THE USAGE OF DEPTH AND COMPLEXITY ICONS WHEN WORKING WITH INTELLECTUALLY GIFTED STUDENTS

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Abstract

The relevance of the studied problem is caused by the need for a special approach of the teacher to work with intellectually gifted students. The aim of the study is to develop a differentiated lesson plan for the development of intellectual giftedness of students and to conduct classes using the depth and complexity icons. The authors' definition of "an intellectually gifted student" is given. They are individuals, who master the educational program; they are characterized by advanced cognitive development, creativity and motivational involvement in the creative intellectual activity. The application of the depth and complexity icons on concrete examples is considered in detail. Two plans for the differentiated classes on genetically modified organisms (GMOs) and gender discrimination in the workplace with the usage of the depth and complexity icons have been conducted and presented. During the interview on the results of the lesson on the implementation of these icons in middle-level classes, the students expressed the idea of the need to use these icons at earlier stages of training, as they allow faster, in-depth and more extensive study of the proposed topics in chemistry, history and other subjects. According to the results of the training quality and feedback, we see that the usage of the icons allows to hold a lesson at a high methodological level, the students are interested in acquiring new knowledge, their analytical skills are developed when working with texts. In conclusion, even a small number of the icons allows to deepen, elaborate and differentiate the educational process, and to develop the intellectually gifted students. Materials of the article can be useful for experts working in educational institutions and researchers who are connected with pedagogy.

Keywords: Education, teacher, student, intellectually gifted, depth and complexity icons, differentiated lesson.

1 INTRODUCTION

Intellectually gifted students are not "average"; they need a special approach from a special teacher. An intellectually gifted student is an individual mastering an educational program and characterized by advanced cognitive development, creativity and motivational involvement in the creative intellectual activity [1].

It is important to consider the work of a teacher with students through the prism of pedagogical creativity. Pedagogical creativity can be considered as a teacher's ability to change the communication situation in such a way that the teacher and students achieve effective mutual understanding in the pedagogical process.

Currently, there is a large amount of information about the development of giftedness, but most researchers come to the same conclusion: it is necessary to use the principles of differentiation - acceleration, complexity, depth, challenge. In modern schools, when organizing the educational process, descriptors (from the Latin descriptor "describing") have begun to be widely used. Using descriptors, the teacher strives to help the student and tries to convey the meaning of the task being performed [2].

The personal experience of the authors indicates that the usage of the depth icons (Big idea, Language of the Discipline, Details, Patterns, Unanswered Questions, Rules, Trends, Ethics) and complexity ones (Across Disciplines, Relate over time, Multiple perspectives) is becoming the most productive. These icons can be used in classes in any subject, at any stage of the lesson, when performing tasks of various types [3].

The aim of the study is to develop a differentiated lesson plan for the development of intellectual giftedness of students and to conduct classes using the depth and complexity icons.

2 METHODOLOGY

To conduct a differentiated lesson aiming at developing the intellectual giftedness of students, we have created and used **a template** for the plan of such a lesson.

Subject:

Concept:

Content Differentiation Form: (Circle only ONE item at this lesson)

Depth	Creativity	Challenge	Acceleration	Complexity

Elements of Logical Reasoning (circle 2-3 elements used at this lesson)

Aim	Point of view	Data / Proof	Results
Assumptions	Consequences	Concepts / Ideas	

Summary: The student learns the nature of_____

while studying_____*(concept)* of _____*(theme)*

using _____, _____, and _____ *(2 or 3 elements of Logical Reasoning).*

Description of what is happening in class:

Describe how each aspect of the differentiation (concept, content, elements) is woven into the lesson.

Three questions, including elements of logical reasoning (Note: these are just examples of high order questions, you can ask other questions. It is best if you can write them from the perspective of how they relate to each other).

1.

2.

3.

3 RESULTS

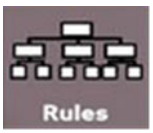
As a result of the research, we have considered the application of the depth and complexity icons on specific examples (subsection 3.1). Two plans for the differentiated classes on genetically modified organisms (GMOs) and gender discrimination in the workplace with the usage of the depth and complexity icons have been conducted and presented in subsection 3.2. The survey on the results of the lesson on the implementation of these icons in middle-level classes is given in subsection 3.3.

3.1 Practical application of the depth and complexity icons

We consider the application of the depth and complexity icons on specific examples in more detail and present the results in Table 1.

Table 1. Practical application of the depth and complexity icons on specific examples.

Icon	*Meaning*	*Practical application of the icons*
 You can use this icon as the following image – ).	**Big Idea.** Knowing various theories and facts, students understand the main idea of the theme (topic), the purpose of the lesson.	This icon suggests that this is information from a text, a slide from a presentation, a summary of a topic, with an explanation of something completely new. During the lesson, the teacher tells the main idea of the material being studied. This is usually a statement of the concept, consisting of one, rarely two, sentences. In fact, it is quite difficult to express the main idea without using excessive details. For example, a smartphone is a pocket computer connected to the Internet; a bicycle is a vehicle on two wheels ridden by a person. Think about how you would highlight the main points when describing a bee to a person, who has never seen one, or how you would explain the essence of the basketball game.

	**Language of the Discipline**. Students are able to use terminology and subject vocabulary necessary for mastering science.	At school, the concept of “discipline” is used, which refers to an area of study or branch of knowledge, such as mathematics, biology, geography, history and others. The language of the discipline involves the usage of certain terminology and vocabulary at each individual lesson. Students examine the hydrolysis of salts in chemistry, the organ systems of living organisms in biology, and optical phenomena in physics. Each discipline uses its own subject terminology.
	**Details.** Students can determine the details, which characterize the features of the studied or examined material.	The lesson involves setting up the goals that students should achieve. Students must understand what they need to do, the means by which the training will be carried out, what knowledge will be acquired at the end. Using this icon, the teacher tries to draw attention to certain details necessary to parse the whole topic.
	**Patterns.** Students are able to determine cause-and-effect relationships, knowing the patterns.	The patterns tool asks learners to think about cause-and-effect relationships, about what they see. Patterns differ from rules in that they can be broken, but the rules cannot be changed. For example, in chemistry, when studying how certain substances are obtained, students learn about certain conditions under which compounds are produced, but you can invite students to change any condition (concentration of reactants, gas pressure, temperature) and express their versions about how the product yield will change. Students solve problems using certain patterns or algorithms and determine the necessary actions. Sports games have certain patterns. They are repeated, but can also be broken. Patterns are observed in biological processes, poetic forms, and historical sciences, but there is always the possibility of their change.
	**Unanswered Questions.** There is a focus on issues that have not been studied yet (What is not clear yet? / What else needs to be studied?). It is up to students to realize what they need to learn in order to understand a particular area of science.	Perhaps it is the most underused of the icons. It is much more than "What questions do you have?" Instead, students should be encouraged to ask, “What else don’t we know about this topic?” or “What can’t we know?” It is important to consider questions that truly remain unanswered for humanity.” After studying a particular topic or section, students must understand that they still have questions and that there may not be answers to them at the moment. For example, how to fight a disease for which there are no drugs yet? Why were there certain historical prerequisites for a certain event and what was the reason it did not happen? etc.
	**Rules.** Students must use the proposed structure and rules of the given area to conduct research.	The presented thinking tool is called rules. There are certain rules in any school discipline: decision rules, design rules, game rules, etc. But how to develop the student's thinking? Every smartphone is linked to an internet connection. It should be able to make phone calls and have an app store that can be updated. But we must not forget the legal rules of using gadgets in public places: turn them off if necessary at meetings, at school; do not write messages or talk while driving a vehicle, etc. In order to make a bicycle, you need to use a steering wheel, a frame, and two wheels. This rule is necessary for the manufacture of any bicycle. There are also rules for its operation. A cyclist must have appropriate equipment, move on specially designated paths, give pedestrians priority, etc. To obtain pizza, there are rules for the use of tomatoes, cheese, and various additives. When selling, trade rules are observed, but we must not forget about health rules (regulations).
	**Trends.** Students identify factors that can be used to change something and conduct research.	In every science there are trends indicating the development of a particular process. We live in an independent state, and students can be asked about the changes that took place in it at different time stages, about the reasons that led to specific changes. We have the right to vote, the right to choose our leaders, but what caused this trend? After reading a literary work, one can ask how the hero’s behavior is changing at this particular moment in history. What has caused this and what can the consequences of this trend be?

	**Ethics.** Students consider moral principles.	If we are talking about a smartphone, then we understand its advantages. A mobile phone allows you to access a large amount of information and keep in touch with relatives and friends anywhere in the world. At the same time, it can be distracting (about 60% of car owners use this device while driving a car). More than a century ago, the German scientist Fritz Haber proposed a method for producing ammonia, which is used to produce nitric acid, nitrogen fertilizers, and dyes needed in the modern world [4]. At the same time, this scientist participated in the development of methods for using poisonous chlorine in World War I against enemy soldiers in the trenches. Getting around by bike provides excellent exercise and it is environmentally friendly. However, you should remember the following: in order not to create dangerous situations on roads, it is necessary to use appropriate protective equipment, have the appropriate dimensions and travel on the appropriate paths. Thus, the usage of this icon should allow students to identify contradictions in the topic being studied. They begin to think about the ethical issues associated with the idea and delve deeper into the topic.
	**Across Disciplines.** Using interdisciplinary connections, students, find common points between the structural elements of educational content, expressed in concepts, scientific facts, laws, theories, etc.	The more examples of intersection between disciplines are found and the more often one topic of one discipline intersects with several different disciplines, the stronger the need for creating interdisciplinary research is manifested and the more intense the complexity is expressed in the development of students' giftedness. The usage of this icon will prompt the need to discover and prove interdisciplinary connections when studying protein biosynthesis, traffic, muscle functioning during physical activity, water tension, etc.
	**Relate over time.** Students find elements of the past, present and future in the material they are studying.	This icon can be used when studying the history of the material (object or phenomenon), observing its present state and trying to predict future changes. We know how a car or a telephone has changed over the decades, we understand what functions they are performing now, but it is always interesting for students to imagine what the object will look like and what functions it will perform in the future. Students provide evidence.
	**Multiple perspectives.** Students explore different points of view on what is happening or what has been previously studied. They propose the course of development of a particular problem.	The ethical component of the studied topic closely resonates with the content of this icon, called “Multiple Perspectives”. It involves exploring different points of view on the problem posed. For example, during the spread of coronavirus, there were several opinions about the danger or non-danger of this disease. Students should study in detail the various statements of scientists, recovered patients, etc. Students should understand how different people view the same historical event, each from a different perspective.

The more icons you use, the more your students will immerse themselves in the material being studied. The icons can complement each other. We suggest giving students the opportunity to understand the meaning of the icons truly before using them. In practice, it takes up to a week for students to understand the need to use an icon.

The proposed examples are not the only ones. Each teacher is free to make their own statements. Try creating your own statements using a combination of depth and complexity. You will probably find out that some prompts fit together very naturally, while others do not fit together.

Do not be afraid to experiment and come up with new ideas. You may not always use pretty pictures. Instead, draw icons by hand while you are teaching and encourage students to do the same. The depth and complexity icons are ultimately tools for students, and they should use the tools whether or not they have access to material that is printed on paper. By adding the depth and complexity tool, we should always imagine how we could improve the students' knowledge.

3.2 Differentiated lessons for the development of intellectual giftedness of students

For example, there is a lesson on **genetically modified organisms (GMOs)**. This is a very large topic and it is necessary to "narrow" the area of study. You can ask students to consider *the risks* of using GMOs. Students read an article or textbook paragraph about a scientific study of GMOs, and then read public opinion about GMOs in the media. They should identify similarities and differences in how scientists and journalists describe the risks of GMOs and then describe how different perspectives lead to different or similar beliefs about the risks of GMOs. At the end of the micro-study, students must be asked questions for logical reasoning:

1. Describe what each author says about the consequences of using GMOs, especially the risks of using GMOs ( ).

a. Article A: _____

b. Article B: _____

2. What specific words reveal the author's point of view? ( )?

3. How are the author's points of view revealed through the use of evidence? Give two examples of evidence used to support the point of view (, ,).

In this particular example we can see that the usage of Big Idea , Language of the Discipline , Multiple perspectives , Details , Ethical issues icons will be able to concentrate students on specific things when studying the topic.

We consider another example.

An example of a differentiated lesson plan with the usage of the depth and complexity icons

Subject: Gender discrimination in the workplace

Concept: 

Discrimination

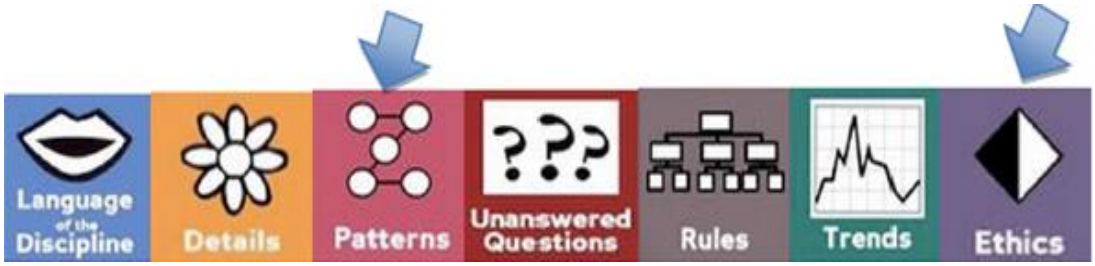
When considering the issue of gender discrimination in the workplace, discrimination can be taken as a central concept.

Content Differentiation Form: (Circle only one or two items at this lesson)

Depth	Complexity

At the beginning of the lesson, students should be oriented to the need to use the following icons:

– Depth: *Patterns and Ethics*



– Complexity: *Multiple perspectives*

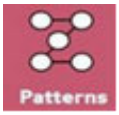
Lesson content:

Students are divided into two groups.

Group 1 will examine interviews with employers from different countries and find out how many women were not hired and why. This group of students should draw parallels between countries that have fewer women in the workplace and find out what other similar elements exist in these countries.

Group 2 will examine employee statistics, taking into account the number of men and women according to the profession. This group of students should draw parallels between professions that fewer women have and find out what other similar elements these professions have.

At the end of the micro-study, the students are asked three **logical reasoning questions:**



1. What patterns can be seen in countries that have fewer women in the workplace?

2. How did employers justify their decisions and prospects? How do women view these decisions? How do the society and the government view this?

3. Do you think it is ethical for employers not to hire women based on their gender today? If not, do employers realize that this is unethical?

It is very convenient to use the “frame”, shown in Figure 1, to work with the icons in class.

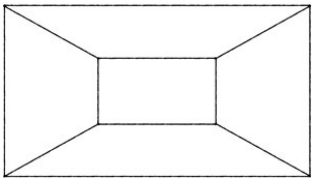


Figure 1. Frame for using the icons

This frame can be of any size. To cover a large amount of information or work in a group, a large frame can be made (e.g. on a paper board, marker board). If the work is individual or in pairs, then it is best to use an A4 sheet.

Using this framework allow to understand what problem the students are working on and how they are trying to solve it. For example, in the center of this frame there is a topic, picture or text, something to be learned during the lesson, and there are icons located around the perimeter.

3.3 Survey

The proposed icons will allow students to gain a deeper understanding of any topic, any section, any subject. They are ideal for differentiating learners who need more in-depth training. To this end, a Lesson Study was conducted and the students were interviewed.

The icons used and the descriptors developed with colleagues enabled the students to analyse the information in order to identify the characteristics of the salt hydrolysis process. Using various sources, the students were able to write down the definition of salt hydrolysis correctly, indicate key terms, determine the patterns of salt hydrolysis and indicate their details. In the task where it was necessary to match available information and icons, students either made no errors or made an inaccuracy in one pair, which suggested collaborative planning reflected in the descriptors. This result showed that the

usage of the proposed icons enabled the students, individually or when working in pairs, to determine the main characteristics of the salt hydrolysis process. The lesson attempted to utilise this toolkit in an experimental activity. After completing their research, the students were asked to write a conclusion using the Big Idea and Details icons. 100% of the students (8 out of 8) were able to explain their answer, carry out the investigation correctly and complete the required table, identify the type of hydrolysis of the salt solutions in the proposed test tubes. However, only 75% of the students (6 out of 8) were able to indicate the details of how these reactions took place. As a result of the feedback, the students were able to understand the nuances of these reactions.

Next, the students were interviewed. They were asked a few questions. The interview revealed that when asked “What can you do now using the icons?” and “What could you not do before using the icons?” the following responses were received. Student A stated that using these icons it became easier for him to remember the material studied at the lesson and practise it. Student B noted that now he could identify the main idea, highlight the terms he had learnt during the lesson. Student C believed that using the icons he could highlight the main information and understand it better. All of the students gave positive answers to the question “Do the icons allow you to do something better at the lesson?” In addition, student B believed that when leaving the classroom after the lesson, one could forget the material, while the icons allowed one to analyze it and thus learn it better. Student C thought that using the proposed toolkit took less time to study the material. According to the results of the training quality and feedback, we see that the usage of the icons allow to hold a lesson at a high methodological level. The students are interested in acquiring new knowledge, their analytical skills are developed when working with texts. The majority of students believe that if the same lesson is conducted in another group, it is necessary to explain to them the meaning of these icons, which should lead to a quick and better understanding of the studied material.

The results of the lesson showed that by combining the icons and the developed descriptors, quantitative characteristics (e.g., the number of details required for analysis, terms, patterns, and so on) should be introduced at the next stage of the study. The usage of high-order questions should be emphasized to develop analytical word processing skills, taking into account each individual student's abilities and thinking type. It is important to organize feedback and apply various forms of reflection.

4 CONCLUSIONS

In conclusion, in order to adapt and modify the curriculum and assessment to meet the needs of gifted learners, it is necessary to differentiate the learning process. To do this, the teacher should know the five forms of differentiation - acceleration, complexity, depth, challenge, creativity - and be able to use them. Acceleration allows students to understand the content faster; complexity allows to find more connections between objects; depth means immersion in the subject; challenge is used when putting forward a certain problem; creativity implies the usage of more original tasks.

Mastering the technology of the depth and complexity icons usage allows the teacher to help intellectually gifted students become more successful, as it promotes the development of thinking, teaches to propose and develop various ideas, use different resources, set goals, strive for excellence, and take intellectual risks. Each teacher can apply this toolkit at any stage of the lesson.

Even a small number of the icons contributes to deepen, elaborate and differentiate the educational process, and to develop the intellectually gifted students.

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