Educational Psychology
Between Certitudes and Uncertainties

Edited by Victorița Trif

EDUCATIONAL PSYCHOLOGY - BETWEEN CERTITUDES AND UNCERTAINTIES

Edited by **Victorița Trif**

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Meet the editor

Victorița Trif is an associate professor at the Faculty of Psychology and Education Sciences from the University of Bucharest (Romania). She is also an author of many articles and books, including *Cognitive, Semantic and Social Dissonances into Assessment*, published in Germany (Lap Lampert Academic Publishing). She won Best Paper Award for the study *Deconstruction and the Curriculum* at the ARSA Annual Conference in 2014 in Slovakia (http://www. arsa-conf.com/arsa-award/) and has been awarded for her books *Lesson Planning: Good Practices* and *Academic Profession or About the Business of Knowledge* at the International Exhibition for Sciences and Teaching Books, Chișinău 2013, in Moldavia (www.bsclupan.asm.md). She has wide experience in research and in teaching courses in the fieldwork of educational psychology and educational sciences.

Contents

Preface

A systematic review of the literature on recent educational psychology reveals a rebranded jigsaw that contains classic texts, updated and revised research, as well as prospects of strategies to managing behavioral difficulties according to the educational psychology services. Beyond the familiar preferences of the previous critical studies in the fieldwork, which reconsiders the topics of trend analysis, citations, individual differences, statistics, content analysis, educational psychology deconstruction, or research methodology, this exegesis delineates five major themes considered important for the future development of theories, practices from the educational psychology services, and public policy.

The title of the book, *Educational Psychology - Between Certitudes and Uncertainties*, is relevant for dynamic and low predictable research from genetics, neurosciences, technologies, and empirical evidence of the relationship between mind, brain plasticity, communication, and education that produces challenges and exchanges across sciences. There are various perspectives on the epistemology in the field, new results of experiments, different hermeneutics and misinterpretations of data collected, multiple scientific simulations, and diverse substantial evaluative data. Eccentric, exotic, and strange theories of the new epistemic communities coexist with traditional approaches to educational psychology. This new framework argues that this book is to be considered a fairly unique and realistic way to rebuild the incongruities and paradoxes in this area. Naturally, "certitudes and uncertainties" is a common denominator for the existing sophisticated academic conventions and for the immense potential of continuous professional development. The title of the book reflects the state of the art, a new trend in the conceptual fabric of educational psychology, and an attitude toward an academic market in the age of many battles in the world of science.

A distinctive characteristic of this book is that it intends to provide a new perspective on the current hypothesis from educational psychology. It consists of five chapters, covers the most discussed problems from the areas of study, and brings together notorious experts from different cultures. From the number of intentions submitted, four contributions were selected and incorporated.

Within each chapter, theories linked with practice issues and emerging conclusions are examined.

The first chapter (author Victorița Trif) examines the polarized paradigms from educational psychology, combining parallel explanations and concerning the identity of the scientific domain. The research questions are in interdependence with future trends in the fieldwork, as well as with a new comprehension of uncontrolled multiliteracy and of the contemporary state of interconnected paths, models, or reconsidered branches of psychology. The title of the chapter ("Will a Cooperation between Polarized Paradigms in Educational Psychology Be Possible?") suggests a possible answer to the potential cognitive model of solving an asynchronous conglomeration of knowledge in the area.

Chapter 2 (author Carlos Ossa-Cornejo) discusses the critical role of the psychologist according to a reflexive educational psychology. The theoretical synthesis is focused on the following relevant guidelines: the transition of educational psychology from simplicity to complexity, critical thinking as a strategy for the evolution of educational psychology, and a new dimension of educational psychology—a critical one. The ontological and epistemological analysis of the author takes into account the vast variety of human situations, paradigms from the area, and concerns related to clear, measurable, and unambiguous knowledge.

Chapter 3 (author D. Tzuriel) presents the relationship between the effects of mediated learning experience and children's cognitive modifiability. The findings and discussions are focused on how mediated learning experience processes are internalized by the child, because of various strategies—intentionality and reciprocity, mediation of meaning, mediation of transcendence, mediation of feelings of competence, mediation of self-regulation—used by the mother while interacting with the infant. The dynamic assessment of cognitive modifiability and the role of maternal stimulation are related to the theories of Vygotsky and Feuerstein.

Chapter 4 (authors Huy P. Phan, Hui-Wen Wang, Jen-Hwa Shih, Sheng-Ying Shi, Ruey-Yih Lin, and Bing H. Ngu) draws attention to the concept of "optimal functioning," defined in terms of positive psychology. The key questions of the study ("What is the best that I can do as a person, both academically and nonacademically?" and "How do I achieve my best in a subject matter?") are correlated with different conceptualizations of mindfulness. The structure of the chapter (the importance of optimal functioning, the overview of mindfulness, mindfulness from an Eastern perspective, mindfulness and optimal functioning, and the conclusion) mirrors the methodological conceptualization of the authors.

Chapter 5 (author Susana Occhipinti) develops research anchored to earth sciences and geosciences education according to Italian features of the education system. Multidisciplinary connections are inserted between different scientific areas of knowledge (geochemistry, volcanology, petrography, geophysics) and various disciplines (history, literature, art). The network of resources from the chapter is reconsidered in terms of conceptual nodes and it is related to the epistemology of complexity.

This book is essential reading for teachers, students, researchers, and practitioners from educational sciences, educational psychology, and hybrid domains.

The most important message of the book is that the multitudinous contents of educational psychology are relevant to different stages of science development and, in the current phase, are amalgamating the perspective of traditional control knowledge and rival paradigms. This explains the "cyclone" of knowledge in the conceptual framework that generates uncertain and contradicting expectations and anticipations concerning the future of educational psychology. At the same time, this process is not entirely negative, false, or confusing. A possible answer for both the inside and outside enemies of a storm could be that of assuming an intergenerational effort for us to manage the academic interest in the field of educational psychology.

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Introductory Chapter: Will a Cooperation between Polarized Paradigms in Educational Psychology Be Possible?

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Additional information is available at the end of the chapter

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1. Introduction

Over the past decades, the educational psychology knowledge was constantly rebranding and revising due to performance pressure and need to solve authentic educational problems. The multiple case studies [1], the mastery experiences, and the different kinds of results from the research nurtured new mutual communities of knowledge in the area. This book comprises a variety of styles, debated issues, many theoretical positions, substantial details concerning knowledge, and tensions between extreme methodological rules, and discusses the most important academic market topics.

2. Why this book?

Even though the contemporary epistemology is very sophisticated [2], this book addresses an alternative position to the fragmented educational psychology knowledge. The following characteristics lead to the current explanations from the educational psychology framework and sustain the intellectual architecture of the book.

2.1. Epistemology

For most of the people, knowledge is relative and the epistemology of educational psychology is cognitively represented at the crossroads between different branches of psychology and educational sciences. In many cases, this view significantly differs from the classic body knowledge. Such assumptions remain endemic without a masterly demonstration. In order to

provide some insights, it is necessary to examine the diversity of knowledge [3] and the polarization of various thinking schools from the area of educational psychology:

- standardized versus unconventional methods of research,

- passive construction knowledge versus active construction knowledge,

- global versus local statements, sociocultural view of knowledge versus personal view of knowledge (In terms of reflective judgment, the specific beliefs about the knowledge model is part of the epistemological paradigms.)

- constraints versus opportunities,

- reality of educational psychology as "discovered" databases versus reality of educational psychology as "invented" dimension,

- mediated technology versus nonmediated communications, and

- domain specificity versus domain generality.

These themes of critical analysis reflect the researches expansion, multiple discourses, and models of academic practices, as well as the uncertainty of the conceptual framework. It is also a general development of ways of thinking practice and mutual empowerment. In different cultures and theories, the data were interpreted both by a nonrelativistic epistemology and by personal dispositions to consider the organization of knowledge.

2.2. Links with other sciences

On the other hand, the contemporary identity of educational psychology is influenced by other sciences' challenges. These include to assuming the potential of new techniques, strategies, methods, new technologies that impose both new potential risks and benefits. Certainly this is not a "colonization" of knowledge or values, but a rapid feedback of the researchers under the tyranny of "supercomplexity." It is a sophisticate and improbable context within the epistemology of educational psychology combining rigorous results, unsolved research problems, new case studies, unoriginal patterns, prospective models, parallel explanations, polemic discussions, conventional assumptions, as well as stable structures of knowledge. This new comprehension of epistemological dimension conveys a conglomeration of contents mixing credible judgment models and spasmodic or uncontrolled contributions to formal science. Obviously, the synchronous and asynchronous shifts regarding past, present, and future knowledge require authors' metaskills.

2.3. International meanings of educational psychology as academic site effect

The structure of different professional curricula is associated with particular working groups. The topics and the content vary from country to country despite the fact that the goals of transnational students are comparable. Teaching psychology for both psychologists and nonpsychologists is personalized, without separating the objective form from the subjective. The following addresses illustrate the wide spectrum of practices:

http://www.psy.msu.ru/educat/uno

http://www.bps.org.uk/dtrp

http://www.groups.psychology.org.au/tlpig

http://www.bps.org.uk/dtrp|what-is-the-psychology-teachingreview.cfm

http://www.interteachpsy.org

The critical analysis of this kind of ICT resources demonstrates the heterogeneity of narratives, the different learning and teaching styles involved, and the hybridity of educational psychology. In fact, there are different cultures of educational psychology.

2.4. Multiliteracy and communication issues

Besides the conventional literacy, the scientific framework review of educational psychology includes written and visual representation of science according to various science activities: video data (oral discourses or interviews, experiments, etc.), written studies, games, online tests, physical activity from the labs, etc. To extend that the qualitative analysis of data collected can be examined from the vantage point of dichotomy popular versus high culture. The discussion about multiliteracy of educational psychology can also refer to the fractioned communities of researchers from the fieldwork and their preferences to multimodal texts negotiation. The critical review illustrates a scientific discourses area evidencing intertextuality. The scientific meanings are related to social semiotics, cognitive or metacognitive approaches, transdisciplinary efforts, neurosciences measurements, computer-mediated communication, etc. Thus, as examined in previous critical exegesis, there are interfered observations, empirical results, experiments, qualitative metrics, ethnographies, communications paradigms, and so on.

In terms of communication language, this complex network reveals meanings uncovered by psychologists, governments, or practitioners from worldwide schools. From stratified knowledge point of view, educational psychology could be considered a milestone involving particular combinations between the multiliteracy parts:

* soft or classic educational psychology,

* narrative of science,

* level of paradigms related to the shift from expanded paradigms to the "paradigms wars,"

* the conglomeration of knowledge at crossroad between transversal communication (it is related to the exchanges between science and society), vertical communications (there are various generations of authors), and horizontal communication (there are scientific texts produced by peers) in the fieldwork, and

* contemporary exercises that are difficult to be introduced in a trend (it is about revolutionary conceptions—e.g., J. Bruner decision to attack the folk psychology and pedagogy [4], or other American studies that assume new characteristics of adolescents/new developmental features, etc.).

2.5. Meta-analysis

Despite the fact that it is a social pressure for educational psychology, an essential part of the literature illustrates the interest to knowledge review. Academic resources include consistent critical exegesis of the theories, practices, and current researches. It offers bases of decisions vital for future findings and topics covered in the area as well as for emerged themes and possible trends. The most important studies are examined in terms of declarative knowledge, procedural knowledge, representational knowledge and acquaintanceship knowledge. A possible summary of substantive scientific knowledge in the fieldwork of educational psychology could include various models of epistemological development. As a result, multiliteracy and multimodality reveal multiple directions, mechanisms, and schemes regarding epistemological understanding. As a review result, we suggest a new version of the results in terms of the knowledge semantic network. In this case, the interactive multimodal semantic network could be designed by key terms as expertise of knowledge, received knowledge, subjective knowledge, purpose of knowledge, simplicity of knowledge, absolute knowing, transitional knowing, independent knowing, contextual knowing, separate knowing, connected knowing, ways of knowing, nature of knowledge and truth, source of truth, justification of knowing, etc. This qualitative exegesis supports the idea that scientific discourse of educational psychology is developing under conflicting patterns.

As a consequence of the abovementioned aspects, the hiatus between formal educational psychology and the post—post knowledge (the knowledge after all the currents, trends and theories) requires a possible protection against possible negative effects in real school life. My main scope as editor of this book was not to point out or to hunt unreasonable or past conceptual equipment or discourses, but to produce a volume that would represent a prospective exercise for the international concerns regarding educational psychology.

From the shared knowledge point of view [3], educational psychology is the result of different psychology branches (experimental psychology, clinic psychology, etc.), influences, and stands at the crossroad between positivism and narrative criticism. This overlaps with other explanation: educational psychology as applied psychology. In fact, it is about a "mixture" generated by different generations of psychologists, a multiplicity of discourses (cognitive, semantic, social or cultural discourses; intellectual, practical, and social or personal reasons) generating a new "core curriculum" of educational psychology. In these terms, the book aims to introduce the reader into a contemporary version of science based on hybrid conceptualization, internationalization of students, new technologies, new research in neurodiversity of learning, new insights on brain mechanisms, new case studies, and other psychological costs of challenge into a globalized society assaulted by social dissonances [2].

3. Some explanations regarding the book

This book is based on the need to prepare the educational psychology course—as author—as well as on multiple case studies received from schools during last decade in order to be solved.

This volume incorporates an international perspective on the developmental theory literacy and brings together six authors with different topics. Their contributions cover prominent area of research that are important for the complexity of conceptual understanding of science.

The book was not designed as a "unique" solution to the inhomogeneous educational psychology problems [5] (e.g., divergent learning and teaching cultures, different discourses about cultural psychology, brain plasticity, etc.) [6] but as a tool for teachers, policy planners, and educational psychologists, contributing to the growth of professional reflexivity in the area.

The most important problem of the book might include the key question: How to prepare an international course of educational psychology for a globalized society? We assume the fact that this book structure—as a prioritized conception—is convergent with this question.

4. Purposes of the book

A converging consensus on educational psychology is reflected into the purposes of the book:

a. to negotiate a global perspective on complex knowledge from the area,

b. to include chapter-based current research written by authors recognized in the fieldwork,

c. to provide content relevant for international comparisons. There are multiple cultural accents that justify the need of reflexivity, and

d. to deal with contemporary prospective in educational psychology.

5. Prospecting future

In order to understand and support the development of educational psychology as well as to establish remedial interventions—in terms of professional accountability—the future conceptual perspective on the fieldwork could be induced by following questions:

Toward a "correct" answer in educational psychology? A possible battle for authentic relevance? Intellectual independence? Many experiences? Cultural reasons? Irregularity of knowledge? Connectivity in multiliteracy? Dissimilar paradigms? New hypotheses in science? Crisis in educational psychology? It is educational psychology a puzzle of rivalry paradigms?

These interrogations could be considered recommendations for implementing new trends in educational psychology knowledge.

Acknowledgements

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A Critical Role of the Psychologist: A Way to Achieve Complexity in Educational Psychology

Carlos Ossa-Cornejo

Additional information is available at the end of the chapter

Abstract

The purpose of this chapter is to present a theoretical proposal for the adoption of a professional role characterized by thinking and acting critically, in order to generate educational changes. Educational psychology has been shaped by theoretical and epistemological perspectives that have not placed emphasis on the reflection or discussion of issues relevant to discipline, which has led to establishment of areas, functions and roles that are unclear and lacking consensus, from a paradigmatic logic of simplicity. It is proposed, through the bibliographic review of articles and book chapters, a position of educational psychology that promotes critical thinking as an essential part of the professional role, which allows, on the one hand, to discuss the foundational basis of this discipline, allowing greater clarity on the scope of the scientific and the professional field. On the other hand, it allows the development of a facet of promotion of changes in the educational community, from this same critical role, bringing it closer to a paradigm of complexity. Finally, the advantages and disadvantages of this position are discussed, and it is concluded that this view would establish a new perspective of educational psychology, which can be complemented by the traditional view.

Keywords: educational psychology, professional role, educational change, complexity, critical thinking

1. Introduction

Educational psychology has a long history that has been lost in the dawn of time, hand in hand with the first concerns of Greek philosophers in relation to human thought and their ability to know. However, as a discipline it does not have a transient nature of more than 100 years, a scarce time compared to other fields of knowledge.

It is possible to establish that its birth and development is mainly generated in the twentieth century, spite the identification of a varied range of European precursors such as North Americans [1] in the previous centuries. The birth and consolidation of this discipline, found between the years 1900 and 1920, is sustained and guided by ideologies and conceptual frameworks linked to the behavioral and functionalist perspective of psychology [1, 2], that will print an unmistakable seal of scientificity, evaluation and intervention of the medium to guide such behavior. This seal will be maintained throughout the twentieth century as part of the professional role.

These perspectives of psychology and their cognitivist derivation (cognitive behavioral psychology) were developed on the basis of the conception of the world and the human being of the paradigm of simplicity, which aims to value objectivity, control and reduction of variables [3, 4]. Even though other psychological views populated the twentieth century (psychoanalysis, humanistic psychology, transpersonal or systemic psychology, etc.), they have not had the same impact on educational psychology, as well as on education as a socio-cultural phenomenon, perhaps due to the fact that they search exactly the opposite, that is, the integrity, the subjectivity, the emotional; in other words, the complexity.

With a discipline inspired by the eighteenth and nineteenth centuries, and materialized in the twentieth century, I think it is fair, at the dawn of the twenty-first century, to establish a reflexive, innovative and transformative review of the educational psychology. This is necessary because even with the great amount of knowledge and expertise that has accumulated, educational psychology has not significantly impacted the educational process or contributed to the sociocultural change that is required in these times to learn and teach [5].

What kind of educational psychology does the twenty-first century need? This is a great question to answer. However, little has been done about it [6].

In this chapter we propose a resignification of the work of the educational psychologist in order to establish a complex and non-simplistic discipline that allows facing the essential tensions and dilemmas that have never been clarified [6] such as: what is the identity of educational psychology, and what is the purpose in the generation of knowledge. This desirable horizon, educational psychology from the complexity, requires a crucial tool: the availability of critical thinking. The nature of a professional is to use criticality to generate change, both of themselves as a professional and as a person, as well as of the educational community in which they are located.

The critical concept has different acceptations, on the one hand, it is seen as something decisive or of priority, which must be resolved in a timely manner, and on the other hand, as the constant evaluation of an idea or situation (definition from the Royal Spanish Academy or RAE in Spanish) [7]. In this way, and from a superficial synthesis of these acceptations, critical thinking is a tool that would allow facing relevant situations of the person or the community through questioning and reflection, in order to achieve a change in said situation, and therefore, should be the strategy that allows the work of educational psychologists to promote change as a part of the sociocultural interaction in the educational community, a focus that César Coll was already pointing out in 2001.

2. Transitions of educational psychology from simplicity to complexity

Munné [8] has pointed out that the discussion of simplicity and complexity is linked to the search for knowledge, which relates this discussion with an ontological and epistemological analysis with which human beings have explained reality. The preceding is due to the fact that it is a search for knowledge that has guided the development of scientific and professional disciplines. The way in which this search has been based has been to a great extent, although not in a single dimension, on the rationality and reductionism that are characteristics of the traditional and positivist scientific outlook. This has allowed the capturing and understanding of reality in a sequential and orderly manner, and with basic processes of cognition that promote the processing of information in an expeditious and efficient manner, in order to achieve clear, measurable and unambiguous knowledge.

This perspective is oriented by the human need of seeing this reality as something ordered, perfect and harmonious [4, 8], where even the knowledge of the people and the educational theory should also be equally ordered, structured, and specified in stereotyped actions, with a hierarchical, clear and objective management, that leaves out the problems and noises that arise in the educational level (such as learning difficulties, school demotivation, violence and power) as they cannot be explained nor adequately controlled [4, 9].

According to the perspective of the simplistic paradigm, psychology as a scientific discipline (as well as the traditional educational psychology) would fit greatly in that model, as it would present characteristics that are focused on individual attention (preferably), on the assessment of technical knowledge, in the functionality of a pathology, in the standardization of behaviors to behavioral standards (norms), and in the hierarchical relation between the fields of knowledge [6].

Even the history of educational psychology has been influenced by the characteristics of simplicity, as its birth and consolidation seemed to have responded more to pragmatic-conceptual determinations, such as the adherence to the behavioral theory of the 1920s and 1930s, rather than an academic reflection [6]. This adoption of the scientific position (uncritical and amoral), has established a reductionist approach that is focused on the teaching and learning process as a central object of educational psychology [1].

It is necessary to properly recognize the contribution of a scientific view of simplicity that has allowed the conceptual and empirical field of psychology to develop as a serious and respectable discipline, thus, producing the same result in educational psychology. However, nowadays this view has been imposed as the only acceptable paradigm for the development of knowledge and professional performance, generating difficulties in the theoretical, paradigmatic and even technical evolution that this discipline presents in its link with the educational process, which results in an inability to provide adequate answers for the challenges that arise [10].

Therefore, it is necessary to direct our practices toward the development of a perspective centered on complexity, as it is part of our everyday reality, and can give an account of our most

human characteristics, the solidary interconnection of the phenomena, and the uncertainty and the contradiction [3]. Its nature is holistic and evolutionary, in constant transformation, and includes the subject as an integral part of the construction of change. It sees knowledge as a multidimensional aspect, integrated by diverse approaches, which allow the integration of diversity, error, interculturality, emotionality and uncertainty [11].

This paradigm is characterized by a transdisciplinary conception of knowledge and praxis, which is achieved through an intricate conformation that must modify itself and, at the same time, modify the subjects that integrate its action, in a constant and participatory manner. In particular, it would allow the generation of a complex, dynamic and non-linear methodology that centrally deals with variability. This paradigm should be endowed with characteristics that are simultaneously so general as to explain phenomena in a vast variety of human situations, which is what science requires, and, at the same time, be able to accept specificities that rescue individuality and subjective contextualization [12].

Thus, in educational psychology, a view that comes from this paradigm is needed to a great extent, due to the fact that education is, precisely, one of the eminently complex areas of human interaction that requires balancing community needs such as discipline, coexistence and the curriculum, with individual needs, motivation and learning demand.

It would imply constructing from psychoeducational knowledge, with awareness, participation and meaning, aiming for a change and allowing it to change us, that is, with a tension between the technical and the critical versus knowledge and practice. In other words, generating knowledge, tools and techniques from theoretical and empirical bases as it has traditionally been done, but reflecting and modifying said elements from experience and interdisciplinary collaboration [6].

The preceding would also imply understanding and valuing the teaching-learning process as a tension between stability and change, given the need to transmit knowledge (what we call recurrence), in order to maintain the culture and, at the same time, to generate new knowledge, to produce what should lead us to change and transformation. In addition, it implies the establishment of a tension between the expertise, with all the knowledge and power that it can grant a person, and the inexperience, with all its ingenuity and dependence, while also valuing the social interaction and feedback that we generate with the other members of the educational community [13]. Finally, it would involve promoting the tension between the construction of knowledge, the techniques and professional identity, and the construction of knowledge based on the expert and inexperienced collaboration of the views, professional and non-professional, of those who share the educational framework.

To achieve this perspective from the complexity, it is of great importance to discuss the tensions of the discipline, as it is through reflection and dialog that we define the limits of knowledge and its adaptation to everyday reality. This does not involve leaving out research and disciplinary conceptualization, but establishing a balance between the latter and the social and cultural reality.

Through this, it would be possible to channel one of the greatest challenges promoted by the perspective of complexity, that is, transdisciplinarity [3]. This concept has been recently developed, due to the evolution that disciplinary groups have experienced in research, as a

result of cultural valuation, being an ideal that combines the main values of social construc-tionism, in clear opposition to the reductionism and disciplinary focus that has been gener-ated in some fields of knowledge that are born from the simplistic view.

3. Critical thinking as a strategy for the evolution of educational psychology

The critical perspective is a position in the search for knowledge that allows us to reveal other different perspectives, which opens our understanding toward interpretations different from those given to us by tradition. Critical psychology has its roots in the critical theory of the Frankfurt School, with thinkers such as Horkheimer, Adorno, Marcuse, or Habermas [14].

In this view the acceptance of the world as it is was rejected, with its inequalities and injus-tices, and with the domination of classes, indicating that reality is not determined by natu-ral reasons, but by historical and particular reasons that lead to a certain order [15]. Some of the most significant, worldwide known, authors of this perspective are Michel Foucault and Paulo Freire. Foucault is mainly known for the redefinition of concepts such as power, knowledge and discourse, as power is not exercised only with sovereignty or laws, nor with weapons or force, but with knowledge. In this sense, knowledge refers to all our opinions and knowledge about reality, to our convictions about basic facts of daily life, as well as to the value parameters we give to such events, good and evil, what is normal, and right or wrong, whether that is to an individual or social organization level.

Freire rescues the human sphere in a more social sense, politically committed with education, and argues that the traditional powers as well as authority impose an inequitable system in which the poor are deprived of their opportunity to participate and change the schemes that maintain said inequity. In addition, he advocates an education that breaks the culture of silence and generates awareness in the oppressed of the cultural and economic causes of their situation, that is, to free the human being through the awareness of their reality and their potential. For this purpose, education must be changed, because this is one of the great mechanisms that reproduce the established order and domesticates individuals in those reali-ties that do not allow them to evolve as human beings [15].

Critical psychology does not act only on dominant theories, it also deals with methods, and its central task is to face the values and practices of psychology that do not review or question the forms of oppression that could be being transmitted or reproduced by them. The questioning, through critical judgment, of the different ways of exercising power, as well as its explicit and implicit manifestations in psychological practice and in daily life, are subject of critical stud-ies, due to the fact that they can be presented as natural ways of being of some situations not discussed or, in some cases, argued as the only appropriate form of social existence.

Criticism as a reflective activity, in a kind of thinking that allows us to analyze the level of foundation of an information or idea, based both on reflection itself and on the reflection of others [16, 17]. In this way, psychology has been developed into two flows, on one hand, from social critical psychology, that is, a more theoretical approach that questions the processes

and sociocultural phenomena [18]. And on the other hand, from cognitive psychology, which has developed the concept of critical thinking, which has historically been defined as a type of elaborate thinking, that is, a cognitive process that involves evaluation and reflection [16, 19].

This type of thinking allows the construction of new knowledge, and the strategic use of it in the solution of problems present in everyday life [19–21]. Critical thinking is also defined as a type of process that is both complex and cognitive, and is composed of interrelated subprocesses that allow a person to evaluate analytically and reflectively process, judge and accept, or reject information produced in social contexts or in scientific studies [22].

However, it should not be considered only as a process oriented toward information but also to action, in a context of problem solving and interaction with other people [23, 24]. Likewise, Saiz [25] states that critical thinking is aimed at the effective resolution of situations that allow achieving wellness.

Taking account of these considerations, it is possible to consider critical thinking as a fundamental tool for the twenty-first century professionals, due to the fact that, currently, society requires professionals with high-quality work and research skills for the development of disciplines. Professionals that will not be influenced by ideological pressures or power groups, but rather, be able to move toward an autonomy of thought [26, 27]. Critical thinking is a fundamental tool in order to achieve the above, as it allows the development of high-level cognitive skills needed to achieve these tasks. This kind of thinking is considered + a tool that allows people to confront situations with less ingenuity while transcending toward the implicit objectives of processes, thus, it is essential for today's professionals, who must face increasingly complex and diverse social situations [27].

There are some situations that nowadays would benefit educational psychology by using critical thinking as a tool of their performance, as they would allow educational psychology to contribute not only to knowledge but also to social change. One of these situations is related to the relevance and effectiveness of cognitive assessment models and instruments, which are very needed in education; another example is the overcoming of the gap between theory and practice that has characterized various conceptualizations and proposals of educational psychology [6].

It is necessary to understand that the use of critical thinking as part of professional development must consider the purpose of community change in order to achieve greater welfare situations, both individual and collective [25]. This implies serious ethical considerations regarding the way in which we face both the professional exercise and the generation of disciplinary knowledge.

The ethical component in professional construction has been considered as a secondary element in the conceptualization of educational psychology in different cultures [28], due to the fact that usually, as a scientific discipline, it should be axiologically neutral (trait inherited from the paradigm of simplicity). However, this alleged neutrality is unthinkable of achieving in the educational context as its essence is eminently cultural [29].

A proposal with critical thinking in educational psychology needs to consider, among others, the previously seen topics, and complement their conceptual and practical evolution with them. This path is fundamental for the present time, based on the multiplicity of challenges that society, history and politics have brought to the education of the twenty-first century, which affect, I believe directly, this discipline.

Not considering these aspects (a path taken by traditional educational psychology) involves constructing fragmented and reductionist proposals of the human being, the educational process and the sociohistorical and political context [13], this fragmented view has allowed our discipline to be co-responsible and complicit in situations that are seen as negative. For example, the labeling and maintenance of conditions that enabled, and still enable today, discriminatory education of children and young people who present situations of intellectual disability, endorsing an unfair and segregating system.

We must have a reflection in regard to the way in which educational systems are confronted with current social requirements [5], asking, what education does the twenty-first century need? This question can be accompanied by our question stated in the introduction to this chapter. What educational psychology does the twenty-first century education need? The answer is, in my opinion, a critical and complex educational psychology.

4. A critical educational psychology as a means to achieve a complex educational psychology

A critical educational psychology should be understood as a field of action, training and critical research in the face of situations that negatively affect the educational process, including discrimination in policies and the educational system, which prevent the achievement of an education for all, as well as the recognition of human diversity as a universal right of the human being. In order to achieve this, such education should use critical thinking in massive standardization processes that fail to generate good levels of meaningful or contextualized learning for the vast majority of students [6].

In addition, a critical educational psychology could provide new insights into teaching-learning techniques and processes, so that they are able to generate both a result that is appropriate for students (and that meets quality criteria for teachers), and a process that enables the experimentation of a satisfactory pedagogical relation. And, in this context, this kind of education could support the generation, promotion and prioritization of democratic, liberating and significant relationships among the members of the educational community, in order to promote actions, spaces and policies of school and social coexistence that promote happiness, participation and meaning.

As Redondo points out [30], we should not only expect from educational psychology a proposal based on scientific knowledge that enables a psychological explanation to individual and social problems, and on more than one occasion, that makes a tradition of the psychologization of social problems, but we should also expect a proposal of empowerment that allows educational communities (at any level) to collaborate in the co-construct of their own meaningful educational establishments. The foregoing is relevant due to the fact that that is precisely the purpose of inclusive education [31], which is directly linked to the search for common welfare, through meaningful and dialogued consensus, an idea that can also be achieved through critical perspective.

The school organization is a complex reality as the notion of education itself is complex, thus, its study and action should be approached from the same perspective. It is possible to find the conditions of complexity that pointed out for organizations in general (related to the productive

field) [32], and characteristics of socio-affectivity, individual and group evolution, socio-cultural guidelines, political and ethical-regulatory impositions, etc., that are clearly evident in the school organization.

Complexity must be comprehended from the complex [33], which would imply abandoning certain beliefs and paradigms that have strongly marked the field of educational psychology (such as the focus of the teaching and learning process, individualization, and the pathologisation of behaviors). Therefore, the adoption of critical analysis should also be counted, so that a questioning of the concepts, actions, and meanings of those actions is developed [34].

Educational psychology, from a critical and complex perspective, provides an epistemological framework more in line with the great concerns of today's society, through the development of a disciplinary and professional field that would enable us to collaborate in participative and satisfactory social processes and institutions for professionals of the same area as well as for the community in general, and this certainly would allow us to achieve greater social and political relevance for educational professionals, both for teachers and non-teachers.

This would be achieved through well-known strategies, dialog, reflection, participation, the willingness of agreements; social tools that can be articulated with other logical (scientific and administrative) and technological (digital means of information and communication) tools. In the complex perspective all these elements have a place and are complementary, as they are all products of culture, history and society.

The social-(methodo)logical-technological articulation is carried out through the ethical and social understanding and valuation, which we must give to the educational phenomenon, instead of letting ourselves be caught in traps set by the simplistic view such as the excessive concern for the measurement and evaluation by the quality indicators that have been imposed in the majority of the educational systems in the world [35].

Looking for the meaning of education and the actions that generate learning is one of the central features of the socioconstructivist perspective of learning, and this is exactly what a complex and critical educational psychology should promote, as it is precisely in its core that such constructivist perspective is developed. However, it is necessary to recognize, that given the fact that there is a variety of interests and understandings in a society, we could have different meanings when it comes to education; but there is something that should not be forgotten in this twenty-first century, the fact that the imperative of human rights and the preservation of the environment has been established. For this reason, one of the aspects that can mainstream this disparity of interests and senses is the notion of quality of life, which leads to promote healthy and sustainable environments, respectful and reciprocal human relations, and self-care behaviors [36, 37].

Critical and complex educational psychology must value as an educational purpose the achievement of conditions that ensure a positive and nutritious quality of life for the members of the educational community. In addition, it should promote dialog and democratic consensus among the members of said community, as well as support respect and participation in political and administrative systems. Finally, it should encourage reflection, innovation and adaptation of people, groups and organizations to the incidences of the environment, promoting change at individual, group and organizational levels.

These purposes of critical and complex educational psychology can be achieved through the support of two tools that emerge from the reflection on new perspectives for education and psychology, posed by educators and psychologists interested in the evolution of this field. One of these tools is institutional metacognition, defined as a process of participatory reflection in the educational institution, which allows analyzing information, actions, assumptions and regulations (among others), with the participation of members of the community, in order to make people aware of the ideas, routines and actions that underlie educational decisions, enabling organizational learning and the development of learning communities [38–40].

A second element of support for the tasks outlined above is the notion of a critical friend as central role of the educational professional; this idea of a critical friend establishes the figure of an agent that questions and promotes the change of educational actors through communication and reflection, guiding these agents to impose significant changes in their decisions and actions [41–43]. The role of the critical friend is characterized by its empowering nature, to the extent that its action is oriented to promote collaborative work, potentially contributing to generate a global vision of the school [44], and above all, to favor reflective processes on the practices, make explicit assumptions and beliefs that can facilitate the transformation of educational discourses and practices [45].

These tools, among others that can be integrated or constructed, are necessary for educational psychology to maintain the basic elements that define it as a complex and critical proposal, by prioritizing, as previously indicated, reflective, communicational and participation processes in the educational community.

5. Conclusions

In light of the above, it can be noted that educational psychology presents a history of respectable tradition, contributing to the development of educational processes for just over 100 years. However, nowadays, a great problem related to the relevance and effectiveness achieved by educational psychologists when trying to contribute to educational improvement has begun to be considered [46].

The foregoing does not imply that this discipline is no longer relevant or obsolete, or that it does not share common topics with education and the school system, but rather that it is restricted by a simplistic and technical view of the person, the community and education in general. This simplistic view specifically emphasizes what is less relevant to society and education: The human being.

For this reason, a way to modify that is to redirect the focus and essence of educational psychology, equipping it with tools such as critical thinking, which will provide spaces for reflection and systematic evaluation in the face of its knowledge and the actions that it undertakes with the purpose of establishing effective and significant changes.

The traditional educational psychology cannot offer the answers that the educational challenges of the twenty-first century demand. Therefore, these answers should be obtained through the construction and evaluation of a critical and complex educational psychology, as the latter values the search of senses, collaboration, participatory reflection, innovation and creativity, etc.

The innovative approach proposed, would offer to the educational system, professionals who understand the mixed nature of the teaching and learning process, which are both individual and collective; value the great imperatives of the twentieth century, such as social participation, the valuation of human and civil rights, the democratization of management spaces, the sustainability of the environment and the impact of the human being in their environment, etc. Concerns that are, in turn, related to the topic of quality of life, which should be one of the central purposes of today's education, as it combines elements of personal well-being, socio-cultural, environmental, etc. [37].

This critical and complex educational psychology can support this response relevant to the current educational situation through at least two tools: the first being the institutional meta-cognition, a tool for school management that, based on reflection and participatory dialog, can contribute to the search of intentional and significant actions in the learning and coexistence of the educational community and school organization [40]; while the second is the role of a critical friend, a performance that educational psychologists can achieve, through advisory instances that seek to promote resignification for change, both on a personal and institutional level [41, 42].

The benefits of this position of critical and complex educational psychology are that, on one hand, there would be conscious and intentional discipline in the achievement of a quality education, while taking care of the development and respect of human values. On the other hand, there would be an innovative educational psychology that promotes an organizational change, so that it would seek to generate instances in order for the community and the educational organization to be able to adapt, in an appropriate way, to the always dynamic socio-political and historical environment.

Likewise, elements that have a greater relationship with the social than with the cultural will be reinforced, which would give a space of importance to people rather than, mainly, to knowledge. The promotion of participation, democratization of decisions and critical reflection will enable people to take more informed and respectful decisions regarding the rights of the community.

On the other side, considering the obstacles and disadvantages that may arise, we cannot fail to mention the impact of the paradigm of simplicity that often restricts the development and the potential of the disciplines. Besides, it should be noted that complexity encourages and respects uncertainty and chaos as fundamental parts of the construction of knowledge, and that is exactly what is often not allowed in educational environments.

In relation to the above, it can be projected as a difficulty, the valuation of change in the educational organization, a central element in a critical psychology, as that change is precisely what should give us new answers and development conditions. However, change is an annoying and unpleasant process for many people, and it is a phenomenon that disrupts the continuum of educational institutions, which suggests that educational agents are reluctant to promote and value change as part of the process of human formation.

Finally, we must consider the same construction of educational psychology as a discipline, and the difficulty of modifying the idea that education responds to individual processes, centered on the cognitive and based on logical and orderly sequentialities, issues that have dominated the definition of this field from the traditional perspective.

The possibility of generating a critical and complex educational psychology, should be a necessary horizon for this discipline, so that we can move forward with the current challenges and face them with relevant and constructive responses from the society and the human being, which would allow us to lay the foundations for a society that reaches, in the near future, these great ideals that we have today.

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Mother-Child Mediated Learning Experience Strategies and Children's Cognitive Modifiability: Theoretical and Research Perspectives

David Tzuriel

Abstract

The focus of this chapter is on the effects of *mediated learning experience* (MLE) interactions on children's *cognitive modifiability*. The MLE theory is presented followed by selected research findings, demonstrating the impact of MLE strategies in mother-child interactions in facilitating cognitive modifiability. Research findings support the effects of distal factors (e.g., socioeconomic status) on MLE processes and the effects of the proximal factors (MLE) on cognitive modifiability. Mediation for Transcendence (expanding) was found consistently as the most powerful strategy predicting cognitive modifiability. Distal factors in samples of children with learning difficulties were found as directly predicting cognitive modifiability. These findings might indicate a need to modify or refine the MLE theory. A few suggestions are offered for future research.

Keywords: mediated learning experience (MLE), cognitive modifiability, dynamic assessment, mother-child interaction

1. Introduction

A growing body of theory and research in the last three decades supports the crucial role of *mediated learning experience* (MLE) strategies and cognitive modifiability [1, 2–5]. In this chapter, the role of MLE strategies in mother-child interactions as a proximal factor of cognitive modifiability is focused and the empirical validation is presented. In the first segment of this chapter, the MLE theory is presented, and in the second segment, selected research findings are demonstrated supporting the crucial role of MLE strategies in facilitating cognitive

modifiability. Finally, the discussion segment deals with suggestions for future research and an integrative summary.

2. MLE and cognitive modifiability: theoretical perspective

MLE processes designate a special quality of interaction between a mediator and a learner [1, 2–5]. In this qualitative interactional process, parents or other socialization agents interject themselves between the information surrounding the child and mediate the information to the developing child. Mediation is carried out usually by modifying the information to the child so that he/she can register and internalize it [6]. Feuerstein et al. [1] conceived the MLE processes as a proximal factor that explains directly cognitive development and cognitive modifiability. *Cognitive modifiability*, which is a key concept of the MLE theory, was defined as the propensity of individuals to learn from new experiences and to change their cognitive structures. Cognitive modifiability is characterized by three main aspects: *permanence*, *pervasiveness*, and *centrality*. Permanence is the tendency of the cognitive change to be durable over time. For example, learning of the concept of number will be durable over time. Pervasiveness is characterized by a process by which a change in one part of the cognitive system affects other parts of the system. For example, learning of analogy in a figural domain will spread to understanding of analogy in a verbal domain. Centrality is characterized by a self-perpetuating process; changes in the cognitive system become autonomous and self-regulating. For example, a child who learns the concept of reversibility will tend to explore it further and apply it creatively in different contexts than the original context in which the concept was acquired.

Feuerstein et al. [1] suggested that "MLE provides the organism with instruments of adaptation and learning in such a way as to enable the individual to use the direct-exposure modality for learning more efficiently and thus become modified" (p. 206).

According to the MLE theory, parents are perceived of as active-modifying mediators that shape child's development. In the mediation process, parents use different strategies (i.e., focusing, providing meaningful stimuli, alerting attention, altering stimulus frequency, ordering events, fluctuating intensity of stimuli, linking novel information to familiar contexts, and regulating the order and timing of information sequence). Adequate mediation refers as well to motivational aspects such as arousing of attention, curiosity, and vigilance, focusing on relevant characteristics of the situation and providing meanings to neutral stimuli. Internalization of MLE processes helps the child in the future to benefit from new experiences. The integrated MLE processes facilitate not only learning from others but also autonomous self-mediation. It should be emphasized that as the child develops self-mediation strategies, the mediator should gradually withdraw from provision of mediation and encourage the child to be more autonomous in the learning process. Satisfactory MLE interactions help the learning individual to develop various cognitive functions and strategies, mental operations (i.e., comparison, analogy, syllogism), metacognitive strategies, cognitive flexibility, and intrinsic motivation. Adequate MLE processes by parents depend on numerous factors such as parents' mediation skills, awareness to the importance of mediation in developing the child's cognitive development, the child's cognitive abilities, need for mastery, emotional factors (e.g., attachment,

security, trust), behavioral predispositions (e.g., temperament, hyperactivity), characteristics of stimuli (e.g., task complexity, novelty, intensity), and situational conditions (e.g., stress, time pressure). The more the child experiences MLE interactions, the more he/she is able to learn from direct exposure to formal and informal learning situations, regardless of the richness of stimuli they provide.

Lack of or poor MLE may be derived from either inadequate environmental condition for mediation (i.e., poverty) or inner barriers for acceptance of mediation, which is potentially available (e.g., physical or mental inability of the child to benefit from mediational interactions). In the first case, limited mediation is derived from parents' low educational level, lack of awareness to or knowledge of the importance of mediation, and adverse life events.

Feuerstein's MLE theory is in some respects like Vygotsky's [7, 8] concepts of the *zone of proximal development* and *internalization* and the concept of *scaffolding* [9–12]. A basic assumption of MLE theory is that individuals learn by way of two main modalities: *direct exposure* to stimuli and *mediated learning experience* (see model in **Figure 1**). Direct exposure is characterized by unmediated encounters of individuals with stimuli in the environment. In **Figure 1**, the top and bottom arrows from the S (Stimuli) to the O (Organism-learner) represent the direct exposure. The arrows directed from the S to the H (Human) and from the H to the O represent MLE interaction. In MLE, learning is carried out by an experienced adult (i.e., parent, teacher) or peers who interpose themselves between the learner and the environment. In order for the information to be registered efficiently by the learner, the mediator modifies it in various ways. For example, the mediator may change its frequency, reorder its sequence, enhance its intensity, present it in a new context, arouse the child's curiosity, alertness, and perceptual acuity, and improve the cognitive functions required for effective input, processing, and output of information.

As can be seen in **Figure 1**, the mediator not only conveys to the child the external stimuli but also mediates how to respond to others the outcomes of processing and thinking. This phase of mediation is represented by the arrows pointing from the O to R (i.e., from mediator to child's own response). The MLE processes depend not only on parent's adequate mediation but also on children's cognitive strengths and deficiencies, motivational, emotional, and personality factors, behavioral tendencies, task characteristics, and situational conditions. The mediator represented by the H should be flexible and "elastic." He/she should adjust mediation based on the phase of child's phase of learning. Mediation should be enhanced or withdrawn based on the child's difficulty level or progress and improvement as well as on environmental conditions that affect the learning process.

According to the MLE theory, a clear distinction is made between distal and proximal factors of cognitive modifiability. Distal factors are not considered as direct in explaining cognitive
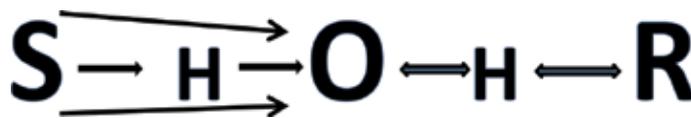
Figure 1. The mediated learning experience (MLE) model (copied by permission from Feuerstein et al. [1]).

modifiability. Examples of distal factors are poverty, socioeconomic status, hereditary factors, and emotional disturbance. They might correlate with cognitive modifiability and have indirect effect through the proximal factor of MLE. MLE interactions are conceived as a *proximal* factor explaining individual differences in learning and cognitive modifiability.

In developing the MLE theory, Feuerstein et al. [1] suggest 12 criteria or strategies; the first three criteria are considered as necessary and sufficient for an interaction to be classified as MLE: *Intentionality and Reciprocity*, *Meaning*, and *Transcendence*. These three strategies are universal and can be found in all cultures. They do not depend on the language modality or content of mediation. They might be expressed by body gestures, face mimics, and verbalization. The other 10 criteria are culturally related, task-dependent, and reflect the mediator's and child's unique characteristics such as cognitive style, motivational orientation, and types of skill and content.

The first five MLE strategies were operationalized and observed in interactions of mother-child (e.g., [2–4, 6, 13–18], peer mediation [19–28], siblings [17, 22, 29], and teachers [30, 31]). These strategies are presented in the following section.

2.1. MLE strategies

a. *Intentionality and Reciprocity* refers to a mediator's deliberate efforts to change a child's attention, awareness, and perception. Mediation for Intentionality alone is inadequate without the child's reciprocity (vocal, verbal, or nonverbal). Intentionality and Reciprocity is observed, for instance, when a caregiver offers a toy to a child or verbally focuses a child's attention to a plant and the child responds to it. This strategy is considered crucial for starting the mediation process and later on for enhancement of other MLE strategies such as feelings of competence and self-regulation.

b. *Mediation of Meaning* is characterized by mediator's behavior that conveys the affective and value-oriented significance of an object or event. It can be expressed verbally ("Wow, how beautiful") by relating it to other events and emphasizing its importance and value ("I received this ring from my mother"). Mediation of Meaning may also be expressed nonverbally by facial expression, tone of voice, and repetitious actions that convey the significance of the object or event. Children experiencing Mediation of Meaning tend to actively attach future meanings to new experiences rather than passively wait for meanings to appear.

c. *Mediation of Transcendence* is characterized by interactions in which the mediator goes beyond the concrete situation or beyond the immediate needs of the child. The mediator tries to reach out for goals that are beyond the specific context or activity. A parent who interacts with his/her child may go beyond the specific experience at a certain time and teach strategies rules and principles (i.e., "draw first the main figure and then the secondary lines") to generalize to other situations. For instance, in a play situation, the parent may mediate the principles of game and generalize them to other situations. Mediation for Transcendence depends on the first two strategies. The combination of all three first

strategies enhances the development of cognitive modifiability and expands the individual's need system.

d. *Mediation of Feelings of Competence* refers to an interaction in which a mediator rewards the child for a successful performance or interprets to the child his/her own success. Mediation of feelings of competence is also carried out when the mediator sequences the task, organizes the environment, and provides occasions to ensure success.

e. *Mediation of Self-regulation* is characterized by interactions in which a mediator helps the child to control behavior by either slowing down or accelerating his/her response to events, depending on task difficulty level. Mediation for self-regulation is expressed most frequently when the mediator helps the child to inhibit impulsivity level by delaying response to a stimulus. Self-regulation is mediated usually by arousing awareness to task characteristics (e.g., analyzing the task components), providing metacognitive strategies and modeling of self-regulation behavior.

3. Dynamic assessment of learning potential

An integrative component of the MLE theory is related to dynamic assessment (DA) of learning potential. DA refers to "an assessment, by an active teaching process, of a child's perception, learning, thinking, and problem solving. The process is aimed at modifying an individual's cognitive function and observing subsequent changes in learning and problem-solving patterns within the testing situation" (p. 6, 2). DA is based on perception of the cognitive system as modifiable beyond barriers of age, etiology, and severity of handicap [1, 2, 32–38]. DA has been motivated by the inadequacy of standardized static tests to provide accurate information about the individual's learning ability, specific deficient functions, metacognitive strategies, mediation strategies that are required for cognitive modifiability, specific learning processes, and specific recommendations for individualized learning plans. DA approach is different from static standardized tests in terms of goals of testing, nature of tasks, test situation, change of test focus from end product to process orientation, and interpretation of results. Cognitive modifiability is measured in most studies by DA, which tap "learning how-to-learn" skills. DA of learning potential is based mainly on Vygotsky's sociocultural theory [7, 8], specifically the *zone of proximal development* concept, Feuerstein's *mediated learning experience* (*MLE*) theory [1] and Tzuriel's DA approach developed in the last four decades [2–5, 35–43]. Unlike *standardized* (*or static*) tests where the examiner presents items to the child and records his/her response without any attempt to intervene, in DA the examiner tries to teach and change the child's performance while observing the amount and quality of changes. The conceptualization behind DA is that it reflects MLE strategies at home more than standardized static measures of intelligence. The MLE strategies used within the DA procedure are more similar to learning processes in other life contexts than do standardized testing methods. They give therefore better indications about learning potential and future changes of cognitive development. For a detailed discussion, the reader is referred to Tzuriel's writings [2, 3, 36–42].

4. MLE and cognitive modifiability: research perspective

The effects of parent-child interaction on cognitive development captured the interest of researchers for several decades [1–8, 14, 19–22, 29, 31, 44–49]. The general hypothesis in studies deriving from the MLE paradigm is that parent-child MLE interactions predict significantly children's cognitive modifiability and that *postteaching* performance on DA is reflecting children's cognitive ability more than *preteaching* performance (i.e., static measure). This hypothesis is based on the idea that adequate parent-child MLE offers children "psychological tools" [7, 8] that serve to expand and differentiate their *zone of proximal development* (ZPD). According to Vygotsky, MLE interactions are more accurate in predicting the upper level of ZPD than static test performance [2]. In the following, the *Observation of Mediation Interaction* scale [13–16] that was used to measure MLE strategies and Tzuriel's DA approach that was used to measure cognitive modifiability are presented. Following these methodological aspects, research that validates the impact of MLE on cognitive modifiability is presented.

4.1. Observation of Mediation Interaction (OMI) scale

Research on MLE processes has been carried out mostly by videotaping of the interaction and analyzing them later by observers using the *Observation of Mediation Interaction* scale (OMI; [14–17]). For instance, when a parent focuses the child's attention on some aspects of a stimulus, it has been coded as *Intentionality* (*focusing*) only if it was *reciprocated* by the child's response. Transcendence (*expanding*) was coded when the mediator tried to generalize a rule, suggest a concept, or a principle that goes beyond the concreteness of the situation. The OMI is based on an interaction "event" that might contain one or more MLE strategies. A basic assumption of the OMI is that MLE processes observed in a seminatural experimental context reflect the spontaneous MLE processes at home; this has been supported in several studies [13–17]. In all studies, dyads of mothers with their children (or peers or siblings) were videotaped in a seminatural context of an adjunct room of the kindergarten, or in the child's home; both places were familiar to children and their mothers. In a free-play condition, sets of games and play materials were placed on the table in a kindergarten room or at home. Mediators were instructed to play in whatever they want with their child for 15 minutes. More specifically, they are instructed to play in a similar way they are used to play at home. In a structured situation, mediators were given a few problems, which they had to teach their child. The tasks in different studies were composed of analogical problems, picture arrangement, and problems requiring logical inference; all tasks *were not* related to the tasks used in the following DA procedure. It should be emphasized that no directions were given as to how to teach the child. The OMI was found as strongly reliable as measured by interrater reliability and as robustly valid in many studies [2–6, 13–22, 29].

4.2. Tzuriel's dynamic assessment approach of learning potential

Tzuriel's DA approach [2–5] with young children is based on both Vygotsky's sociocultural theory and Feuerstein's MLE theory. The assessment approach is characterized by innovations of test materials, assessment procedures adapted for the developmental stages of young

children, clinical and measurement versions of assessment, communication aspects, phases of assessment, and recording and scoring methods.

In all studies reported below, we used a measurement approach according to which pre- and postteaching phases are given without mediation and the child's responses are scored; a short-term mediation phase is given between the tests. In the following, an example of a DA measure of young children, the *Children's Analogical Thinking Modifiability* (CATM; [43]) is presented. For further description of Tzuriel's DA measures, readers are referred to Tzuriel [2–5].

The CATM (see **Figure 2**) is composed of three phases of teaching: preteaching, teaching, and postteaching. Each phase is composed of analogies increasing in level of difficulty. The operation of analogy was chosen as it has been considered as a powerful operation that covers a wide range of cognitive processes and as a principal operation related to problem-solving tasks and academic activities [50–53]. The CATM test is composed of 14 items for each of the preteaching, teaching, and postteaching phases. The test materials include 18 colored blocks used to present and solve the analogies, and problem cards for the examiner. The problems are graduated in level of difficulty. The advanced problems require a relatively higher level of abstraction and cognitive functions such as systematic exploratory behavior and simultaneous consideration of a few sources of information. In item 13, for example (**Figure 2**), the child must compare the colors in the first pair of the problem, grasp the principle of opposite position of colors, apply the same principle in the second pair, and then compare the relations of shape and size in the first pair and apply the same relations in the second pair. As can be seen in **Figure 2**, the relation of colors is opposite in the first pair: **top**-yellow changes to **bottom**-yellow and **bottom**-red changes to **top**-red. The child must apply the rule of opposite colors to the second pair: **top**-blue changes to **bottom**-blue and **bottom**-yellow changes to **top**-yellow. After finding the correct colors, the child can analyze the relations for the other two dimensions of shape and size. In the teaching phase, the child is mediated to (a) search for relevant dimensions required for solution, (b) understand transformational rules of analogy, (c) use systematic exploratory behavior, (d) verbally anticipate the answer, and (d) improve search efficiency. There are two scoring methods: "all-or-none" (e.g., a score of 1 to full answer) or "partial credit" (e.g., a score of 1 for each correct dimension of color, shape, and size).
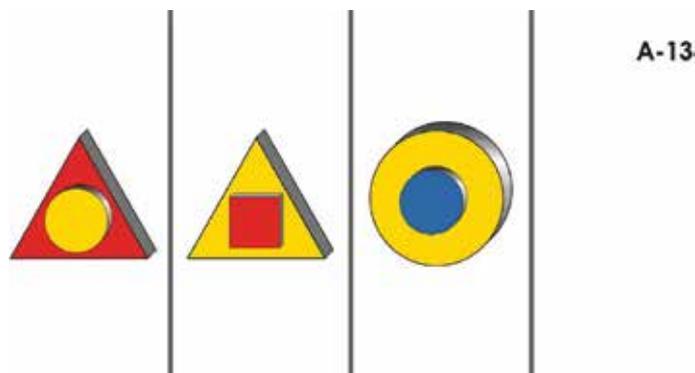
Figure 2. Example problem from the *Children's Analogical Thinking Modifiability* [43] (by permission of the author).

4.3. The effects of MLE strategies on cognitive modifiability

The general hypothesis in studies deriving from the MLE theory is that parent-child MLE is more accurate in predicting the cognitive modifiability of the child (i.e., postteaching score) than a static test score (i.e., preteaching score). This hypothesis is based on Vygotsky's theory [7, 8] that proper mediation affords children "psychological tools" that serve to expand their *zone of proximal development* (ZPD). Therefore, the upper level of ZPD measures would be more accurate as a predicted outcome of MLE interactions than static test performance [2]. In a series of studies carried out at Bar-Ilan University laboratory by Tzuriel [2–5, 38], it was demonstrated that MLE strategies directly explain cognitive modifiability of children as measured by DA instruments. In the following, studies demonstrating the relation between parent-child MLE interactions and cognitive modifiability are presented. Because of space limitation, only two example studies are presented.

The main objective of the studies reported below was to validate the relationship between MLE processes and children's cognitive modifiability and support the main hypothesis that the proximal factor of MLE is a causal factor that explains cognitive modifiability. Another objective was to find out which specific combination of MLE strategies predicts children's cognitive modifiability. A summary of findings is presented in **Table 1**.

A major finding repeated in almost all studies was that children's postteaching scores on DA measures were better predicted by MLE mother-child interactions than by static test scores (or preteaching DA scores). Because of space limitations, only two studied are reported here [20, 21]. The most striking finding emerging from **Table 1** is that in 10 out of 12 studies the strategy that has emerged as most powerful in predicting cognitive modifiability was *mediation for Transcendence* (expanding), a finding that will be discussed later.

Study 1. In the first study, a sample of kibbutz mother-child dyads (n = 47) was observed in a free-play situation for 20 minutes [20]. The kibbutz young children (22 boys and 25 girls, age range = 4:7–7:8 years) were then administrated the *Raven Colored Progressive Matrices* (RCPM) [54] and the *Children's Inferential Thinking Modifiability* test [40]. Performance on the CITM provides three types of scores: preteaching, postteaching, and gain. The data were analyzed by three stepwise regression analyses, one for each score. In each analysis, the RCPM and MLE-Total scores were assigned as predicting variables. The findings, presented schematically in **Figure 3**, revealed a very interesting pattern of prediction. The preteaching (static) score was predicted only by the RCPM (R = 0.40, *p* < 0.004). The postteaching score was predicted by both MLE-Total and RCPM (R = 0.69, *p* < 0.002). The gain score was predicted only by MLE-Total score (R = 0.43, *p* < 0.001). The interpretation of this progression of prediction was as follows. The preteaching score, which is a static score, was predicted only by the RCPM, which is also a static score. This finding settles with the notion that the common variance of two cognitive tests is higher than the common variance of a cognitive test with an observed behavior (i.e., MLE score). The postteaching score is presumably composed of two components: the previously acquired inferential skills (manifested in preteaching performance) and what has been learned as a function of mediation provided in the teaching phase. It is therefore reasonable to assume that the first component (postteaching score) was attributed to the static RCPM score and the second component (postteaching score) to

Study	Grade	Age	n	Sample	Dyad	DA tests	Analysis	MLE strategies
1. Tzuriel and Eran [20]	K	5–6	47	Typical	M-C	CITM	Regression	MLE-Total
2. Tzuriel and Ernst [21]	K	5–6	48	Typical	M-C	CATM	SEM	Transcendence
3. Tzuriel [60]	K	5–6	48	Typical	M-C	CATM	Regression	MLE-Total competence
4. Tzuriel and Weiss [26]	2	7–8	54	Typical	M-C	CITM	SEM	Transcendence regulation
5. Tzuriel and Hatzir [61]	K	5–6	60	Typical	M-C + F-C	CATM CF	Regression	Transcendence intentionality and reciprocity
6. Weitz and Tzuriel [62]	3–4	5–8	56	LBW + NBW	M-C	CATM CF	Regression	Transcendence regulation
7. Tzuriel and Weitz [28]	3–4	9–10	85	LBW + NBW	M-C	CMB CF	Regression	Transcendence
8. Tzuriel and Shomron [25]	2–4	7–10	100	LD	M-C	CMB	SEM	Transcendence
9. Tzuriel and Bettan [27]	K	5–6	72	ADHD	M-C	CMB	SEM	Transcendence
10. Tzuriel and Rokach [31]	3–6	8–12[a]	90	Typical	Siblings	CMB	SEM	Transcendence
11. Tzuriel and Caspi [19]	3	8–9[a]	100	Typical	M-C + Peers	CMB STI	MANOVA Regression	Transcendence
12. Tzuriel, Rotem and Kashy-Rosenbaum [63]	K	5–6	100	Typical	M-C + T-C	CATM	ANOVA Regression SEM	Transcendence

[a]Age of older sibling.

Reading: LBW = low birth weight, NBW = normal birth weight; LD = learning disabled; ADHD = attention deficit hyperactive disorder; SEM = structural equation modeling; M-C = mother-child; F-C = father-child; T-C = teacher-child; CATM = *Children's Analogical Thinking Modifiability*; CITM = *Children's Inferential Thinking Modifiability*; CMB = *Cognitive Modifiability Battery* (Analogies Subtest); CF = *Complex Figure*; STI = *Seria-Think Instrument*.

Table 1. Studies on MLE strategies and cognitive modifiability: sample characteristics, DA measures, analyses used, and MLE strategies (partially adapted from Tzuriel [5], with permission of the publisher).

the mother-child MLE score. Analysis of the gain score was significantly predicted only by mother-child MLE score. This increasing pattern of progression of prediction across the three regression analyses is quite intriguing as it shows that "*the more the criterion score was saturated with teaching effects, within the testing DA procedure, the higher was the variance contributed by MLE mother-child processes*" ([2], p. 155).

Study 2. In this study [21], we observed a sample of kindergarten children (n = 48) and their mothers in free-play and structured (teaching) conditions and tested the children with the
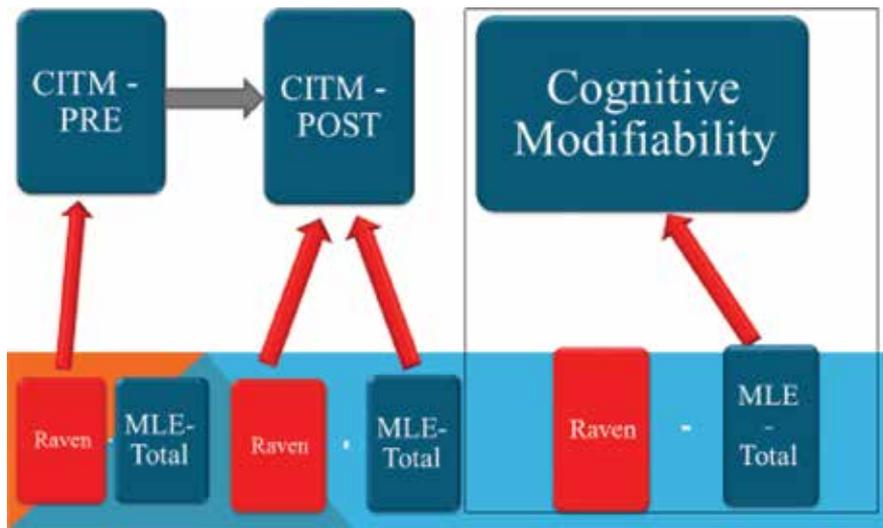
Figure 3. Prediction of CITM preteaching, CITM postteaching, and cognitive modifiability by Raven's score and total MLE score.

CATM test (see above). Mothers' socioeconomic status (SES) and intelligence measured by *Raven's Standard Progressive Matrices* (RSPM) [55] were considered as distal factors, MLE strategies as proximal factors, and CATM postteaching score as indicator of cognitive modifiability. Children's performance on the RCPM and the CATM preteaching scores were introduced as static test scores for comparison with the CATM postteaching score. The findings, analyzed by *structural equation modeling* (SEM, see **Figure 4**), show that the MLE strategy of Transcendence significantly predicted the CATM postteaching score and the MLE strategy of Meaning predicted the preteaching score. The children's RCPM score did not predict or was not predicted by any of the variables. None of the distal factors of mother's SES or intelligence predicted cognitive modifiability (i.e., CATM postteaching). The authors interpreted the findings as supporting the MLE theory regarding the causal effects of distal and proximal factors (MLE) on cognitive modifiability. Furthermore, the contribution of the *specific MLE strategy* could be attributed to the phase of testing. The prediction of CATM preteaching score by mediation of Meaning, which includes labeling of information, was interpreted as signifying the importance of verbal labeling of information in first encounters with analogy problems such as the CATM preteaching problems. On the other hand, the prediction of CATM postteaching score by mediation for Transcendence (expanding) indicates the significance of learning of abstract rules, cognitive strategies, and principles such as those mediated in the teaching phase and later assessed in the postteaching phase. Thus, children whose mothers used high level of mediation for Meaning internalized this mechanism of mediation and therefore performed better on the preteaching phase. Children whose mothers used a high level of mediation for Transcendence internalized this specific mechanism and used it later in other learning contexts. These results support the "specificity" [56] of the MLE strategies as predictors of cognitive outcomes.
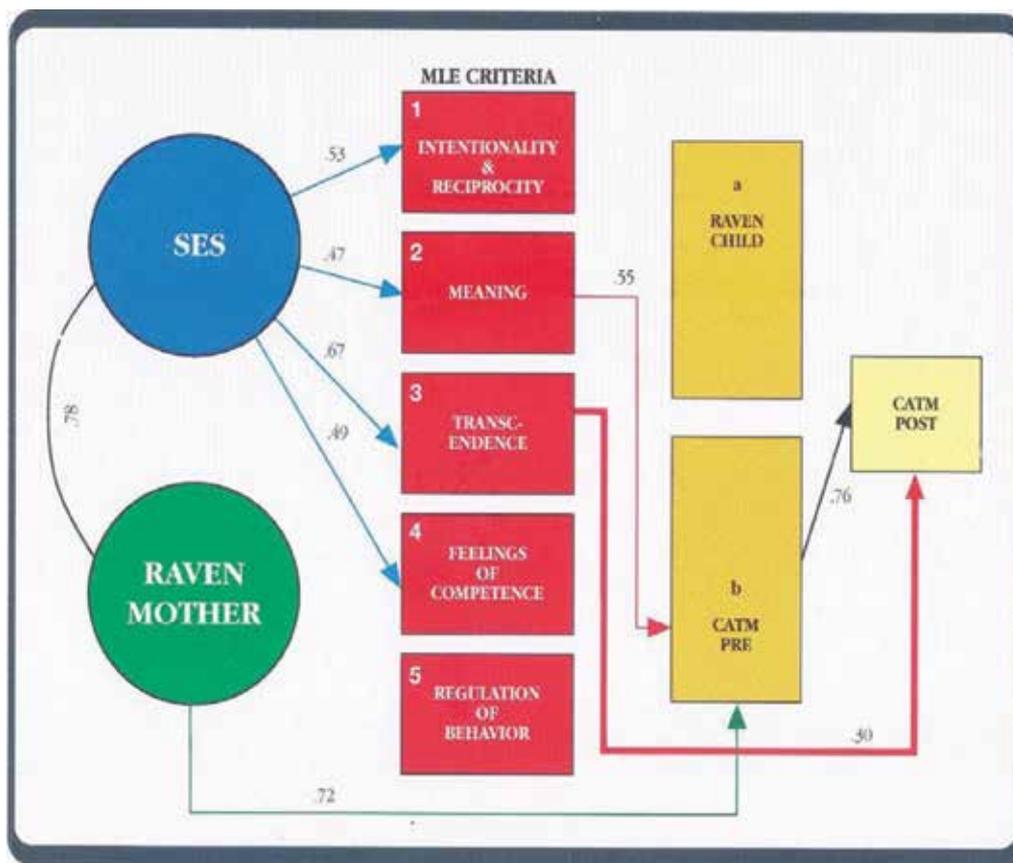
Figure 4. Structural equation model analysis: the effects of distal factors (mothers' socioeconomic level and intelligence) and proximal factors (MLE strategies) on children's cognitive modifiability (copied by permission from Tzuriel and Ernst [21]).

The SEM analysis approach was applied in a series of seven studies [19–22, 29, 31, 25–28]. In all studies, we established the theoretical model of the effects of distal and proximal factors on cognitive modifiability. The overall results of the SEM analyses were congruent with MLE theory, according to which proximal factors explain individual differences in children's cognitive functioning, whereas distal factors (i.e., SES level, mother's intelligence, child's personality, mother's acceptance-rejection of the child) do not have a direct effect on children's cognitive modifiability, although they do explain some of the MLE strategies (proximal factor).

In contradiction to the MLE theory, in two studies, distal factors were found as directly predicting cognitive modifiability; the samples in both studies were composed of children with learning and behavioral difficulties. For example, in a study carried out on kindergarten children with ADHD [51], two MLE strategies, Meaning ($\beta = 0.26$) and Transcendence ($\beta = 0.46$), predicted cognitive modifiability. Two distal factors severity of the ADHD ($\beta = -0.26$) and mother's SES level ($\beta = 0.46$) explained directly children's cognitive modifiability; these findings do not correspond

the MLE theory. These findings indicate that the higher the severity of the child's ADHD and the lower the mother's SES level, the lower the cognitive modifiability of the child. Similarly, in Tzuriel and Shomron's [25] study on children with learning disability (LD), one distal factor *Home Environment* (HOME [47]) explained directly children's cognitive modifiability ($\beta = 0.60$) together with a summed score of four MLE strategies ($\beta = 0.41$). These findings indicate that for children experiencing learning difficulties, the distal factors influence directly the child's cognitive modifiability. It is possible to explain these findings by the fact that in samples of children with learning difficulties (e.g., ADHD, LD), even adequate mother-child mediation is not sufficient to overcome or "nullify" the distal factors' strength of predicting children's cognitive modifiability. It should be emphasized that mothers of children with learning difficulties had no prior training for mediation. We assume that training of mothers to use better MLE strategies in their spontaneous interaction with their children would reduce significantly the effects of the distal factors on children's cognitive modifiability. These findings offer an elaboration of the MLE theory. The effects of distal factors on children's cognitive modifiability in samples of typically developing children are not direct (as conceptualized by the theory), whereas in samples of children with learning difficulties, distal factors have direct effects on children's cognitive modifiability unless a more intensive level of mediation is applied. An intensive use of MLE strategies would minimize the effects of the distal factors. Enhancement of MLE strategies is essential to ameliorate the direct effects of distal factors on cognitive modifiability.

This modification of the MLE theory should be investigated in intervention studies where mothers of children with learning difficulties will be trained to use MLE strategies. We suggest that mothers trained to mediate (experimental) would be compared with nontrained mothers and their interactions with their children should be observed a year later after the effects of training are internalized and assimilated into the mother-child interactional system. The children should then be administered DA measures to assess their cognitive modifiability. My hypothesis is that distal factors will directly affect children's cognitive modifiability among nontrained mothers but will be significantly lower or disappear among trained mothers.

5. Discussion and conclusions

The empirical findings of studies on the effects on mother-child MLE strategies on children's cognitive studies support both commonsense knowledge and the MLE theory. MLE strategies used spontaneously in family interactions seem to facilitate the child's ability to benefit from mediation offered within the family context and later to generalize to other formal and nonformal learning situations. An intriguing finding that has emerged consistently in most studies is that cognitive modifiability was predicted most powerfully by mediation for Transcendence (expanding) (**Table 1**). The effect of mediation for Transcendence is articulated in view of the fact that it is the least frequent strategy. Mediation for Transcendence is expressed by the mediator's efforts to focus the child on concepts, generalizations, and principles, thus developing his/her abstract abilities.

The findings that distal factors in samples of children with learning difficulties [25, 27] directly predict children's cognitive modifiability might indicate a need to modify or refine the MLE theory.

The distal factors were found as predictors of the proximal factor of MLE strategies in typically developing children, but they do not predict children's cognitive modifiability. The MLE strategies in turn do predict children's cognitive modifiability. However, in samples of children experiencing learning difficulties, the distal factors (adverse conditions) were found to affect directly children's cognitive modifiability. It was suggested that to cancel or overcome the adverse effects, much more "robust" mediation efforts should be applied. The effects of the distal factors on children's cognitive modifiability would diminish should mothers be trained to mediate.

I suggest refining the MLE theory and extend the concept of MLE to include it within a more complex transactional-ecological model. We should reconsider the reciprocal nature of MLE and cognition within a broader scope of environmental factors, as well as dealing with the MLE processes as one component within a holistic framework. This is especially important because of the menace of overextending the influence of MLE processes and overgeneralizing it to explain too many cognitive and noncognitive phenomena. It is imperative to establish the conceptual limits of MLE theory and delineate its specific effects. The term "transactional" (rather than interactional) is aimed at the idea that MLE processes and cognitive functioning are reciprocal and have mutual effects. Wachs and Plomin [57] distinguish between interaction and transaction. Interaction involves individuals differentially reacting to similar environments, whereas transaction implies effects that are differential for both individuals and environments. A different distinction was suggested by Tzuriel [2, 5]. Interactional process is conceptualized by relative simplicity and transience of effects, whereas a transactional process is dialectically *circular* with a continual change and mutual adjustment of the factors involved. This dialectical circularity poses a real challenge for theory development and methodology, but with recent advances in technology and sophisticated statistical analyses, it can be handled effectively. There is a possibility though that the children's cognitive functioning might influence parent-child MLE strategies and that the circular relation between these factors depends on wider family, social, and cultural contexts. A similar conception has been discussed in Bronfenbrenner's [59] ecological approach and by Super and Harkness [58], who proposed the concept of *developmental niches*. Some evidence for the effects of age, context, and severity of a child's problems and cultural background has been reported as well [13–16, 19–22, 25–28]. In addition to cognitive aspects, we should consider children's affective and motivational processes as prerequisite factors in determining the nature of MLE processes and children's cognitive modifiability.

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The Importance of Mindfulness in the Achievement of Optimal Functioning: Conceptualization for Research Development

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Additional information is available at the end of the chapter

Abstract

The concept of 'optimal functioning' has emerged as a major line of research development in *educational psychology*. Optimal functioning, which reflects the paradigm of *positive psychology*, is concerned with a person's achievement of maximization in his/her functioning, whether it is mental, cognitive, emotional, or social. This inquiry places strong emphasis on importance of flourishing, happiness, and the proactivity of human endeavors. An important question then for consideration, from this testament, is how researchers optimize the achievement of optimal functioning. We have recently made progress by focusing on empirical research development and methodological conceptualizations into the study of optimization. Our conceptualizations, collectively, contend that there are psychological, educational, and psychosocial variables that operate as sources of 'energization', which then stimulate the buoyancy of motivation, personal resolve, effective functioning, strength, and effort expenditure. Energization, in its totality, from our postulation, may then arouse, intensify, and sustain a person's internal state of functioning. Our cross-institutional, cross-cultural research collaboration (e.g., Australia, Malaysia, and Taiwan), to date, has considered one notably construct that could serve as a source of internal energization for the achievement of functioning: *mindfulness*. We strongly believe that the totality of mindfulness, positive in nature, could play a central role in the psychological processes of human agency.

Keywords: positive psychology, mindfulness, optimization, optimal functioning, cross-cultural beliefs, Buddhism, nirvana, enlightenment

1. Introduction

Positive psychology [1, 2] is an important paradigm in the field of psychology that focuses on the importance of *proactivity in human agency*. This theoretical positioning places emphasis on a person's achievement of *optimal functioning* and his/her state of *flourishing*. Optimal functioning, in this case, is concerned with the maximization of a person's internal state of functioning, whether it is mental, cognitive, emotional, and/or social.

An important of research inquiry for consideration may entail examination of optimal functioning. *What is the best that I can do as a person*, both academically and non-academically? *How do I achieve my optimal best in a subject matter*? These questions are reflective, in nature, and form the basis for personal growth, where appropriate. The best that a person can do (e.g., achieving exceptional wealth), in this case, indicates his/her internal state of optimal functioning—mediocrity, for example, may indicate an internal state of low optimal functioning. Understanding the nature of a person's internal state of optimal functioning and how one reaches this state of exceptionality is the central focus of this chapter.

Our cross-cultural research collaboration, merging ideas, knowledge, and philosophical beliefs from both Western and Eastern contexts, has so far resulted in an innovative conceptualization of the theoretical concept of *mindfulness* [3]. We argue, in this chapter, that personal engagement in mindfulness could actually assist a person to achieve a state of optimal best. This postulation regarding the potential role of mindfulness, we contend, may yield a number of educational significance for educators, school administrators, and industry bodies—for example, the design and creation of an educational program, reflecting the tenets of mindfulness [3], which could then optimize a student's internal state of functioning (e.g., optimal cognitive functioning).

2. The importance of optimal functioning

Positive psychology explores the *proactivity of human behavior.* This theoretical orientation is non-deficit and suggests that the study of achievable human endeavors is a main priority for consideration [1, 4]. Negative and deficit models of human behavior (e.g., behaviorism) tend to focus on maladaptive functioning (e.g., school disengagement: [5]), pessimism, and preventive measures for rectification purposes. This approach to the study of human behavior is outdated, perhaps, as very little is made to understand about human strengths and the facilitation of self-fulfillment of inner needs.

Positive psychology, credited to Seligman, Csíkszentmihályi, Diener, Maslow, and others is a 'branch' of psychology that focuses on inner strengths, resilience, virtues, and personal flourishing. This theoretical orientation places emphasis on the 'positives' and the self-gratification and self-fulfillment of a person's inner needs [1, 2]. Rather than focusing on weaknesses, shortcomings, and preventive measures, positive psychology delves into positive outlooks in life, such as the personal enrichment of positive emotional functioning (e.g., an

extreme sense of happiness), positive social climates, and achievement of optimal functioning [6, 7]. In the context of academia, for example, a secondary school student may project and incline towards positive outlooks in life, and not focus on past and/or current shortcomings and failures. This may consist of personal resolve in the learning of different subject areas for mastery, personal growth, and enjoyment purposes. From a non-educational point of view, likewise, a senior citizen may capitalize on his/her positive feel-good experiences to lead a healthier lifestyle.

We contend that optimal functioning is an important facet of personal development. Optimal functioning varies in accordance with the context at hand, for example, an extreme state of happiness that is sustained (e.g., *optimal emotional functioning*), exceptional mathematic results (e.g., *optimal cognitive functioning*), and/or proactive social relationships with others in the community, consequently resulting in the establishment of networks, etc. (e.g., *optimal social functioning*).

Specific to positive psychology is the tenet that individuals, in general, strive to achieve self-fulfillment and live to their fullest potentials [8]. What is of interest for us, as individuals, is how *we achieve an internal state of optimal functioning*. This is a pervasive issue that a number of scholars, to date, have made concerted attempts to address (e.g., [9, 10]). In the area of *student motivation*, a number of researchers have proposed different theoretical orientations that could explain students' motivational beliefs, cognition patterns and learning experiences, for example: *personal self-efficacy* [11, 12], *academic buoyancy* [13, 14], *optimism* [15, 16], and *hope* [17, 18].

Our own research development has also made theoretical, methodological, and empirical contributions to the study of optimal functioning. In particular, for consideration, clarity, and in-depth understanding, our seminal publication in 2016, titled '*Introducing the concept of Optimal Best: Theoretical and methodological contributions*', proposed a framework to explain the concept of optimal achievement best [19]. We revised this initial proposition in 2017 and formally introduced our theoretical contribution of optimal functioning, coined as the *Framework of Achievement Bests* (e.g., [7, 8]). The Framework of Achievement Bests provides theoretical understanding into *the process of optimization*, which we argue could account and explain a person's achievement of optimal functioning. Like any other inquiries, our theorization of optimization is ongoing in terms of its development [3]. One notable aspect, arising from the recent Phan et al. [7] publication is a focus on the methodological conceptualization of the process of optimization. In this chapter, we want to delve in detail into a methodological model of optimization for investigation that we have just conceptualized. Some aspects of this innovative conceptualization of optimization have briefly been mentioned in Phan et al [26].

2.1. The process of optimization: an overview

How individuals reach their optimal functioning in life is a question that of interest for many scholars. Existing research, interestingly, has explored other theoretical concepts that also connote the importance of optimal functioning: *personal best goals* [20, 21], *flourishing* [22, 23], *thriving* [24, 25], and *personal striving* [26, 27]. However, despite this development, very little is known about a *process* that could facilitate achievement of experience of flourishing, thriving, etc.

Optimization is process that could serve to facilitate and optimize a person's state of functioning. Researchers have often used terminologies and phrases such as 'optimizing effect', 'Variable A can optimize Variable B...', and 'human optimization' without truly explaining what they actually mean. The notion of optimization, we contend, is not analogous to the concepts of 'enhancement', 'predictive effect', and/or 'causal flow'. Fraillon's [9] theoretical overview of subjective well-being briefly mentioned the concept of optimization, which the author theorized as the difference between a person's *actual best functioning* and his/her *notional best functioning*. This definition, despite its limited scope, provided grounding for the development of our Framework of Achievement Bests [7, 8].

Our theorization of the Framework of Achievement Bests, derived from Phan et al.'s [19] article, postulates the *dichotomy of levels of best practice* by which there are there are different levels of a person's functioning—for example: *realistic achievement best*, defined as a person's actual level of functioning at the present time, and *optimal achievement best*, defined as a person's indication at the present time of the maximization of his/her competence in a subject matter. In the context of academia, for example, realistic achievement best focuses on a student's actual demonstration of knowledge and/or skills (e.g., I can solve 20 easy arithmetic problems and get 90% correct). Optimal achievement best, in contrast, emphasizes a student's mastery competence of his/her learning, which in this case reflects the best of his/her ability (e.g., I know that I can solve more complex arithmetic problems and get 85% correct). Our theorization [7, 8], this case, contends that reaching optimal achievement best from realistic achievement best would require some 'form' of optimization.

Adapting from our recent work [3, 7], **Figure 1** illustrates a methodological conceptualization of the process of optimization that we recently developed. We argue that in order to understand the process of optimization, it is important for us to expand on the tenets of optimal functioning. In this analysis, from our conceptualization, an achievement of optimal functioning requires the fulfillment of three main criteria: (i) that there is a *point of reference*, denoted as
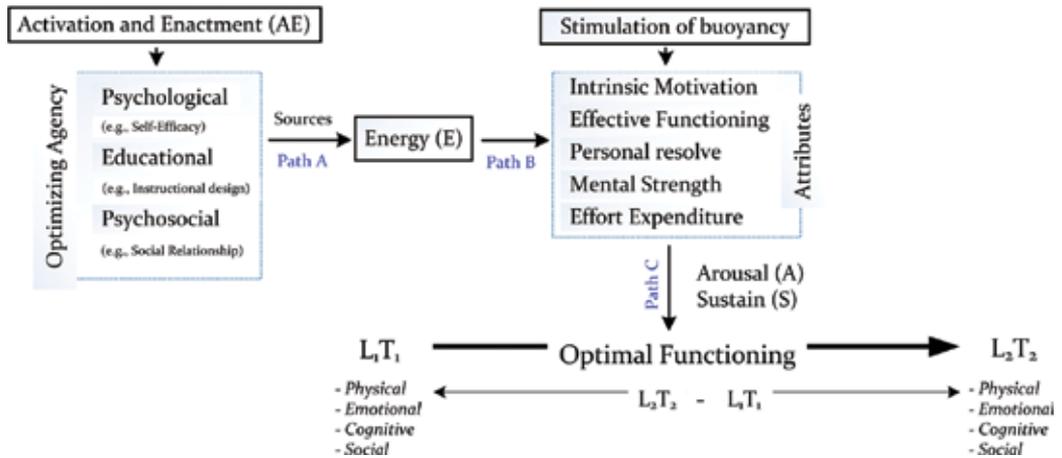
Figure 1. Optimization and levels of best practice. Adapted from Phan & Ngu [8] and Phan et al. [7].

L_1T_1, for personal benchmarking with the level of optimal best, which is denoted as L_2T_2, (ii) the requirement of *time precedence* in order for a person to develop and experience an 'increase' in optimal functioning, and (iii) the *activation and enactment* of psychological, educational, and/or psychosocial agencies in order to facilitate, mediate, strengthen, and improve a state of functioning from T_1 to T_2. Overall then, from this explanation, achievement of optimal functioning is made when we are able to gauge into the difference between L_2T_2 and L_1T_1 (i.e., ΔL_{21}), where L_1 = realistic achievement best, L_2 = optimal achievement best.

Optimization consequently, from our conceptualization, would assist in the achievement of L_BT_2 from L_AT_1. Differing from previous theorizations (e.g., [22, 28]), we contend that successful accomplishment of ΔL_{21} would indicate *experience of flourishing*. Personal flourishing, in this sense, reflects a person's successful accomplishment of a state of optimal functioning (i.e., L_2T_2). Our revision of the Framework of Achievement Bests [3, 7] theorizes that the operational nature of optimization involves the activation and enactment (AE) of *psychological* (e.g., hope: [29]), *educational* (e.g., an instructional design: [30]), and *psychosocial* (e.g., teacher-student relationship: [31]) agencies that serve as *sources of personal energization* (E), which then stimulates the buoyancy of *intrinsic motivation* (i.e., defined as a person's intrinsic motive to persist a course of action—for example, learning Calculus), *personal resolve* (i.e., defined as a person's internal state of decisiveness and resolute to strive for optimal functioning), *effective functioning* (i.e., defined as a person's purposive state of organization, structured thoughts, and behavioral patterns and his/her deliberate intent to succeed), *mental strength* (i.e., defined as a person's mindset that he/she has the capacity to deal with obstacles, stressors, and pressure), and *effort expenditure* (i.e., a person's conscious attempt to achieve a particular outcome) in order to *arouse*, *intensify*, and *sustain* (AIS) a person's state of functioning. We consider the importance of these five comparable attributes for their positive nature—that is, individually and/or in combination, they encourage and facilitate a person to achieve optimal outcomes.

We argue that the differential influences of psychological, educational, and psychosocial agencies are subject to the contextual situation at hand, as well as the timely opportunity that may arise. For example, the optimization of physical functioning (e.g., a football player's scoring of goals) may benefit more from psychological (e.g., the use of self-efficacy beliefs to convince the football player's resolve) and/or psychosocial (e.g., the provision of an adequate environment for training) agencies, whereas educational agencies (e.g., the teaching of an effective instructional design) would be more appropriate in the optimization of cognitive functioning (e.g., a student's academic performance in mathematics). In a similar vein, we argue that on a daily basis, the provision of opportunities for optimization purposes may vary in accordance with the contextual situation and/or other reasons. What this means then, from our conceptualization, is that at any point in time, not all different types of agencies may be available for usage.

The source of energization from psychological, educational, and psychosocial agencies, we contend, may then stimulate the buoyancy of five distinctive and comparable attributes (e.g., intrinsic motivation). The same argument here is that influences from these five attributes to arouse, intensify, and sustain an internal state of functioning also vary. In other words, as an example, the optimizing impact of a psychosocial agency (e.g., teacher-student relationship) on emotional functioning may only stimulate intrinsic motivation and personal resolve. In a

similar vein, a psychological agency (e.g., personal self-efficacy for academic learning) to optimize cognitive functioning may stimulate intrinsic motivation, mental strength, personal resolve, and effort expenditure. An effective educational agency (e.g., the use of an appropriate instructional design), likewise, may instead stimulate intrinsic motivation, effective functioning, and effort expenditure.

Our theorization of the concept of optimization, expanding on from our original Framework of Achievement Bests, suggests that unlike associative (i.e., r) and predictive (i.e., β) effects, the impact of optimization would result in a person experiencing some form of 'energy', which then could enable the achievement of optimal functioning. One interesting facet for consideration is whether and to what extent we could actually 'quantify' the process of optimization. The quantification of optimization, from our point of view, considers the *magnitude* (or strength) of a person's experience of energization. In our recent work [3, 8], for example, we introduced the concepts of *intensity of optimization* (i.e., defined as the amount of resources that would be needed to optimize a person's level of functioning) and *scope of optimization* (i.e., defined as the amount of time and effort that would be needed to optimize a person's level of functioning). The magnitude of optimization, in this case, is postulated to encompass both intensity and scope. A level of optimal functioning that is relatively simple from a current level is likely to require minimal optimization. In contrast, however, a level of optimal functioning that is more complex (e.g., L_1T_1: knowing how to solve equations with one unknown, x: $x + 5^2 = -10 \rightarrow L_2 T_2$: knowing how to solve quadratic equations with two unknowns, x and y: $(x + y)^2 = 4$ and $-4x + 10y = 20$) would require a greater amount of optimization.

With the possible quantification of optimization, we consider a related theoretical concept, which we coin as the *index of optimization*. We propose that the index of optimization, denoted as γ, is intricately associated with the difference between a person's current level of functioning and his/her level of optimal functioning (i.e., ΔL_{21}). The quantification of the index of optimization, from our proposition, is as follows:

$$\gamma = AE + E + AIS \tag{1}$$

where γ = index of optimization, AE = activation and enactment of psychological, educational, and psychosocial agencies, E = the experience of energization, which consists of the stimulation and buoyancy of motivation, personal resolve, effective functioning, mental strength, and effort expenditure, and AIS = arousal, intensity, and sustainability.

This postulation regarding the index of optimization and, more importantly, the quantification of optimization is innovative, as it connotes that, likewise, it is possible to measure, assess, and quantify a person's level of optimal functioning. The index of optimization, in this case, reflects the totality of AE, E, and AIS, and equates to a person's experience of flourishing—that is, $\gamma \approx \Delta L_{21}$. In other words, from our theoretization, a person's energy is likely to assist and result in a level of optimal functioning. At this stage, however, we recognize one notable issue that is unresolved: the calculation of the index of optimization. Despite this uncertainty, we argue that our expanded theorization of optimization is effectual for its explanatory account of a person's state of flourishing. The acquisition of a source of energization, in this case, is of interest for us to discuss in detail. The psychological agency, as we explained [7], may serve as a major source

of a person's experience of energization. Our interest for discussion entails the extent to which *mindfulness, as a psychological agency, could energize a person to achieve optimal best*.

3. Overview of mindfulness

Mindfulness is a psychological process that emphasizes on a person's meditational state. It is defined as "the unfailing master key for knowing the mind and is thus the starting point; the perfect tool for shaping the mind, and is thus the focal point; and the lofty manifestation of the achieved freedom of the mind, and is thus the culminating point" [32]. In other words, as Kabat-Zinn [32] explains, mindfulness is concerned with a person's *moment-to-moment, non-judgmental self-awareness*, which is cultivated by his/her directed attention towards the present moment, non-reactively and non-judgmentally. An envisage of mindfulness as a meditational practice suggests a state of consciousness and self-awareness that may be strengthened over the course of time [33].

The psychological construct of mindfulness is postulated to closely associate with the positive psychology paradigm [1, 4, 34] for its characteristics and emphasis on positive yields. Central to this theoretical contention is the fact that mindfulness is *meaningful*, and contradicts with the negativities that may exist in life such as pessimism and mindlessness [35]. Mindfulness, in this sense, is a feat of human agency that reflects to a large extent the essence of a person's temperament, personality, and state of mind. Engaging in the meditational practice of mindfulness produce two important yields [36–40], namely:

i. A person's experience of a *present state* in any social milieu, which may reveal clear focus and personal contentment. Non-judgmental concentration at the present time, in itself, could serve to instill and facilitate an internal state of calmness, ease, and clarity.

ii. The *subsequent outcomes* that may arise from the aftermath experience of mindfulness, including positive emotions (e.g., happiness), weakening in negative emotions (e.g., anxiety), and improvement in personal functioning (e.g., performance in a subject matter).

Engagement in mindfulness practices, in this sense, emphasizes personal experience both the present moment and the future state of functioning. The two aforementioned yields signify and support the use of mindfulness theories [41–43] in educational and non-educational contexts. Educationally, in this case, it has been noted that there are a number of educational programs for usage in the practice of mindfulness (e.g., Master Mind Program: [44], Mindfulness Education: [45]). For example, Schonert-Reichl and Lawlor [45] recently explored the effectiveness of the Mindfulness Education (ME) program, which involves a universal teacher-taught preventive intervention that focuses on "facilitating the development of students' emotional and social competence via a series of lessons in which 'mindful attention awareness' is taught and practiced, and in which students engage in lessons designed to promote optimism and positive affect" (p. 138). The results of the study showed, for example, that adolescents who participated in the ME program improved on their optimistic beliefs.

Meiklejohn et al.'s [33] in-depth review is also interesting, indicating the effectiveness of mindfulness programs for both teachers and students, alike. A number of programs have been developed from different countries to teach and facilitate engagement in mindfulness practices (e.g., *Inner Kids Programs* from the United States for Pre K-8; *Mindfulness in Schools Project* (MiSP) from England for children aged 14–18 years; *Sfat Hakeshev* (The Mindfulness Language) from Israel for children aged 6–13 years). The results arising from implementations of these programs indicate, for example:

i.   For teachers—(i) the cultivation of mindful skills and knowledge in everyday lives, both insider and outside of classroom settings, (ii) improvement in subjective well-being experiences, (iii) improve effectiveness in providing emotional, behavioral, and instructional support to students, (iv) improve engagement and prosocial relationships with students and co-workers, alike, and (v) decrease negative emotions (e.g., anxiety level) and increase motivation towards the profession, in general.

ii.   For students—(i) strengthen students' capacity to self-regulate attention, (ii) facilitate students' capacities to relate to any experience, whether pleasurable, neutral, stressful, or difficult, (iii) decrease negative emotional functioning (e.g., anxiety level) and behavioral problems, (iv) improvement in social skills and academic performance, (v) increase in optimism, subjective happiness, and mindful awareness, and (vi) improvement in emotional regulation, feelings of calmness, relaxation, and self-acceptance.

The above mentioning provides empirical grounding for further rigorous scientific research development into the efficacy of interventions and programs into mindfulness. According to Meiklejohn et al. [33], there are three major reasons as to this research inquiry is needed, namely: (i) validating the *effectiveness* of interventions and programs into mindfulness, (ii) *how* and *why* the intervention works, and (iii) *predictive effects* and under what *conditions* the intervention would be effective. This recommendation from a psychological point of view is valid, and has credence for implementation. Any theoretical orientation in social sciences, for that matter, requires a cogent conceptualization, which is then followed by strong high-quality empirical evidence for efficacy and effectiveness. The authors, for example, recommend the following issues for guidance in the advancement of mindfulness as a distinct theoretical orientation: establish a theory of change for mindfulness-based programs, expanding the evidence-based for mindfulness-based programs, development and validation of appropriate outcome measures, assess socially valid outcome measures, and address school-based implementation barriers.

A persuasive argument could lend itself in terms of providing a conceptualization that focuses on the relationships between mindfulness and levels of personal functioning. This consideration is insightful, aligning to Meiklejohn et al.'s [33] contention for further research development into the operational nature (i.e., predictiveness) of this theoretical construct. The argument here, in this analysis, is that mindfulness could play a central role in the achievement of optimal functioning. Specifically, as discussed in the subsequent sections of this article, it is argued that meditational practice of mindfulness could result in the activation of a series of sub-processes, which may then assist in the optimization of achievement of optimal functioning.

4. Mindfulness from an Eastern perspective

The preceding section has described the concept of mindfulness. However, we argue that existing research from Western scholars, placing emphasis on the psychological nature of mindfulness alone is somewhat confined. We make this argument consequently as a result of our own research development into this matter, which takes into account the importance of *Taiwanese philosophical beliefs*, *meditation practices*, *professional and personal experiences*, and *Buddhist wisdom and knowledge*. Our professional development, especially for authors 3, 4, 5, and 6 includes in-depth knowledge and teaching of Asian philosophies to postgraduate students, extensive research undertakings in the area of mindfulness, teaching meditation to undergraduate students, and daily practice of rituals pertaining Buddhism. Our theoretical positioning of mindfulness is more inclusive and proposes a holistic model for consideration.

4.1. A proposed model of mindfulness

A model of mindfulness that we want to consider is shown in **Figure 2**. This proposed model, which we recently described [3], reflects an integration of both Western and Eastern ideas, knowledge, and philosophical beliefs. Our conceptualization posits mindfulness as a hierarchical and multifaceted structure that encompasses three major components: *psychological component*, *philosophical component*, and *spiritual component*. We contend that this conceptualization of mindfulness is more inclusive, taking into account Eastern ideas, understanding, and philosophical beliefs and the premise of *Buddhism*. Furthermore, from our proposition, each major component of mindfulness espouses specific attributes—(i) the psychological component espouses the
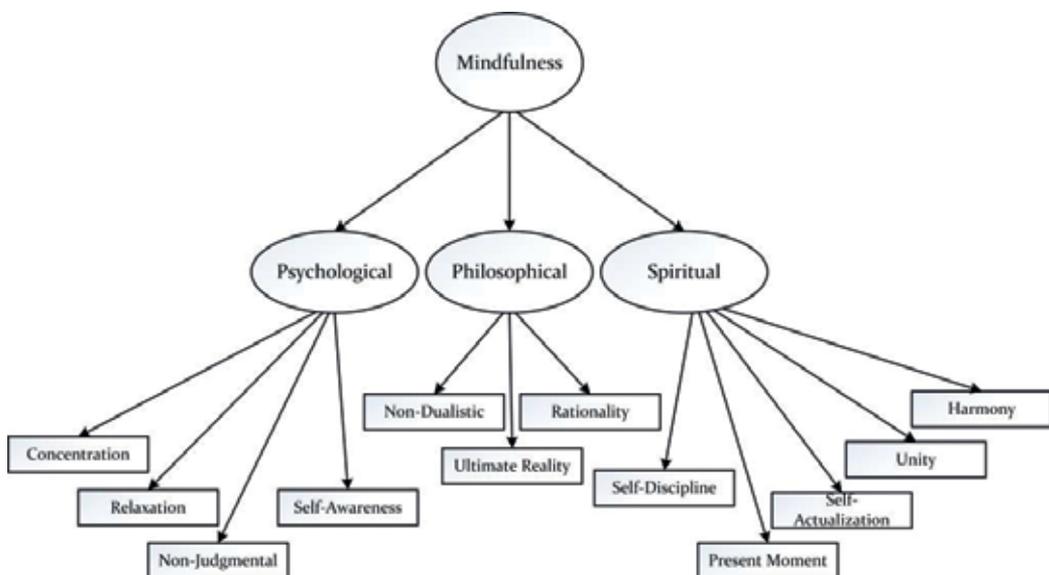
Figure 2. Conceptualization of mindfulness.

attributes of *concentration*, *relaxation*, *non-judgment*, and *self-awareness*, (ii) the philosophical component espouses the attributes of *non-dualism*, *ultimate reality*, and *rationality*, and (iii) the spiritual component espouses the attributes of *self-discipline*, *present moment*, *self-actualization*, *unity*, and *harmony*. These attributes have been discussed in detail in our recent work [3], and will not be described here.

Our proposition of mindfulness is holistic and recognizes the importance of both Western (i.e., the psychological component) and Eastern (i.e., the philosophical component and the spiritual component) ideas and theoretical contributions. From the literature, very little is known about the two non-psychological components that we have proposed. What is unique here, from our conceptualization, is that we consider Buddhism to underpin the nature of the philosophical and the spiritual component of mindfulness. *What does this actually mean then, in its totality?* Mindfulness, for us as Taiwanese scholars, is more than just a person's psychological state of ease. It is somewhat limited to infer that mindfulness is simply a reflection of a person's purposive concentration to ensure that no judgment is made on any aspect of life at the present time. In other words, we argue that *personal experience of mindfulness* may serve to amplify beyond the actual psychological state of a person's mindset.

When a person experiences a state of mindfulness, from our conceptualization, he/she seeks 'nearness' to Buddha. Hence, in the teaching of meditation practice, we often ask students to 'visualize' the image of Buddha as a focal point of concentration. In other words, one major difficulty that many novices face is their inability to concentrate when practicing meditation. Non-judgmental concentration in this sense, according to many Buddhist nuns and monks, is a challenging feat to achieve. Nearness to Buddha or perhaps, Buddhism itself, is to reach *nirvana* (i.e., enlightenment). According to Buddhist beliefs, a state of enlightenment relates to a person's experience of *contentment*, *prosperity*, *happiness*, *peace*, and *harmony* [46]. Mindfulness through meditation, in this analysis, is more than just a state of concentration and self-awareness; when we practice meditation in order to experience mindfulness, we seek to explore and understand the meaning of life in a non-materialistic sense. An important aspect of Buddhism is for a person to live a life that is full of richness. Life is not simply concerned with having materialistic wealth. An enriched life for any person for that matter is to not have attachment, other than to have Buddhist faith.

Our proposed model of mindfulness is significant for its underpinning of Buddhism, emphasizing the importance of Eastern philosophical beliefs and the nature of spirituality. We argue our conceptualization touches on elements that do not necessarily abide by the natural laws of sciences. This argument posits that understanding of mindfulness in its truest sense requires personal experience that may transcend beyond the realms of reality and the physical world. For example, unlike academic performance, social relationships, and/or achieving economic growth, which are also measurable, mindfulness from our point of view is somewhat different— it is not an easily achievable and/or explanatory feat. True, meaningful understanding of mindfulness requires *contemplation*, *reflection*, and *true faith in Buddhism*. When one successfully reaches a state of mindfulness, there is then 'evidence' of inner satisfaction. Mindfulness, in this case, indicates a person's peaceful 'Buddha-like' state of mind, which may detach itself from materialistic things, financial wealth, and worldly success. Moreover, from our point of

view, a state of mindfulness would enable a person to live a life that is non-judgmental, non-subjective, and non-biased. In essence, a positive effect of mindfulness would consist of a person's self-awareness of free will to do things without any negative emotion, and/or to care what others may think.

Existing research has used quantitative methods to seek clarity into the definition, meaning, and structure of mindfulness. For example, using non-experimental designs, a number of researchers have focused on validating the factorial structure of mindfulness (e.g., [47–49]). Evidence from Likert-scale and open-ended surveys, in this case, has led to inconsistent perspectives of the factorial structure of mindfulness [3]. We argue that our proposed conceptualization of mindfulness, especially with its emphasis on the philosophical and spiritual component and their respective attributes is relatively difficult to assess, measure, and evaluate. Referring to the preceding sections, the personal achievement of nirvana is not an easily feat to 'quantify'. Indeed, we recognize the complexity of our proposed model, and contend that other alternative, non-conventional methods may be needed. In a similar vein, we believe that the potential optimizing role of mindfulness in the achievement of optimal functioning is somewhat complex to validate. One notable problem, of course, relates to the issue that we previously outlined, namely, a lack of clarity into the operational nature of optimization. In this section of the chapter, we discuss a methodological conceptualization that could integrate our proposed model of mindfulness within the framework of optimization.

5. Mindfulness and optimal functioning

Optimization, we contend, is an underlying process that could assist in the achievement of optimal functioning. Our recent conceptualization of optimization, derived from previous research [7–9], emphasizes the potential optimizing influences of different psychological, educational, and psychosocial agencies. An important question then is whether and/or to what extent mindfulness, as a multifaceted concept, could operate as a psychological agency and hence, a source of energization in the process of optimization. As a research inquiry into this potentiality, we focus on a methodological conceptualization that we have developed, as shown in **Figure 3**. This depiction is innovative for its proposition into the optimizing effect of mindfulness.

According to **Figure 3** and taking into consideration our proposed model of mindfulness, the practice of meditation would result in the achievement of nirvana. Nirvana enables a person to experience contentment (i.e., realization that one is fine with life as it is), prosperity (i.e., recognition that one is prosperous in terms of well-being—that is, life is good), a sense of happiness (i.e., one's experience of internal happiness), peace and harmony (i.e., one's understanding that life is harmonious with nature and the contextual surroundings), which then operate as energy sources. Our pedagogical practice of meditation involves a number of procedural steps, such as the recitation of specific Buddhist scriptures and chanting (e.g., *Amitabha*). Visualizing the image of Buddha as we begin would assist with concentration, relaxation, and the experience of 'nothingness'. Unlike Western perspectives perhaps, mindfulness from an Eastern point of view is concerned with a state of ease and one's ability to be 'Buddha-like' and to reach enlightenment.
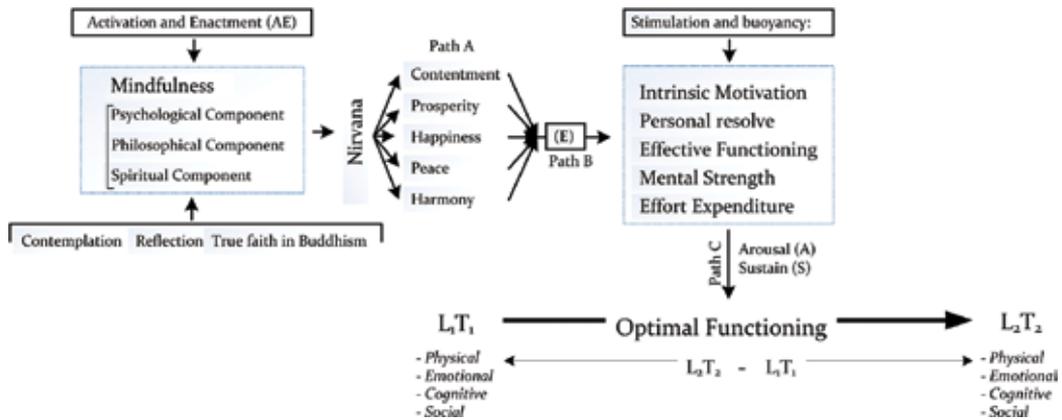
Figure 3. The relationship between mindfulness and optimal functioning.

From our postulation, a state of nirvana would serve as a source of energization—in this sense, we contend that mindfulness would vitalize a person to recognize that there is no greater cause than for him/her to attain a Buddha-like stature. What does this mean for the process of optimization? A Buddha-like stature would, in our consideration:

i.   Enable a person to feel *intrinsically motivated* with life itself at the present time, regardless of any obstacles and/or difficulties that may exist. This intrinsic motivation emphasizes the importance of a person's inclination towards individual growth and non-materialistic matters. For example, in a non-academic sense, a person may feel intrinsically motivated to assist others to be at peace, content, and be happy with themselves. Academically, in contrast, intrinsic motivation may reflect a student's inner desire to seek new knowledge for interest and intellectual curiosity purposes.

ii. Instill a strong sense of *decisiveness and determination* to persist in a course of action, academically and/or non-academically. This personal resolve reflects an autonomous and determined mindset, such as a person's decision to encounter and resolve a problem despite his/her uncertainty. Academically, for example, a sense of decisiveness could compel a student to choose an appropriate course of action (e.g., seeking help from someone capable) for his/her learning purposes. Non-academically, likewise, a person may act on his/her determination to make sound decisions that could impact on others.

iii. Ensure there is consideration of *organization*, *structured thinking*, and *efficiency* in one's course of action. There is self-awareness of the implication of wasted time and effort, and the weighing of resources that are available. From mindfulness, one is able to accomplish a task or a set of tasks with clear deliberation. Non-academically, for example, a person may seek out pathways to expeditiously complete a task at work, despite numerous disruptions. Academically, likewise, a student may choose an appropriate cognitive strategy to learn Calculus in order to minimize his/her time wasting.

iv. Instill *high-energized mental strength* to enable a person to face difficulties and obstacles with a sense of resolute and positivity. Consequently as a result of mindfulness, one is

able to experience a mindset that is full of clarity, clearness, and unhindered thoughts. Mental strength, we contend, may overcome feelings of pessimism, indecisiveness, and uncertainty. Non-academically, for example, mental strength may assist a person to feel confident and efficacious to combat a health issue. Academically, in contrast, mental strength may help a student to confront his/her learning difficulties with determination, and to persist despite this hardship.

v. Enable a person to focus on the *expenditure of time and effort* in order to accomplish a given task at the present time. Mindfulness, from our point of view, may serve to negate stagnation, inaction, and procrastination. Consequently, as a result of mindfulness, a person may feel more motivated and compelled to spend time on practicing, revising, and consolidation. Academically, for example, via means of mindfulness a student may come to realize that effort is intricately linked to personal success. It is through effort likewise, as the student comes to realize, that ensures a lay person is able to achieve a Buddha-like stature.

What is important, from the above, is that mindfulness is a source of energy that is positive, in nature. From our theorization, we argue that a state of mindfulness, which results in a perceived sense of enlightenment, is in accord with the paradigm of positive psychology [1, 2]. Mindfulness, for us, consequently, is concerned with the *achievement of happiness and the true meaning of life*. This experience of energization, as we explained, may stimulate the buoyancy of intrinsic motivation, personal decisiveness and determination, mental strength, effort expenditure, and one's self-awareness of efficiency. These attributes, in their totality, may then arouse, intensify, and/or sustain a person's internal state of functioning—whether it is physical, emotional, cognitive, or social.

In terms of functioning, consider the *importance of cognitive functioning*. In the context of academia, cognitive functioning may consist of academic performance and/or the seeking of mastery competence in a subject matter [7]. Achieving an exceptional result in Calculus, for example, may indicate optimal cognitive functioning in mathematics. It is pertinent then that we consider, conceptually and practically, how we could optimize a student's academic learning experiences, which may be subject to both performance and mastery-based criteria. The totality of mindfulness, according to our conceptualization, is concerned with a person's achievement of nirvana. This experience, from our own personal recalls of understanding, knowledge, and experiences over the years, reflects the true meaning of life—to detach oneself and feel unpressured from the competitive and materialistic world. We argue that a mindset void of everything in life, except the fulfillment of contentment, prosperity, happiness, peace and harmony would bring forth *a state of serenity and tranquility*. Here, at this personal state, a student does not feel pressured and appreciate everything there is to know, regardless of his/her existing level of understanding. What this would mean for a student then, is that academic learning is a personal journey that is full of enrichments and no ends. Acquiring knowledge, in this regard, is autonomous, personal, and free from extraneous influences. Failures and successes, in this case, are irrelevant as the true meaning of learning is to experience life itself. Learning Calculus or any other academic subject matters, in this instance, is part and parcel of being a person where there is no specific 'timezone'. Importantly, focusing on the philosophical and/or religious beliefs of Buddhism, one realizes that learning is an endless journey that has no destiny to achieve.

Hence, from the preceding section, mindfulness could serve to optimize a person's cognitive growth. At the same time, of course, we contend that as a psychological agency, mindfulness could also optimize physical (e.g., a healthy lifestyle), emotional (e.g., happiness), and social (e.g., social relationship and friendship) functioning. Considering that ultimately mindfulness is concerned with enlightenment, we argue that the positive psychological, philosophical, and spiritual nature of a person's mindset would help:

i. Instill confidence and efficacy for one to live life to the fullest, regardless of existing and/ or potential health issues. Life, at the present moment, is concerned with personal enjoyment and appreciation of the fact that one is living, and to recognize there is a *karmic cycle* (i.e., *samsāra*).

ii. A person to learn to place emphasis on the notion of 'nothing'—that is, nothing in the world matters other than the achievement of *continuous inner happiness* by fulfilling one's own desire to help others reach a state of nirvana. Negative emotional functioning has no existence, as all positive attributes of Buddhism take precedence.

iii. A person to willingly relate to others within the contextual environment. It is poignant for a person to view the world with a sense of unity. The world, from the view of Buddhism, is a holistic entity with no distinction between us, animals, and nature, in general.

6. Conclusion and research development for consideration

Optimal functioning is an important facet of the totality of human agency. This theoretical concept of optimal functioning reflects the tenets of the paradigm of positive psychology [1, 2]. The study of optimal functioning has, to date, been substantive with research undertakings in the fields of Education, Psychology, and Health Sciences. Our research development, international in scope, has been substantial, especially in terms of our theoretical, methodological, and empirical contributions [3, 26]. One major contribution, which commenced in 2015, consisted of our development of a theoretical model that we argued could explain the achievement of optimal functioning. The Framework of Achievement Bests [7, 8], in this case, emphasizes the importance of optimization, an underlying process that may explain and facilitate the experience of flourishing. We advance this theorization by proposing a revised conceptualization, by which we detail the intricate operational functioning of the process of optimization.

Another important contribution, arising from our recent collaboration, consists of the proposition and development of a hierarchical, multifaceted structure of mindfulness, which places emphasis on the positive psychological, philosophical, and spiritual nature of a person's mindset. Mindfulness is more than just concentration, self-awareness, and/or a relaxed, nonjudgmental state. For us, mindfulness is closely associated with Buddhism and more importantly, the achievement of a Buddha-like stature. When experience a state of mindfulness, via means of meditation, we ultimately achieve the experience of enlightenment. Indeed, we argue that our proposed model of mindfulness is innovative for its inclusiveness of both Western and Eastern ideas, knowledge, and philosophical viewpoints. This development of an alternative

model has also led us to consider mindfulness, in its totality, as a psychological agency that could operate to optimize a person's state of functioning.

We recognize that there are some major complexities, which pose difficulties in the assessment and measurement of the conceptualization that is depicted in **Figure 3**. Social sciences research would require rigorous methodological designs that enable, for example, the quantification of variables and statistical inferences of their relationships [50]. From a Western perspective then, as we previously described, researchers have focused on the factorial structures of mindfulness (e.g., [47, 48]). In this analysis, researchers have varied in their conceptualizations and the subsequent results found from factor analyses—from a one-factor model [51] through to a six-factor model [52]. The issue, however, is that our proposed model of mindfulness is non-conventional, and takes into account Buddhism as an underlying focus of inquiry. How do we measure and assess Buddhism in its entirety? More importantly, referring to our proposition, how do we measure and assess the extent to which one has reached a state of enlightenment? We contend that the notion of spirituality, which is one main component of mindfulness, is extremely difficult to gauge at and/or to measure and assess. Delving into the nature of a person's contemplation, reflection, and his/her true faith in Buddhism, we contend, is not an easy task to determine. A traditional methodological approach that consists of the use of a Likert-scale measure is somewhat problematic and/or limited, as a subject's response may not necessarily indicate his/her 'inner' feeling and experience of enlightenment.

From our theoretical positioning, enlightenment upon successful meditation would enable a person to experience a Buddha-like stature that, in this sense, reflects contentment, prosperity, happiness, peace and harmony. Some Buddhist nuns and monks, likewise, would argue that in-depth practice of meditation would also enable some to experience *transcendence*—the perceived ability of a person to exist in another realm that is outside the existing time-space realm. Hence, in a similar vein, we gather that it is non-feasible and non-viable to consider the use of the traditional methodological approaches. In this analysis, it would be more enriching and insightful if we could develop non-traditional methodological means to seek understanding into the nature of our proposed model of mindfulness. As practicing Buddhists, for example, Authors 3, 4, 5, and 6 of this chapter have considered the potentiality of methodological designs that the natural laws of physics may not be able to explain. How this is possible is beyond the scope of our understanding at the present time.

In a similar vein, we recognize the complexity of mindfulness as a psychological agency of the process of optimization. This conceptualization, indeed, is complex and difficult to validate, especially when we consider the limitations of traditional quantitative methods. Notwithstanding the obstacles that we have discussed, over the past couple of years we have explored an interesting line of inquiry, namely, the proposition and development of 'methodological conceptualization' that could address a particular area of research. This research-based approach is innovative as emphasis is placed on a researcher's synthesis of existing studies, in-depth knowledge, and strongly rationalized postulation. The main focus of this discourse is to initiate social dialogs, and to encourage researchers to make theoretical, methodological, and/or empirical contributions to the conceptualized inquiry. A proposition, we contend from our research-based discourse, may be accepted, advanced, and/or revised. Other researchers, for example, may offer

their interpretations, viewpoints, and alternatives to a postulation that we propose. Hence, from this personal contention, we argue that our proposed theoretical-conceptual model may have plausible credence, despite its complexity. In particular, aside from mindfulness, we recap and highlight the following inquiries for researchers to explore the following:

i.   Validating the quantification of the process of optimization, especially the proposition regarding the index of optimization (γ). It would be insightful to consider the operational nature and measures of Path A, Path B, and Path C.

ii. Considering the measure of the proposed concept of energization, which may apply and have consistency across different types of functioning—for example: physical functioning *versus* cognitive functioning.

iii. The derivative and calculation of γ, which we equate it as the sum of AE, E, and AIS. However, despite this proposition of γ, we are uncertain of its standardization—that is, from a quantitative point of view, does a numerical value of ≈ 8 for γ for optimal physical functioning equate to that of optimal emotional functioning?

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Educational Tools and Methodological Approaches to Enhance Interest and to Grow Skills in the Teaching-Learning of the Earth Sciences: A Research in the Italian Schools

Susanna Occhipinti

Additional information is available at the end of the chapter

Abstract

Earth Sciences teaching-learning process in the Italian schools, where the research has been developed, has highlighted a widespread lack of knowledge among students. This corresponds to a lack of sensitivity toward geological and environmental issues and to our territory, moreover, often characterized by widespread disruption phenomena and natural hazards. This lack of awareness is also widely spread in the society. The goal of this research is to contribute in spreading a greater awareness in Earth Sciences' different disciplinary fields. The aim is also in recognizing its concrete applications in our life and in its quality. The students' training is essential, but must pass through more operative educational tools and paths, based on more effective methodological and educational approaches: hands-on practices, active teaching, inquiry, and investigation. It is necessary to increase students' interest and passion to promote competences and skills. Research has shown that Earth Sciences can be a formidable tool for promoting these skills, but they require a systemic vision and a more solid epistemology.

Keywords: educational approaches, skills and competences, tools and paths, multidisciplinary links

1. Introduction

The paper presents a research developed in Italian schools over several years: starting from a proven lack of sensitivity toward geosciences, the work highlights the need to identify new effective educational approaches to promote interest toward a discipline so important for its

strong ties to the territory. New approaches for new educational tools paths are necessary to promote this interest, basic in a country, like Italy, rich of cultural, natural, and architectural values, but brittle and highly sensitive to geological problems.

Earth sciences are in fact a subject rarely taught in schools, being students', and even teachers', feeling strongly conditioned by the idea that Geology concerns just "stones and catastrophes." Too often, they become aware of dangers only when something dramatic happens, when the damages to people and things have already occurred—even in presence of vulnerable assets and risks close to daily life. And, often, they are attributed to Earth's anger.

This lack of awareness, this general basic ignorance of natural phenomena, in a brittle country as Italy is, lead to a widespread difficulty in understanding the reason of dramatic events connected to geological events. The effects are unavoidable: on the safety of buildings, on the economy, on environmental protection, and ultimately, on the quality of life. The awareness of the fragility of our planet not only leads to a greater perception of natural risks, but it is also fundamental to understand the need for a more sustainable use of resources and a greater attention to pollution.

The research highlighted some theoretical, methodological, and practical aspects that, as correctly developed, can produce interesting effects on the teaching-learning of Earth sciences and, which is even more important, may have effects on the perception of the evolutionary dynamics of the Earth.

Even the strong links with the other scientific fields can be helpful to increase the growth of technical and citizenship skills.

2. Theoretical outlines

Earth Sciences are a young discipline: the theory of Plate Tectonics was processed, consolidated and shared only in the 1980s and a lot of phenomena has still to be defined and studied: new discoveries follow one another, without interruption, theories are still evolving in the field of Earth sciences, biogeology, and space science.

Precisely, because discipline is young, many areas still wait to be explored, being this an element that makes this science, even more than others, exciting and fascinating. It is well-known that Earth Sciences are a complex discipline: but the word complex should be clearly used in its real meaning, that, coming from the Latin *cum plicato*, which means bent together, not necessarily difficult. This word means, rather, a contest rich of relationships, interacting with each other in all their different components: together, they constitute a system.

In fact, as every scientific discipline, Earth Sciences consist of branches and sub-disciplines, increasingly specialized as the research progresses. It ranges from petrography, climatology, astronomic geography, soil science, paleontology, to name a few of them. Each of these disciplines, in turn, is subdivided into thousand streams and it is inevitably intertwined with other.

This is the meaning of "complexity" of Earth sciences.

It explains the complexity of the relationships, the intertwining of natural phenomena and scientific laws, shared with Chemistry and Physics' world, even more with the world of living beings; inspected connections link geological phenomena and historical events. Earth sciences are, ultimately, the true connection between the "abiological" and the biological world, the inanimate and animate one.

Obviously, it is necessary to know the constituents and the properties of these relationships: it is the lack of this knowledge that makes Earth Sciences so difficult to be understood and loved, and, but, for the "initiates," geologists, geoscientists, teachers of the discipline, enthusiasts, all that represents its charm.

Unfortunately, Earth Sciences suffer to be considered as a "derived" science, compared to experimental counterparts like Physics and Chemistry: these disciplines are in fact endowed with their own methodology and logic. They are based on a millennial history and of great theories. They are studded of illustrious scientists and Nobel prizes.

Earth Sciences are, with Biology, considered just narrative and not really experimental, by many scientists and educational researchers. In fact, some of its basic theories are considered fragile, because they are not applicable to all contexts, not repeatable which makes them unscientific for many: actually, an eruption or an earthquake is an example of this perception.

Earth sciences suffer, also, of a certain lack of sense of belonging and an inadequate pride for its knowledge. And, because of a certain rationalism and a concrete sense of priority, an epistemology of Earth sciences, necessary to support and to attribute its identity as a science, has never been developed.

The result is that Geosciences education, in terms of numbers of teachers, students taught, and perceived importance, has been lagging behind the other science disciplines for decades. This fact is harmful, if we consider that the geosciences are essential in order to know, understand, and protect our planet; they are can help to create a global perspective. Moreover, to grow an environmental awareness in young people is essential to understand that Earth is system, because, as future citizens, it will determine the quality of environment and life on our planet. Furthermore, Earth Sciences, with its wealth and complexity, its disciplinary plots and its links with many other scientific fields, constitute a remarkable tool to promote students' competences and skills.

3. Analysis of the contest

Unfortunately, the Italian education system does not support the teachers in this transformation, because it is still mainly based on the transmission of knowledge: most of the teachers remain anchored to a process of teaching-learning based on a transmissive approach.

The educational approach should clearly distinguish between goals and objectives, between knowledge and skills: it should be structured starting by identifying the priority skills, then

the goals and, only later, the involved disciplinary objectives. Knowledge should be just a mean that allow these abilities transforming in skills.

Turning this traditional, acquired, and consolidated educational approach into a process, starting from skills, requires constant and strong commitment. If this does not happen, in everyday practice, the testing of acquired knowledge of their students seems to be the priority.

The Italian school system, with its encyclopedic content, does not facilitate the development of methodological approaches of active teaching-learning, such as problem solving, peer education, case analysis, and inquiry-based teaching-learning.

In fact, they require the teacher to abandon the traditional role of master of knowledge and transmitter of contents to become guide, collaborator, and mediator of the activities.

Earth Sciences are taught in all schools and all ages, with different levels of depth and of teaching quality. Plate tectonics and natural hazards, as volcanoes or earthquakes, are curricular topics; but people do not perceive the danger and the risk of living on the sides of a volcano, or in a seismic area, even when the area has already been affected by disastrous events in the recent past. Human memory is very short.

Many researches [1–5] have highlighted the poor skills of Italian students, in the Earth sciences field, during and at the end of their course of study, whatever is their school curriculum and level of scientific specialization. The knowledge is often superficial and fragmentary, due to the respect of the ministerial curriculum. This curriculum, in fact, although renewed in recent years, lacks of prerequisites and of coordination with other scientific disciplines, as Physics, Chemistry, and Biology, although taught by the same teacher.

Moreover, even today, even in scientific schools, it does not foresee neither the Biology, nor the Earth Sciences among the subjects of the written test in the final exam, and an inadequate knowledge does not allow the acquisition of effective and fundamental skills.

4. Working hypothesis

The training to promote the teaching-learning in Earth Sciences should pass by more effective educational approach. The use of educational tools and of learning objects seems to be particularly effective and involving.

It is a widespread belief, based on tested and shared practices, that Science teaching-learning should be based primarily on active teaching methodological approaches. In the case of the so-called hard disciplines, Physics and Chemistry, the experimental and laboratory approach is a widespread and shared heritage: the use of machines, tools, and objects allows to develop experimental activities with the increasing complexity. The approach is generally based on the scientific method of Galilean memory, scientifically correct but with little space left for intuition and autonomous reasoning.

In other scientific disciplines, as biology and geology, experimental practices are perhaps less widespread. But when they are used, they allow the development of operative paths favoring

investigation and promoting curiosity: but especially they push the student toward the research, at first guided by the teachers/experts, then gradually let to become autonomous.

In Earth Sciences, the hands-on approach is naturally part of the teaching of petrography and paleontology, where the learning object can be manipulated, observed, studied, analyzed, and compared. On the contrary, complex phenomena, as global tectonics, earthquakes, or faults and folds, require a different approach.

It is not easy, for an "uninitiated," to appreciate the history of a rock, the dynamics of a landslide, the richness of information and connections of a stratigraphic sequence, and the beauty of a fold. Then, the teacher's task must not stop to illustrate scientifically the phenomenon of the fold, the rock in which it was formed: he must also to discover the link with Physics (temperature and pressure), Chemistry (composition of materials), and geological history (the event that formed it); he should also help to discover the fold's beauty, as if it were a masterpiece of nature.

It is not easy to discover alone, the not always understandable beauties of geology.

5. The educational path

The educational path to promote interest in Earth Sciences, and then make grow students' knowledge and skills, should pass by some steps: they may seem obvious and even trivial, but are instead fundamental.

In fact, the lack of awareness toward Earth Sciences can derive from the lack of very simple tools; certainly, a part of the responsibility depends from the brittleness of teachers' knowledge, but also passion, effective educational approaches, educational tools, and even multi-disciplinary links are needed.

The analysis is not exhaustive [4–8]; it should be extended to the history of Italian school, characterized, from its birth, by a prevalent humanistic culture. The reason why should be analyzed more deeply, despite the presence of great Italian scientists, from Leonardo da Vinci to Fabiola Gianotti, Natural Sciences, and particularly Earth Sciences, struggle to be loved.

The tools proposed below, already experimented and monitored, are certainly not sufficient to change this set-up, but they can be a valid starting point.

5.1. Passion

To propose, as the first instrument of educational efficacy, the passion with which Earth Sciences should be taught could seem banal and perhaps obvious: but to excite our students in this discipline, which seems too difficult and a bit boring, we must be, in turn, teachers passionate of the topic.

But it is necessary to be aware of the discipline to be passionate about it. If we want to be able to explain the contents and to answer to the inevitable questions, if we want to go deepen and to intrigue, it is obviously necessary to master the contents. Unfortunately, in Italy, sometimes sciences teachers are not masters of the discipline because they are predominantly biologists.

If using effective methodological approaches, innovative paths, engaging educational tools, developing and encouraging links with other scientific or humanistic disciplines, with the aim to promote skills and competences, is considered absolutely essential, teachers' work should be supported.

They should have more tools, more targeted training, and clear and experimented indications of work. Also, they should have less pressure from the system to achieve the disciplinary objectives required by the "program" and necessary to face the final exam. Finally, they should be seriously convinced of the importance, in a globalized system that is moving in this direction, of the priority of the skills toward the pure content.

But only a deep passion, and a great professionalism, allows to grasp the challenge that involves the experimentation and the use of new methodological approaches, of new educational tools. Obviously, the risk of not obtaining the desired effect, always remains: it is possible when we try and try again until we get the desired effect. We must overcome the concern of not being able to manage our students in new and less traditional contexts.

But the satisfaction of seeing their curiosity, their interest, and finally their passion grow justifies all the work that will be necessary.

5.2. Educational approaches

Frequently, Earth Sciences' theory is presented, in Italian schools, by not involving boring approaches, even a bit: they seem not useful to promote passion and interest. But the need to change the traditional transmissive and deductive approach with an active and inductive teaching-learning, although not yet shared and disseminated, is well-known and widely documented [6–8]. At school, many teachers and students, thanks to the cultural heritage deriving from the Galileo Galilei's principles, which consists in the use of the experimental scientific method, as the most correct methodological approach, believe that science advances linearly, following the hypothesis and testing model in the classroom.

But this view is increasingly inadequate to represent scientific inquiry: sometimes scientists have no hypotheses, other times discoveries are made by chance. It would be a challenge to find evidence of a linear scientific method in every research and in particular in the field of Earth Sciences. Moreover, the scientific experimental method of the scientific world, the basic tool of educational research and experimentation, is too often presented, in the daily work of the teacher, as a rigorous protocol to be followed. It should instead be considered as an opportunity for reasoning, for hypothesis, development, and formulation of the solution.

It is necessary to revolutionize, even if not always, our methodological approach, in order to involve and motivate students. It is enough to have few tools, few learning objects, but it requires, simultaneously and above all, the knowledge of the methodological approach from a theoretical point of view. Furthermore, a solid ability to manage the class, a talent for conducting activities and verifying any unexpected events during the course is required.

There is always an element of risk, as in any innovation, but, step by step, the teacher masters the class and the different ways of working and gains self-confidence. Unfortunately, there are no rules: we must experiment and find them in the practice of daily teaching. Teachers'

mission should be to excite our students in the discipline, so that through the acquisition of knowledge it is possible to increase students' skills. Experiences and paths, with suggestions for their methodological approaches, are numerous and widely documented.

To capture this complex skill, we need to renew the teaching of sciences; we must break the habit, encouraged by textbooks, of presenting science as a finished product, trying to show it as a passionate problem-solving, an adventure, that many have committed themselves to with passion: this is what we call an approach active. However, the term active in the daily practice of teaching has many ambiguities: it is not simply a practical, manipulative activity, although this is certainly useful in a school based mainly on transmissive teaching.

There are many requirements that make a learning activity really active:

- the activities must correspond to the tasks of the real world, rather than to the de-contextualized or scholastic works;

- the activities require the students to define the tasks and the related articulations;

- activities should involve students in examining work from different perspectives, using different resources to solve and separate relevant from irrelevant information;

- collaborative work is basically required to solve the task;

- activities should promote interdisciplinarity and allow students to have different points of view: this helps develop skills more than a single well-defined field;

- activities that allow a series of results open to multiple solutions, rather than a single correct answer obtained from the application of predefined rules and protocols are preferable.

Active and survey-oriented laboratories stimulate students to develop independence and can improve subjects' understanding and promote positive attitudes toward science and science learning. These approaches are generally focused on investigative processes, such as problem-based learning, which requires the identification of driving questions, and fundamentally the development of pathways through practical laboratory activities.

Other approaches have been tested: the traditional "application of experimental protocols" is generally simpler, but less effective and less enjoyable; "formulating and testing hypotheses" is more complex and formative, but involvement depends on the topic or issue; "practical experimentation" is undoubtedly the most popular, even if it presents the risk of being a little playful. Also the Inquire Base Science Education, known as IBSE, has been experimented: IBSE is the most widespread education approach, thanks also to the extensive literature that has seen it as the protagonist, but in my opinion it retains much rigidity and does not always help promote passion and autonomy among the students.

In fact, my experience has oriented me in time toward the Problem-based learning approach, which is generally based on an abductive approach. The process is aimed at using the power of authentic problem solving to engage students and improve their learning and motivation. From my experience, it has proved to be the most effective for developing critical thinking

and creative skills, to improve problem-solving skills, with the aim of making students apply their knowledge to new situations. Facing situations in their context and appropriately structured problems, students must investigate and discover meaningful solutions.

Indeed, it is an approach that is rich in meaning and potential results, but requires commitment, time, and passion. Moreover, it is obvious that it cannot completely replace the more traditional lessons in our school system. It is important not to confuse PBL with simple practical activities included in the traditional education system, just to vary educational communication or as the culminating event of a training unit. However, PBL poses challenges for teachers. In fact, the role of the teacher changes significantly as it becomes a facilitator of learning, promoting an investigation environment rather than providing facts, thus testing the student's ability to remember these facts through memorization. The teacher loses the role of lecturer, culture transmitter, the holder of power in the classroom: he must be open to his constructivist nature, be able to take a student-centered approach.

Furthermore, this approach requires much more material than a course based on conventional lessons. Finally, it requires a great sense of responsibility and professionalism, which is acquired through competence and experience: in short, it requires being a professional.

5.3. Educational tools

In the teaching-learning of Earth Sciences, the main goal is the understanding of complex phenomena. Despite the availability of useful and engaging software, it is sometimes very effective and interactive. My personal experience has shown that the use of hands-on tools is often the most effective with the students. Secondary schools in Italy have, very often, in their scientific laboratories, high quality instruments such as seismographs, weather stations, or telescopes. Often, we can also find historical collection of minerals, rocks, and fossils. Both typology of tools are essential for the approach to the contents of the discipline, and are useful because they allow students a manipulative approach. But a deep change of mentality is needed: in fact, while it is easily possible to be fascinated by the beauty of a mineral, from the history contained in a fossil, it is less easy to discover what "hides" a rock sample. Too often, this appeal does not emerge, and a rock remains a simple stone.

In the Earth Sciences teaching-learning, it is necessary to find a different approach, which is able to make students understand the richness and variety of the relationships between the biotic and abiotic world, the contribution that each piece of rock can have in the complex system of the Earth [2].

As it is not possible to reproduce in the laboratory the real movement of the plates, the eruption of a volcano, or the movements of the air, it is necessary to use models. In my personal experience of researcher, with the aim to support teachers' work, I have focused the attention on finding more effective ways to create teaching tools and paths. To be effective, the different tools should primarily have the function of

- stimulating observations,

- hypothesis,

- reasoning and,

- to help the formulation of more general rules and, when possible, of laws.

Finally, models should be able to stimulate the abstraction and the ability to identify connections between different elements and principles, intra- and inter-disciplinary.

It was possible to verify that more simple, rough, self-produced, even banal were the models, the more effective the results. Of course, they must be compared with the events to which they correspond in the Earth dynamics. The use of learning objects was actually experimented in various contexts: using models and tools, the utility of hands-on in the growth of knowledge, in understanding phenomena but also in the importance of emotions in the learning process, was demonstrated. This seems strange and unpredictable, particularly in a subject such as the Earth Sciences that generally seem rather prosaic and rigid for students, where nothing can be misleading or disruptive.

It might be useful to show some easy and tested examples of the different materials produced. All these tools are intended as learning objects to apply the principles of Problem-based Learning and the use of driving questions (see above) (**Figures 1–3**).

The educational paths and the kits have been tested for their feasibility in various aspects: with students of different ages and different contexts, monitoring the understanding process, and evaluating the contents and the skills acquired [1, 2, 4].

5.4. Multidisciplinary connections

If we remain closely connected to Earth Sciences' contents, at first sight, it seems not easy to find relationships and links with other disciplines. Earth sciences, so *cum plicate* (see above) and sometimes closed on themselves, do not seem to have such tight ties, links, or connections with other disciplines: few efforts are made in both directions.
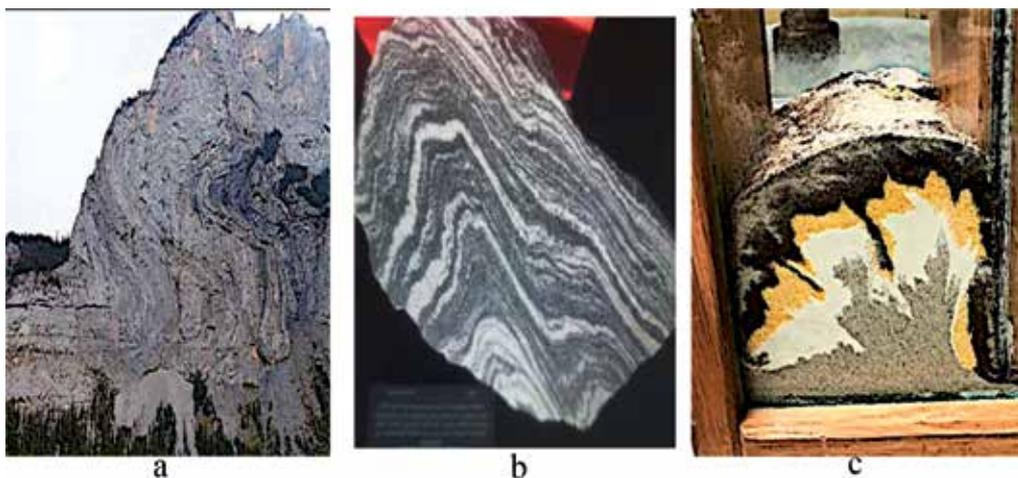
Figure 1. (a) A fold in lower Jurassic limestone layers of the Doldenhorn Nappe, Switzerland. (b) A bent gneiss sample. (c) A model of fold, made with cocoa, white and yellow flour, and sand.
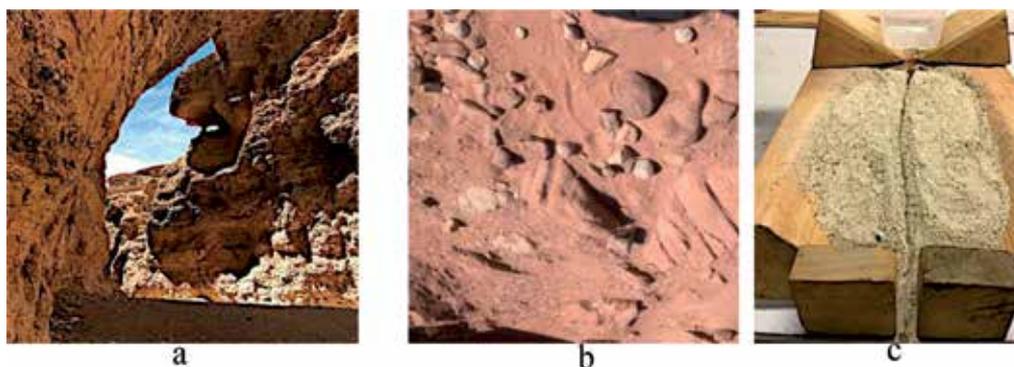
Figure 2. (a) A deep alluvial Ouadi-Namibia. (b) An eroded rock sample. (c) A model of water erosion—regional scientific laboratory.
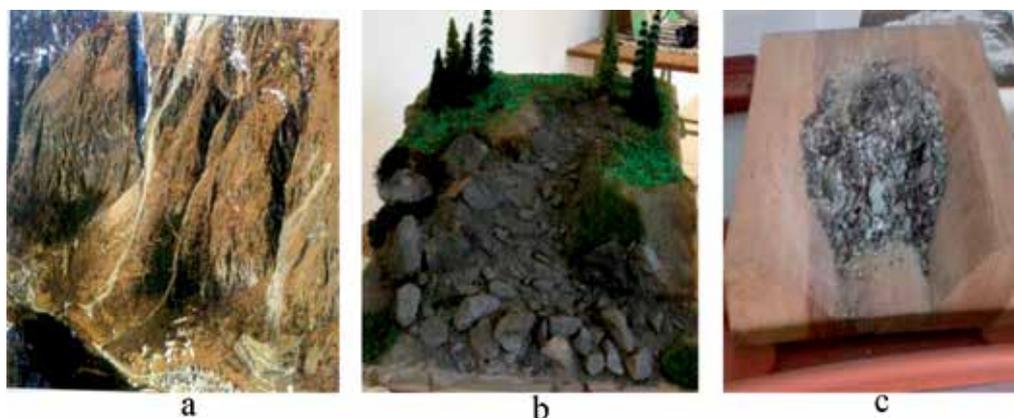
Figure 3. (a) A landslide, (b) a landslide model, and (c) preparing a landslide.

We are realizing that new scientific discoveries in the research' world derive more and more from the boundaries of the disciplines, more and more distant from the traditional and well-known contents, or the intertwining of different scientific areas. It is from the astrophysics, from the astrochemistry, from the molecular engineering, from geobiology that interesting and amazing data are emerging. Even in the Earth Sciences, the most intriguing aspects can be derived from these plots. The discovery of connections, of relations of cause and effect, of relationship between seemingly distant topics, make every subject a source of amaze.

I personally have always found the proposal of these connections fascinating especially when unexpected; even among the students, the discovery of these connections has given surprising answers, an occasion for motivation and re-motivation toward Earth Sciences. It is possible not only to bridge the gap between the various disciplines, which is surprisingly very narrow, but also discover that Geosciences are at the basis of many events in the natural history of the Earth, just like in the history of the human species. Many events in the past, eruptions, earthquakes, and major disasters that may have strongly influenced the climate in geological eras, had also a strong effect on organisms' evolution [1, 2, 4].

In the Earth Sciences, complex relationships link the different scientific branches that characterize it: geochemistry, volcanology, petrography, and geophysics. Ever more complex and surprising bonds are discovered between volcanic eruptions and the climate, between geological evolution and paleontology. But many others increasingly unpredictable are discovered in the field of different scientific disciplines. But it cannot be so surprising, indeed, if we think that all living beings, the autotrophs and the heterotrophs, depend strictly on the soil, on its chemical composition and on its structure, which in turn depend on the substrate and therefore on its geological history and from the age of the minerals and rocks that compose it.

Other links, more transversal, subtle, and even more surprising are interconnected with different disciplines: history, literature, and art. They have conditioned, modified, and transformed them. And vice versa, a historical event could have favored new discoveries and new theories: the exploration of the ocean floor for defensive purposes during the Second World War was the occasion to clash with the oceanic ridges at the center of the Atlantic and to favor the development of the plate tectonics theory.

The relationship between the early stages of the hominization process and the opening of the African rift is quite documented; recent discoveries are correlating the impact of a meteorite and the shift of the Earth's magnetic field with the extinction of Neanderthals for genetic mutations. The relationship between the impact of the Cixculub meteorite in the Jucatan peninsula, highlighted by the rich level of iridium studied by the Alvarez, in Italy the Bonarelli level, with the extinction of the dinosaurs is known and quite documented. The relationship between the formation of the Dekkan Traps and the great extinction of the late Cretaceous is less known, but perhaps chronologically more coherent.

But the unexpected connections that very often we can find in all the subjects we daily face are even more surprising. Many know the relationship between the eruption of Tambora, in April 1815, and some English literary works, such as Mary Shelley's Frankestein and John Polidori's Dracula. The two authors, in the cold summer of the "Year without summer" that followed the eruption of Tambora in 1915, were passing their holidays in Switzerland. Without the possibility of excursions, because of the bed weather, they could not spend their time outside; then, they challenged those who had written the best horror novel. Less well-known is that even the Fairy Tales of the Grimm Brothers resented the special cold climate that marked that year, or how it influenced the colors of the well-known paintings of William Turner and migrations of many Italians, forced by famine toward America and, when arrived here, the Conquest of the West.

And it is known to many, the impact that the Little Ice Age had on history and society between 1650 and the end of 1800; less known is that the harsh climate marked the growth of the trees, making the growth rings smaller and the wood more compact, allowing the creation of musical instruments, the Stradivarius violins, particularly precious for its exceptional acoustics.

5.5. Competences and skills

The traditional definition of competence, which comes from literature, is the implementation of a performance in a given context that involves the use of attitudes and motivations, knowledge, competences, and skills, and is aimed at achieving a purpose. More precisely, competence is, "What, in a given context, one can do (ability) on the basis of a knowledge to achieve

the expected goal and produce knowledge. It means to choose, use, and master knowledge, skills, and abilities appropriate in a given context, to set and/or solve a given problem" [7] The acquired experience has shown that Earth Sciences are the discipline that more promote citizenship and transversal skills and, furthermore, develops the ideas of system and complexity. It is surprising how these skills can be easily applicable, malleable, and adaptable to different contexts and contents of Earth Sciences, where they become tools to think, observe, connect, relate, research, solve, and communicate.

The goal is to be able to understand that every single phenomenon, a landslide, a flood, a volcanic eruption, or an earthquake, is part of the global system: all are connected to each other. It is possible to pass from a single case to a general law of nature. In the case of the approaches traditionally used in the sciences, inductive and deductive reasoning, in which the rule is given from the beginning, the definition of a law occurs regularly, and with relative ease. In the case of the abductive process, such as in the Problem-based Learning, ability to synthesize becomes an essential element: understanding why landslides can fall or earthquakes occur requires a general ability to synthesize [8, 9].

More precisely, the analysis of the phenomena studied by the Earth Sciences, phenomena are not always predictable but interconnected, allows to promote:

- the ability to synthesize and generalize, which implies being able to collect many cases in a more general case that involves them all;
- the capacity for abstraction, which implies being able to formulate a rule that describes the events of the case: the characteristics of a rock, the morphology of the slope, and the geographical position.

In the case of natural phenomena, of course, the variables are many and not always easy to connect: this represents a challenge for the scientist and for the student. It is not always possible to define a law, but we can always find a cause-effect relationship. Each landslide or any meteorological phenomenon can be triggered by a person kicking a stone or by the beat of a butterfly's wings.

6. Epistemology

It is not superfluous to recall the strong cultural importance of Earth Sciences, which is not obvious: in the past, too many have considered that the science of the Earth, like other scientific disciplines, is simply "technical" and has no cultural depth. Instead, Earth Sciences offer a unique possibility of a conceptualized phenomenon through time and space, in a complex and interactive historical approach.

Understanding how the Earth works requires the retrospection that makes inferences about the past; it requires to interpret the present as the result of large-scale natural experiments: Earth Sciences prepare the ground for understanding the complex relationships between the sciences and for making hypotheses about the possible future.

But the promotion of Earth Sciences as a discipline that most develops ideas of system and complexity, whose understanding is essential to promote scientific skills, requires a strong disciplinary epistemology. Unfortunately, the level of research on epistemology of Earth Sciences is very weak. Earth Sciences, like any scientific discipline, should be based on their epistemology, necessary to face the fundamentals of the discipline, and to define the conditions that allow to build scientific knowledge and to develop methods to reach this knowledge.

But Earth Sciences, unlike other scientific disciplines, have a complex history: from time to time they have faced sociological, economic, technological, and human aspects, from which it has been difficult to break away to develop an abstract epistemological theory. This resulted in a lot of explanations concentrated more on the various components involved, that a search for universal laws, typical of other scientific disciplines [10, 11]. While the philosophy that inspired the work of the founders of modern geology, from Steno to Lyell, between the eighteenth and nineteenth centuries, led directly to a discipline characterized by the principles of identity and unity, in the following years, up to the twentieth century are characterized by research by many of specialists, each attentive to their field, certainly not interested in the epistemological theories of the discipline.

As a global geological theory was far away in time and would still have required many years, everyone was focused on building their own small model, in a reductionist approach, away from the idea of the complexity of the knowledge system. The same happened in the past for Chemistry and Physics. Later, however, chemists and, above all, physicists were able to construct a common language and vision, which led philosophers and historians of science to use these sciences as an epistemological model. In the current model of science, there is a sort of hierarchy that separates the hard sciences from the soft ones, like the natural sciences: Biology and Earth Sciences.

But the specificity of Earth Sciences derives precisely from this fragmentation. It seems particularly useful to develop an epistemology of complexity and in particular it allows to support the idea of non-linearity, useful when the linear model seems too simple and not adequate. In a non-linear model, every component and every phenomenon must be related to other systems, and it is not possible to find a separate law for each fact. A complex system cannot be static or linear: it is a combination of random processes and non-linear interactions. It is the result of an evolution of the process, in which sometimes it is not possible to recognize relationships of cause or effect between the different components, because both are the result of their common history.

The complexity that characterizes the Earth sciences does not allow to identify a single formal structure of the discipline and is the responsible of its weakness; however, this complexity, due to the presence of so many fields of study that even if in different forms, have to do with the Earth system, is also his wealth [1].

7. Conclusions

The promotion of Earth Sciences' teaching-learning in Italian schools requests to pass through tools, both theoretical and practical. On a practical level, it is necessary to identify effective educational tools: objects, models, and paths, similar to those presented. At the theoretical level, it is necessary to reconsider the different educational approaches, choosing the most

effective ones, the ones most closely related to the own way to teach, the most consistent and significant with respect to the topic we want to develop.

Teachers must naturally be aware of the system of knowledge that constitutes the discipline and of the innumerable interconnections that exist among the different branches of the Earth Sciences. A sector of educational research should be dedicated to research what to teach/learn because it is particularly meaningful and identifies the different conceptual nodes: deep time, flows, relationships, and complexity.

This requires a network of resources to build relationships between universities and schools, trying to bridge the gap between research and education. Only clearly defined and strongly shared objectives can bring teachers and geologists, aware of the importance of this discipline, of its field of research and of its development, for the protection and enhancement of the environment, natural or artificial.

Finally, it should be a priority for all those who are interested in this discipline to define a shared, coherent, and focused epistemological state for the Earth Sciences. This will allow to recognize that all the disciplines that constitute Earth Sciences are interconnected: only then, we would be closer to a model and a unified vision of our discipline. But everyone must be equally aware that this knowledge, with its plots and intuitions, is essential to develop basic skills for the student and for the citizens of today and the future.

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The title of the book *Educational Psychology - Between Certitudes and Uncertainties* is relevant for the dynamic and low predictable research from genetics, neurosciences, technologies, etc. that produce challenges and exchanges across sciences. This new framework argues that this book is to be considered a fairly unique and realistic way to rebuild the incongruities and paradoxes in this area. Naturally, "certitudes and uncertainties" is a common denominator for the existing sophisticated academic conventions and for the immense potential of continuous professional development. The title of the book reflects the state of the art, a new trend in the conceptual fabric of educational psychology, and an attitude toward an academic market in the age of many battles in the world of science.

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