical framework? Discuss its relevance. "Worksheet C" (Available through Moodle).
Study Variables	What are the study variables (i.e., independent, moderator, intervening, control, and dependent)? Give the conceptual and operational definitions of the variables.
Data Collection	Discuss the procedures of data collection. What are the study instruments and tools of data collection? Are the psychometric characteristics of the instruments and tools discussed? Are they valid and reliable measures of the variables under study?

Data Analysis	What are the quantitative and/or qualitative procedures of data analysis used in the study? Are these procedures correct and appropriate?
Literature Review	Does the literature review focus on the study variables and propositions? Is the review comprehensive, accurate, and up to date?
Study Findings (Results)	Are the study results valid and reliable? Do they address the research questions in a convincing manner?
Study Implications	Discuss the study theoretical and practical implications.
Study Limitations	Discuss the study limitations, if any.
Reflection	Reflect on the strengths and weaknesses of the study based on your experience and knowledge.



Copyright for the content of articles published in *Teaching & Learning Inquiry* resides with the authors, and copyright for the publication layout resides with the journal. These copyright holders have agreed that this article should be available on open access under a Creative Commons Attribution License 4.0 International (<https://creativecommons.org/licenses/by-nc/4.0/>). The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited, and to cite *Teaching & Learning Inquiry* as the original place of publication. Readers are free to share these materials—as long as appropriate credit is given, a link to the license is provided, and any changes are indicated.