



An Ontological Approach of “Risk” in Teaching

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Authors' contributions

This work was carried out in collaboration between both authors. Author VZ designed the study and wrote the first draft of the manuscript. Author IF managed the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

The concept of “risk” is a key feature in many disciplines and areas of human activity. This paper attempts to approach “risk” as a structural entity in teaching, in order to derive ways to address it with the aim of reducing or even eliminating it. Initially, there is a conceptual and etymological approach to the term “risk” in Greek and international lexicography, accompanied by a series of “risk” definitions. Then, “risk” is approached ontologically and epistemologically, attempting to formulate a functional definition of “risk” in teaching.

Keywords: “Risk”; teaching; ontology; epistemology.

1. INTRODUCTION

“Risk” in teaching is an epistemological neologism. Its structural determination in the educational/teaching process presupposes both an ontological and an epistemological approach which is, as will be shown below, very difficult to

conduct. The complexity and difficulty of defining the concept of “risk” appears even in lexicography - explanatory and etymological - which provides an initial descriptive basis on what exactly is considered as “risk”. There is no literature at all about “risk: in teaching. Thus, the objective of this paper is to formulate a definition

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for “risk” in teaching. To reach this objective, the authors try to find the roots of the word “risk” and then borrow some terms about “risk” features from other scientific fields. The next step is to define the ontological status of ‘risk’ based on the available literature and highlight an interdisciplinary approach to “risk”. The final step is to formulate the very first definition in literature for “risk” in teaching and briefly refer to the many factors involved in its analysis.

2. LEXICOGRAPHICAL DEFINITIONS AND ETYMOLOGY OF "RISK"

In Greek dictionaries, the term “risk” associates mostly with “danger” and “hazard”. In the Tegopoulos & Fytrakis Dictionary, “risk” equals to an “adverse event” and a “dangerous energy or activity» [1]. Bambiniotis defines “risk” as “danger”, “jeopardy” and “dangerous action” [2]. In the Papyros Dictionary of the Greek Language [3], the definition of “risk” is synonym to “danger” and “dangerous energy” as well as the verb “risk” means “to put something in danger”. The Academy of Athens [4] defines “risk” as an “exposure to danger in the hope of gaining profits” and “any dangerous energy”. The Triantafyllidis Foundation Dictionary of Modern Greek Language refers to a “potential loss or failure of action with uncertain outcome” while links the verb “risk” to the phrase “to play heads or tails” [5].

Similar definitions can be found in foreign lexicography. In English, Reader’s Digest Encyclopedic Dictionary [6] defines the term “risk” as “hazard” and “chance of negative consequences”. Collins Gem Dictionary of Synonyms and Antonyms [7] adds the synonyms “jeopardy” and “peril”, distinguishing “safety” as a “risk” antonym. The same dictionary in its modern online version refers to the remarkable increase of the use of the word “risk’ in daily life after the 1950s [8]. This is probably due to the incorporation of the concept of “risk” in many disciplines such as economics, medicine, food science, pharmaceutical and engineering. Standard Dictionary of the English Language uses the above definitions by completing them with other synonyms such as “chance of harm” and “danger” [9]. The Thematic Dictionary of Economic Transactions (1973) adds the term “venture” to these definitions [10]. In its online version, the distinguished American dictionary Merriam-Webster [11] defines “risk” as a “probability of loss” or “injury” as “someone/something who/which creates or

suggests a hazard” but also as a state of non-protection against “injury, loss or evil”. The same dictionary contains the words “threat”, “menace”, “pitfall”, “trouble” or “distress” in its “risk” synonyms, while terms like “guard”, “protection”, “asylum”, “shelter”, “safety”, “security, and “secureness” are distinguished as antonyms.

As to other languages, Larousse [12] defines “risqué” in French as “more or less inconvenience in which one is exposed”. “Risk” is also a “prejudice” and a “sinistre” but also as a “possibilité”, a probability of an action or an event, that can be considered as harm (“mal”) or damage (“dommage”). The same dictionary also points out that “risk” is a “commitment to an action that could bring an advantage but involves a danger”. In the Italian language, “rischio” is defined as “the possibility of suffering a fatal event (“fatto negative”) [13], while the online encyclopedia Treccani [14] defines it as “the possibility of suffering harm associated with circumstances more or less predictable”.

Concerning the etymology of “risk”, its correct root is rather uncertain [15]. Greek scholar Bambiniotis [16] links the origin of the word “risk” to the medieval and modern Italian language, derived from “risco, rischio” and the verbs “risicare, risicare” meaning “to face the danger to throw the ship to a steppe”. Thus, the association of the term “risk” with the sea passes by the concept of “danger”. A steppe –“risco” in medieval Italian- in seamanship (as well as metaphorical) is considered as a major danger. The origin of “risco” appears to be either the Medieval Greek “rizikon” (= “fate”, “destiny”), or the arabic “rizq” (= a tax to the inhabitants of medieval Egypt for the maintenance of troops). However, the Arab etymon originally meant “what comes from God for someone to tread”, related to the concept of “destiny” and everyday survival.

In addition, Lidell & Scott [17] point that the word “risk” means a “coffer” or “chest”, as well as a “sarcophagus”, connecting the concept of “risk” to the loss of valuable goods or life itself. Koumanoudis [18] agrees with this definition regarding the Latin-Greek translation of the term, as well as the online JM Latin-English Dictionary [19] regarding its Latin-English translation.

In Greek, the etymology of “risk” refers to the Homeric epic poems and is associated with the ancient Greek word “riza” (“=“root”), which was used in Latin to declare a steep rock or a cliff. Specifically, Odysseus, in his attempt to save

himself from the cliffs of Scylla and the vortex of Charybdis, grabs the roots of a wild fig, hanging in the void and risking his life [20]. This Homeric episode with Scylla and Charybdis unifies the link between the concept of "risk" to seamanship and survival, for which "luck", "fate" and "destiny" plays a prominent role. Medieval Greek literature also preserves word "rizikon" (= destiny) in poetry. This "risk", "luck" and "danger" complexity finds its connection in English, where the word "hazard" comes from the Arabic word "al zahr" meaning "dice" [21].

In conclusion, "risk" is associated with danger, uncertainty about the outcome of an action and the probability of loss or negative consequences of an action. In any case, "risk" concerns an action for the sake of a benefit that always involves the possibility of partial or total failure. The connection of "risk" to luck and destiny adds to the definition the notion of man's small ability to influence an action's outcome. Moreover, if any "action" is defined as the realization of a decision [22], it can be assumed that any action involves "risk."

Although lexicographical definitions provide an initial basis to define "risk", they are not enough to determine its structural elements in a critical way.

3. "RISK" IN DISCIPLINES AND HUMAN ACTIVITY

In commercial activity, "risk" is concerned as the dangers related to the general operation of the commercial activity [23]. "Market risk", is defined as the risk of loss of profits resulting from unfavorable movements in market prices or the percentage of shares. It is also the danger that derives of a change in the market value of a business portfolio, or the danger of losses in the balance sheet arising from changes in market price [24]. Added to the above, "liquidity risk" deals with the dangers arising from the cost or the inconvenience of not finding a buyer or financing as well as "legal risk" results from the failure to execute a contract [25].

In medical science, the concept of "risk" associates with the probability of body dysfunction and the predictability of improving and maintaining life [26]. It is an objective reality, measurable, controlled and manageable [27].

In food technology, "risk" relates to the possible harmful effects on the human body caused by

chemicals contained in food. The relative analysis of "risk" factors includes, except food chemical composition, the relevant social and economic production factors [28] that affect consumer's health along with their impact on the natural environment [29].

In environmental sciences, "risk" links to the possibility of exposure of individuals, populations or ecosystems to toxic substances or dangerous conditions and the severity of the relative consequences [30]. It is also defined as the possibility of harm to the physical, social and psychological prosperity of humans [31]. Especially, "ecological risk" is considered as a threat to the environment due to unreasonable human activities [32].

The term "political risk" is placed between the terms "country risk" (a country's infrastructure, the general economic situation, along with the attitudes and views of the population on the issues of its own) and "sovereign risk" (the consequences of default of payment of a country's debt by governments). It concerns every decision made by the government of a country [33].

Economics is dominated by the term "credit risk", defined as the risk of loss resulting from the failure of a pledged payment [34], or the failure to receive promised repayments for outstanding investments due to inability for early payments or repayments [35]. It also concerns the risk of value changes in relation to unforeseen changes in credit quality [36] and in general, exposure to default, probability of uncertainty and loss [37]. "Operational risk" includes the dangers arising from internal systems malfunction or the people involved in them [38] and the losses resulting from inadequate or failed internal processes, people and systems or from external events [39]. Generally speaking, "financial risk" is any event or action that may adversely affect an organization's ability to achieve its goals and implement its strategies [40]. It is a quantification of uncertainty about the unwanted change in the value of a financial commitment [41]. Frank Knight distinguishes "risk" from "uncertainty," claiming that "risk" can be quantified (e.g. the chances of an investment), while uncertainty, not (e.g. the chances of a financial system collapse in the next year) [42]. This kind of "risk" is crucial, as its assessment helps in making important decisions [43].

In the above definitions, we must add the definition of the International Standards

Organization (I.S.O.). According to the I.S.O. [44], "risk" consequence is the deviation from the objectives of expected achievements, characterized by the reference to possible events often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and its relative probability of occurrence. In addition, "risk" relates to the uncertainty regarding the state of understanding an event, its consequences or the probability for its occurrence. Additionally, Aven [45] classifies the definitions of "risk" in the following categories: "risk" as an expected value, as an unpleasant event, as uncertainty, as probability and possibility of loss or damage of serious consequences.

The overall set of definitions is an attempt to describe how disciplines and some fields of human activity see "risk". Summarizing the definitions provided, we can underline the following common elements that can be considered as the structural features of "risk":

- Decision: It refers to the final opinion that someone formulates after processing the data available to him/her.
- Uncertainty: It is the ascertainment of someone's weakness to predict an event. Uncertainty is a psychological state, created either by the lack of sufficient evidence for something (e.g., the teacher does not have any information about his pupils at the beginning of the school year), or by the absolute randomness of the events (e.g. an earthquake at the time of the lesson).
- Probability: Whether positive or negative, probability is related to the degree of possibility of something happening. The probability of being accurate must be measurable.
- Outcome: It concerns the positive or negative outcome of an action. It cannot be predicted accurately, but it can be assessed by providing data for future estimations.

4. AN ONTOLOGICAL APPROACH TO "RISK"

Thomson [46], interpreting the concept of "risk", refers to the following features:

- "Risk" is subjective, because it is the psychological state of a person

experiencing doubt, uncertainty or concern about the outcome of an own action or another's action that affects him/her.

- "Risk" is objective when reference is made to the difference between actual losses and the expected ones.
- "Risk" is real when relates to the probability of negative consequences that may emerge from an action.

Combining Thomson's remarks to the above definitions of "risk", a resulting question is whether "risk" is a subjective size or an objective concept.

The supporters of "risk" subjectivity consider that "risk" is a creation of human thought. It depends on human psychology and morality and is determined depending on the case [47]. In fact, Oloffson et al [48] found that people of various nationalities and sexes show different perception on "risk". Aven [49] emphasizes that "risk" analysis bases on the statistical probability of repetition of historical data concerning a situation, an event or a person. As long as an action is close to this probability, the more its outcome can be predicted, so that similar predictions are possible in the future. Aven considers "risk" as an instability in the performance of a system, quantified by the probability of observable quantities, and as a combination of the probability of an event and its consequences. In addition, the Hellenic National Research Foundation [50] lists "risk" as the probability of something undesirable to occur. In economics, the "risk" data are precisely quantified, being defined by the height of the acquired profits. Therefore, "risk" is the prospect of profit or loss/damage that is present in every human activity. This raises questions about "risk" management, which involve the circumstances under which certain characteristics of this prospect can be accepted or prevented [51].

The question is also about the objective characteristics of "risk" that Rosa states that "refers to uncertainty about and severity of the consequences (or outcomes) of an activity with respect to something that humans value" [52]. This danger refers to the severity and uncertainty of the consequences or results of an activity in relation to a pre-existing estimate or prediction. Huang [53] likens the "risk" to a dragon, which others see as a major disaster and others perceive as an opportunity to activate dynamically choices and actions. Huang perceives "risk" as a state of the future,

Table 1. Althaus's interdisciplinary taxonomy

Discipline	How it views "risk"	Knowledge applied to the unknown
Mathematics and Logic Science and Medicine	«Risk» as a calculable phenomenon «Risk» as an objective reality	Calculations Principles, postulates and calculations
Anthropology Sociology Economics	«Risk» a cultural phenomenon «Risk» as a societal phenomenon «Risk» as a means of securing wealth or avoiding loss	Culture Social constructs or frameworks Decision-making principles and postulates
Law	«Risk» as a fault of conduct and a judicable phenomenon	Rules
Linguistics History	«Risk» as a concept «Risk» as a story	Terminology and meaning Predictability through conventional reflection
Religion Philosophy	«Risk» as an act of faith «Risk» as a problematic phenomenon	Revelation Wisdom and reflection

which is neither visible nor tangible. However, there is a probable outcome. At the same time, Aven et al [54] point out that "risk" presents inter-subjective characteristics that relate to the uncertainty associated with something that is about to happen with uncertain results. Therefore, "risk" exists as an ontological view irrespective of whether it can be discerned.

According to Rosa [55], the realization that "risk" exists is not enough; in order to take appropriate management countermeasures, we must assess the extent to which "risk" poses a danger. This approach requires an ontological understanding of "risk" through its epistemological documentation, based on the prospect of its outcome, the predictive assessment of its impacts and its management. This epistemological approach leads to a better "risk" management, i.e. reducing of losses or failures, and pursue of the maximum possible positive objectives achievement.

Along with these views, Hermansson [56] points to the need for a holistic approach to "risk", so that each decision is objective and any possible loss more predictable. Althaus [57], attempting to give a more precise definition of "risk", points out that every discipline perceives risk differently in dealing with the uncertainty and attempts to address it through the dynamic of documentation of the knowledge. Althaus records the above perspective in a taxonomy as follows:

According to the Table, in Educational Sciences, "risk" is a state of questioning and concern and can be addressed through review and reflection on the theoretical documentation and options, as

well as on the planning, organization and implementation of the teaching process.

Althaus points out that "risk" is a mirror for science, revealing each discipline's weaknesses, prejudices and capabilities in reducing uncertainty. In this context, "risk" is a mixture of apparent contradictions, it is undefined, - and this is why it needs to be identified and calculated – it involves both subjectivity and objectivity, it can be visible but also invisible, it can be understandable but also incomprehensible, predictable and unpredictable, individual and collective.

"Risk" management, therefore, requires a multifactorial study, emphasizing on the holistic interdisciplinary approach, which contributes to a more precise epistemological definition and relates not only to its ontology but also to its individual descriptive features, placing to the center of the interest the person that makes the decisions.

5. THE "RISK" IN TEACHING: DEFINITION AND THEORETICAL DOCUMENTATION

It is clear from all above definitions that "risk" is an actual situation that is present in every action or decision irrespective of the person that acts or makes a decision. "Risk" includes both quantitative and qualitative characteristics that can be used in its analysis and prediction. The basic elements that characterize "risk" are decision, uncertainty, probability and outcome. However, the concept of "risk" requires a more accurate definition, which can be achieved by the

use of a holistic interdisciplinary approach, which will seek to identify its existence, analysis, assessment as well as its management.

On the basis of the above features about "risk" detection, analysis and management, we can argue that "risk" in teaching is an existing situation, which exists whether or not it can be perceived by those involved in the teaching process. At the same time, its approach can be better achieved through a learning theories review.

Particularly:

- Behavioral theories focusing on the control of behavior, considering knowledge as a change in behavior acquired through a controlled process of stimulus manifestation.
- Cognitive theories focus on the processes by which the student perceives and codifies the external world, considering learning as the creation of organized internal structures compiled in a process of acquiring and codifying knowledge.
- Social-cognitive theories are interested in the role of the socio-cultural context in changing behavior and consider knowledge as a change of behavior that takes place within specific socio-cultural contexts in which pupils interact by implementing specific activities.
- Theories of Constructivism rely on the processing of open-ended problems and consider that knowledge has the characteristic of relativity. They aim at developing skills that can lead to the solution and implementation of the problems that the teacher organizes and formulates within the teaching process with the aim of achieving the best possible result that is the maximum success of teaching [58]. However, teaching is a dynamic situation characterized by the element of unpredictability and uniqueness [59]. This implies that teaching involves both anticipating and unpredictable developments, the existence of which strengthens uncertainty and is therefore associated with the concept of "risk" [60].

Based on the above, the authors' definition about "risk" in teaching can be formulated as follows: "Risk" in teaching is an actual situation concerning the success (or not) of teaching, the organization of which is a decision-making

process. At the same time, the decision - as a structural feature of "risk" - belongs to the teacher, who organizes the teaching plan. The teachers' decisions on the teaching plan aim at mitigating and/or preventing unwanted developments during the course of the process and the ongoing learning outcome. However, the teacher's decisions are based on hypotheses that involve the element of uncertainty, but also on measurements that contain the element of probability.

In addition, "risk" analysis in teaching is a complex process of taking into account a number of factors and should be included in the teaching plan process, given that "risk" management in teaching is based on data provided by the analysis and aims at preventing undesirable developments in the course of teaching.

Based on Althaus's classification, "risk" can be identified, analyzed, and rendered manageable with the contribution of the disciplines involved in the design and the formation of the teaching process. Developmental Psychology provides information about the students' cognitive development so that the teacher can design activities within the students' cognitive context [61]. Educational Psychology helps the teacher understand how the students learn and, in doing so, to choose the appropriate teaching method or technique [62]. Special Education provides an insight into how the teacher can help students with special educational needs in their class. School Pedagogy provides methods of classroom organization and discipline [63]. Teaching Methodology provides the framework within which all of this information will be integrated into the phases of didactic planning.

In addition, the teacher has to combine all information from various disciplines with a number of factors concerning:

- The student. The teacher takes into account the personal and family profile of the student, such as his/her developmental normality, school-attending regularity, the type of family he/she belongs to, the family's cultural and socio-economic status and the family's expectations from the student. In addition, the teacher needs information about each student's learning profile, such as abilities, motivation, pace of learning, learning readiness, adaptation to the classroom/school environment, self-esteem, emotional maturity, free time management.

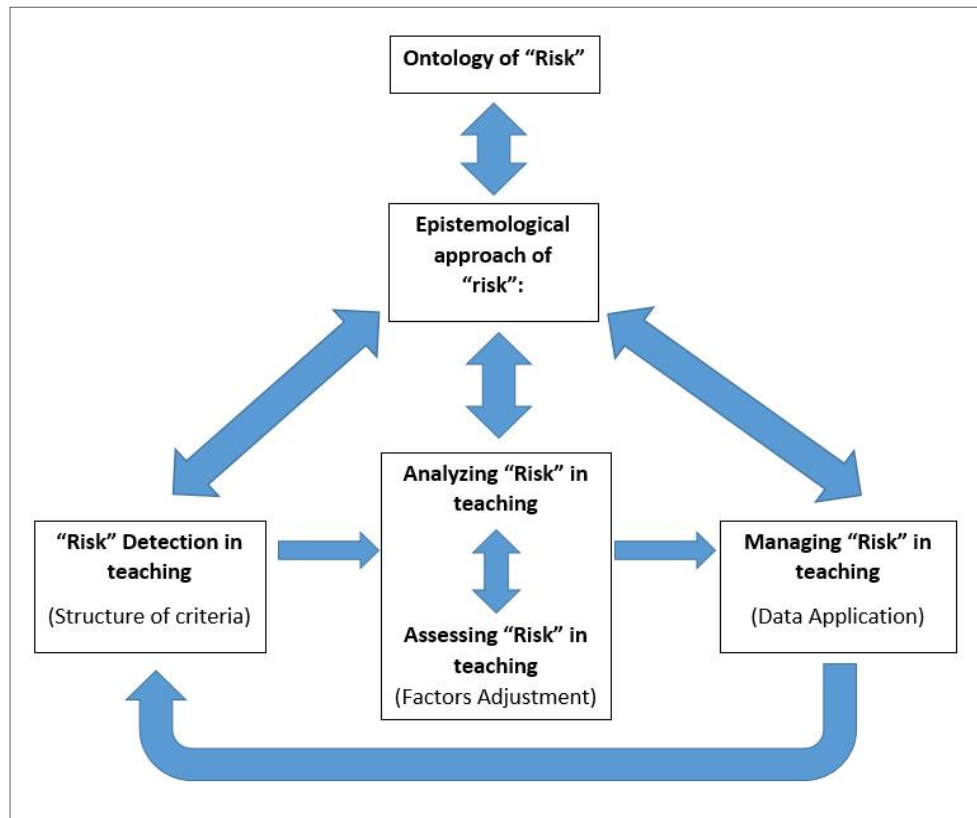


Fig. 1. Schematic representation of "risk" in education

- The teaching subject. The teacher has to know the position of the processing chapter within the curriculum and the textbook, the chapter's content, the curriculum-based objectives, the available teaching materials and techniques, the potential use of technologies and assisting tools, the potentials on coordinating the teaching process, and evaluation techniques.
- The teacher. Teacher-related factors refer to his/her professional profile (experience, development opportunities, job satisfaction, motivation, exhaustion) and his/her teaching profile (personality, philosophical view of teaching, system of school discipline support, style of teaching behavior, development of a suitable pedagogical climate, management of teaching time).
- The educational environment, which has to do with the profile of the school (infrastructure, demographic characteristics of school population, culture and politics on academic issues, internal

organization and discipline policy), but also the profile of the class (internal social organization, learning background, special educational needs).

Some of this information are of short-term consideration and other of long-term. For example, a student's family cultural status affects teaching design at the beginning of the school semester but cannot be ignored in everyday teaching. Similarly, the teaching subject related factors are of everyday teaching design consideration. In this way, a teacher who plans to teach the basic features of Islam in Religious Lesson, must take into account or exploit the existence of Muslim students in his/her class. In addition, some of this information are measurable. For example, the number of students who managed to solve a series of mathematical problems and exercises or to find all the capitals of the Balkan countries is measurable. However, not all educational results are measurable. When there is a metacognitive or emotional objective, e.g. to help the students sympathize the troubled Syrian refugees or to

lead them develop their own way of studying History, the assessment of these objectives' achievement cannot take place within the context of a simple and brief one-hour teaching evaluation. This highlights the fact that "risk" management in teaching is a multileveled and complex process, the analysis of which is currently under the authors' investigation.

6. EPILOGUE

Although the conceptual content of "risk" can be precisely defined only to a limit, "risk" is impossible to be excluded from human activity, and therefore from teaching. This raises questions about what can be done, but also what can be accepted and under which conditions, etc. It is therefore clear that a study on the factors affecting the effectiveness of teaching is required, in order to investigate the extent to which each of them involves "risk" and how, ultimately, this "risk" and its individual features can be predicted and addressed, in order to achieve more effective learning for students.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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