Countering the Dunning–Kruger Effect Using Debugging Strategies

إستراتيجيات التصحيح الذاتي في مجابهة تأثير دانينج كروجر

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ملخص البحث

بحثت هذه الدراسة في تأثير تدريب طلاب الفرقة الأولى بجامعة خاصة على إستخدام إستراتيجيات التصحيح الذاتي كأحد أنماط إستراتيجيات ما وراء المعرفية وذلك لمواجهة مبالغة الطلاب الأقل كفاءة لغوياً في تقدير قدراتهم اللغوية عند دراسة اللغة الإنجليزية كلغة أجنبية وهو ما يعرف بتأثير دانج حيث وجد الباحثان ان هؤلاء الطلاب لا يقدموا على محاولة تنمية قدراتهم اللغوية ظناً منهم أنهم ليسو بحاجة الى ذلك مما يؤدي إلى تولد "وهم المعرفة" بينما يستطيع الطلاب الأكثر كفاءة لغوياً بتقييم أدائهم بدقة أكبر، وأشارا الى أن التقدير الفعال والدقيق لأوجه القصور لدى المرء هو محرك قوي للاستقلالية. فكان الهدف من الدراسة الحالية هو محاولة عكس تأثير دانج كروجر من خلال تحسين الممارسات ما وراء المعرفية في القضاء على هذا التحيز المعرفي. وأظهرت النتائج الكمية للدراسة من خلال تحليل إختبار التباين وتحليلات الانحدار المتعددة، تحسنًا كبيرًا في تقدير المجموعة التجريبية لقدراتهم اللغوية، وأستمر هذا التحسن لمدة ٤ أشهر بعد إنتهاء التدخل. تشير هذه النتائج إلى أنه يمكن بالفعل مجابهة تأثير دانج

كروجر لدى الطلاب الأقل مهارة من خلال تحسين الممارسات ما وراء المعرفية ، وذلك باستخدام استراتيجيات التصحيح الذاتي.

الكلمات المفتاحية: مجابهة تأثير دانينج كروجر، الإستقلالية، إستراتيجيات ما وراء المعرفية، إستراتيجيات التصحيح الذاتي، التقييم الذاتي، معايير الكفاءة، وهم المعرفة، أصول التعلم والتعليم.

Abstract

This study investigated the impact of debugging instruction on students' metacognition and how this is perceived to counter their overambitious calibration of their proficiency. Dunning & Kruger found that the less-skilled, least competent learners tend to overestimate their own abilities resulting in an "illusion of knowledge". Low performers vastly overestimate their performance while high performers more accurately assess their performance. Countering the Dunning Kruger Effect in promoting accurate estimation of one's shortcomings is believed to be a strong drive for autonomy. Effective and accurate estimation of one's shortcomings is believed to be a strong drive for autonomy. Quantitative results, achieved through ANOVA testing and multiple regression analyses, showed significant improvement in the experimental group's calibration scores, which were maintained 4-months post-intervention. These results suggest that countering/reversing the Dunning Kruger is achievable through optimization of

metacognitive practices, using debugging strategies.

Keywords: Countering Dunning-Kruger effect, metacognition, autonomy, debugging strategies, self-assessment, proficiency calibration, illusion of knowledge, pedagogy.

Introduction

1. The Dunning Kruger Effect (DKE)

According to the DKE, underachievers tend to overestimate their abilities. This means that they expect themselves to be performing at a higher level than they actually can. This often leads to them failing to seek additional extracurricular help (Oxford, 1990) and, hence, will never achieve autonomy. Autonomy is strongly driven by accurate realization of one's shortcomings and overcoming the DKE can help students continue "grow and create effective learning experiences that are new and exciting" (Tobias & Everson, 2009). The major objective of the study was to find out whether the influence of the Dunning-Kruger effect on tertiary students' writing performance can be reversed or countered by enhancing learners' metacognitive abilities. And if so, whether this will lead to autonomy.

2. Metacognition

Initially, metacognitive techniques (MCTs) have been depicted as such skills as "planning, monitoring, and self-assessment or

evaluation strategies" (Flavell, 1979). Planning refers to the learners' ability to select the appropriate strategy for the task at hand; that is, it is their ability to adequately allocate resources for any task. Monitoring one's progress is yet another essential skill that entails being able to check and observe one's progress in relevance to task performance, whereas evaluation or assessment of one's performance relates to being able to appraise the outcome or learning product(s) and the regulatory processes involved in producing it/them.

In subsequent literature, metacognitive regulation has been further detailed to include "the ability to seek appropriate selection of strategies and adequate allocation of resources for relevant tasks," Schraw and Moshman (1995). In 1997, Schraw & Graham proclaimed that two additional metacognitive strategies, namely debugging and information management strategies, are encompassed under such a MC model. In 1999, Roca contributes a definition for debugging strategies (herein referred to as DBSs) by explaining that it is a learner's ability to identify and correct errors impeding comprehension between interlocutors (p.87). Later on, information management strategies were added to cover skills in "processing, organizing, elaborating, and summarizing information efficiently" (Manchón, 2001). This MC model was adopted from Manchón and adapted by the researcher to illustrate how debugging strategies fall within the schema of MC as seen in Fig. 1.

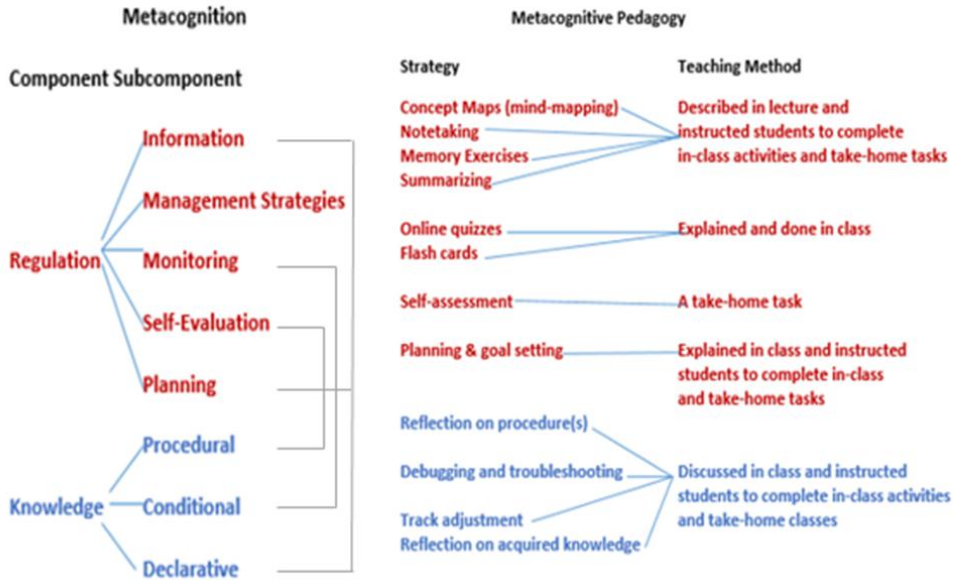

Figure 1 Proposed Metacognitive Pedagogy (Abdalla, 2023)

3. Debugging vs Self-Assessment

Debugging is an important skill that many novices find quite difficult to master. While it has become inherent to the Computer Science field in general and programming, in particular, few researches have borrowed the term to describe the process a language user, both novice and expert, undergo when experimenting with the language (Chamot, 2018).

Debugging transcends self-assessment in that it does not stop at identifying the error in one's learning process and constructing their schema of knowledge, but rather it offers paths that the learner can take to fix errors in their productive speech, be it writing or speaking. This requires that they employ a series of "if 'no' 'then' if 'yes', 'then'" steps (Abdalla, 2023). Debugging lets the learners work through the different MC strategies till they identify the one

that will actually help them express themselves correctly in writing. Such strategies and tools include identifying the genre, lexical diversities, locus of control, gradient semantics, to name but a few. Output is then tested through self-assessment using online concordance software (e.g. Lextutor.com) and/or online dictionaries (e.g. Merriam Webster) (Hyland, 2007).

During a debugging task, a novice must have a fair amount of metacognitive awareness to help monitor their progress and keep track of strategies that have been successful and unsuccessful (Mokhtari & Reichard, 2002). There is evidence that suggests that scaffolding for metacognitive awareness helps with debugging or 'trouble-shooting'. Debugging can generally be broken down into four steps: "understand, diagnose, locate, and correct" (McCauley, 2010). Once a learner realizes that their word/sentence did not get them the intended response, they know that an error exists. That form is then rejected and does not get transferred to the 'automaticity domain' for permanent acceptance as part of their language inventory. The projected autonomy cycle is depicted in the following figure.

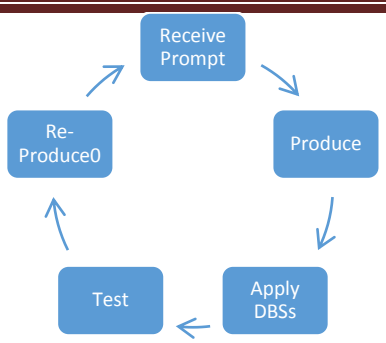

Figure 2 Proposed Autonomy Cycle (Abdalla, 2023)

2.1Debugging Form

To facilitate this, learners are provided with a debugging sheet devised by the researcher (Appendix A) to help them track their troubleshooting process by asking them such questions as "How is your structure/vocabulary erroneous?" and "What have you tried so far to correct it?" This form enabled learners to recognize the initial steps of debugging and to organize their thoughts. It was designed based on the researcher's MC awareness teaching practices and experiences.

2.2Exit Survey

The researcher devised an exit survey (Appendix B) to find out how helpful the participants deemed the debugging form "Be Metacognitive" about the debugging process (Krosnick, 1999). Results indicate that the learners experienced several 'eureka' moments where they were able to identify the error, fix it, and test comprehension, precluding the need to seek help from the course instructor. This is seen as a potential indicator of autonomy, where learners are expected to carry on this newly acquired skill to future

situations.

4. Automaticity

DBSs are a necessary component of automaticity in that they identify which forms/structures get automaticized. Once a form or structure is tested using DBSs, accepted forms/structures are permanently transferred from the short-term, working memory to the learners' language inventory (Abdalla, 2023). Through repetition of the newly tested and approved forms/structures, automaticity occurs and the working memory is freed up to re-start the process of testing other new forms and structures. Simply put, acquisition has taken place and achieving fluency is now a matter of time, which will take place through usage and repetition.

Conclusion

Teaching DBSs have been found to help learners assume the role previously held by instructors in any learning situation. Previously, an instructor's presence was claimed to be pivotal in helping learners navigate into their zone of proximal development (ZPD) (Vygotsky, 1978, p. 86). He defined ZPD as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance, or in collaboration with more capable peers." Vygotsky believed that when a student is in the zone of proximal development for a particular task, providing the appropriate assistance (by the instructor) will provide the learner with enough of

a "boost" to take risks that they would not normally be willing to undertake. However, this limits the instances of when a learner can actually navigate within their ZPD to situations where a more experienced language provider is available, usually with a classroom setting or at best within the school /university environment.

Technological advancement and what it has to offer from free concordances to online dictionaries or even mobile-mounted software, has demonstrated a potential to stretch learning instances to include other situations where a more skilled guide (MSG herein) is absent. In this case, the MSG becomes the software or concordance site that they can access anywhere, anytime. It is then that the learners will have to scaffold their own learning using the newly acquired DBGs and, thus, climb up the 'proficiency ladder,' if you will, by themselves as they construct and reconstruct their knowledge of the language, hence, ultimately promoting learners' autonomy.

Recommendations

The following are the recommendations arrived at after the above in-depth analysis of the findings of the empirical study. These recommendations cover a number of topics included in this study; recommendations range from administrative to teaching/learning issues and general organization of the university environment. The researcher hopes that the results of this empirical study can be used by the Ministry of Higher Education, especially curriculum planners, in the planning of future English Language Programs (ELPs) for both private and public universities.

Further research should explore the Debugging of MC Strategies as a model, and other related models recommended through the literature reviewed for the teaching and learning of English as a Foreign Language (EFL) for enhancing learners' lifelong autonomy (Mohanty, 2007). Learners should also make effective use of DBSs in order to effectively choose the metacognitive skills and strategies (planning, monitoring, self-regulation, debugging, or reflection) in almost all learning areas in order to be more self-aware of their competencies and, more importantly, their shortcomings because it is the latter that will ensure their continued pursuit of learning and autonomy. The findings of this study should provide insights for individuals and groups who strive to empower ELP teachers in both private and public universities, with innovative skills and strategies as well as effective pedagogies to familiarize themselves with the use of MC skills including the use of debugging strategies in language learning.

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Appendix A

Debugging Strategy Form

Error*	Alternatives**	Fix***	Test****

* error type: spelling, word form, word part, subject verb agreement, punctuation, or run-on sentence.

** alternative: check for lexical inflections, use mnemonics, use context clues, etc.

***apply fix: change part of speech, fix spelling, etc.

****test: peer assessment, instructor assessment, self-assessment via concordance software and/or online dictionary.

Appendix B

Exit Survey (adapted from Lee et al., 2023)

	Question	Results
1.	Have you ever heard of the term 'debugging strategy'? ◦ Yes ◦ No ◦Not Sure	Yes= 11% No= 75% Not Sure=14%
2.	The debugging form helped me with verbalizing the errors.	Somewhat agree
3.	The debugging form helped me explain the error identification process to instructors	Neutral
4.	The debugging form helped me stay aware of my debugging progress	Somewhat agree
5.	I identified at least one error that I was going to ask the instructor about while filling out the debugging form.	Yes=73% No= 27%
6.	I feel more confident in my MC capabilities after learning and using the debugging form.	Somewhat agree
7.	Do you see yourself utilizing this type of method in future EFL classes?	Yes= 34% Maybe= 58% No= 8%