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KULMAN, KATALIN¹**Examining Primary Education Students' Expertise Concerning the Environmental Impact of Economic Activities and Environmental Catastrophes**

This study is concerned with the knowledge on mining, industrial and other economic activities, as well as different environmental disasters affecting the region of Hungary. Students majoring in primary school teaching participated in the research. Through questionnaires, I examined the hypothesized importance of teaching children about the environmental impact of economic activities and environmental disasters in their geography lessons, and I analyzed the results via Fisher and McNemar tests in SPSS. Based on these data we can conclude that there is no correlation between primary education students' previously gained knowledge concerning the detrimental environmental effects of economic activities, and their current motivation in discussing such topics in geography lessons. The conclusion remains valid for environmental disasters as well.

Introduction

Humankind has always struggled with the destructive powers of different natural phenomena and protecting ourselves against them remains no less difficult in our time – not even modern science and technology has been able to achieve full control over these forces. Throughout history, natural disasters have played the most pivotal role in such destruction, but since the beginning of the 20th century the exposure of our communities to disasters have increased through civilizational catastrophes. For example, with the advent of the industrial boom massive industrial complexes were established near densely populated areas where chemicals dangerous for both humans and the environment began to be processed and stored. In some cases, even one tiny mistake in these complex systems was enough to lead to industrial disasters which proved to be impossible to contain.

Inextricably linked to environmental questions, disasters connected to mining and industrial activities are best demonstrated in geography lessons. Out of the various economic activities which are regarded to be the cause of different catastrophes affecting Hungary, some led to bigger ones than others, depending on the size of the given area or the number of impacted

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villages. Recovery efforts usually took an enormous amount of time, and in some cases, they are still on-going.

Key competencies defined by documents determining educational content and the curriculum of geography emphasize the importance of environmental protection and damage control (110/2012. (VI. 4.) Kormányrendelet, 2012; 5/2020. (I. 4.) Kormányrendelet, 2020). Raising awareness to them and discussing such problems with the supervision and expert explanations of a teacher during primary education all play an essential role in the appropriate development of environmental awareness within society.

Environmental catastrophes and Industrial Disasters

The term catastrophe became defined by experts during the 6th World Conference of the International Civil Defense Organization (Geneva, 1974) - the most important characteristics of a catastrophe are: they endanger human lives and possessions; are unexpected events; are more or less forecastable; in some cases, more than one country is needed to contain their impact. They also established three major categories: natural catastrophe (earthquakes, flooding, volcanic eruptions etc.), artificial catastrophe (e.g. warfare) and social catastrophe (including air, food, or water pollution caused by any transport or industrial establishment; explosions or pandemics, etc.) (Nagy and Halász, 2002).

As for Hungary, it was Civil Defense Act XXXVII, 1996. - among others – which defined the term: “Catastrophe: an event which endangers or damages the lives, health, personal property or basic supplies of citizens, or endangers or damages the environment to such an extent that a joint co-operation of different authorities, institutions and organizations is required;”.

When considering their scope, among the different industrial or mining accidents and disasters one can find those which took place in a specific building, or industrial plant or mine, but also those whose impact extended beyond the premises to neighboring villages, or in some cases, even beyond borders seriously affecting neighboring countries (Vass, 2011).

The Hungarian red sludge disaster of 2010 affected three settlements the most severely (Devecser, Kolontár, Somlónásárhely). The container of the by-product of aluminum production burst, resulting in 700 cubic meters of red sludge inundating the surrounding settlements (Berta, 2011). The pH of this material is acidic, which endangered local wildlife (Romhányi et al., 2010). The ecological impact proved to be devastating: the soil of local farms was seriously affected, and entire wildlife of the stream of Torna was eradicated. The incident

had far-reaching effects on local communities: for example, particulate matter originating from the red mud got into the air, and locals were rightfully concerned about its implications for their health. The deluge also severely affected the structure of buildings (Luxné, 2016).

As for social catastrophes extending beyond borders, one example is the Romanian water pollution incident of 2000. About 100, 000 cubic meters of wastewater containing highly toxic cyanide and heavy metal was disposed into the Lápós, Szamos and Tisza rivers, which polluted the Hungarian section of the Tisza for two whole weeks. The disaster impacted the entire wildlife of the river and its environment, and recovery took a long time (Czibolya, 2015).

Research Methods

ELTE-TÓK senior students majoring in primary school teaching participated in the research (N = 41). Each of them represented one of four different specializations: humankind and society, mathematics, Hungarian language and literature, nature study. The research took place through a survey (voluntary questionnaires) in the second half of the fall term of 2019/2020, and the results were analyzed via the use of the SPSS program (Falus and Ollé, 2000). Data collection happened by convenience sampling, therefore representativity factors were not taken into consideration. Detailed results of this pilot study are demonstrated below (Lehota ed., 2001).

The queries I hoped to answer were the following:

- Is there any correlation between whether students majoring in primary school education had dealt with the questions of the environmental impact of economic activities during their own geography studies in primary school and high school, and their present motivation in teaching such materials to pupils?
- Is there any correlation between whether students majoring in primary school education had dealt with the questions of the environmental impact of different catastrophes during their own geography studies in primary school and high school, and their present motivation in teaching such materials to pupils?

Results

The fifth question group of the questionnaire was designed to collect data about whether students had heard about the listed environmental effects of different industrial, mining or other activities and environmental catastrophes affecting Hungary. In the second section of these questions, I asked students whether they feel it important to cover such materials in geography lessons.

During the analysis, I first focused on query A. Due to the relatively low number of elements, instead of the usual χ^2 -test I applied the more robust Fisher test, since on more than one occasion the number of theoretical sample elements in the cross tables ended up being less than five (Field, 2017). As it has been mentioned before, the objective would have been to find a correlation between whether students had studied such problems in their geography lessons and if they feel motivated in teaching such materials in the future, but neither case showed any significant correlation. Only in the case of power production and similar activities did I find some connection, which might have ended up being significant with a larger sample size. This means that if someone had heard about the latter activities, they feel motivated to teach such materials in their geography lessons.

In conclusion we can say that whether someone had studied about the environmental aspect of a given economic activity does not change the person's motivation in discussing them in their own lessons (Diagram 1, Table 1).

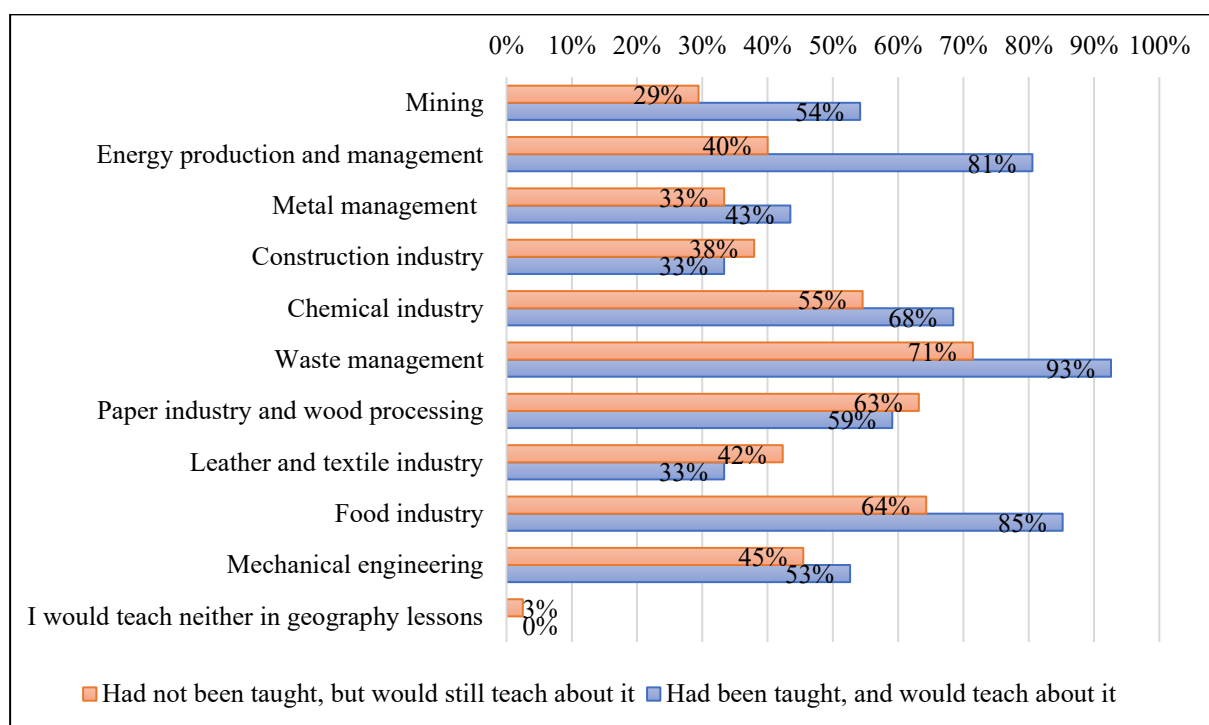


Diagram 1: Results and correlations on economic activities affecting Hungary in the context of whether the person participating in the survey was taught about these during their own geography studies, and whether the person would teach about the related environmental impact in their own lessons.

Activity	Sample	Was not	Was taught,	Fisher-test
		taught, but...	and...	
		...would teach it		Sig.
Mining	41	29%	54%	0,201
Energy production and management	41	40%	81%	0,083
Metal management	41	33%	43%	0,540
Construction industry	41	38%	33%	1,000
Chemical industry	41	55%	68%	0,522
Waste management	41	71%	93%	0,157
Paper industry and wood processing	41	63%	59%	1,000
Leather and textile industry	41	42%	33%	0,742
Food industry	41	64%	85%	0,231
Mechanical engineering	41	45%	53%	0,758
I would teach neither in geography lessons	41	3%	0%	1,000

Table 1: Results and correlations on economic activities affecting Hungary in the context of whether the person participating in the survey was taught about these during their own geography studies, and whether the person would teach about the related environmental impact in their own lessons.

Upon double-checking the dichotomous variables via the McNemar test and upon comparing the answers given regarding the same activities according to whether the participant had been taught the given material and whether was willing to teach it, in only one case – waste management – did I find some significant variance (Field, 2017). This was the activity concerning which a significantly higher number of participants felt that it should be taught in their geography lessons than the number of people stating that they had been taught about it during their geography studies. These results are demonstrated below in Diagram 2, table 2.

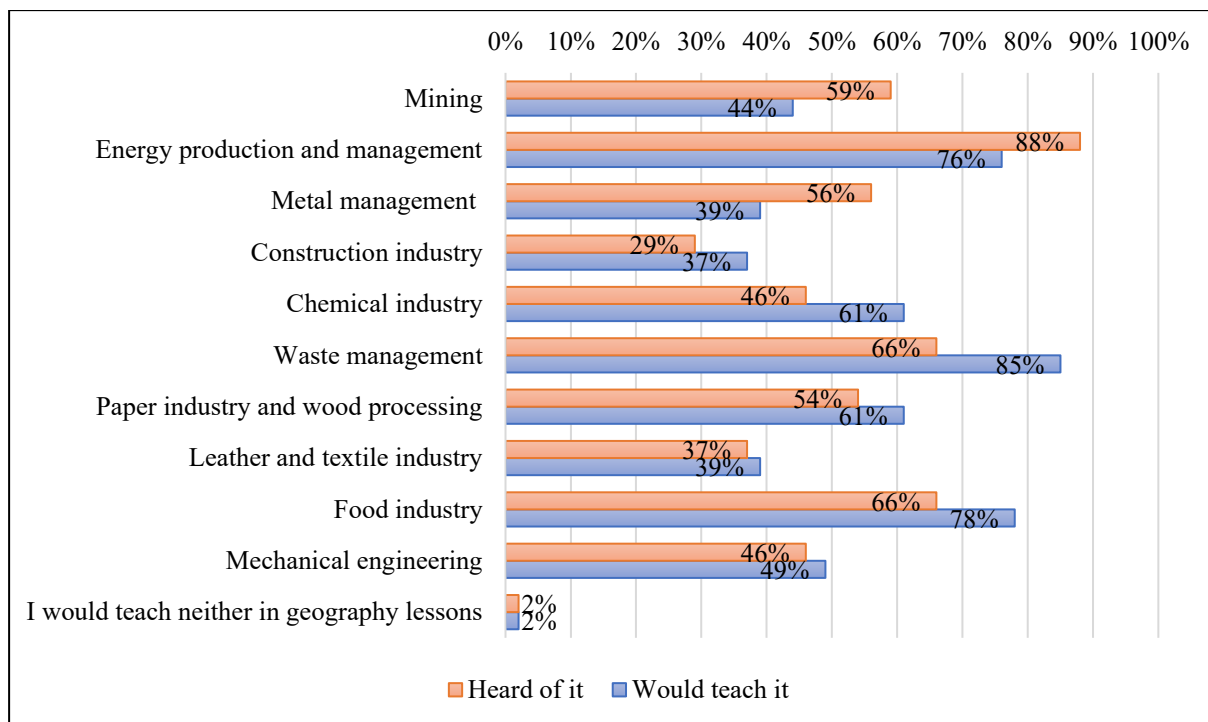


Diagram 2: Results and correlations on economic activities affecting Hungary in the context of whether the person participating in the survey was taught about these during their own geography studies, and whether the person would teach about the related environmental impact in their own lessons.

Activity	Sample	Heard of it	Would teach it	McNemar Test	
				Sig. (2-sided)	Sig. (1-sided)
Mining	41	59%	44%	0,210	0,105
Energy production and management	41	88%	76%	0,180	0,090
Metal management	41	56%	39%	0,167	0,084
Construction industry	41	29%	37%	0,648	0,324
Chemical industry	41	46%	61%	0,238	0,119
Waste management	41	66%	85%	0,039	0,020
Paper industry and wood processing	41	54%	61%	0,664	0,332
Leather and textile industry	41	37%	39%	1,000	0,500
Food industry	41	66%	78%	0,267	0,134
Mechanical engineering	41	46%	49%	1,000	0,500
I would teach neither in geography lessons	41	2%	2%	1,000	0,500

Table 2: Results and correlations on economic activities affecting Hungary in the context of whether the person participating in the survey was taught about these during their own geography studies, and whether the person would teach about the related environmental impact in their own lessons.

As for the questions concerning environmental catastrophes affecting Hungary, the objective was to ascertain whether students had heard of the mentioned environmental disasters and whether they feel it necessary to cover them in their own geography lessons.

Based on the results via the Fisher test no significant correlations were found between whether someone had heard of these incidents and their present motivation in teaching about them. There were two cases in which tendentious correlations between the mentioned factors could be observed: the cyanide incident on the Tisza and the pollution of the Duna by the refuse incinerator at Dorog. In both instances I found that if someone had heard of the given incident, they were more willing to teach about them, whereas lack of knowledge resulted in a lower motivation in covering them in class. Therefore, what a person had or had not studied in geography lessons did not indicate pedagogical motivation or intent in either of the listed cases (Diagram 3, Table 3).

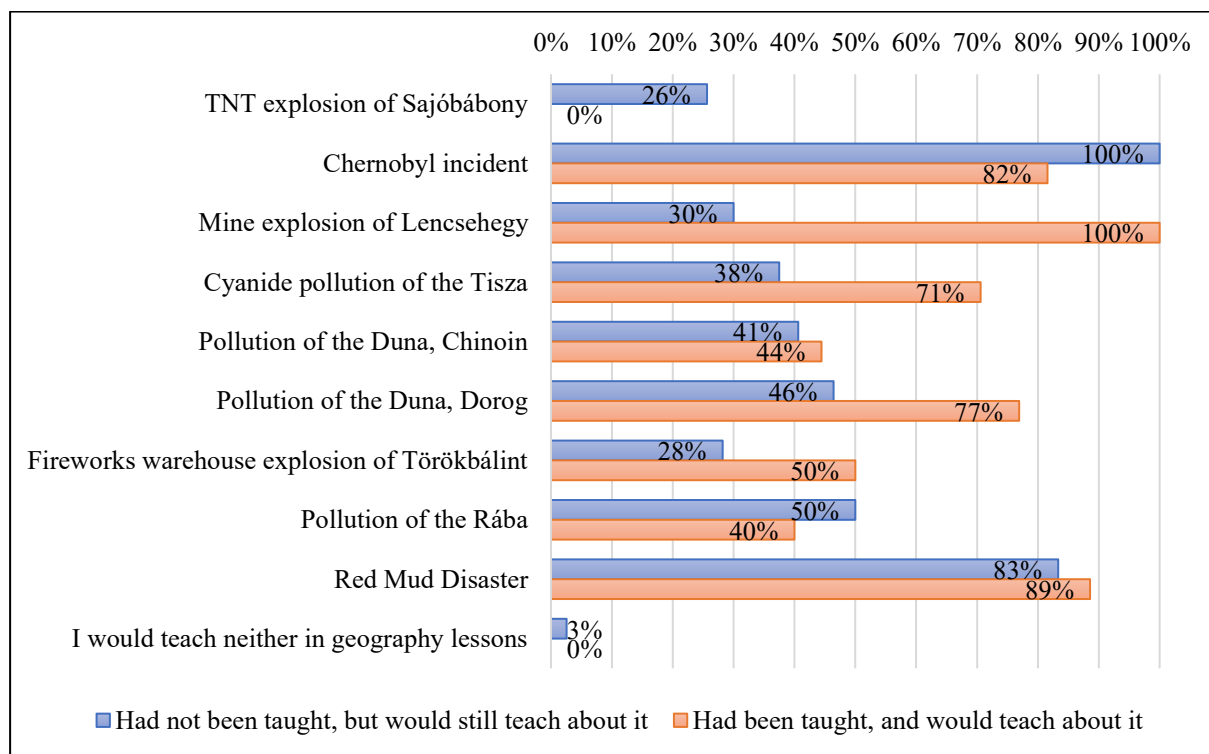


Diagram 3: Results and correlations on environmental catastrophes affecting Hungary in the context of whether the person participating in the survey was taught about these during their own geography studies, and whether the person would teach about the related environmental impact in their own lessons.

Catastrophe	Sample	Was not taught, but... ...would teach	Was taught, and...	Fisher-test Sig.
TNT explosion of Sajóbáony	41	26%	0%	1,000
Chernobyl incident	41	100%	82%	1,000
Mine explosion of Lencsehegy	41	30%	100%	0,317
Cyanide pollution of the Tisza	41	38%	71%	0,058
Pollution of the Duna, Chinoin	41	41%	44%	1,000
Pollution of the Duna, Dorog	41	46%	77%	0,095
Fireworks warehouse explosion of Törökbálint	41	28%	50%	0,505
Pollution of the Rába	41	50%	40%	0,746
Red Mud Disaster	41	83%	89%	0,567
I would teach neither in geography lessons	41	3%	0%	1,000

Table 3: Results and correlations on environmental catastrophes affecting Hungary in the context of whether the person participating in the survey was taught about these during their own geography studies, and whether the person would teach about the related environmental impact in their own lessons.

The McNemar test indicated significant divergencies between the mentioned factors in several cases. Although more than a quarter (26%) of all participants had heard of the TNT explosion of Sajóbáony, nobody regarded it important to discuss this event and its effects with their prospective students. A reverse trend could be observed about the mine explosion of Lencsehegy: only 30% of all participants had heard about this incident, yet all of them considered it important to discuss it. In the two listed cases of pollution affecting the Duna also significant divergences can be observed. In both instances, a higher number of participants stated they would discuss them than the number of participants who stated they had heard about them – the same conclusion can be drawn about the fireworks warehouse explosion of Törökbálint (see Diagram 4 and Table 4).

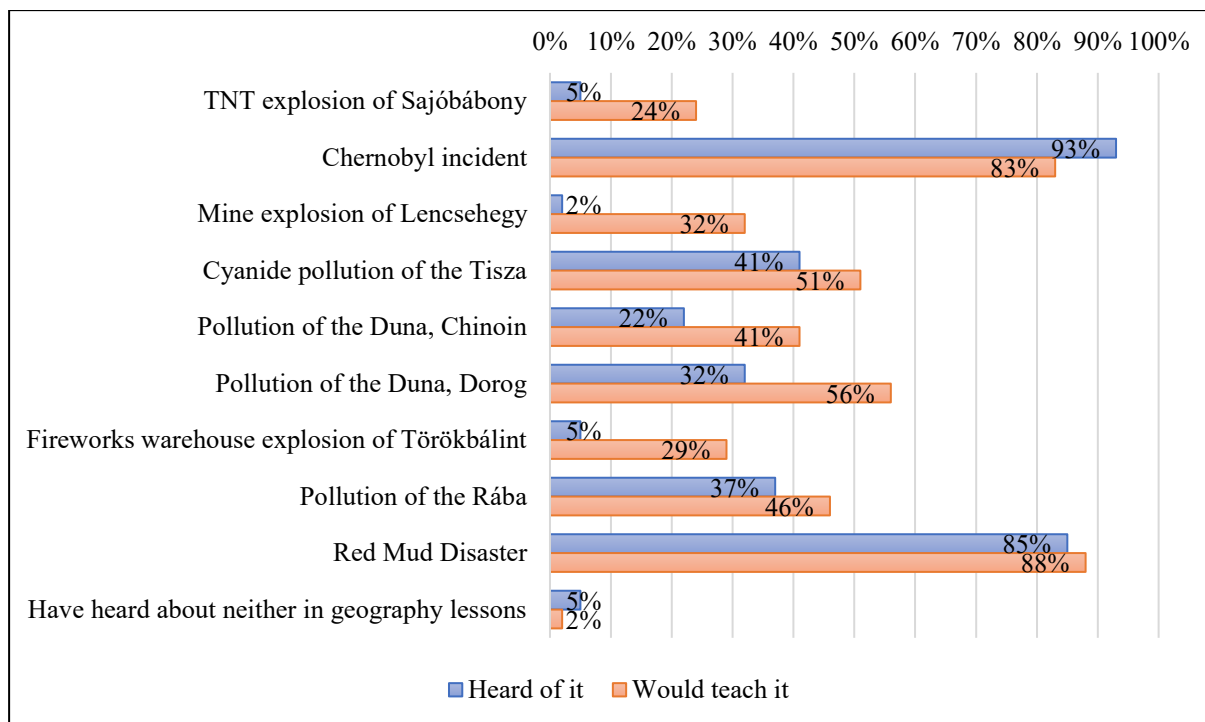


Diagram 4: Results and correlations on environmental catastrophes affecting Hungary in the context of whether the person participating in the survey was taught about these during their own geography studies, and whether the person would teach about the related environmental impact in their own lessons.

Catastrophe	Sample	Heard of it	Would teach it	McNemar-test	
				Sig. (2-sided)	Sig. (1-sided)
TNT explosion of Sajóbáonyi	41	5%	24%	0,039	0,020
Chernobyl incident	41	93%	83%	0,344	0,172
Mine explosion of Lencsehegy	41	2%	32%	<0,001	<0,001
Cyanide pollution of the Tisza	41	41%	51%	0,424	0,212
Pollution of the Duna, Chinoi	41	22%	41%	0,096	0,048
Pollution of the Duna, Dorog	41	32%	56%	0,021	0,011
Fireworks warehouse explosion of Törökbálint	41	5%	29%	0,006	0,003
Pollution of the Rába	41	37%	46%	0,523	0,262
Red Mud Disaster	41	85%	88%	1,000	0,500
Have heard about neither in geography lessons	41	5%	2%	1,000	0,500

Table 4: Results and correlations on environmental catastrophes affecting Hungary in the context of whether the person participating in the survey was taught about these during their own geography studies, and whether the person would teach about the related environmental impact in their own lessons.

Conclusion

In conclusion, it can be observed that almost no correlation exists between whether a person has been taught about the environmental impact of economic activities affecting Hungary and their present motivation in teaching about them in their own lessons. Neither the presence or absence of knowledge transfer and acquisition prove whether a person considers it important to discuss the environmental impact of a certain activity in their geography lessons. Only in the case of waste management did a higher number of participants state that it would be important to discuss it in geography lessons than the number of people who had been taught about it in their own geography lessons.

Similarly, it is difficult to find any correlation between whether a person has been taught about the environmental impact of disasters affecting Hungary and their present motivation in teaching about them in their own lessons. This means that although none of the participants thought that it was pointless to learn about the environmental impact of such catastrophes, they did not feel that although they were not taught about a certain incident, it would be necessary to discuss them in their geography lessons. Out of the listed disasters, in only five cases was the ratio of pedagogical intent higher than the ratio of pedagogical experience.

At the same time, it is interesting to observe that in some cases participants felt motivated in discussing an environmental issue which they had not been taught about during their geography studies – the reasons for this phenomenon could be the object of further research in this area.

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