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## **Modelling and Assessment of Risk in Pedagogical Projects**

**Abstract.** *The article raises the problem of expert risks assessment of the implementation of pedagogical projects and providing a thorough explanation of the concepts related to project risks, risks classification and their assessment by experts. On the basis of a review of the literature, the authors assess the development of the theoretical basis of the studied problem. Results of an experimental study conducted by the authors have demonstrated that the expert survey method is a good way of identifying and evaluating risks in order to take appropriate measures of risk avoidance and minimization.*

**Keywords:** *project, pedagogical project, project activity, risks, risk modelling, expert assessment of project risks.*

### **1. Introduction**

Implementation of education projects is motivated by the urgent need to modernise Ukrainian schools through educational innovations. As a result, there is a rapid trend in the field of educational management to develop project management, since project activities require command, organization, analysis, evaluation and control, forecasting and decision-making at each stage of the project for its continuous improvement.

The relevance of the problem of modelling and risk assessment in pedagogical projects is explained by the fact that while pedagogical design has been adopted on a large scale in general education institutions, risks involved in projects are

not always taken into account and their expert assessment is not as common as it is in economic management. Risk assessment is an economic category and procedure. In the field of pedagogy, schools have only recently started to focus on this problem, although in practice it seems to be merely a formal procedure as project leaders are not always familiar with the theory. However, as a result of media pressure and low stress tolerance associated with the instable world situation, teachers feel the need to be extra cautious in their activity.

## 2. Reasons appearances problems

In the actual practice of projects implementation teachers sometimes specify risks orally, informally. However, in the course of project implementation secondary school teachers pay attention to risks only when they face them. Then they have to take certain measures urgently, so to eliminate factors that could harm the project. If teachers learn to model risks and plan measures of minimizing or avoiding them, pedagogical projects will be implemented within a scheduled framework and project results will coincide with expected ones.

**The goal of the article:** to analyze the concepts related to risks in pedagogical projects, to study the process of potential risks modelling and to present the existing research on expert risk assessment.

**The objectives:**

1. to discuss the problem of risk modelling in the implementation of pedagogical projects on the basis of a review of the literature;
2. to carry out an expert assessment of risk probability by rating and mathematical modelling.

## 3. The research methods and methodology

To organize the experiment a number of methods were used: a review of the literature on risk assessment in economics and pedagogy. To differentiate risks according to selected parameters, methods of classification, ranking, expert evaluation, mathematical modelling were used. The algorithm of organization of expert assessment was developed using the method of rating of evaluation steps.

Despite the fact that the concept of risk is well-known, in our study we used our own definitions. *The risk of a pedagogical project*, from our point of view, is the probable coincidence of circumstances that will affect the further functioning of the project either by slowing it down owing to unforeseen situ-

ations. Probable project risk can be detected only by applying various methods of expert evaluations, for example by brainstorming.

*Risk modelling* refers to the process of describing possible situations by means of forecasting in order to find preventive solutions to avoid risks or reduce their influence. *Expert assessment of pedagogical project risks* can be understood as an assessment made by specialists in pedagogical design regarding the level of influence of personal or environmental risk factors at all stages of the project, for developing of measures which help to minimize their influence.

To conduct the experiment we selected the methodology of expert evaluation, namely, the method of selecting experts, the method of index ranking and expert evaluation technology. In this study we used methods of modelling of expert competencies and their training, which are partially presented in the following published works: Bodnar, Ratushko [2015]; Bodnar [2015; 2016].

#### **4. Theoretical analysis of the concept of a “pedagogical project”, ”risk”, “risk assessment”**

In the scientific literature a project is regarded as the result of transformation activities and as a form of organizing activities [Komar 2013: 102]. The importance of pedagogical projects for the training and learning environment of an educational institution is becoming more and more evident, since this technology involves elements of search, experiment and research, which are crucial for the formation of a creative personality of future students. V. Shkuro emphasizes that projects provide an opportunity to test ideas, perform search and concentrate the relevant resources [Shkuro 2012]. At present, project activity has considerable theoretical foundations: its methodology has been well developed, terms and concepts have been defined and classifications have been constructed [Tsymbralaru 2013; Marmaza 2013; Komar 2013]. However, in our research we are not interested in different kinds of pedagogical projects, but the general idea of a project as an activity involving risks.

Scientists are absolutely confident that pedagogical projects cannot be implemented with zero risk. Yarullin et al. explain this by the changing nature of the educational environment; the impossibility of using methods of direct influence; the adoption of educational innovations without testing and evaluation; personal criterion of information and other subjective factors [Yarullin, Prichinin, Shari-pova 2016].

In risk modelling a certain portion of subjectivity is always present. Therefore, theoreticians of pedagogical design could not avoid such an important problem as risk. In particular, the topic of project development with due regard for risks

was studied by V. Kryzhko (accounting for risks in management projects) [Kryzhko 2005]; O. Marmaza (risk appraisal in projects of educational institution development) [Marmaza 2013]; A. Tsymbalaru (risks in pedagogical designing of primary school educational process) [Tsymbalaru 2013].

It is widely known that the notion «risk» (originating from the Italian word *risicare* – “to manoeuvre between rocks”) has both positive and negative connotations. The positive aspect of risk is that an education manager may take the liberty of introducing innovation. Without risk there is no scientific exploration and bold achievements. At the same time, the prospect of risk makes a person alert to potential situations which can cause personal harm or create obstacles in conducting the planned tasks.

Balalaeva O. explains risk that risk is most commonly explained as a characteristic of a situation in which uncertainty of result is present due to some adverse consequences (uncertainty or impossibility of obtaining reliable information about successful result under the specified restrictions) [Balalaeva 2013].

The scientist determines the risk as a situation of uncertainty having ambivalent scenarios, both positive and negative; we refer risks to the future time as suggested events [Belyaeva 2014].

V. Kryzhko also considers risk to be the level of uncertainty involved in result forecasting, the possibility of danger, failures, and success in forecasting results. The author states that the ability to take risks and is not a human trait, but a special feature that shows itself in certain unpredictable conditions [Kryzhko 2005].

One cannot but agree with V. Abchuk’s and A.P. Panfilova’s statement that: «mastering the mystery of risk lies in the way of understanding its essence». The author points out that risk-taking can be rightful or wrongful. Rightful risk-taking is consistent with the objectives of the project, the goal is achieved by proven means, risk does not harm people and the level of risk is material and acceptable. The positive side of risk is confidence and anticipation of success as a result of applied efforts [Abchuk, Panfilova 2010].

Due to the importance of taking risk into account, in practice it is important to engage management mechanisms which include forecasting and identifying risks of inefficient management of development, working out methods of risk response; control of risk response in the case of inefficient management of development [Bolshakov 2008].

Risk modelling is applied during the implementation of international pedagogical projects; for example, in the eTwinning project the following risks may occur: incompatibility of the mental traits of students’ characters, their ideological and religious preferences; conflicts of interests caused by the idea of obtaining project results; different levels of readiness on the part of project participants which make it impossible to react adequately to the results of other participants and their presentation of the project; the risk of mutual misunderstanding be-

tween the participants. There is also one more important risk associated with the psychological stress experienced by a participant who feels incompetent and could quit the project or their results may not be taken into account [eTwinning Plus. Title from the screen].

There are different types of risks involved in project management depending on various factors:

– *relying on fortune vs checked and calculated*: active and passive, justified or unjustified, situational (the benefit in case of success is more than loss), or non-situational (risk for risk itself); *the probability of achieving the desired result*: blind or rational; voluntary or forced, professional and domestic; *the sphere*: financial, industrial, psychological, technological) [Kryzhko 2005];

– *the degree of influence on the project*: positive and negative [Abchuk, Panfilova 2010: 83];

– *a person's ability to cope with risk through their self-organization*: constructive and deconstructive; *the degree of complexity*: first degree risks (easily predictable) and the second degree risks (cause-and-effect relations which are not in line with one-dimensional rules); *the field*: technological, social, informational; *subject-object characteristics*: individual and collective risk; *conditions in which risk arises*: voluntary and involuntary; *substance*: risk resulting from action and passivity; *possible consequences*: material and moral risks, etc.; *personnel risks*: “flow”, “aging”, “conflict of generations”, etc., *contingent risk*: all risks related to changes in quantitative or qualitative characteristics of students), *procedural risks*: as educational and methodological) [Belyaeva 2014: 18].

The most fundamental description of the problems of management and risk assessment is provided in the field of economics, since it is connected to costs. One of the most interesting published works on risk management is the book [Project Risk. Management Guide 2014], which analyses the problem not only from the point of view of risk management structure, but can also be used as a reference for experts or as the basis for trainings and workshops.

In education, the theory of risk management, in particular, in project activities, has been insufficiently presented in practical applications. However, there are some interesting works by V. Kryzhko [2005], O. Marmaza [2013], N. Chernenko [2016], A.D. Tsymbralaru [2013], V. Shkuro [2012], I.F. Yarullin, A.E. Prichinin, D.Y. Sharipova [2016], Bilyk [2017], which are helpful for understanding the methodology of risk assessment in project activities.

V. Kryzhko emphasizes that the measure of risk is directly connected to the level of demands expressed by the project leader – the higher it is, the more actively persons take risks, irrespective of the fact that it is associated with responsibility. Repetition of events and original experience serves as the base of risk. The author presents research data, proving that only 5% of managers of educational institutions demonstrated aptitude for justified risk [Kryzhko 2005: 376].

N. Chernenko conducted a profound analysis of terms and concepts related to risks in the management of educational institutions. After reviewing a number of works on economic and educational management, the author studies risk as a form of activity under conditions of uncertainty, situation, actions characteristic, personal features, legal category, level of security in a given situation, and concludes that despite its objective-subjective nature, risk exists, irrespective whether or not it is identified and acknowledged [Chernenko 2016: 115-117].

The Polish scientific literature on management of education focuses on risk factors in the work of a director, related to correct time management. An interesting example is presented: in 1939 President F. Roosevelt had a special office for his own time management. This fact is important for every head of an educational institution, so to manage a school project, the director needs to spend at least 4 hours a week to assess all project risks and to help make adjustments at different stages of project implementation. Moreover, risk awareness always causes stress for the school manager. Therefore, the following measures for the perception of risk-induced stress are recommended: sensible evaluation of the situation, identification of the cause of the problem, planning possible ways of securing a risky situation, the development of a certain style of life, in particular certain skills which could help to accept different negative situations and look for ways of overcoming them [Elsner, Ekiert-Grabowska, Kozusznik 1995].

## **5. Justification of results of expert risk assessment in educational projects**

For the purpose of risk modelling and determining the probability of their occurrence, a group of experts was selected from a group of school directors and their deputies attending an advanced training course at Ternopil Institute of Postgraduate Pedagogical Education (Ukraine). Experts were selected according to the following criteria: at least 10 years of school management experience, direct participation in projects, knowledge of the nature of project activity and project management competency. Based on the first two criteria 30 participants were selected out of a group of 25 directors and 27 deputy directors. However, after testing the participants' skills of project management and assessing their knowledge of project activities, only 7 were deemed sufficiently qualified to deserve the status of experts.

We used risk classification proposed by V.A. Abchuk and A.P. Panfilova [2010: 71], who considers such parameters as *uncertainty*, *randomness* and *counteraction*. Table 1 presents the results of modelling and classification of risks of pedagogical projects and summarizes the probability of risk occurrence in the process of project implementation.

Table 1. Determination of risk factors in pedagogical projects according to the criteria uncertainty, randomness and counteraction

No.	Risks resulting from uncertainty	Av. probability %	Risks resulting from randomness	Av. probability %	Risks resulting from counteraction	Av. probability %
1	2	3	4	5	6	7
Personal						
1.	Failure to attain the goal which was not clearly defined (too limited, or too broad, or rather abstract)	22.8	Accumulation of excessive amount of information about the object of study, which becomes information noise	7.1	Counteraction of project participants at a certain stages due to pressure of the leader	8.5
2.	Obtaining an unexpected result	10	Change of project leader	7.1	The participants and leaders do not fulfil their functions	24.2
3.	Non-adequate application of technology	30	Substitution of a large number of participants	2.8	Interference in the project leader management plan, fundamental changes	7.4
4.	Lack of resources	34.2	Participants wish to expand the expected result contrary to the plan	8.5	Position conflict in the groups of participants, rise of informal leaders who do not obey the project leader	8.5
5.	Non-professional acts of participants at different stages	24.2	Some participants are no longer interested in participating in the project	12.8	Some project participants leave the project because of the leader's personality	5.7
Environmental						
6.	Lack of makeup time	30	One-time financial over expenditures due to unpredictable development of the project	21.4	Delay in implementation of project stages due to the lack of coordination with education management authorities	10
7.	Change in project efficiency criteria due to changes of educational environment parameters	14.2	Lack of certified experts for project risk assessment	32.8	Manager of the educational institution imposes a ban on certain stages	4.2
8.	Reorientation of goals as a result of changes in legislation on education	18.5	Negative influence of environmental factors	4.2	Parents want to terminate the project	7.1
9.	Uncertainty of project stage time limits due to external factors: epidemics, school optimization, mental characteristics of the inhabitants of the region.	20	Access to Internet network is interrupted	34.2	The public expresses disagreement with the project content	5.7

Source: own resource.

The experimental data presented in columns 3, 5, 7 are generalized as a result of the aforesaid procedures and describe the integrated probability of a given risk in pedagogical projects based on the following procedure of the experiment.

The next stage of the experiment includes the task for experts: to determine the probability of risks in the implementation of future pedagogical projects resulting from *uncertainty, randomness and counteraction*. The experts determined the probability based on the experience of project implementation in their own schools, so they obtained different figures. The matrix of probability estimates is shown in Table 2.

Table 2. Expert estimates of the probability of risks in pedagogical projects resulting from uncertainty (%)

No. risk	Expert no. 1	Expert no. 2	Expert no. 3	Expert no. 4	Expert no. 5	Expert no. 6	Expert no. 7	Av.rating of factor
1.	20	10	40	30	20	30	10	22,8
2.	10	20	10	0	0	30	0	10
3.	40	40	30	40	30	10	20	30
4.	50	40	30	50	40	20	10	34,2
5.	40	50	20	10	10	30	10	24,2
6.	40	30	40	30	30	20	20	30
7.	10	10	0	20	10	20	30	14,2
8.	10	20	20	10	10	20	40	18,5
9.	30	10	10	20	30	30	10	20

Source: own resource.

Table 3. Expert estimates of the probability of risks in pedagogical projects resulting from criteria randomness (%)

No. risk	Expert no. 1	Expert no. 2	Expert no. 3	Expert no. 4	Expert no. 5	Expert no. 6	Expert no. 7	Av.rating of factor
1.	0	10	0	10	20	10	0	7,1
2.	10	10	10	10	0	10	0	7,1
3.	0	0	0	10	10	0	0	2,8
4.	10	10	0	10	0	20	10	8,5
5.	10	20	20	10	10	10	10	12,8
6.	30	40	20	20	10	10	20	21,4
7.	40	50	40	20	30	20	30	32,8
8.	0	10	10	0	0	10	0	4,2
9.	30	50	40	20	30	30	40	34,2

Source: own resource.



We calculated the integrated probability of the occurrence of a risk in pedagogical projects using the following formula:

$$R = k_1 F_{\max}^{(1)} + k_2 F_{\max}^{(2)} + k_3 F_{\max}^{(3)}$$

where  $R$  is the probability of a project risk,  $k_i$  its weight,  $i$  is the parameter,  $i = 1, 2, 3$ ,  $F_{\max}^{(i)}$  is the maximum probability of a given risk  $i$  and the weight of the parameters can be determined by experts or the project managers so that  $k_1 + k_2 + k_3$ .

For example the weighting coefficients of the parameters equal  $k_1 = 0,45$ ;  $k_2 = 0,3$ ;  $k_3 = 0,25$ . In Table 2 we find  $F_{\max}^{(1)} = 34,2\%$ , in Table 3 –  $F_{\max}^{(2)} = 32,8\%$ , in Table 4 –  $F_{\max}^{(3)} = 24,2\%$ .

So, according to formula (1) we have:

$$R = 0.45 \times 34.2\% + 0.3 \times 32.8 + 0.25 \times 24.2\% = 31.3\%.$$

So the coefficient of the probability of the occurrence of a risk in pedagogical projects in the studied region is 31.3%, which determines the development of preventive measures, adequate management decisions to minimize the impact of the eliminated risks on the course and results of pedagogical projects. Certainly, the specificity of each project will make it possible to more precisely define the nature of risks and develop adaptive solutions for solving problems in the process of implementing pedagogical projects.

Table 4. Expert estimates of the probability of risks in pedagogical projects resulting from criteria counteraction (%)

No. risks factors	Expert no. 1	Expert no. 2	Expert no. 3	Expert no. 4	Expert no. 5	Expert no. 6	Expert no. 7	Av.rating of factor
1.	20	10	10	0	10	10	0	8,5
2.	20	30	10	30	30	40	10	24,2
3.	10	0	0	10	10	0	20	7,4
4.	20	10	10	10	0	0	10	8,5
5.	0	0	10	10	0	10	10	5,7
6.	10	10	10	0	20	10	10	10
7.	0	0	0	10	10	0	10	4,2
8.	10	0	20	10	0	0	10	7,1
9.	0	10	10	0	0	10	10	5,7

Source: own resource.

## 6. Discussion view of the analytical component of the study

When estimating risk we used *the principle of practical certainty*, and the experts estimated probable risks based on their project experience and using methods of analyzing situations and developing alternative solutions for risk avoidance or minimization. Practice shows that risk modelling and assessing the probability of its occurrence depends not only on the experience of experts but also on their mentality. Teachers work facing a constant risk of rejection on the part of their students and are often inclined to exaggerate negative risks and only some of them can see positive aspects of risk.

Of course, the economic situation in Ukraine, the constant underfunding of education, give reinforce the awareness of the existence of risks and their potential for affecting both the process and results of a project. Therefore, the work of heads of education with a group of experts is very important. Participation in trainings, simulations of situations of risk avoidance or elimination, psychological adjustment, positive attitude, training of experts, and assistance in finding necessary literature, analysis of the process of completed projects are an incomplete list of methods for training experts. It should be taken into account that there are more such experts in the field of economy. In education, the institution of an expert is not sufficiently developed; their status has not been legally established. Therefore, as a rule, heads of educational institutions, teachers, scientific and methodical workers are encouraged to carry out expert assessment of risks. As groups of experts are mobile, their choice is situational, the objectivity of expert evaluation is provided through the approval of expert assessment technology and expert advice. Consultants can be scientific workers who, from the perspective of theory and methodology, can show alternative ways of solving problems in assessing risks of a pedagogical project. As can we see from the experimental study, the risk associated with the „Lack of resources” was estimated to be the most likely. The average probability of its occurrence was 32.2%. This is a big risk. The expectation of a high risk is dictated by experience, as in Ukraine all-Ukrainian and regional projects are often financed from local budgets. But it is not worth closing a project because of such a risk. Most pedagogical projects are designed to increase the initiative of teachers. It has long been proven that the initiative of teachers is a huge engine of pedagogical research. In addition, general education institutions in accordance with the new law on education have the opportunity to conduct independent financial activities, which includes the search for sponsorship through fundraising activities and marketing technologies. Perhaps experts exaggerated the probability of this risk but it can have a positive effect. After all, having additional funds for any project is always an advantage.

The second group of risks, associated with randomness, was estimated as ranging from 4.2% to 32.8%. “Lack of certified experts to assess the risks of the

project” was estimated to be the most likely risk. Unfortunately, in education, we still do not have developed technologies for training such experts, because they are trained on an ad hoc basis to evaluate particular projects.

As regards the third parameter, i.e. risk resulting from counteraction, the maximum probability was observed for “Failure of participants and managers to fulfill their functions”. In this case experts relied on the experience of regional and school projects. Non-performance of experts is understood (this was discovered by the method of focus-interview) as a failure to implement certain stages of the project within the scheduled time because project managers are teachers who perform the role of leaders outside the classroom and do not always have the time to perform their functions.

Such an experiment was quite successful because it helped the school directors and their deputies to focus not only on project results but also to manage intermediate results and the processes of individual stages.

The theory of risk management includes such methods as cancellation, prevention and control, insurance and absorption. These methods are applied after expert assessment of risks. Their choice will depend on the probability of risks, their weight and expertise.

Based on the conducted research the algorithm of expert evaluation of project risks was updated and consists of the following steps:

1. Select experts according to established criteria.
2. Discuss and adopt the expert evaluation procedure.
3. Discuss risk analysis in the implementation of other projects.
4. Study the structure and content of the project.
5. Assess the feasibility of all stages.
6. Discuss possible risks.
7. Draw up a list of possible risks by brainstorming.
8. Filter the list of risks.
9. Classify risks in terms of the criteria of uncertainty, randomness and counteraction.
10. Divide risks into personal and health-related.
11. Assess each risk
12. Identify and assess positive and negative risks.
13. Rank the probability of the occurrence of each risk.
14. Estimate the probability of risk occurrence and its influence on the course of the project using the formula.
15. Apply technology to reduce risks. Make predictive alternative solutions to minimize the impact of risks.
16. Reserve time for carrying out activities to minimize risks.
17. Allow for corrections from experts at different stages of the project implementation.

## 7. Conclusions

Analysis of scientific literature and practice in the management of educational institutions shows that school managers often do not analyze and assess risks that occur at all stages of the implementation of pedagogical projects. Risk aversion and lack of their expert evaluation can lead to the interruption or termination of the project, distortion of expected result, loss of authority on the part of project managers, participants' discontent and a decrease in the desire to participate in the project. When implementing a pedagogical project of risk recording, it will also help to avoid all moral, material losses of all participants. If risks cannot be analyzed and estimated, it can lead to adventurism and to the adoption of inadequate solutions. The use of expert assessment technology for risk assessment contributes to the objectivity of identifying risks and the possibility of developing measures to minimize them.

This study shows the importance of involving school managers and their deputies in assessing risks of a pedagogical project because project technologies are used not only in extracurricular activities but also in educational activities. When the school administration has a method of mathematical calculation of risks, they can select the most effective projects, help teachers and project managers' model and evaluate risks, use mathematical calculations to identify projects with the greatest risks and become committed to management decisions regarding the subsequent correction of projects.

This study does not exhaust all problems of managing and evaluating project risks. In future it is necessary to explore the problems of developing preventive measures for minimizing the impact of risks, adapting risk management technologies in managing general educational institutions.

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## Modelowanie i ocean ryzyka w projektach pedagogicznych

**Streszczenie.** W artykule poruszono problem eksperckiej oceny ryzyka związanego z realizacją projektów pedagogicznych oraz dokładnego wyjaśnienia pojęć związanych z ryzykiem projekcyjnym, klasyfikacją ryzyka i jego oceną przez ekspertów. Na podstawie przeglądu literatury autorzy oceniają rozwój podstaw teoretycznych badanego problemu. Wyniki badań eksperymentalnych przeprowadzonych przez autorów wykazały, że metoda ankiety eksperckiej jest dobrym sposobem na identyfikację i ocenę ryzyka w celu podjęcia odpowiednich środków unikania i minimalizacji ryzyka.

**Słowa kluczowe:** projekt, projekt pedagogiczny, działalność projektu, ryzyko, modelowanie ryzyka, ekspercka ocena ryzyka projektu

