Iranian journal of educational Sociology
http://www.injoeas.com/
(Interdisciplinary Journal of Education)
Available online at: http://www.iase-idje.ir/
Volume 5, Number 2, September 2022

An Exploratory Study Explaining the Causes of Success in Science Olympiads: A Multilevel Analysis with Different Units

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Article history:
Received date: 2021/12/11
Review date: 2022/04/10
Accepted date: 2022/05/08

Keywords:
Science Olympiad, Grounded Theory, Case Study, Quality of Actors, School and Family

Purpose: In this study, a minimal theoretical framework was set based on the coexistence of different analytical levels to discover the causes for the success of students and schools in science Olympiads with two separate analysis units.

Methodology: This research has been conducted at two micro and intermediate levels through multiple case study and in-depth interview. At the intermediate level, the analysis unit was school and the statistical population included all schools. The intermediate level research sample included two sets: positive cases (5 successful schools from Yazd province) and negative cases (5 unsuccessful schools from Ardabil province), which were selected purposefully. The strategy used at this level was multiple case studies, and the results were analyzed with the comparative qualitative technique. For the validity and reliability of the measuring instrument at this level, real and theoretical repetition was used. At the micro level, the unit of analysis was Olympiad students and 10 interviews were conducted by considering the condition of theoretical saturation. The research tool included in-depth interviews with students, which were analyzed using the grounded theory and the open-centered-selective coding technique. For the validity and reliability of the measuring instrument, the inter-coder agreement and the review of the results by the members were used, and in the comparative study, real and theoretical repetition was used.

Findings: This study showed that students' success in scientific Olympiads is a function of the constructive interaction of the two main institutions (school Olympiad atmosphere and attracting family support) and regional success experience. Other factors such as student cognitive interest, the attractiveness of Olympiad competition, and external incentives are also important. The results of comparative analysis of schools are parallel to the results of the above research and complement it, as the results showed that among the successful schools, almost all the main criteria, including the seminar to introduce parents to attract their support, educational counseling, and classes by former medalists, among other factors, determine the success of schools.

Conclusion: According to the findings, it should be said that the success of students and schools in the science Olympiad is affected by several factors at the micro, intermediate, and macro levels, including the quality of the actors to the synergistic atmosphere of school and family.

Please cite this article as: Abbasi Taghidizaj R, Malmir M. (2022). An Exploratory Study Explaining the Causes of Success in Science Olympiads: A Multilevel Analysis with Different Units, **Iranian Journal of Educational Sociology.** 5(2): 195-209.

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1. Introduction

Student Science Olympiads refers to a test that is annually held among high school students in Iran. This test is held to create a spirit of vitality and innovation for youth, flourish the talent of Iranian students and improve the scientific level of Iran, and select a team of up to 6 to participate in international science Olympiads. This scientific competition is held annually in fields such as literature, mathematics, physics, biology, chemistry, nanotechnology and computer. The first stage has about 100,000 participants of which about a thousand people are accepted. Only those accepted in the first stage can participate in the second stage. In the second stage, around 40 people are selected for each Olympiad and a course is held for them during the summer. A number of tests are taken during the summer course and at the end of it. Gold, silver or bronze medals are awarded to the students according to the grade of the course exams. Gold medalists participate in another course, usually held in the second half of the same year. After the end of the gold course, the team selection tests are held, and the top students are chosen as members of the national team to be sent to the World Olympiads.

All medal holders are considered elite and benefit from some privileges. Of course, their privileges are different depending on the medal received. Gold medal holders are exempted from the national entrance exam to the university and they can study in their desired field. Silver and bronze holders have a 15% quota in the national university entrance exam. Of course, the facilities for entering the university may change every year. Also, the selected students in each field at the country level are given privileges such as employment in one of the government organizations of the province and the possibility of using a scholarship.

Despite the wide participation of students in this scientific competition (about 100 thousand people), a few students manage to win a national medal and get a quota as a member of the national team to participate in world competitions. This qualitative research aims to discover the reasons for the success of students who were able to be among the few students who won medals and some who even managed to be included in the list of members of the national team of the Islamic Republic of Iran.

In this regard, considering the exploratory nature of the study, the minimal theoretical framework is based on the coexistence of different analytical levels. This research is based on the grounded theory. At micro level, opportunities are created by capabilities. Capability promotion is related to environmental features that facilitate the capability to act. Also, if a specific topic and activity is of high importance and value among students, the effort in its path will be more and therefore the probability of success will be high (Hidi, 2006, p. 70).

At the institutional level, the existence of a competitive atmosphere, role models, incentives and educational facilities play the role of an obstacle or factor in explaining success. By entering the elite schools, a "virtuous cycle" is formed, where advantage creates more advantage, and the resources and activities that are specific to high rank institutions are rewarded to these institutions. They are institutional advantages that are accumulated over time and there is rarely a change in institutional fortunes in the direction of changing a base from advantaged to disadvantaged institutions or vice versa (Hearn, 1991, pp. 158- 159). The school atmosphere - social, emotional and physical characteristics of the school - shapes the students' experience (Jones, Fleming, & Anne, 2020) and the results of various studies confirm that in such a school atmosphere, students' learning and academic success is more (Kwong & Davis, 2015; Wang & Degol, 2016; Berkowitz, Moore, Astor, & Benbenishty, 2018). Van, Wolters, and Muller (2018) and Borki et al. (2018) have also shown that a sense of belonging to school improves learning and students' performance.

In addition according to the research, at the family level, parents' attention and care for children (Jimerson, 2001), economic status and family structure (Battin-Pearson, Newcomb, Hill, Catalano, & Hawkins, 2000), participation and involvement of parents with school and parents' valuing of education (Walker, Grantham-McGregor, Himes, Williams, & Duff, 1998) have had the greatest impact on academic success. In this regard, Grodsky (2007) states that the relative superiority in each level of special education continues in favor of economically and socially advantaged children (Grodsky, 2007, p. 4). Privileged groups make significant efforts to accumulate credit and academic fame for their children in line with the continuity of kinship lines.

Parents with high and medium economic and social base are very involved in their children's academic activities. These parents convey their educational expectations to their children. They better understand the educational prospects and the admission process in the competition (Alon, 2009, p. 736). Following Cohen (2004), Mason refers to financial resources that enable people to fulfill expensive tastes. Also, children whose families have more cultural capital have higher educational aspirations and are better oriented in the educational system. They also experience more risk in choosing academic paths (Binti, Bakri, Mustapha, & Midi, 2010). According to Neogarten's "Activity Theory" (1964), having the emotional support of family members helps to keep a person dynamic and becomes a potential force to support mental health and progress in various fields (Samari Safa, Dashti, & Pourdel, 2021).

2. Methodology

In this study, the qualitative approach and the two strategies of grounded theory and case study were used. Grounded theory tried to explain and describe the causes of the result (the success of Olympiad students). An attempt was made to derive a general and abstract theory of the process of achieving success. This stage required the use of several stages of information gathering, refining and examining the relationships between information categories. In this method, based on the regular method of data gathering, while performing open coding (specifying concepts and categories), axial coding (establishing the relationship between categories), selective coding (integration and refinement of the theory) was done, the first step of which was determining the core category (Strauss & Corbin, 2013).

In this study, for the purpose of an exploratory study regarding the factors affecting students' success, taking into account theoretical saturation and reaching the threshold of repetition of answers, 10 cases of Olympiad students who had received national and international medals in the past years were interviewed to precisely explain the causes of the result (Olympic students' success). In this regard, an attempt was made to extract a general and abstract theory of the process of achieving success.

In relation to the validity and reliability of the measurement tool, the researcher used another person to cross check his codes and what is called the intercoder agreement. This agreement was based on the agreement of two coders in the field of codes used. Accordingly, the researcher reached an agreement in the measurement. To determine the accuracy of qualitative findings, member checking was also used. For this purpose, the researcher returned part of the modified production such as themes, case analysis, grounded theory to the participants. Finally, negotiations with colleagues were used to increase the accuracy of the report.

In this study, the case-oriented comparative approach was also adopted to compare the set of successful and unsuccessful schools and the recognition of causal structures and mechanisms through causal combinations was followed. In this approach, the multiple case study design is based on the logic of repetition. On the one hand, this research design is similar to an analytical comparison that uses the double agreement method, that is, the agreement method and the difference method, that is, the comparison of two sets of positive and negative cases (Neuman, 1991, p. 421). On the other hand, according to the above-mentioned plan, this study has not only used the logic of induction, but according to the theoretical model of the research, it has predicted the results in "two contradictory situations". Hence, the repetition of items used is almost similar to that used in multiple experiments (Yin, 2003, p. 47). In addition, considering that the sample size of the case study will be 10 cases, so it can be considered a qualitative comparative method (given that the number of cases is more than 5) (Ragin, 1987).

As mentioned, the research sample consists of a set of schools, one set contains positive cases and the other contains negative cases. The set of positive cases includes schools that are all successful in Science Olympiad. The negative cases are schools that failed in the above scientific fields. An attempt was made to simplify the potential causal complexities in the research while recognizing the commonalities and differences of the cases under study.

Since science has placed its judge in the validity of the external reality, it is necessary to specify an experiential alternative for the relationships that it establishes intellectually between phenomena. This experiential

alternative is sequence and symmetry of phenomena in reality. In this regard, comparison and its methods have been proposed as a measure to deal with this problem. In this view, when we examine multiple and repeated cases of a phenomenon, we have made a kind of comparison, because we have benefited from comparative methods to test the relationship. This understanding of science considers the method of science to be comparative (adaptive) that in different fields there is a difference only in cases of comparison. In this understanding of comparison, it is assumed that with the increase in the number of cases, the comparison becomes more accurate, because it enables us to identify more accidental associations and get closer to the understanding of real and not accidental relationships. Generally speaking, the explanation method in the qualitative comparative study followed the following pattern.

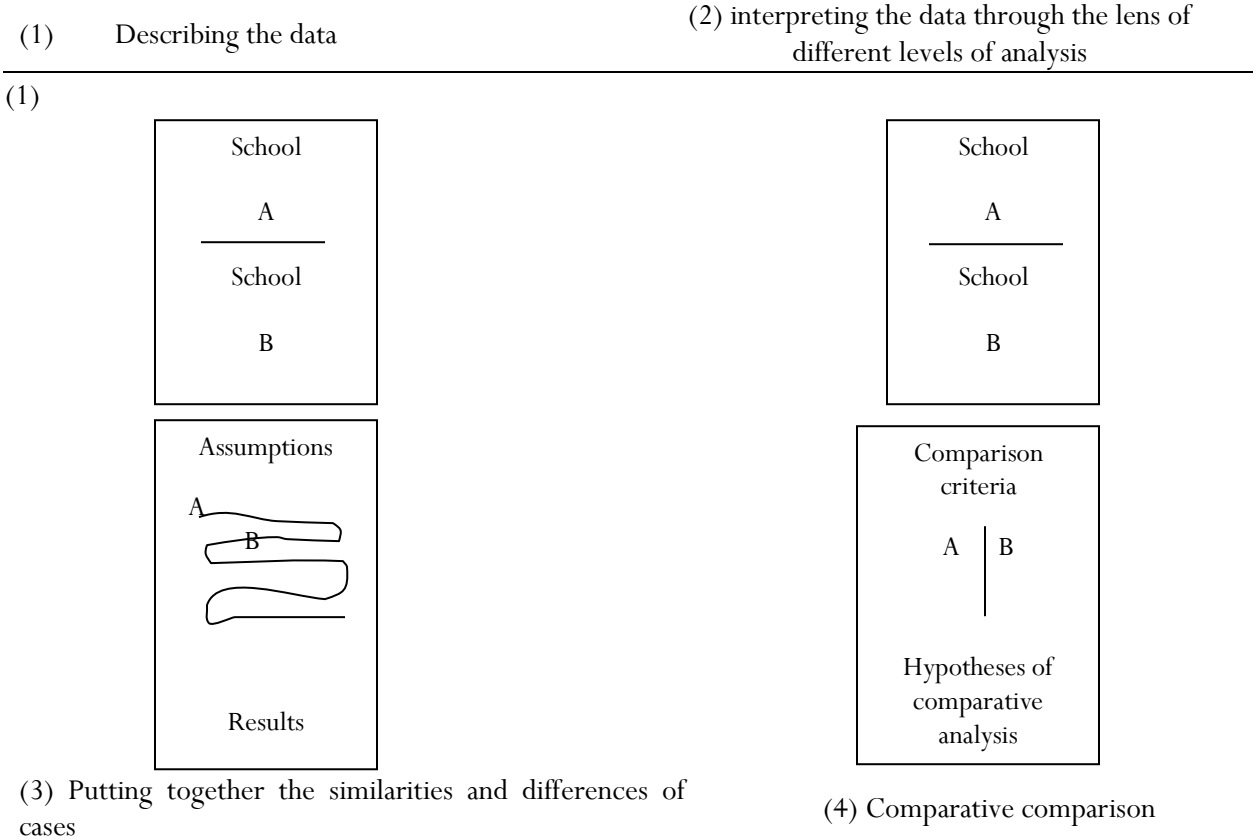

Figure 1. The school comparative analysis process in relation to the success of science Olympiads

Regarding the validity of the measuring instruments, if the sum of causal conditions was met at positive cases at multiple levels, but in the negative cases, it was absent, it can be said that our measurement instruments have the necessary validity. With this in mind, if theoretical prediction matches the results of the positive (so-called actual repetition) and the results of the negative (so-called theoretical repetition), the empirical findings confirm the theoretical pattern of the research, and the results of research can be generalized to similar cases. The nature of the problem under study required that the statistical sample should be determined based on theoretical sampling (YIN, 2003). Therefore, in order to compare the successful and unsuccessful schools, 5 successful schools in the Olympiad from Yazd province (which have received the top national rankings in the past years) and 5 unsuccessful schools from Ardebil province which tailored to the type of school in Yazd province were selected as unsuccessful schools and their principals were interviewed. In general, five successful schools won five national and global gold medals during the years 2005-2020. However, the set of unsuccessful cases had only won four medals.

In this study, we were looking for a combination of causes that resulted in the desired result in several schools, and in other cases this result has not been achieved. For this reason, this research is based on the case study. In this approach, based on a comparative comparison, we sought to determine the causal and combined conditions that generally make one school succeed in this scientific competition and prohibits other school from success. Therefore, in this regard, the table of truth and falsehood of the causal conditions and the outcome were used and the equation of these conditions was obtained. These conditions reflect the possible causal combinations that include the entire cases. This table illustrates the theoretical and empirical importance of the research.

3. Findings

Results of grounded theory

In general, the explanation method in the qualitative comparative study followed the following pattern. In this study, the grounded theory was used to formulate research hypotheses. After the categorization of the main themes, many parts of the dimensions of the variables and items were extracted to explain the factors affecting the success of students in the science Olympiads. The statistical population of the study was comprised of five Olympic students who had received gold, silver and bronze medals in recent years. In-depth interview was used to collect data. The text from the implementation of these interviews is the main research materials for extracting concepts and categories and presenting a paradigm pattern. In this study, the concepts relevant to the open coding in the coding stage was in the form of several major categories and in the selective coding stage led to the extraction of the core category, success in the science Olympiad and receiving medals.

Table 1. Extracted sub-, main and core categories of causes of success in the Olympiad by paradigm pattern components

Core category	Main category	Sub-category	Paradigm
'	Administrative institutional support for brilliant talents	The creation of a young scientific and research club by National Organization for Development of Exceptional Talents (SAMPAD) with the aim of structuring	Causal conditions
		Coordination and creation of a favorable structure in the club	
		Effective and sufficient information about the Olympiad to all students	
		Holding a conference introducing the Olympiad and orientation meetings with the aim of introducing and explaining its process	
		Inviting medalists to SAMPAD schools to hold orientation classes	
		Persuading and familiarizing parents and administrators by inviting them to conferences and meetings	
		Advising students	
		Inviting donors and using their support capacities to cover part of the educational expenses of Olympiads	
		Providing teachers and participating with part of educational expenses (currently, families pay all the expenses)	
		Holding a class using native medalists of the past years and shaping the cycle of completing the Olympiad chain and its continuation	

		Formation of regular and principled classes with a two-year process according to the written planning by the Olympiads with the coordination of education before each stage	
		Provision of nutrition for students at the beginning of classes	
	Olympic atmosphere of the school	Holding orientation classes and familiarization sessions with the Olympiad before the first stage	Causal conditions
		Description of the stages and process of Science Olympiad and the advantages and negative consequences of attending it	
		Support and encouragement of the principal, deputy and school teachers	
		Introduction of the school's Olympiad medalists by showing their photos and posters in the school	
		Creation of the organizational post of Olympiad specialized educational assistant	
		Creation of a competitive environment with synergy and help	
		Holding specialized Olympiad classes after school hours	
		Communication with medalists and receiving guidance from them	
	Family support for the child's educational aspirations	Advising, encouraging and guiding parents	
		Financial support of parents and provision of most of the educational expenses of the classes	
		Academic guidance and follow-up of educational affairs	
		Parent's trust and valuing of the child's decision	
		Acceptance of scientific freedom	
	High cognitive ability and interest	Academic ability	Contextual conditions
		Having a competitive spirit	
		Feeling of self-efficacy	
		High cognitive ability and desire to acquire deep knowledge	
		Risk taking and curiosity	
		Having an Olympian character	
	Previous regional success experience	Having Olympiad medalists in the past years (at least in the last two decades)	
		The emotional attachment of previous years' medalists to the city/province and cooperation with schools	
		Holding a class at the initiative and suggestion of native medalists in the club	
		Communication of students with instructors from other cities through native medalists and making arrangements for their attendance to hold classes	
	Having educational and research facilities	Educational facilities to enter desired field/university	Intermediate conditions
		Benefiting from the facilities of the Elite Foundation	
		Obtaining a research grant at the university	

-	The appeal of competition	Inadmissibility of entrance examination and testing for investment due to superficiality	Intermediate conditions
		The scientific appeal of the Olympiad in the subject of interest is due to its deep content	
		Lack of persuasion of school textbooks (small)	
		Interested in scientific competitions	
		Challenging and scientific nature of Olympiad questions	
		The desire to achieve a high scientific position	
Success in Science Olympiad	Consequences	The cooperation of the school in providing teachers from other cities for the courses and accepting part of the cost	Consequences
		Introduction and preparation of Olympiad books for students on loan	
		School cooperation in exemption for attending general lessons	
		Coordinating with Tehran students in transferring necessary experiences and information	
		Holding a test of the content of resources and books introduced by local medalists	
		Presentation of exercises and questions and answers about the exercises presented	

According to the obtained results, it can be said that the core category is subject to structural, contextual and intermediate conditions, which has led to the success of Olympiad students in successful schools in the form of a combined cause. Regarding the topics included in the sub-categories, the role of institutionalizing support with the formation of a club called the Youth Scientific and Research Club, which is the origin of many activities at the institutional and individual levels, is prominent. That is, in successful schools, a policy has been made for this type of competition in a structured way, and an institution has been defined in charge of this scientific competition. In this regard, one of the participants stated: "We have a club called the Youth Scientific and Research Club, which was in charge of holding classes for children who were accepted in the first stage. This club collected its money from both education and charity, that is, those classes were held for free for children. After the children won medals for a few years, the conditions improved and awareness increased, the number of classes increased, and they gradually began to collect money from the children themselves, and giving money for the Olympiad became conventional like giving money for the entrance exam. Therefore, this result was a concern for several medalists, which led to a favorable result". Because holding class was proposed by the medalists of previous years. Of course, the professors were both native and non-native. One of the Olympiad students stated in this regard that we taught for the following year children and they were teaching for the children one year after themselves (reproduction of success). Another participant said: "Coordination is being done, that is, there is a structure there that success and gaining a result is important to them. Classes will be held there to prepare for the second stage during eve holidays. Therefore, the scientific and research club has been a great help for students and even counseling activities have been done on there.

Besides the creation of the above structure, one should not neglect the Olympiad atmosphere of the school, which is somehow influenced by the external structure, the activity of SAMPAD, and the support of official and unofficial organizations, and with the creation of the organizational post of the specialized educational assistant of the Olympiad, this organization undertakes activities such as holding orientation classes and familiarization meetings with Olympiad, describing the stages and process of the science Olympiad and the benefits and facilities and negative consequences of participating in it, encouraging students to participate in the Olympiad by stimulating them and introducing the school Olympiad medalists by showing their photos and posters, creating a competitive atmosphere with synergy and help, holding Olympiad specialized classes

after the end of school and communicating with the medalists and receiving guidance from them. In this regard, a participant said: "Our school attached great importance to the Olympiad. When I was in first grade high school, I made my mind to choose the path to the Olympiad. On the day of registration in 2nd grade in high school, the photos of some of the students who won medals in the previous years were posted in the school in the principal's room. There they told us that everyone can get results from the entrance exam. They said that we have many people for the entrance exam to get results. But the Olympiad is more important and we need some students to take steps in this path and start studying. This had a great impact on me and was really decisive for me. This was a request from the school that came to my mind." Another stated, "By participating in the Olympiad, we did not go to classes due to the provision of study opportunities and exemption from attending unrelated classes. We got a permission to not attend the class for general subjects. We used to study in the library. There was a gathering where each of the children got a medal. For example, in the second stage of biology, three out of four of us were accepted. Therefore, the atmosphere was good. Although the existing atmosphere should have been competitive, it was more of synergy and help.

The school also invited the medalists of previous years to hold a lecture class for the students regarding the Science Olympiads. One of the participants stated in this regard: "Recently, a medalist came and held an introductory meeting at our school and we gradually got to know the Olympiad. He helped us to know how to start. Until then, I had no understanding of the Olympiad. Then he gave me all the advice I wanted via SMS." The presence of Olympiad winners in schools to introduce students was based on the coordination that was done in schools, and the educational assistants of SAMPAD schools were very much involved in Olympiad programs. In this regard, one of the participants stated that: "The educational assistant of the school encouraged us. We had our own vice-chancellor who followed up on our work and issues. For example, the Olympiad winners were brought to the school by the educational assistant teachers. We had a vice president of the Olympiad" and "the school had already prepared Olympiad books and lent them to us. If we wanted to hire a teacher, the school would help with the cost, if not all of it."

In addition to these two factors, the role of the family should be mentioned. The results of this research in relation to the research sample indicate that the family has assumed the role of counseling and guiding the children by accepting their children's academic freedom and trusting and valuing the child's decision. In this regard, someone said: "My parents were not encouraging, but they were not an obstacle either." As soon as parents saw that I made a choice, they really supported me." "The role of my parents was neither very encouraging nor very inhibiting. They left me free as someone who can make decisions. They gave me guidance, but they trusted me to do whatever I wanted, and it turned out well." Another said: "Fortunately, my parents were with me and encouraged me. They went along with the explanation I gave. Many times they even told me to sit and read for Olympiad, now that you have chosen the Olympiad, you must go in the same direction. That is, they put it on me." Therefore, the student's interest was one of the factors that brought parents with this choice. That is, the students who had a great desire to participate in the Olympiad and had a kind of Olympiad personality, played the main role in this connection.

About the contextual conditions, the two factors of regional success experience and students' cognitive ability and interest have played a significant role in the success of students in science Olympiads. Having Olympiad medalists during the past years (at least in the last two decades) and their emotional attachment to the city/province and cooperating with schools spontaneously by holding classes and facilitating the communication of students with instructors from other cities play an important role in the success of the research sample in science Olympiads. One participant stated: "When someone got a medal, you could see that everyone are getting medals. Therefore, this relationship was very important in getting a medal. Even though it has been 4-5 years since my Olympiad, I am still in touch with some of the students. This makes good things happen and success continues." Another said, "Our region had medalists in previous years, and now I am a medalist, and I hold classes for the children after me, and the class is being held in a formal way, and the children who see that the teacher is like themselves, they can easily succeed, they start studying for Olympiad. For example, I saw myself that I can do this. Therefore, we complete the chain of Olympiads by

ourselves. These golds are from more classes and planning that we have done. If this chain becomes strong, it can continue for years."

In the meantime, one should not neglect their competitive spirit, sense of self-efficacy, high cognitive ability and desire to acquire deep knowledge, risk-taking and curiosity, and their Olympiad personality, as well as the unacceptability of the entrance exam due to its superficiality, the attractiveness of the Olympiad due to its deep content, lack of persuasion of textbooks, interest in scientific competitions, the challenging nature of the Olympiad competition and the desire to achieve a high scientific position. Regarding the cognitive desire and having a competitive spirit, a participant stated: "For me, the motivation to participate in the Olympiad was that I liked the specialized scientific activity, that is, to approach a specialized subject instead of several subjects. I didn't like to study Arabic Language and Binesh memorization books. But the Olympiad lessons were more challenging and scientific. On the other hand, the entrance exam was a test and did not have a correct scientific criterion for evaluation. Another one said: "I somehow do not see the entrance exam as needing three years of studying because it does not satisfy a person. Because I had a competitive spirit, I was somehow looking for my interest. Multiple-choice test was not interesting for me at all and I did not accept the entrance exam. I thought it was ridiculous that I had to answer 40 questions in a few minutes. Therefore, I saw that the Olympiad is something that I like. In order to learn more and follow my interests, I chose Olympiad.

Finally, we should mention the role of incentives. Incentives such as entrance exam facilities, benefiting from elite foundation facilities, and obtaining research grants are included. In this regard, one of the cases stated: "I was aware of the facilities granted by the Ministry of Science in connection with the entrance exam quota and the absence of an exam to enter the field/university of my choice in case of winning a medal, and this was definitely effective as an incentive to choose the Olympiad and succeed in it. If I say it had no effect, it is not true. Otherwise, my family would have prevented me. One was relieved that if he won silver and bronze medals, he would have a chance, and it would be even better if he won a gold. Another medalist stated: "Definitely, this facility encouraged me to participate and succeed in this exam and played a major role in satisfying my parents." Another participant said: "In the orientation meetings, they informed us about the facilities for participating in the Olympiad, and this facility was a good incentive. If it wasn't there, maybe no one would have dared to enter the Olympiad."

Therefore, these factors play a role in the success of students in science Olympiads together in the form of a combined cause as a set of factors, and it can be cautiously said that these factors have a weak presence in unsuccessful cases. The figure below shows the conceptual model of the research for the success of students in scientific Olympiads.

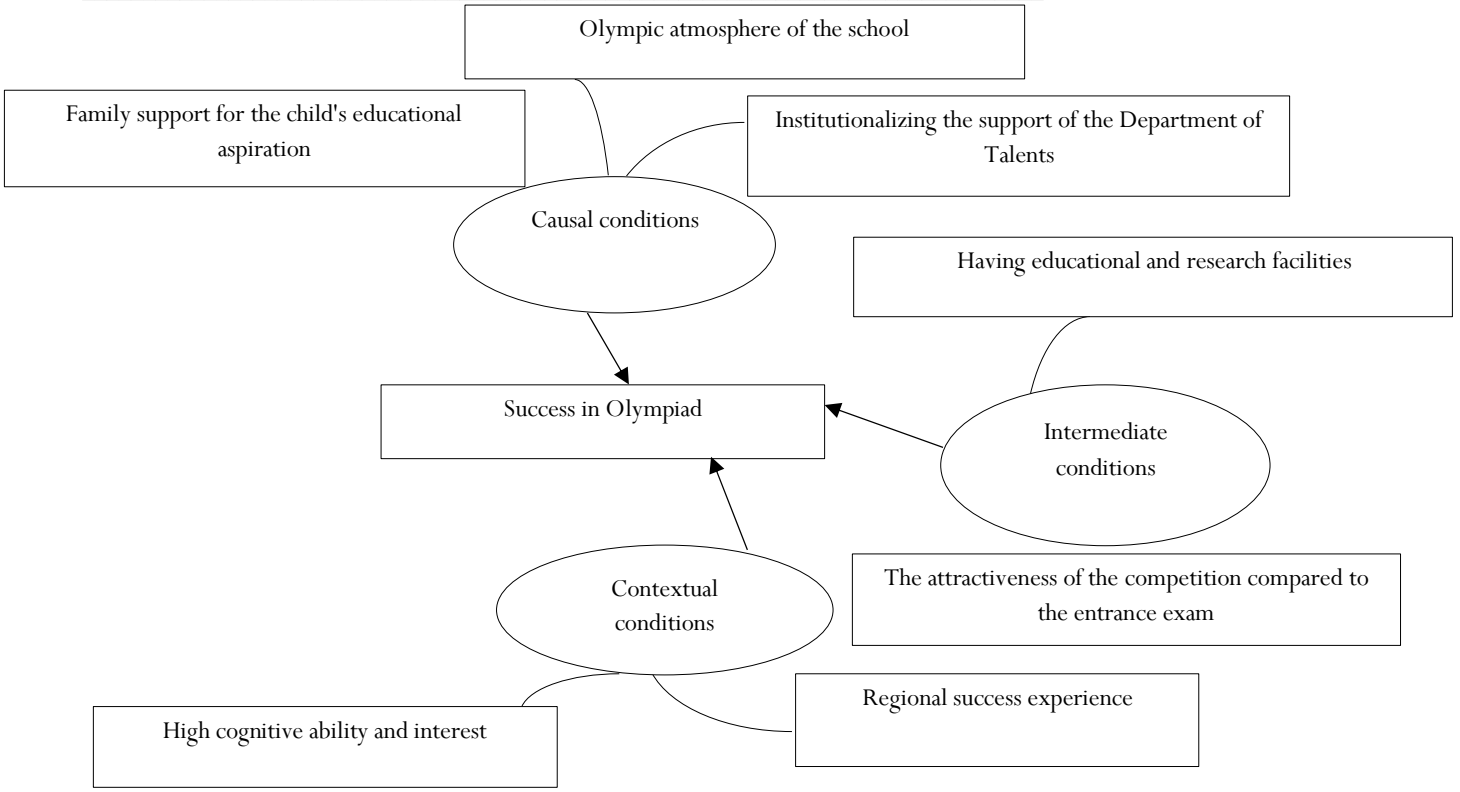

Figure 2. The conceptual (theoretical) model of research related to the success of students in science Olympiads

Comparative study results

In this part, with the school analysis unit (gifted schools), 5 cases were selected from each of the successful and unsuccessful schools and subjected to a comparative comparison. The following table reflects the results of the said comparison.

Table 2. Truth and falsity of causal conditions and results in two types of successful and unsuccessful schools in Science Olympiads[1]

Causal conditions														
Receiving educational support from the Department of Talents	Paying for the cost of books by the school	Payment of education fees by the school	Teaching and holding classes by Olympiad medalists	Monopoly attitude in questioning and violation of procedural fairness	Holding study opportunities in school and introducing resources	Receiving material support from donors	Admission of the applicant based on academic records and scientific test	Educational counseling by medal winning students	Olympiad introduction seminar for parents	Holding an orientation class	Sufficient information	Contextual culture	No.	Cases
+	+	+	+	-	+	-	+	+	+	+	+	+	1	Successful schools
+	+	+	+	-	+	-	+	+	+	+	+	+	2	
+	+	+	+	-	+	-	+	+	+	+	+	+	3	
+	+	+	+	-	+	+	+	+	+	+	+	+	4	
+	+	+	+	-	+	+	+	+	+	+	+	+	5	
-	-	-	-	-	-	-	-	-	-	-	+	-	6	Unsuccessful schools
-	-	-	-	+	-	-	-	-	-	-	-	+	7	
-	-	-	-	-	-	-	-	-	-	+	+	-	8	
-	-	-	-	-	-	-	-	-	-	+	+	+	9	
-	-	-	-	+	-	-	-	-	-	+	+	+	10	

By referring to the empirical examples of successful cases, it can be said that most of the causal conditions are present in the total of positive cases or successful schools. This is despite the fact that most of the mentioned conditions are not present in the set of negative cases. Among the set of successful cases, only the condition of receiving material support from benefactors did not exist in 3 cases. Also, the principals of none of these successful schools did not believe in monopoly in the question design. With the exception of the conditions of favorable contextual culture, sufficient information and holding an orientation class, none of the conditions that were present in successful schools, there were no negative cases at all. It should be noted that the contextual culture and the holding of orientation classes for students were not present in 2 cases of unsuccessful schools, and in one case, sufficient information was not provided. Also, in 2 cases of unsuccessful schools, the principals believed that there is a bias in the exam and monopoly in designing questions in favor of certain schools.

In order to achieve a final equation, the results of the minimization of the combined causal conditions indicate that the conditions of the Olympiad introduction seminar to parents to attract their support, educational

[1] The sign (+) in this table means the presence and the sign (-) means the absence of the causal condition among the set of inflectional and combined conditions to explain the occurrence/non-occurrence of the result and consequence.

counseling by medalist students, acceptance of the applicant based on academic records and scientific test, holding study opportunities in the school and introduction of resources, holding classes by Olympiad medalists, provision of educational fees and purchase of books by the school, and receiving educational support from the Office of Talented Students have all contributed to the success of the schools in the Science Olympiads. The set of conditions that were not present in the set of unsuccessful schools. Therefore, according to De Morgan's law, the absence of these conditions has led to the failure of students from unsuccessful schools in this scientific competition.

4. Conclusion

The results of this research generally indicated that success in science Olympiads is subject to structural, contextual and intermediate conditions that lead to students' success in the form of a combined causality. In this regard, the role of institutionalizing support with the establishment of an institutional system (structuring) becomes the source of many activities at the macro, institutional and individual levels, especially because it has a prominent role in creating culture and providing effective and sufficient information.

At the institutional level, the interaction of two middle institutions, namely family and school, plays a significant role in this field. Therefore, the Olympiad atmosphere of the school is a condition that plays a significant role in creating a synergistic atmosphere in the interaction with the family institution. By holding a seminar introducing the Olympiad and holding orientation sessions for parents with the aim of introducing the Olympiad and explaining its process, while persuading and familiarizing the families with the goals of the Olympiad, they will make them accept the academic freedom of their children, value and respect children's decision and material and spiritual support for them play an irreplaceable role in these successes.

At the macro level, the experience of regional success is another important factor that should not be neglected. The emotional attachment and commitment of the medalists of the previous years led to their active presence in the education of interested students in the following years, and by holding regular classes based on a two-year process according to their written planning, shaping the cycle of completion and the chain of success in this scientific competition is possible.

In the meantime, one should not neglect the innate talent, sense of self-efficacy, high cognitive ability and desire to acquire deep knowledge, risk-taking and curiosity and having a competitive personality of the students. Also, the unacceptability of the entrance exam due to its superficiality, the attractiveness of the Olympiad, the unconvincingness of the textbooks, the challenging nature of the Olympiad competition, and the desire to achieve a high scientific position are also among other factors. Finally, the role of external incentives should be mentioned. Other incentives are obtaining educational facilities to enter the field/university of interest, benefiting from financial facilities and cash awards from trustee institutions, earning points to pave the way to career success, and obtaining research grants.

Based on this, all these factors together in the form of a combined causality as a set of continuous factors play a role in the success of students, and it can be cautiously said that these factors were almost absent in the unsuccessful case.

Parallel to the results of the research with the individual analysis unit (students), the results of the qualitative analysis with the intermediate level of analysis (school analysis unit) also showed that among the set of successful cases, almost all conditions (seminar introducing the Olympiad to parents to attract their support, educational counseling by the medalist students, accepting the applicant based on academic records and scientific test, holding study opportunities in the school and introducing resources, holding classes by Olympiad medalists, providing educational fees and purchasing books by the school and receiving educational support from the National Organization for Development of Exceptional Talents) have collectively determined the success of the schools in science Olympiads. Meanwhile, in the set of unsuccessful cases, we see the absence of these conditions to a greater extent. In total, the findings show that the prediction of the general research theory is correct, that is, the causal conditions are all present in the positive cases, and therefore the results match the prediction (so-called actual repetition) and likewise the predicted causal

conditions are present in the negative cases (the so-called theoretical repetition). Therefore, the obtained results confirm the theoretical correctness of the research and its analytical generalization capability, at least for similar cases.

According to the total results obtained, it can be said that the minimal theoretical framework of the research, which is set based on the synergy of different analytical levels, somehow reflects the experimental findings. That is, the success/failure of students in these scientific competitions is influenced by several factors at the micro, intermediate and macro levels. Factors that start from the characteristics and quality of actors at the micro level and include the structural and institutionalized supports at the macro level with the theoretical coverage of school and family realities. Therefore, the results of interaction between structural and individual factors in this relationship are constructive and effective.

Acknowledgments

This research was carried out with the cooperation of the staff of SAMPAD units and the research office of the general education departments of Yazd and Ardabil provinces. Therefore, the authors consider it necessary to thank and appreciate all these dear ones as well as the Olympiad students of the mentioned provinces who participated in the project.

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