

## From Ivory Towers to Castles in the Air? An Exploration of the Conditions, Mechanisms and Teaching Methods in the Far Transfer of Undergraduate Learning to the Real World

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**Abstract:** The purpose of education is the transfer of learning from the classroom to real world applications, with transfer being accepted as a precursor of competence. Transfer concerns prior learning that affects new performances. However, evidence exists stating that such an aim is not guaranteed. Therefore, the belief in the retention, transfer and application of knowledge and understanding after four years of undergraduate study clearly needs investigating. A literature review maps the origin and changes in the understanding of the key concept of educational transfer, with a distinction drawn between near and far transfer, and continuing with an exploration of the rationale and mechanisms required in the facilitation of far transfer. Ultimately, this research claims that it is necessary for educational providers to understand the variables of active learning, constructivism, metacognition and expertise related to cognitive apprenticeship required in the successful transfer of learning to future work environments.

**Keywords:** Near and far transfer of learning, active learning and constructivism, metacognition, expertise, cognitive apprenticeship model

### 1. Introduction

The purpose of formal education is the transfer of learning from the classroom to real world situations, with transfer being accepted as a precursor of competence (Billing, 2007). Such transfer is to a future time and place of unplanned tests when teachers are no longer present (Halpern & Hakel, 2003). It is therefore understandable that transfer is seen as crucial to all learning (Marini & Genereux, 1995), a key concept in formal education (Perkins & Salomon, 1992), and the foundation of learning, thinking and problem-solving (Haskell, 2001). Indeed, Ellis (1965) argued that there is perhaps no more important topic in the psychology of learning than transfer of learning. Transfer research has also been extended to a wide range of work-related settings, such as management settings (Longenecker, 2004), nursing (Wong, 1979) and legal education (Kowalski, 2000).

Nevertheless, Day and Goldstone (2012) observe that after more than a century of research, knowledge transfer remains a very challenging and contentious issue for both psychology and education. Almost everyone in education assumes and strongly believes that what students learn in schools and universities facilitates problem-solving in their future lives, so *far transfer* – positive transfer to a dissimilar context – is of special interest because of its direct relevance to everyday life (Eysenck & Keane, 2013). However, a troubling statistic appeared which

called into question the whole enterprise of education: it has been estimated that only 10% of a student's investment in education pays off in terms of transfer of knowledge, skills and behaviour (Awoniyi, Griego, & Morgan, 2002, in Merriam and Leahy, 2005). Subedi (2004) has also observed that most training programs and courses fail to transfer. This situation has led Georghiades (2000) to claim that the inability of students to transfer the knowledge, skills and attitudes acquired within school to different contexts of wider social network indicates that education has no real meaning. Certainly, educationalists are faced with a serious challenge to their profession if the possibility of the transfer of learning is seriously undermined as a viable phenomenon. It is not surprising then that in 1999 the President of the American Educational Research Association identified transfer as one of the six most pressing areas in need of research progress (Lobato, 2006).

It is assumed that previous experience allows a person to solve current problems faster and more easily than without the experience (Perkins & Salomon, 1992). However, up to the present day, finding and establishing a body of evidence for the transfer of learning has proven to be challenging. For instance, Barnett and Ceci (2002) and DeCorte (2003) argue that transfer is not an automatic given, while Haskell (2001) claims that such transfer has not been achieved at any significant level. Further evidence for the elusiveness (Lobato, 2006) and even failure of transfer from school-based learning environments to outside activities has been provided by Boaler (1998) and Molyneux and Sutherland (1996). Larsen-Freeman (2013) explains that when the assumed and expected knowledge transfer does not occur then the problem of *inert knowledge* results. Even further, several researchers note the lack of agreement of the extent of transfer and the nature of its underlying mechanisms (Barnett & Ceci, 2002; Beach, 1999; Greeno, 1997; Lave, 1988). Eysenck and Keane (2013) have even asked whether learning transfer is actually possible, that is, whether one can solve a similar problem in the present as one once did in the past.

Nevertheless, there is no question that past and present learning experiences affect future learning experiences (Bransford et al., 2002). As Hager and Hodkinson (2009) point out, everyday human experience is replete with learning, thinking and problem-solving, although the intentional facilitation of such a process is known to be often unsuccessful (Beach, 1993; Greeno, 1997; Lave, 1988; Mayer & Wittrock, 1996; Salomon & Perkins, 1989). Even so, as Lobato (2006) has highlighted, the transfer literature is subject to a paradox: on the one hand gaining evidence for transfer, whether in laboratories or classrooms, is hard to come by, but on the other hand, most theories of learning posit that people learn using prior learning. The research problem in this paper springs from the need to ascertain evidence for the optimal conditions for the transfer of learning to later work contexts in order to justify the huge expenditure in terms of money, time and human resources. The belief in the transfer of learning and the retention of knowledge after four years of undergraduate study, as well as the spending of a not insignificant sum of money, is therefore a state of affairs that clearly needs investigating. The aim of this research is to review the transfer literature to establish the conditions and mechanisms of such transfer.

The plan for this research is as follows. First, three research questions will be given. Second, the key term *transfer of learning* will be defined and analysed followed by a distinction into three types of transfer that researchers work with, namely, *near and far transfer*, *low-road*

and *high-road transfer*, and *positive and negative transfer*. Third, a literature review will set out to answer the research questions by carrying out an overview of the historic conceptual development of transfer of learning (Kowalski, 2000). Based upon this review, in which the concept of the active learner, constructivism and expertise will be highlighted, the appropriate teaching methods required to maximize such transfer will be proposed, with a specific reference being made to the influential work of Biggs and Tang's (2011) *Teaching for Quality Learning at University*.

A final note to this section – this review of learning mechanisms of far transfer research constitutes the second of two papers, the first paper having been presented at the 6th International Conference on English, Discourse and Intercultural Communication at Macao Polytechnic Institute (Davis, June 2017, ELT Conference presentation). The aim of that first paper was to gauge the extent to which graduate students of Macao Polytechnic Institute are able to retain and use the knowledge learned in their respective Degree programmes, with a particular focus on the researcher's graduate students of Social Work and their EFL acquisition and transfer of such language skills to employment settings.

### 1.1. Research Questions

The research questions in this review are:

- 1) Under what *conditions* does transfer occur? (Salomon & Perkins, 1989).
- 2) What are the *theoretical mechanisms* underpinning the transfer of learning?
- 3) Based on the above conditions and mechanisms, what suitable *teaching methods* should be used to facilitate transfer?

### 1.2. Key Terms and Definition

A host of definitions of *transfer of learning* can be found in the transfer literature (in chronological order: Ellis, 1965; Broad, 1972; Cormier & Hagman, 1987; Gick & Holyoak, 1987; Salomon & Perkins, 1989; Perkins, 1992; Perkins & Salomon, 1992; Detterman, 1993; Marini & Genereux, 1995; and Lobato, 2003b). In the present study, Marini and Genereux's (1995) definition will be utilized as this one is generally accepted amongst researchers (Kowalski, 2000):

the transfer of learning is *prior learning affecting new learning or performance*.

The transfer of learning has at least three distinctions: *near and far transfer*; *positive and negative transfer*; and *transfer of learning vs transfer of training*, with this paper focusing on the first of these distinctions. Near and far transfer (Clark & Voogel, 1985; Cree & Macaulay, 2000; Perkins & Salomon, 1988; Royer, 1986; Salomon, 1988) has several other names, such as “low road”, “vertical”, or “specific”, and “high road”, “horizontal” or “general” respectively (Bossard et al., 2008). Near transfer is the applying of knowledge and skills to contexts similar to the initial learning environment, such as an exam containing similar material to that practised in the classroom (Anderson, et al., 1996; Perkins & Salomon, 1992), or the developing of

some knowledge and skill to a high level of automaticity via extensive and varied practice (such as car driving) involving modeling and reinforcement (Salomon & Perkins, 1988, 1989). Learning to read, involving extensive practice with diverse materials, is a further example (Perkins & Salomon, 1992), as are the processes of socialization, acculturation, the acquisition of habitual behavior patterns, response tendencies based on stimulus cues contained in the memory, personality traits, cognitive strategies and styles, expectations, and belief systems (Salomon & Perkins, 1989).

Far transfer involves knowledge and skills being applied in situations that change, one important skill being the ability of the student to make effective judgments in the new situation, involving analogical reasoning (Larsen-Freeman, 2013). Examples include: learning to drive a car to drive a truck; the learning of maths helping to learn physics; learning to live well with siblings helping one to get along later with others; and learning chess to become a better strategic thinker in business or politics (Salomon & Perkins, 1989). Much research on positive and negative transfer has involved *analogical problem solving*, which is where a person uses similarities between the current problem and previous problems, a classic example from the history of science being Rutherford's solar system analogy to understand atomic structure (Eysenck & Keane, 2013). In relation to academic achievement, far transfer requires principled understanding (Alexander & Murphy, 1999) and purposeful and conscious analysis, abstraction and application that cuts across disciplines, that is, the mindful or intentional abstraction of an idea for transfer, followed by the conscious and intentional application of the idea when faced by a problem (Salomon & Perkins, 1988, 1989). In other words, far transfer refers to generalizable skills, such as reading, that are applied to different contexts (Anderson, et al., 1996; Perkins & Salomon, 1992).

Essentially, near transfer deals with the same types of problems in the same subject domain – positive transfer to a similar context in which the focus is on the immediate application of knowledge and skills from one situation to a similar one (Eysenck & Keane, 2013). Far transfer covers two domains (Billing, 2007). In other words, near transfer refers to closely related contexts and performances, while far transfer relates to different contexts and performances (Perkins & Salomon, 1992).

Both types of transfer have weaknesses. Near transfer is hampered by the lack of adaptation of knowledge and skills when circumstances change in the intended applied setting (Clark, 1999). Such a situation is especially relevant when one considers the claim that teachers often “teach to the test” when in fact far transfer is much more important for students' future success (Barnett & Ceci, 2002). Indeed, the educator should be concerned to take the student beyond the test and near transfer because high test scores do not guarantee enduring or transferable learning (Halpern & Hakel, 2003). Furthermore, near transfer is far from real-world applications where people have access to texts, friends, feedback from others and, in general, a support network (Eysenck & Keane, 2013). Meanwhile, the challenge for far transfer is that deep structure is the most difficult to attain (Detterman, 1993). For instance, Spencer and Weisberg (1986) discovered that even small changes in the context of learning eliminated all evidence of transfer, despite the physical context being the same, a finding which calls into question the whole enterprise of education (Day & Goldstone, 2012). Another disadvantage is the difficulty of instructing for such transfer to occur (Clark, 1999). In addition, real life

matches of problems are hard to come by and, when they do, are often imprecise (Eysenck and Keane, 2013), despite the fact that real life scenarios are more important in which structural similarities are the standout feature (Blanchette & Dunbar, 2002; Dunbar & Blanchette, 2001). This review is an attempt to overcome these challenges to the achieving of far transfer.

Regarding the distinction between *positive* and *negative transfer*, the former can be seen in language acquisition, that is, the ability to generalize from one syntactic structure to another (Larsen-Freeman, 2013), while the latter is the solving of a problem in the past that sometimes disrupts one's ability to solve a similar current problem (Eysenck & Keane, 2013). In a second language setting, negative transfer refers to cross-linguistic influence (Larsen-Freeman, 2013).

The final distinction is between the *transfer of learning* and *transfer of training*, the former being the generation of knowledge and information through education leading to a knowledge base and generic competencies, whereas the latter focuses on specific competencies that may be derived from the generic competencies (Subedi, 2004) in order to perform a specific target task (Bossard et al., 2008). Another way of looking at this is that training focuses on procedural knowledge and near transfer, while education in general concerns declarative knowledge and far transfer (Subedi, 2004).

## 2. Literature Review

### 2.1. Conditions of Far Transfer: the Learner, Task and Instructional Context

To begin answering the first research question on the *conditions* required for the facilitation of far transfer, a trinity of factors will now be presented. According to Marini and Genereux (1995), the successful transfer of learning requires three elements:

- 1) The learner
- 2) The task (including materials and practice problems), and
- 3) The instructional context (including the physical and social setting and its norms and expectations).

Factors in the transfer of *training* are comparable: *trainee, training design and delivery* and *organisation and workplace environment* respectively (Baldwin & Ford, 1988; Ford & Weissbein, 1997; Subedi, 2004).

Regarding the first task, the learner must be motivated (Ellis, 1965). The significance of learner motivation is made clear in a conceptual distinction pointed out by Lobato (2003a) between learning itself and transfer to a different time and place, that is, learners can transfer what they have learned in a classroom to novel situations without any new learning taking place. Transfer should thus be seen as inseparable from motivation because learners of all ages are more motivated to transfer when they see the potential usefulness of what they are learning (Anderson, Simon, & Reder, 1996) as well as having interest in what is being learned (Pugh & Bergin, 2006). A student's motivation is linked to *learning dispositions* such as qualities of openness to new experiences, willingness to take risks, self-confidence, perseverance and the desire to perform optimally (Kowalski, 2000). Merriam and Leahy (2005) add to these factors

by including the learner's intentions, self-efficacy and expectations. It should also be pointed out that the motivated transfer of knowledge is an emotional as well as cognitive process because students transfer not only what they know but also the emotional valences of that knowledge to new scenarios (Helfenstein, 2005). Thus, Evans (1999) points out Walkerdine's (1989) assertion that meanings are not just intellectual, as well as Buxton's (1981) idea that emotion powers reason, concluding that the quality and intensity of affective charges are a major influence in the success or failure of attempts at transfer. The second element of successful transfer of learning concerns the task, that is, the learning content must be relevant, which corresponds to the curriculum and syllabi (Ellis, 1965). Kowalski (2000) points out that the learning content of a syllabus involves conceptual/content knowledge of basic facts, core concepts and schematic relationships, as well as the procedural/strategic knowledge of specific steps of transfer coupled with metacognitive strategies for monitoring and evaluating one's own thinking. As for the third element of instructional context, this concerns workplace factors such as supervisory support and organizational culture (Merriam & Leahy, 2005).

## **2.2. Theoretical Mechanisms of Far Transfer**

Regarding the second research question on the *mechanisms* involved in learning transfer, Kowalski (2000) has presented an historical overview of such, starting with the *Classical approach* of the formal disciplines model which posited that transfer would be enhanced by studying certain arts and science courses (namely, Latin and mathematics) that in themselves would train the memory, attention and judgment, an approach that has been disproven (Macaulay & Cree, 2000). A second suggested mechanism is the *Behavioural approach* originating from Pavlov's stimulus generalisation theory, which in turn led to the *associationism* explanation for the transfer of learning such as the *identical elements* model of Thorndike and Woodworth (1901) which posited that transfer only occurs when the primary and secondary learning domains share similar and concrete elements (Kowalski, 2000). This approach has been criticized for being only applicable in controlled laboratory conditions that fail to generalize to the complex dimensions prevalent in real life classroom and workplace settings in which understanding and meaning are required (Kowalski, 2000). At best this model can explain near transfer where the new context of the application of learning is close to the original learning domain (Kowalski, 2000). A third mechanism explaining the transfer of learning is that of *cognitive approaches*, namely, *information-processing*, *Schema theory*, and *metacognition*. The fourth mechanism is that of *Socio-cultural theory*.

### **2.2.1. Cognitive Approaches: Information-processing**

Concerning information-processing, Eraut (2004) has delineated the stages of the transfer process: extraction of relevant knowledge from the point of acquisition, understanding of the new situation, recognising the relevant knowledge and skills, transforming them to the new context, and integrating the above in order to communicate in the new situation. The information processing model is useful as it brings to our attention that any educational system has in-built limits to the transfer of learning, with one obvious limit being the processing of

information, referred to as *Cognitive load theory* (Sweller, van Merriënboer, & Paas, 1998), which distinguishes between different kinds of cognitive demands placed on a learner based on their relevance to learning. Another limit is minimal mastery of the subject matter (Salomon & Perkins, 1989).

### 2.2.2. Cognitive Approaches: Schema Theory

Also under the cognitive umbrella, *Schema theory* proposes that memorized knowledge, in the form of mental models or representations known as *schemata*, influence all aspects of learning, including perception, comprehension, memory, reasoning and problem solving (Cust, 1995). Such schemata can be stored in the form of concepts, procedures, images and episodes (Brooks & Dansereau, 1987). Anderson (1990) also showed the power of schemata to organize large amounts of information into meaningful systems. Extending Schema theory and learning transfer, Bransford, Brown and Cocking (1999) built upon Bruner's (1986) findings on the learner's active construction of knowledge structures or schemata as being pivotal in expanding on the notion that transfer was simply a matter of establishing commonalities across situations or tasks. Importantly, an increase in worked examples leads to developing meaningful schemas, faster processing, and superior learning and transfer (Day & Goldstone, 2012).

Furthermore, regarding the active nature of learning, educational transfer involves conceptual change. *Conceptual change learning* (CCL) assumes that knowledge is subjective in that it is personally as well as socially constructed and built upon previous experience (Driver, 1989). In a school setting, CCL implies that a curriculum is a series of learning tasks, materials and resources that students must individually reconstruct as personal models of understanding and meaning concerning the world. In this sense, the inability to transfer knowledge could imply that only a low level of conceptual change occurred (Driver, 1989).

### 2.2.3. Cognitive Approaches: Metacognition

In addition to the concept of *schemata*, another higher order cognitive process was introduced to explain transfer, namely, *metacognition* (Flavell, 1976; Brown, 1978). Metacognition has been described as "thinking about one's thinking" (Adey & Shayer, 1994), "cognitions about cognitions" (Meichenbaum et al., 1985), "knowing about one's knowing" or "learning about one's learning" (Marini & Genreux, 1995; Brooks & Dansereau, 1987). Perkins and Salomon (1992, 1994) delineate several metacognitive skills, such as explicit abstraction, active self-monitoring, mindfulness, and using metaphor or analogy. Regarding abstraction, metacognition shows that learners can abstract principles of knowledge and understanding to other contexts. For instance, in order to go beyond mere memorization and involve understanding (Bransford, Brown & Cocking, 1999), the abstraction of rules and principles from one's learning and the development of subsequent schema is required and not just the memorizing of facts or fixed procedures (Bransford & Stein, 1993), which is similar to the work of Alexander and Murphy (1999) above who argued that transfer is nurtured by promoting principled understanding and the teaching of analogical thinking. In doing so, abstraction employs generalisation, which is the ability to identify similarities between new situations and previous situations (Macaulay &

Cree, 1999). In particular, abstraction is the making of a representation that involves making a comparison to an original form based on generic or basic qualities or attributes, that is, subsuming individual cases according to a rule, principle, schema, or category, such as furniture being an abstraction of a chair (Salomon & Perkins, 1989). In this way general principles are formed from particular learning experiences (Macaulay & Cree, 1999) or, expressed in another way, commonalities are extracted from a set of concrete examples (Rosch & Mervis, 1975). Abstraction is thus conceived as a process of decontextualization (Lobato, 2006). As such, abstraction provides a cognitive explanation of transfer in which the formation of sufficiently abstract representations is a necessary condition for transfer (Reed, 1993; Singley & Anderson, 1989). Such a process of abstraction can account for creative insights in the history of scientific inventions, such as Gutenberg's idea for a printing press while observing a wine press in operation (Koestler, 1964, in Salomon & Perkins, 1989). In this regard, Cobb (2004) and Lobato (2004) also advocate reflective abstraction (Piaget, 1977/2001), in which a learner personally structures their learning according to their individual learning goals and prior knowledge (Piaget, 1980). Georghiades (2000) also reasons that being able to make comparisons between one's concepts leads to deeper understanding, which in turn leads to successful transfer, with cognitive retention being aided by metacognition. With reference to active self-monitoring, Benander and Lightner (2005) stress the importance of making learning expectations explicit in order to enhance transfer. As for mindfulness, this is related to Schon's (1983, 1987) idea of reflection-in-action and describes an awareness of problems, situations and ways of thinking and talking about them (Salomon & Globerson, 1987). The importance of mindfulness in learning is that the learner is helped to see similarities between contexts, allowing their personal schema to encompass new information and evolve (Kowalski, 2000).

Continuing with the theme of active learning, metacognition offers a mechanism for far transfer by being a skill and subset of active learning (Kowalski, 2000). Indeed, Soini (1999) argued for the self-reflected management of knowledge as one of the preconditions of active transfer. In seeking to pinpoint the factors responsible for *far* or *general transfer*, Macaulay and Cree (1999) became firm believers in the concept of the *active learner* and *constructivism*, with knowledge actively acquired, interpreted and represented by each individual (Billet, 1994). In this regard, Saxe (1989) conceptualised transfer as a protracted and highly dynamic process of repeated constructions of appropriation and specialization rather than as a one-time immediate alignment of prior knowledge to new functional contexts. The significance of this is that learning interventions that involve active learning show positive transfer results (De Rijdt, Stes, van der Vleuten, & Dochy, 2013). Thus, while Detterman (1993) advocates teaching people exactly what you want them to learn in a situation as close as possible to the one in which learning is to be applied, Cox (1997) argues that transfer should go beyond merely producing an apprentice-type education to one in which metacognition and active learning help a learner to adapt to new environments. One other influential feature of metacognition in the support of far transfer is the generation of personal meaning. For instance, Merriam and Leahy (2005) note that professional practitioners such as social workers, nurses, lawyers and educators see transfer as a process of meaning making and not simply transfer of information from one context to another.

#### 2.2.4. Socio-cultural Approaches

Hager and Hodkinson (2009) argue that a further influential concept of active learning is seeing it as participation in human practices, which assumes that learning is a complex social construction of interdependence, that movement is of the learner rather than knowledge itself, and that learning does not transcend its context. This leads to the fourth mechanism in understanding learning transfer, namely, *socio-cultural theory* as founded upon Vygotsky's research programme (1978). For Vygotsky (1978), the human being is an expression of culture. Vygotsky explored the connections between environment and mind, or culture and cognition, particularly the influence of sociocultural factors such as history, social institutions, cultural meanings and artefacts, cultural signs such as language, and interpersonal interactions upon the higher mental functions of thinking, reasoning, problem-solving, and voluntary attention (Wertsch, 1985). At the immediate personal level, society influences higher psychological development through face-to-face interactions in a "zone of proximal development" (Vygotsky, 1978), which is defined 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"* (1978, p. 86, author's italics).

Vygotsky's highlighting of the role of adult guidance has led to interest in the role of the expert and the interactions between them and their students. Vygotsky's insight that the social context is a key element of learning in which informal apprenticeships can play a significant role in everyday settings is a feature which led to the *cognitive-apprenticeship model*, in the same way that people learn craft apprenticeships (Kowalski, 2000). Social learning theory and its inclusion of a knowledgeable mentor to guide the student through their zone of proximal development has an obvious link to expertise. Expertise *is* situated learning but which also involves abstraction (Eysenck & Keane, 2013). Macaulay and Cree (1999) have stressed the role of expertise in the transfer of learning (Atkins et al., 1993; Benbenishty, 1992; Benner, 1984; Billett, 1994; Creedy et al., 1992; Guberman & Greenfield, 1991), with expertise being the ability to coordinate the use of conceptual knowledge, specific skills and general procedures when confronting problematic situations (Stevenson, 1994). With this understanding, teaching and learning becomes a face-to-face collaboration and series of interactions with an expert who encapsulates the knowledge and practices of a specific environment, this theory forming the basis for what is known as the *cognitive apprenticeship model* that can prepare a learner for a future working context and the nurturing of specific skill sets and areas of expertise by using procedural knowledge, analogical principles of reasoning as well as intuition. Macaulay and Cree (1999) also support the cognitive apprenticeship model whereby a learner is facilitated by an expert in a role (Billett, 1994; Gott, 1989, in Macaulay & Cree, 1999). Hence the importance of placement supervisors, as well as study groups, peer coaching and mentoring (De Rijdt, Stes, van der Vleuten, & Dochy, 2013). Macaulay and Cree (1999) also highlight the crucial role played by the placement supervisors in helping the student bridge theory and reality. In

particular, Ford and Weissbein (1997) recommend “guided discovery” as increasing motivation and therefore transfer. Furthermore, expert instruction can be used to point out connections between isomorphs – activities that have the same logical structures but different appearances, such as in the use of classroom games and exercises (Simon & Hayes, 1977, in Perkins & Salomon, 1992). Whittington (1986) also points out that the teacher has a crucial role in helping students to make meaningful patterns from learning experiences, to transfer learning to new situations and, especially, to understand how they transfer that learning.

### 2.3. Teaching Methods

Given the above *conditions* and *theoretical mechanisms* for the facilitation of far learning, what *teaching methods* or approaches should be employed to affect new learning and performances? The challenge for educators now becomes clear – what teaching methods should be used in the delivery of formal academic knowledge? In this regard, Biggs and Tang (2011) have made a major contribution to the literature on far transfer in their book *Teaching for Quality Learning at University*. The ensuing discussion section will present their findings according to the research questions in this review, namely, the *conditions* of far transfer (the learner, the task, and the instructional context), the *theoretical mechanisms*, and *teaching methods*.

## 3. Discussion

Regarding the first condition of the *learner* and the all-important factor of student motivation, Biggs and Tang (2011) state that teachers must hold a theory of teaching that is student-centred, according to which learning is a function of student activities, with the critical factor of student motivation resulting from the perception of effective teaching and not just an individual personality trait. As for the learning *task* involving curricula and syllabi, Biggs and Tang (2011) explain that an important objective is facilitating “performances of understanding” via relevant learning activities and not simply studying theoretical knowledge. This requires making decisions on a relevant knowledge base with associated topics for study, and linking this to appropriate criterion-referenced assessment tasks that are designed according to outcome statements.

Concerning the *theoretical mechanisms* of effective teaching and learning, Biggs and Tang’s (2011) work fully acknowledges the importance of *constructivism* as based on the theories of Piaget (1950), that is, learners construct knowledge with their own activities and interpret concepts and principles in terms of *schemata* they have already developed.

Based on the above conditions (learner, task, and instructional context) and theoretical mechanisms (Cognitive theory and Social learning theory), Biggs and Tang (2011) point out that *teaching methods* must be built upon students’ experiences and conceptual change and not simply via the acquiring of information. Furthermore, since understanding is built upon an interpretive process, the promotion of understanding requires an active participatory process (Ramsden, 2003). Given such features of learning, Biggs and Tang (2011) argue that teachers must not think that effective teaching means automatically resorting to lectures, arguing that lectures prevent students from being active – it’s more about teacher performance rather than

the student's (Bigg & Tang, 2011). While lectures undoubtedly have their uses – being effective for transmitting information and introducing students to the most recent developments in the field involving the lecturer's expert angle and critical perspective – lectures are ineffective for stimulating higher-order thinking, the latter being better stimulated by outside reading (Bligh, 1972). Furthermore, while some students learn best by reading or doing, it is known that lectures are not effective at promoting memorization of material, nor are lectures well-suited to higher levels of learning such as critical thinking and problem-solving (Ramsden, 2003). Halpern and Hakel (2003) also warned of the limits of traditional methods of teaching such as lectures, arguing that while such an approach to learning supports information recognition and repetition in examinations, it limits in-depth understanding of a topic and therefore transfer to new situations. Besides that, a learner's attention span is typically 10-15 minutes, after which learning drops off rapidly, so regular changes in activity are required (Bigg & Tang, 2011). In addition, lectures cannot be relied upon to inspire change in students' attitudes (Bigg & Tang, 2011). Consequently, Bigg & Tang (2011) challenge teachers to ask themselves: "Can I offer my students something that the textbook cannot?" If your answer is negative, then use lectures sparingly!

The understanding that learning is an active process links with Biggs and Tang's work (2011) on *deep* rather than *surface approaches to learning*. Surface learning relies upon joyless memorization instead of understanding, while a student who seeks a deep approach to their chosen subject wants to know the underlying structure of their subject, which requires theorizing, hypothesizing, reflecting, inventing and proving/solving from first principles.

In arguing that knowledge is created by a student's learning activities as facilitated by an effective teacher, Biggs and Tang (2011) have provided a list of teaching activities on a scale from minimal to extensive student participation, including: lectures → assigned readings, lab work, and concept mapping → peer teaching and group work → collaborative learning and chat rooms → self-directed reading, Web searches, metacognition and acquiring study skills. For Biggs and Tang (2011), however, the most effective all-purpose teaching method is teaching students to be metacognitive and manage their learning by themselves.

Finally, regarding socio-cultural theory and expertise, Biggs and Tang (2011) state that research on teaching expertise has identified two factors: management (lesson planning and preparation) and improvised spontaneous conversation based upon their expertise and critical perspective; the teacher should also be an agent for transforming knowledge, helping students to interpret and to construct their own knowledge, not a passive substation that relays pre-formed messages to them.

#### **4. Conclusions and Recommendations**

Far transfer and how to achieve it is a crucial concept in education because if prior learning does not affect new learning or performance then the whole edifice of education as a viable and meaningful construct in the acquisition of knowledge and understanding is seriously undermined. Bransford et al. (2000) state that the ultimate goal of transfer is for students to generalize the knowledge learned in school to practical environments such as home, community and workplace. But how such far transfer can be realized is another matter entirely. The aim

of this review was to pinpoint and clarify evidence for the conditions and mechanisms of far transfer with a view to highlighting the optimum teaching methods that can ensure graduates can retain and use their knowledge and skills after graduating from their programmes of study.

The three main conditions of successful transfer involve the triple tasks of learner motivation, the learning task, and the context of instruction; three theoretical mechanisms; and student-centred teaching methods. Given the criticisms of the explanatory mechanisms of transfer inherent to the Classical and Behavioural approaches, this research focused on Cognitive (*information-processing*, *Schema theory*, and *metacognition*) and Socio-cultural approaches. Metacognition has proven to be particularly fertile, being a subset of active learning (Bruner, 1986) by which a learner's active and reflective abstraction of principles of understanding via analogical reasoning leads to the construction of personally meaningful models of knowledge that in turn stimulate creative approaches to student-centered active methods of teaching and learning. Finally, Socio-cultural theory highlights the importance of teacher expertise and a relationship that can be described as a cognitive apprenticeship. In effect, the lecturer becomes an expert guide, mentor, and facilitator.

Research into far transfer is far from over. Eysenck and Keane (2013) point out several limitations in the research evidence gained so far. First, few studies have manipulated context similarity, including social context. Second, why a change of context from an initial problem-solving situation to a later one reduces transfer is still a mystery. This relates to the factors involved in the decay of learning (Whittington, 1986). Third, what is the role of individual differences? Individual differences in finding analogies do make a difference, although little research has been done on such a variable (Eysenck & Keane, 2013). It is also known that children of high intelligence do not need previous experience to perform as well as children of average intelligence who did, while gifted children show substantial positive transfer compared to average children when exposed to only one instance of problem-solving (Davidson & Sternberg, 1984). Furthermore, DeCorte (2003) found that training in metacognition produces even more transfer amongst the most intelligent students. Finally, De Rijdt, Stes, van der Vleuten, and Dochy (2013) suggest incorporating the conceptions of teachers as an influencing variable on learning transfer.

The need to go beyond near transfer and its associated temptation of "teaching to the test" adds impetus to pinning down the mechanisms and conditions of far transfer, both for the sake of the mission of education as going beyond examination scores and to prepare students for the world of work where adaptability and creativity are key requirements. Learning is now seen as a continually evolving process of active construction and meaning making of bodies of knowledges or discourses rather than a series of discrete acquisitions of pieces of information (Hager & Hodkinson, 2009). This suggests that it is what the learner *does* with that knowledge that must be the focus of education. Ultimately, it is important for educational providers and institutions, as well as academics and students, to understand the variables required in the successful transfer of learning to future work environments.

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