Discovery-Based Teaching Methodology: 
A Framework for Quality Teaching and Learning

Aali Ouzzine
ALCS Lab, Chouaib Doukkali University, El Jadida
Reddad Erguig
ALCS Lab, Chouaib Doukkali University, El Jadida
Abdelaziz Boudlal
Hassan II University of Casablanca


Abstract

The adoption of the standards-based model in the Moroccan EFL context entails an implementation of effective teaching methodologies which ensure the provision of excellent and equitable learning experiences for all learners. Discovery teaching is an example of a pedagogical model which focuses on the learner as an active member in the learning process. This pedagogical tool has been reported to be effective in assisting learners to understand difficult concepts and retain long term information. This literature-based article seeks to define discovery-based teaching method, discuss its added value in the teaching-learning process and illustrate its effectiveness on both teachers and learners. Previous research has shown the role of this pedagogical tool in promoting teacher effectiveness and thereby enhancing student learning. Based on this, the present article argues for the need to adopt this teaching method in different educational
contexts as an effective style of instruction that can ensure quality teaching and learning.

Keywords: Discovery-based instruction, effective teaching, minimal guidance, quality teaching and learning

0. Introduction

All over the world, educational policy-makers and practitioners have devoted their attention to improving the quality of education. In the Moroccan educational context, the adoption of the standards-based movement as a pedagogical model has been intended to achieve quality at the level of educational outputs. It aims at enabling learners to acquire the necessary skills, strategies and knowledge in order to be able to operate accurately and appropriately in different real-life situations. This could be attained only through adopting effective teaching methodologies that favor learner-centered approach, placing the learner at the center of the learning process. In this respect, discovery-based teaching methodology seems an effective style of instruction to fulfill these tasks.

The objective of the present article is two-fold. First, it is intended to define discovery-based teaching methodology, outline its characteristics and highlight its theoretical framework. Second, it provides research-based evidence on its related impact on both teachers and students. Given that teachers in the Moroccan EFL context should be familiar with effective teaching skills which will help them to ensure the provision of equitable and meaningful learning experiences for all learners, the article argues for the effectiveness of discovery teaching in promoting teacher effectiveness and thereby bringing about significant improvements in student learning.

This article is divided into four sections. The first section provides a conceptual discussion of discovery-based teaching methodology and provides working definitions for the instructional styles discussed in the paper. The second section outlines the different characteristics of this style of instruction pertaining to both the teaching and learning processes. The third section offers insights into the theoretical framework that underpins this teaching method, while the fourth
1. Conceptual Discussion

Discovery teaching is conceived of as a broad concept with multifarious definitions within instructional research (Alfieri, Brooks, Aldrich & Tenenbaum, 2011; Anderson, 2002; Bicknell-Holmes & Hoffman, 2000; Domin, 1999; Mayer, 2004; Tomlinson, 2018). It is generally defined as a hand-on teaching methodology intended to foster positive attitudes towards learning and inquiry through noticing, hypothesizing and experimenting principles. Having been developed as a reaction to a perceived failure of traditional styles of instruction which conceive of learners as passive recipients of knowledge through teachers’ lectures and presentations (Abrahamson & Kapur, 2017; Bruner, 1961; Schunk, 2012), discovery teaching provides learners with opportunities to “organize [their] learning in such a way as to make what [they] learn usable and meaningful” (Bruner, 1977, p. 20). As a general principle, it involves helping learners to discover things for themselves rather than provide them with the to-be-learned material.

The thrust of discovery-based teaching methodology is the creating of a learning environment where students are offered various tasks which allow them to discover the intended learning material and/or skills. In other words, discovery-based instruction is “an approach to learning rather than an approach to teaching, namely one in which learners themselves investigate samples of language use in order to make discoveries about how the target language is typically used” (Tomlinson, 2018, p. 1). In a similar vein, Loyens and Rikers (2011) define discovery-based instruction as “a learning format in which students work on examples presented by the teacher, in order to discover the relations among the examples and to formulate general principles that apply to them” (p. 369). Given that teaching and learning processes overlap, discovery method is an effective teaching scheme which involves learners in the process of constructing an
enhanced understanding of the target learning material through associating it with their prior knowledge base, thereby resulting in a meaningful learning experience. In this regard, discovery method is defined as a student-based exploration of the intended learning material through ensuring learners’ active and mindful participation (Honomichl & Chen, 2012) throughout the different learning tasks, ranging from noticing the target learning material through experimenting with it in a real-life situation to extending it to other situations.

The related research literature has provided various labels for discovery teaching and defined it form different perspectives. According to Anderson (2002), inquiry teaching is often used in the American context to design guided discovery learning and open inquiry learning. Within the context of Domin’s (1999) taxonomy of laboratory instruction styles, discovery learning, or more specifically guided discovery learning, refers to a method of instruction in which students are encouraged to discover a predetermined learning outcome which is manifested in a shared objective between the teacher and students. Through a set of procedural tasks, the students achieve this learning outcome by studying a context-bound situation. On the other hand, inquiry learning or open inquiry learning, also referred to as pure or open discovery learning (Mayer, 2004), is an instructional style in which students are required to formulate their own procedure. Without a predetermined learning outcome, inquiry-based tasks are characterized by more student involvement as the learners assume more responsibility for generating the learning outcome and the procedural options to be followed (Domin, 1999).

Given this multifarious conception of discovery teaching, it is relevant to provide working definitions for the instructional methods discussed in the framework of this article, namely pure discovery method, guided discovery method and expository methods. Pure discovery learning consists in providing learners with problems to solve without any guidance from the teacher, while guided discovery method is associated with providing learners with problems to solve together with the amount of guidance needed. As for expository methods, they are concerned with an explicit presentation of the material to be learned together with the rules and structures to be used. The
conception of guided discovery is particularly relevant in this article and it will be the point of focus. Discovery teaching and guided discovery teaching will be used interchangeably throughout this article.

2. Characteristics

Discovery-based instruction is characterized by a set of features which consist in fostering problem solving, reasoning and critical thinking skills (Wahyudi, Rukmini & Bharati, 2019). It is considered as “a necessary condition for learning the variety of techniques of problem solving, of transforming information for better use…for learning how to go about the very task of learning” (Bruner, 1961, p. 60). In this framework, learners are encouraged to ask questions, inquire through exploration, work collaboratively and share their discoveries (Dorier & Garcia, 2013; Stokke, 2015) and employ them in the experimenting stage (Tomlinson, 2018) in order to formulate their own tentative answers (Hanafi, 2016). Providing learners with opportunities to take responsibility for their learning fosters a shared ownership in the classroom environment among students and teachers in order to meet a given lesson objective (Abrahamson & Kapur, 2017), which encourages open-mindedness and dialogue (Dorier & Garcia, 2013). In this regard, learners become active members of the learning experience and are required to discover the content to be learned rather than be given the information through traditional methods of instruction which favor teacher presentations (Bruner, 1961; Mayer, 2004; Schunk, 2012; Tomlinson, 2018) and encourage repetition and memorization of concepts and facts (Stokke, 2015).

More specifically, discovery learning is characterized by involving students in a set of procedural tasks where they fully and independently engage in learning rather than spoon feeding them with the target information and skills (Abrahamson & Kapur, 2017; Alfieri et al., 2011; Bruner, 1961). According to Bicknell-Holmes and Hoffman (2000), discovery learning is characterized by three main attributes, namely (i) exploring and problem-solving to create, integrate and generalize knowledge, (ii) employing student-driven tasks in which students have control over the sequence and frequency of the learning tasks, and (iii) focusing on activities which encourage
the integration of new knowledge into the learner’s prior knowledge base.

Bonwell (1998, as cited in Bicknell-Holmes & Hoffman, 2000) added a number of features which characterize discovery learning. First, discovery learning is a process-oriented scheme. It favors the mastery and application of skills and concepts over memorization. Second, discovery learning considers failure as an essential tool for examination and reflection. Hypothesizing tasks, therefore, offer different learning opportunities for learners in their pursuit of mastering the target skill. Third, discovery learning incorporates tasks with higher levels of cognitive processing, engaging learners in such higher-level skills as analyzing, extrapolating, evaluating and synthesizing the learning material. Fourth, discovery learning stresses the importance of feedback during instruction as a key factor of fostering the heuristics of discovery.

From a constructivist and social constructivist perspective, discovery learning is regarded as an effective instructional method which provides students with ample opportunities to work in groups in a learning environment with minimal or no guidance (Mayer, 2004). It is classified as a method of instruction that fosters deep understanding of concepts and supports conceptual learning with minimal guidance. In terms of classroom instruction, minimal guidance is offered in the form of task-relevant information (Kirschner, Sweller & Clark, 2006), scaffolding situations (Pea, 2004) or in the form of providing direction, modeling, coaching and offering feedback on learners’ actions and productions (Abrahamson & Kapur, 2017; Mayer, 2004). In this respect, effective instructional methods which promote a constructivist view of learning “involve cognitive activity rather than behavioral activity, instructional guidance rather than pure discovery, and curricular focus rather than unstructured exploration” (Mayer, 2004, p. 14).

3. Theoretical Background

Discovery-based teaching methodology is anchored in constructivist learning theory. This theoretical framework is based on the premise that “knowledge cannot be transferred from one person to another; it
must be actively constructed by the learner through interactions with the environment” (Domin, 1999, p. 1). To construct the desired learning outcome, learners seek to make sense of the learning material through selecting relevant information, organizing it and integrating it with their prior knowledge (Mayer, 2008).

Two main assumptions underlie this framework. First, learners are supposed to solve authentic problems and, thus, construct new knowledge in different real-life contexts. This process of problem-solving and knowledge construction is coupled with minimal guidance. In point of fact, learners need enough freedom to activate their cognitive ability in the process of constructing new knowledge as well as enough guidance so that they can construct meaningful knowledge (Bruner, 1977; Mayer, 2004). This assumption is premised on the belief that encouraging learners to construct their own solutions leads to the most effective learning experience (Bruner, 1961; Newman & DeCaro, 2019). The second assumption is based on the premise that knowledge can best be acquired through experiences equivalent to or based on the procedures of a given discipline (Kirschner, 1992; Kirschner et al., 2006). In this regard, learning is viewed as an active process in which learners construct new ideas based on their prior experience or knowledge base (Bruner, 1961; Mayer, 2004; Tomlinson, 2018).

Constructivist learning theory highlights the idea that learners construct knowledge through minimal guidance (Bruner, 1961, 1977; Mayer, 2004). In this regard, the teacher’s main task is to guide and encourage the students to discover principles by themselves. Using Dearden’s (1967) words, “the teacher does not teach: the children find out everything for themselves” (p. 93). In this vein, the teacher is no longer the focal point of the classroom and is rather seen as a “facilitator, mentor coach, or consultant” (Honebein, 1996, p. 20). Within the constructivist theory, emphasis is laid on the process in which learners construct knowledge rather than on the amount of content that a learner should retain (Alfieri et al., 2011; Bruner, 1961; Tomlinson, 2018). The teacher and the students should therefore engage in an active dialogue with a view to an effective learning experience. According to Bruner (1961), our main task as teachers is
to give our student as firm a grasp of a subject as we can, and
to make him as autonomous and self-propelled a thinker as we
can – one who will go along on his own after formal schooling
has ended. (p. 58)

In this regard, Bruner (1961, 1977) contends that education is a
process of personal discovery. Within this process, learners are
required to seek out the information necessary to solve problems and
reorganize what they already know in order to construct new
knowledge. Learning through discovery is conceived of as “a matter
of rearranging or transforming evidence in such a way that one is
enabled to go beyond the evidence so reassembled to additional new
insights” (Bruner, 1961, p. 58). In this conception of guided discovery
learning, Bruner (1977) posits that any subject can be effectively
taught to any child at any stage of development in some intellectually
honest form. The task of the teacher is to represent the structure of the
subject matter within the child’s perception. This instruction-related
scaffolding enables learners to use all of their biological and cultural
tools in order to build their own understanding of a given task
(Bruner, 1977; Pea, 2004). In short, a constructivist model of
instruction to learning and teaching is based on the notion that learners
construct their own knowledge rather than knowledge being
transferred by an instructor.

4. The Impact of Discovery Teaching: A Review of Case Studies

This section reviews a set of data-based research studies on the impact
of discovery teaching. It seeks to fulfill two objectives. First, the aim
is to shed light on the debate on the amount of guidance needed during
instruction, arguing that the conception of direct instruction in some
studies falls within a guided version of discovery-based teaching
methodology. Second, the goal is also to ascertain the potential
benefits of teaching the language components and the four skills using
a discovery-based teaching procedure.

4.1 Instructional guidance in discovery teaching

There has been an ongoing debate as to the amount of guidance to be
provided during instruction. It is often argued that students are more
likely to remember concepts if they are engaged in the act of self-discovery as opposed to those who are taught through direct instruction (Bruner, 1961). In this pure discovery teaching scheme, instructional guidance is likely to impede learners’ natural processes in activating their prior knowledge to construct new knowledge (Dean & Kuhn, 2007; Kirschner et al., 2006; Klahr & Nigam, 2004; Mayer, 2004).

While a small number of studies argue for the superiority of direct instruction, most studies argue that discovery-based teaching methodology is more effective. In an experimental study with 112 third- and fourth-grade children, Klahr and Nigam (2004) assessed the relative effectiveness of direct instruction and discovery learning. The study results showed greater learning in direct instruction. Based on this finding, the researchers argued for the effectiveness of direct instruction over a discovery-based teaching method. However, Klahr and Nigam’s (2004) argument is questioned in terms of two main points. First, their conception of direction instruction consisted in a style of instruction with minimal guidance, which makes it fall within an assisted version of discovery teaching. With this in mind, the findings of the study support the effectiveness of a guided discovery teaching pattern over a pure discovery teaching procedure. Second, Klahr and Nigam (2004) employed a pretest incorporating the to-be-learned material, which may have activated students’ prior knowledge base in seeking to comprehend the target learning material (Newman & DeCaro, 2019).

Likewise, Kirschner et al. (2006) argue for the effectiveness of direct instruction and hence its superiority over discovery-based teaching methods. They claim that adopting an explicit style of instruction will ensure an effective learning experience for all learners. Their argument is based on cognitive load theory asserting that purely constructivist approaches ignore the capacity limits of working memory. In the classroom context, they posit that discovery-based activities impede learning as they incorporate high cognitive load. With students’ limited working memory resources, such activities become harmful for the learning process. In this vein, novice learners will not have the ability to work out solutions when presented with problems as “[the] free exploration of a highly complex environment.
may generate a heavy working memory load that is detrimental to learning” (Kirschner et al., 2006, p. 80).

Nevertheless, Kirschner et al’s (2006) argument is questioned on four main grounds. The first issue is definitional. According to Kirschner et al. (2006), minimally guided instruction is defined as a learning context in which “learners, rather than being presented with essential information, must discover or construct essential information for themselves” (p. 75). Direct instruction is defined as “providing information that fully explains the concepts and procedures that students are required to learn” (p. 75). In principle, the two definitions could be conceived of as two complimentary components of minimally-guided instructional styles, with the first definition being a condition of discovery learning and the second as a condition of providing learners with the amount of guidance needed in the process of discovery. The second issue is pedagogical. Kirschner and colleagues (2006) have grouped different pedagogical styles – discovery learning, problem-based learning, inquiry-based learning, experiential learning and constructivist learning – under the category of minimally guided instruction (Hmelo-Silver, Duncan & Chinn, 2007). These instructional styles involve minimal guidance to facilitate and improve student learning in a scaffolded manner. In this regard, guidance and scaffolding do not necessarily mean direct instruction.

The third issue is evidential. Kirschner et al’s (2006) claim that minimally-guided instructional styles are ineffective has been questioned by empirical evidence that supports the effectiveness of such instructional styles (Hmelo-Silver et al., 2007). The fourth issue is instructional. Kirschner and colleagues’ argument focuses on determining and implementing the most effective style of instruction in the learning process, ignoring the content of teaching. In addition to identifying an effective style of instruction, it is also crucial to determine the learning material to teach, seeking ways to approach students’ personal interests and expectations in order to pursue their own learning (Kuhn, 2007). In this regard, the focus should be on “what sense students are making of things if we hope to influence their behavior” (Kuhn, 2007, p. 110). It is important to examine what students “are undertaking to learn in school, what they think it means,
how they construe the meaning of this material in relation to
themselves, and whether they can see it as worth learning” (Kuhn,
2007, p. 110). To provide effective instruction in this situation,
teachers are called upon to “offer opportunities for exploration [and
discovery]” (Kuhn, 2007, p. 110).

4.2 Discovery teaching of language components and skills

Discovery-based teaching methodology has been claimed to be more
productive in terms of learning outcomes. Its superiority over
expository styles of instruction has been manifested in enhancing
retention and transfer of concepts (Bruner, 1961; Mayer, 2004),
promoting student engagement and motivation (Bruner, 1961;
Castronova, 2002; Tomlinson, 2018), developing students’ critical and
creative thinking (Rahman, 2017; Syolendra & Laksono, 2019;
Wahyudi et al., 2019) and fostering students’ heuristics of discovery
(Bruner, 1961; Chase & Abrahamson, 2017). Numerous data-based
research studies have demonstrated the potential benefits of discovery
method as an instructional style in teaching grammar (Mahmoud,
2014) and vocabulary (Bahri, 2009), reading (Sari & Abdulrahman,
2019; Zahara, 2017), listening (Hanafi, 2016), speaking (Palupi, 2015;
Wahyudi et al., 2019) and writing (Indriyanti & Prasetyo, 2018;
Prawerti, 2014; Sobari & Husnussalam, 2019).

4.2.1 Language components

Using a rotational group experimental method, Singaravelu (2012)
investigated the impact of discovery learning strategies on learning
English Grammar among middle school students. The study findings
showed that middle school students encountered more problems in
learning English grammatical structures and tenses through expository
methods as they scored only 18% in the pre-test; whereas students in
the experimental group scored 82% marks. For the achievement mean
score, no significant difference was observed between the pre-test and
post-test of the control group. Yet, a significant difference was noticed
in the pre-test and post-test results of the experimental group. In
effect, the discovery learning model has gradually improved students’
mastery of grammatical structures and tenses. Such a teaching scheme
has provided a ground for designing tasks in which students learn for
themselves and are able to apply what they have learned in new real-life situations, thereby managing to produce an effective learning experience. These findings were echoed in Mahmoud’s (2014) quasi-experimental research study on the effect of using discovery-based teaching methodology in teaching grammar to first year secondary school students’ academic achievement and metacognitive skills.

Based on the aforementioned findings, it is safe to state that discovery learning method is more effective than expository methods in learning English grammar. Students feel involved in the different procedural tasks of learning grammatical structures and tenses and have more responsibility in discovering and learning the concepts through experimenting with approximate real-life tasks. In this way, students learn the target structures at their own pace of learning.

Concerning the implementation of a discovery-based procedure for the teaching of vocabulary, Bahri (2009) examined whether there was any significant impact of the discovery technique over the drill technique in learning and mastering vocabulary items by intermediate-two level students in a conversation program. Based on the results of this experimental study, it could be inferred that the discovery-based technique has showed more significant effect than the vocabulary-drill technique in improving students’ vocabulary mastery in a conversation class in the experimental group.

4.2.2 Language skills

In a quasi-experimental research using a matching only pre-test post-test control group design, Zahara (2017) examined the impact of teaching eleventh grade students reading sub-skills using guided discovery method. The study results showed significant changes in the learning outcomes of students having been taught reading sub-skills via guided discovery method over those in the control group having been taught by direct instruction. Similar findings were echoed in a recent pre-experimental research study conducted by Kurniadi, Regina and Rezeki (2020), who investigated the effectiveness of discovery-based instruction in teaching reading comprehension. The study results showed a moderate effect of the discovery method on eighth-grade students’ ability in reading comprehension given that the pre-
test mean score was 58.2; whereas the post-test mean score was 64.8. These findings support discovery-based instruction over direct instruction in teaching reading sub-skills.

For the teaching of listening, Hanafi (2016) investigated the impact of discovery method on high school students’ listening outcome and social attitude in relation to curriculum implementation in an experimental study with one group pretest-posttest design. The study findings indicated that the implementation of discovery teaching method had a positive impact on students’ listening and social attitude scores. In line with the effectiveness of discovery teaching of reading sub-skills, this study has showed that discovery teaching, which emphasizes the discovery process of principles and concepts, can improve students’ listening and social attitude scores in the English subject. Implementing a discovery-based procedure in the teaching of listening sub-skills can help learners to recognize their listening difficulties and improve them through contextualized tasks, thereby fostering their awareness and perceptual processing (Wislon, 2003).

With regard to the teaching of speaking sub-skills through a discovery-based procedure, Palupi (2015) explored the potential impact of the implementation of the discovery method on tenth-grade students’ speaking sub-skills using a quantitative research with one group pre-test and post-test design. The study indicated that the implementation of the discovery method led to noticeable improvements in the students’ speaking sub-skills of fluency and accuracy with words and pronunciation. Based on the empirical evidence in support of discovery teaching, the researcher concluded that this style of instruction should be applied in teaching speaking sub-skills as it provides students with more opportunities to enhance their spoken proficiency in speaking.

In the same vein, Wahyudi et al. (2019) used the Research and Development (R&D) design in developing the discovery-based speaking assessment model to stimulate tenth-grade students’ critical thinking and creativity. The study results showed that there were improvements in the students’ speaking mean scores. The significant improvements indicated that the implementation of the discovery-based method in teaching speaking sub-skills was effective in
improving students’ speaking proficiency, critical thinking and creativity. In this regard, Ouazzine, Erguig and Boudlal (2020) highlighted the importance of equipping learners with different speaking sub-skills. Their argument is that discovery teaching method provides an effective procedure for teaching the different speaking sub-skills, with a focus on a single sub-skill at a time.

The implementation of the discovery-based teaching method in teaching writing has yielded significant improvements in students’ mastery of the different writing sub-skills. In a classroom action research, Indriyanti and Prasetyo (2018) investigated the potential impact of discovery teaching method on learning the writing sub-skills by fifth grade students. The researchers opted for observation, task, and documentation as techniques for collecting data and employed observation sheets and writing performance as instruments of data collection. The study indicated that a discovery teaching pattern of the process writing improved students’ writing sub-skills as manifested in students’ observation sheet and writing performance. In a similar vein, Prawerti (2014) conducted an experimental study to reveal whether the implementation of a discovery-based procedure in teaching writing to tenth grade students was more effective than the use of direct instruction. The study findings supported discovery teaching over direct instruction for the teaching of the writing skill.

In short, the selective literature discussed in this section has been concerned with two main points. First, it has addressed the issue of guidance during instruction, providing a reasonable ground for the effectiveness of a guided version of discovery-based instruction in studies that argue for the superiority of direct instruction. Second, it has showed the added value of discovery-based instruction in the teaching of language components and skills. Nevertheless, there is still a need for a detailed data-based study to account for the effectiveness of discovery-based instruction in the Moroccan EFL context.

5. Conclusion and Implications

The results of previous research lend support to discovery-based teaching method over expository styles of instruction in teaching the language components and skills. Based on this, it is safe to state that
this instructional style can be an effective scheme for promoting teacher effectiveness and thereby enhancing student learning in the Moroccan EFL context. In a word, its research-based impact on both teachers and learners serves as a strong basis for its adoption in different educational contexts.

Several implications can be drawn in the light of the related literature discussed in the paper. First, successful instruction does not require an extensive use of teacher presentations. This implies that attention should be geared towards adopting a discovery-based scheme which actively involves learners in the learning process and makes them accountable for their own learning. Second, adopting an expository style of instruction has run short of consolidating the skills and strategies acquired in the course of classroom instruction and ensuring transferability to other situations. This implies that discovery-based teaching method is highly recommended to foster and consolidate the learning material and increase the likelihood of successful extension to different real-life situations. Third, it is important to ensure the provision of effective in-service teacher training opportunities to equip teachers with the essential steps to be taken into account in order to foster learners’ heuristics of discovery.

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