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Anticipatory Thinking as a Key Competence in Management for Sustainability: The Results of Research Among Polish Teenagers

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Abstract: It seems that the need to change the existing lifestyle of contemporary societies has never been more urgent. According to experts, the optimal model of sustainable development assumes that change can occur if the global society obtains and develops competencies defined as key to sustainable development. These competencies include anticipatory thinking, which allows us to envisage the results of our decisions and actions from multiple perspectives. Anticipatory thinking is extremely important at many levels in the context of sustainable management, including human resource management, economic management, environmental management, and natural resource management. This paper attempts to answer the question about the level of anticipatory thinking declared by Polish students living in rural and urban areas. This study was conducted among 877 students aged 13–20 years from the Małopolska region (southern Poland). A correlational research design was adopted, in which the method used was a survey, and the technique was a self-assessment test. We investigated which selected sociodemographic characteristics of the teenage respondents were related to a high, moderate, or low level of anticipatory thinking. Girls showed a lower level of anticipatory thinking, whereas age and education level were not significantly correlated with the level of this competence.

Keywords: anticipatory thinking; education for sustainable development; key competencies for sustainable management

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1. Introduction

1.1. Background

The need for modern society to solve complex challenges has never been more urgent; ongoing social, technological, economic, and environmental changes are forcing people living in this fluid reality [1] to constantly search for new solutions, adapt to changing living conditions, and foresee the consequences of their actions. The far-reaching consequences of our present actions must be recognized as soon as possible to prevent the negative effects of humans and keep them compliant with the sustainable development paradigm.

In this context, the ability to deal with future dimensions is extremely important [2]. As Michael Geden and his co-workers stated, anticipatory thinking is a critical cognitive skill for successfully navigating complex, ambiguous systems in which individuals must analyze system states, anticipate outcomes, and forecast future events—for example, in military planning, intelligence analysis, business, medicine, and social services, where individuals must use information to identify warnings, anticipate a spectrum of possible outcomes, and forecast likely futures in order to avoid tactical and strategic surprises [3]. Given the global challenges of sustainable development, a competence in anticipatory thinking should be one of the outcomes of formal education. The concept of sustainability calls for long-term future orientation and the envisioning ("sustaining" and the "needs of future generations"), anticipation, and prevention of harmful unintended consequences, and intergenerational equity ("future generations") [4].

It is extremely important that today's students are able to deal with all of the complexity and uncertainty of future problems [4]. Studies show that even though many young people show an interest in the global future, a sense of helplessness or even hopelessness is quite common among adolescents [5–7]. Properly planned and effectively implemented education for sustainable development should equip young citizens with competencies that will empower them to take responsible and effective action today as they bear in mind the requirements of the future and the possible positive and negative outcomes of their present activities. Future-oriented thinking is a necessary competence if the main SD postulate is to be met: to work out a development model that will allow the next generation to live in conditions that are no worse (at least) than those the present generations live in [8,9]. This includes both envisaging alternative and preferable futures and anticipating and preventing the future negative developments and consequences of global sustainability problems/challenges [10].

1.2. Research Problems

Our exploratory study aimed to determine the level of a critical competence for sustainable development—anticipatory thinking—as declared by students attending schools in Małopolska. We identified potential variables correlated with their declared level of this competence: gender, place of residence, and level of education (derived from the students' age). This study had an exploratory and descriptive purpose.

The objective of this study was to determine the declared level of anticipatory thinking competence in students aged 13–20 years from the Małopolska region (Southern Poland). First, a general definition of competence is presented, and then definitions of anticipatory thinking, with reference to sustainable development assumptions and education (ESD), are selected. Then, the methodology used in the research is summarized. The survey was conducted among 887 learners from primary and secondary schools. Next, the results are described. The final sections are the Discussion and Conclusions sections.

2. Competence in Anticipatory Thinking and Its Meaning for Sustainability

2.1. Competence as a Determinant of Human Activity

In recent decades, the concept of competence has become a subject of reflection and study for experts in many fields: psychology, pedagogy, sociology, management, and others.

Robert W. White defined competence as the cognitive abilities, skills, knowledge, strategies, and routines necessary to master specific demands, expectations, and performance criteria (a specific performance disposition), the subjective estimation of personal performance resources, and related motivational action tendencies [11]. Another definition of competence assumes that it is the "capability to perform effectively" [12]. The term 'competence' functions as a possibly rational and objective determinant of human activities. One can create a list of the competencies necessary to carry out certain activities. Competence, however, does not refer to an activity itself but rather the practical knowledge and ability to act in a reflective manner. Competence should be taken as a synonym for "agency"—the level of knowledge, practical skills, attitude, and emotional involvement that guarantees the effective completion of a goal or a task. Needs, emotions, and motivations, as well as some personality traits, value systems, creative thinking, and knowledge-shaping abilities, have direct impacts on an individual's set of competencies and their ability to acquire and develop them. In contrast, a wider range of competencies enriches one's personality, expands one's views, and influences perception and analytical skills, thereby facilitating life-long development through the continual updating of existing competencies and the acquisition of new ones. In the subject-matter literature, competence is also used to describe a certain attitude toward oneself, connected with the belief that people can adapt to and impact their external environment. In this sense, competence is necessary to deal with a problem, and if successful, it further strengthens one's self-esteem. Thus, being competent and self-aware (knowing oneself and being aware of one's competencies) can be described as confidence in one's effectiveness. Competence is a multifaceted construct referring to

certain areas of functioning and acting—because every self-aware individual knows which roles they play better and in which areas of life they do not cope as well (are less competent).

Many authors have noted that in their efforts toward sustainable development, individuals and—in the wider context—societies need specific competencies defined as key/core for sustainable development [13–17]. The most common view seems to be to perceive sustainability competence as a holistic, contextual, relational, and emergent concept [18]. The key competencies in sustainability are to provide knowledge, skills, and attitudes, which enable those who possess them to act toward developing a sustainable order; they are the basis for building up further competencies for shaping a better—more friendly, fair, and diversity-accepting—future for the next generations.

2.2. Anticipatory Thinking as a Key Competence for Sustainability

There has been growing interest in sustainable development, both globally and locally, with many aspects of daily life reflecting this trend. Recently, the United Nations launched seventeen sustainable development goals to address societal challenges across various domains, including material, technical, industrial, and social dimensions [19]. The fourth aim of SD is high-quality education. The result of this education is that students acquire competencies that will help them act according to the rules of sustainable development.

One of the most often mentioned key competencies for sustainable development is anticipatory thinking [20–26]. As Anim Wiek and his co-workers stated, "Sustainability education should enable students to analyze and solve sustainability problems, to anticipate and prepare for future sustainability challenges, as well as to create and seize opportunities for sustainability" [10] (p. 204). In a document entitled The 'Future of Education and Skills 2030. Learning Compass 2030—A series of concept notes' [27], the OECD emphasized how important the ability to anticipate future problems and their possible solutions is for sustainable development.

According to Geden and his coworkers, anticipatory thinking is a deliberate, divergent exploration and analysis of relevant futures to avoid surprise [28]. It involves the ability to imagine how uncertainties may impact the future, helping to identify leading indicators and causal dependencies within future scenarios, and complements forecasting, which focuses on assessing the likelihood of outcomes. Anticipatory thinking is a critical macrocognitive function of individuals and teams [29]. Having this competence means, among others, the ability to prepare for future problems and opportunities.

Anticipatory thinking is the process of recognizing and preparing for difficult challenges, many of which may not be clearly understood until they are encountered. It is a form of sensemaking. Sensemaking often involves explaining events and diagnosing problems—a retrospective process. It can also take the form of formulating expectancies about future events [30,31].

Anticipatory thinking competence is understood as the ability of a person to anticipate the course of events with a high probability, to predict the development of situations and their own reactions to them, and to act with temporal–spatial anticipation [32]. Additionally, it is worth stressing that people with anticipatory thinking competence can prepare themselves for future events rather than simply predict what might happen.

In the field of ESD, anticipatory thinking refers to the capability to think in a forward-looking way and to acknowledge and deal with uncertainty constructively [2]. Wiek and colleagues [10] defined anticipatory thinking competence as "the ability to collectively analyze, evaluate, and craft rich 'pictures' of the future related to sustainability issues and sustainability problem-solving frameworks." Having this competence means being able to comprehend and articulate their structure, key components, and dynamics; the ability to evaluate refers to comparative skills that relate to the "state of the art"; the ability to craft integrates creative and constructive skills [10]. Humans use anticipatory thinking to identify potential future issues and proactively take action to manage their risks. This differs from predicting a single correct outcome in that its goal is to identify key indicators or threatening conditions so one might proactively mitigate and intervene at critical points

to avoid catastrophic failure. This unique human ability allows us to learn and act without actually experiencing it [33].

Education implemented according to the sustainable development paradigm supports learners in acquiring and developing anticipatory thinking competence. Rieckman [20] stated that future dimensions, such as anticipatory skills, skills to introduce change empowerment strategies, and competency to cope with ambiguity, frustration, and uncertainty related to these future dimensions, are mentioned frequently in relation to ESD practice. Thus, according to researchers and experts, the future and the complexity connected to it ought to be an important part of ESD. In turn, Maria Ojala wrote—in the context of anticipatory thinking—about hope and the ability to cope with uncertainty, anxiety, and fear of how the world will look in the future [2].

Anticipation is understood generally to be a key component of expertise in many task domains [34,35]. Anticipation reflects the capacity to effectively perceive future risks and manage them cognitively, enabling conflict resolution in small steps. This makes it a key competence in the context of adapting to changes within energy management systems, including the use of renewable energy sources. Although the production and consumption of renewable energy are becoming increasingly attractive alternatives, the adoption and use of RES in Central and Eastern Europe is still relatively early [36]. In this context, the knowledge, skills, and attitudes that constitute competencies are extremely important. In 2020, environmental fossil fuels were the source of as much as 83% of the energy consumed in Poland. This value is five times greater than the value of energy obtained from RES, which puts Poland in the infamous first place in Europe for obtaining energy from fossil fuels [37]. As a result, electricity generated in Poland is also the most "dirty" within the EU: to produce 1 kWh of energy, an emission of 724 g of CO_2 is needed, which is three times more than the European average. Power generation in Poland is mostly based on the combustion of hard coal and lignite; therefore, as the probability of their exhaustion seems real and to meet its obligations toward the European Union, the government of Poland should intensify its actions to promote RES in the country [38]. For every national economy, achieving energy security is the overriding goal [39]. This term denotes a market's ability to cover all present and future needs of fuel and energy consumers [38]. It is obvious that in the context of climate, social, and economic changes, it is extremely important to use "clean", renewable, and cheap energy sources and achieve energy independence. The use of RES is an important element of the sustainable development of each country and improves the local energy balance, saves energy fuels, reduces CO_2, SO_2, NOx, and other pollutant emissions into the air, and reduces the costs of obtaining electricity [40]. However, research shows that knowledge about RES is unsatisfactory among European Union citizens [36]. In Poland, analysis of the school curriculum and teachers' knowledge of RES is insufficient [41–43]. In this context, the role of the school and the teacher in developing anticipatory thinking competencies is extremely important. Our common future depends, to a large extent, on the implementation of the principles of sustainable development in all areas of human functioning. Having anticipatory thinking competence enables both decision-makers and citizens to take action and make decisions that, in the long run, will be optimal for the environment, the energy security of the country/region, their households, and the economy. Anticipatory thinking allows for a proper evaluation of the long-term benefits of investing in RES, even on an individual basis and in everyday contexts, where these benefits may not be immediately obvious. Anticipation is a fundamental aspect of human functioning at both the individual and group levels.

An example of anticipatory thinking, in the opinion of Adam Amos-Binks, Dustin Dannenhauer, and Leilani H. Gilpin, is when a homeowner uses historical data to estimate the value of home insurance based on the home's location. The home is in a geographic area where available information based on historical data indicates there is very little risk of hurricanes [44]. The authors stressed that this competence is used in everyday life, from bringing an umbrella when it might rain and deciding on insurance premiums to specialized high-risk scenarios like operating rooms.

It is also worth stressing that the cultural aspect of anticipatory thinking is very important. It is no exaggeration to say that each country/region has its own conditions for anticipatory thinking: its own typical problems, prospects, opportunities, and threats. Therefore, the development of this competence cannot take place without taking into account the local context. The context of implementing anticipatory thinking causes challenges and barriers to developing this competence. For example, in Poland, traditional education programs and the core curriculum emphasize students' acquisition of knowledge and the development of other competencies while neglecting the development of anticipatory thinking. Teachers complain that the core curriculum is too extensive and difficult to implement, and they do not have the time and tools to develop competencies because, first of all, they must prepare students for tests and exams. Only education at the university level allows the freedom to develop competencies other than those that are tested.

To summarize, anticipatory thinking competence can be defined as follows: the ability to understand and evaluate multiple futures—possible, probable, and desirable—to create one's own visions for the future; to apply the precautionary principle; to assess the consequences of actions; and to deal with risks and changes [45]. This competence is particularly relevant in a risky society [46], where citizens are constantly challenged by fear, a sense of threat, and uncertainty.

The key definition of sustainable development assumes that it is a development that meets the needs of the current generation but guarantees that subsequent generations will be able to enjoy the same privileges as the current ones. This postulate is impossible without thinking, which allows us to identify potentials and threats whose effects may be felt in the future. A person with anticipatory thinking competence is able to anticipate how sustainability problems might evolve or occur over time (scenarios), considering inertia, path dependencies, and triggering events while also creating and crafting sustainable and desirable future visions and considering evidence-supported alternative development pathways. Individuals who think in a future-oriented way are efficient in sustainability problem solving, decision making, and motivating change. They are able to manage their own career and anticipate how their job might evolve and how their professional activities might contribute to or mitigate future sustainability problems [10,47].

In the context of sustainable development, future-oriented management is crucial. Owing to anticipatory thinking competence, individuals are able to manage not only their own careers and development but also strive for sustainable development in their organization and the local environment. Anticipating the consequences of actions taken in the present can facilitate management in many contexts. Sustainable management is not only about identifying potential threats but also about searching for opportunities and alternative solutions. It allows you to use the potential of the group, environment, and team and to recognize strengths and weaknesses. Of course, an important aspect of sustainable management is recognizing threats and quickly reacting to them, which is possible thanks to anticipatory thinking competence.

Education for sustainable development, which is a major agent in transforming current society into a more sustainable one [48], is based on the values of justice, equity, tolerance, sufficiency, and responsibility, with respect as its core [49]. It is impossible to access those values without forward-looking competence. This is why it is so important to determine the level of this competence among young people—future decision-makers managing the natural, economic, and social environment. After determining its level, actions should be taken to develop anticipatory thinking competence, especially among those groups that show a low level of it.

3. The Methodological Assumptions of This Research

3.1. The Main Goal of This Research

The cognitive goal of this study was to determine the level of anticipatory thinking competence—one of the key competencies for sustainable development—among Polish adolescents. Moreover, we wanted to identify which sociodemographic features of these

students are related to their level of anticipatory thinking. The completion of this research goal may inspire practical actions such as the introduction of changes to the curricula, which would facilitate more effective acquisition and development of anticipatory thinking competence by students.

The object of our research was the level of anticipatory thinking competence among Polish adolescents.

The competence level can be determined based on the long-term observation of individuals who possess or do not possess a certain competence or through tests (questionnaires), including self-descriptive scales. To meet the research objective, we decided to conduct a survey (quantitative method) using a self-assessment questionnaire. The assumption was that adolescents can describe their level of competence reliably because, according to the competence theory, the competence prerequisite is the belief in being able to face challenges associated with a certain competence. This means that competent individuals who are convinced of their effectiveness in a certain area/aspect can determine their level of this competence.

3.2. Research Problem

The main research problem in our study was formulated as follows: what is the level of anticipatory thinking competence declared by students aged 13–20 years?

The dependent and independent variables were set for the purposes of the survey, as presented in Table 1. The variables were set in reference to a previous study, which indicated what factors may influence the process of teachers developing certain key SD competencies [50].

Table 1. Dependent and independent variables set in this study.

Independent Variables	Dependent Variables
Gender (female, male)	Level of anticipatory thinking competence declared by students
Students' place of living (village, small town, big town)	
Stage of education (grades 7–8 of primary school—students aged 13–15 years/grades 1–4 of high (secondary) school—students aged 16–20 years)	

Of course, correlations do not answer the question of causality, but by taking into account the specificity of the study and the designated variables (Table 1), it can be stated that certain sociodemographic characteristics of the respondents may cause a given level of anticipatory thinking.

In our study, we focused on sociodemographic features that may influence the self-declared level of anticipatory thinking competence. Among the many factors that may be correlated with the level of anticipatory thinking, we selected those that, based on the literature analysis, primarily determine students' competencies and self-esteem. It is worth emphasizing that self-esteem in this area is very important because, in everyday situations, people act based on beliefs about what competencies/abilities they have and what the possible outcome of their actions is. In other words, being convinced that they have a given competence and can perform a given task, individuals make efforts to cope with these tasks [51]. Additionally, Rommel AlAli and Shoeb Saleh stressed that self-efficacy is the realistic awareness of one's cognitive, emotional, and social capabilities, ability to solve problems, preferred thinking style, confidence in oneself, and handling of desirable and difficult life activities in online learning environments [52].

3.3. Measurement Instrument

This study was designed based on the nomothetic paradigm, and a quantitative strategy was used. To answer the research question, we used the "60 statements—6 compe-

tencies" survey method for the six key competencies of sustainability, which are critical thinking, anticipatory thinking, cooperation competence, dynamic adaptation to change, ability to project development, and creativity. The tool was a questionnaire designed for this study. The respondents were asked to respond to each of the 60 statements included in the questionnaire. Based on their answers, the levels of specific key competencies and their determinants for SD were identified.

One of the six key competencies for sustainability was included in our study, i.e., anticipatory thinking. Ten specific statements were designed to describe this competence. Students needed to mark whether the sentence was relevant for them; in other words, they needed to write down "x" for those sentences that were true for them. Cronbach's alpha reliability for this part of the questionnaire was 0.793 (CI 95%: 0.772; 0.812).

A list of statements was created based on a thorough analysis of the literature on the subject—both for classic (Snowden and Klein) and newer works.

To determine the self-declared level of anticipatory thinking competence and its correlation with the designated variables, the following were used: Pearson's chi-squared test, a likelihood ratio test, linear relationship test, and Kramer's V test.

3.4. Population and Sample

We decided to use convenience sampling [53,54], which is a non-random sampling method for selecting respondents due to their accessibility and proximity. In the case of our study, the participation of students depended on the consent of teachers and parents in the case of minors (13–17 years) or on their own consent in the case of respondents aged 18–20 years. Prior to participating in the survey, underage students were required to bring the written consent of their parents/guardians, whereas adult students had to provide their consent verbally. All of the respondents were informed about the scientific character of the study and that the results would be coded and fully anonymous. Then, the students received a hard copy of the questionnaire to fill out during class. Once the questionnaires were completed, the researcher collected them.

This study was performed in the southern, well-industrialized part of Poland.

In total, the sample consisted of 877 students from grades 7 and 8 of primary schools (aged 13–15 years) and grades 1–4 of high schools (aged 16–20 years). Of the respondents, 59% were primary school students. The respondents lived in different areas. There were slightly more students from villages (36%) than from other locations. Learners from small towns constituted 34% of the sample, whereas students from big cities comprised 30%. A total of 53% of the respondents were female.

3.5. Research Area and Procedures

This study was conducted in primary (grades 7 and 8) and high schools in the Małopolska region. In total, 52 classes from 36 schools in Małopolska (Southern Poland) participated. During the pilot study, the students received the questionnaire and were asked to rate to what extent they agreed with the questionnaire statements (from "I do not agree at all" to "I totally agree"). However, the analysis of the results of the pilot study showed that the students most often chose extreme answers and found the questionnaire difficult (they had to evaluate each of the 60 statements using a scale). Thus, the final version of the questionnaire did not have the scale. We decided that for our diagnosis, it was important to determine which of the statements the students found relevant for themselves. We tried to design the tool in such a way that every competence included knowledge, skills, and attitudes.

The results were analyzed using SPSS statistical software version 20. The relationships between the variables and contingency coefficients were measured using Chi-squared tests (phi coefficient for two variables: level of school and gender; Cramer's V for the variable place of living).

4. Research Results

The results were analyzed based on the data obtained from schools using questionnaires filled in by the students. The original questionnaire was developed for the purposes of this study based on an analysis of the literature, including the results of other research studies. During the study, the levels of six competencies described as the key competencies for sustainable development were investigated [50]. The questionnaire consisted of 60 statements, and the respondents were asked to mark (select) all of the statements with which they agreed. For this study, we analyzed 10 statements dedicated to anticipatory thinking competence (examples of the items include #3 "I can recognise present and approaching problematic situation"; #7 "I am a careful observer"; #9 "I think that decisions must be made responsibly and with consideration given to their future consequences").

For every student, all statements rated as true within certain areas were summed up. In each area, the sum of positive answers could range from 0 to 10. To determine the competence level, the following scale was adopted:

- **Low** competence level: 0 to 3 positive statements.
- **Average** competence level: 4 to 7 positive statements.
- **High** competence level: 8 to 10 positive statements,

The statements dedicated to anticipatory thinking to which the students needed to respond were developed on the basis of the literature review.

The analysis results indicate that fewer than one-fifth of the respondents showed a low level of anticipatory thinking (see Figure 1). Slightly more than one-third of the students rated statements that allowed them to determine their level of anticipatory thinking as average (35.46%). Almost half (46.07%) of the respondents showed a high level of anticipatory thinking competence (Figure 1).

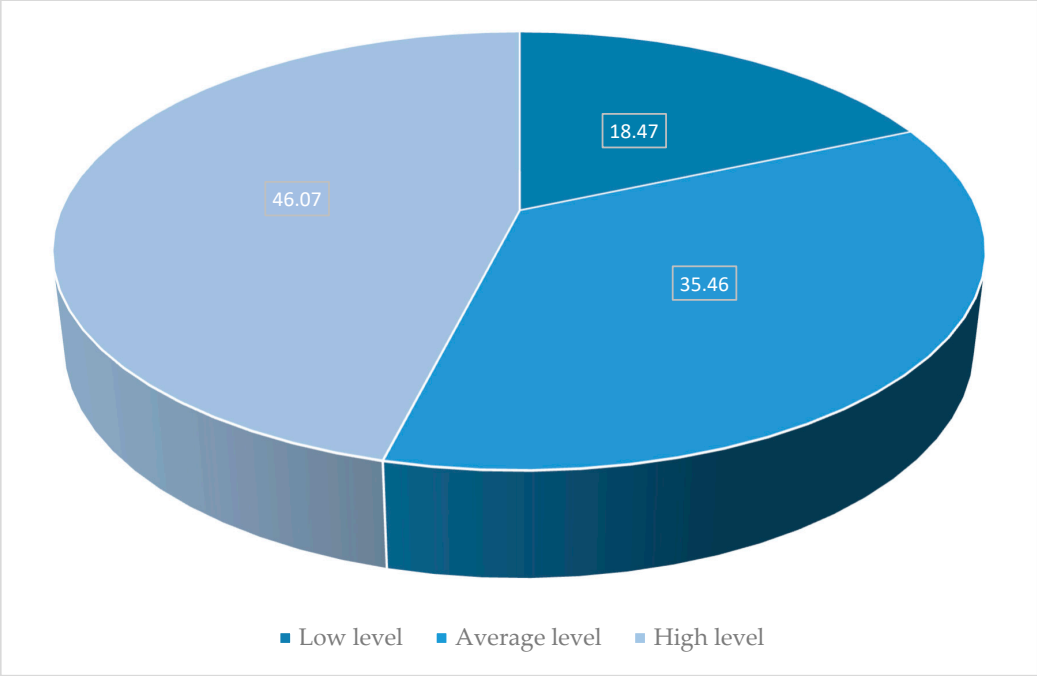

Figure 1. Level of students' anticipatory thinking competence according to their answers.

The mean value for all of the respondents was 6.75. According to the analysis, almost 30% of the students rated all of the statements in this category as true for them. No statement was chosen by less than 1% of the respondents.

In total, 65.91% of all students who took part in the research stated that they could draw conclusions based on the signs observed. Less than 60% (58.61%) believed that they always seek explanations for the phenomena they see. Approximately two-thirds of the

respondents (61.92%) declared that they can recognize present and approaching problematic situations. Almost 65% of the respondents correctly anticipated the outcomes of their actions and the actions of others. More students (73.77%) declared that they wonder what problems/difficulties may arise in the future, which is an extremely important ability in the context of sustainable development. Almost three-quarters (71.84%) of the respondents saw themselves as careful observers. Fewer students (64.99%) indicated being able to quickly respond to changes; similarly, 64.99% of the respondents reported always considering all possible consequences when making decisions. More than 70% of the students who took part in the study (71.61%) thought that decisions must be made responsibly and with consideration given to their future consequences.

Of the skills and behaviors associated with anticipatory thinking, the most frequently chosen was the statement about creativity. It was indicated by 77.3% of the respondents. The second most popular was "*I wonder what problems/difficulties may arise in the future*", which means that reflection on the future is typical for the vast majority of the interviewed students.

The results showed that girls evaluate themselves more critically than boys and less frequently choose certain statements as relevant. The difference between the variables was statistically significant. The mean value for girls was 5.84, whereas for boys, it was 7.79.

In addition, 26.67% of girls showed a low level of anticipatory thinking (compared to 9.26% of boys). Twice as many boys as girls (62.86% vs. 31.18%) indicated a high level of anticipatory thinking competence. None of the 10 statements describing the studied competence was selected more often by girls rather than boys. The most similar results among girls and boys were connected with the statement "*I am creative*". In turn, the statement "*I can draw conclusions based on the signs observed*" was much more frequently chosen by boys than girls (the greatest difference in declarations).

Only every other girl reported being able to recognize a problematic situation. Three out of four boys declared having this ability. In addition, boys declared more often than girls that they can respond to changes quickly. More male than female students declared that they seek explanations for the phenomena they see Figure 2.

To summarize, it is worth noticing that the respondents' gender is strongly correlated with how they evaluated their anticipatory thinking competence. Female students in both primary and secondary schools declared lower levels of skills typical for anticipatory thinking.

Education level determined the respondents' answers to a small extent—but less so than gender.

Primary education in Poland takes eight years and begins at the age of seven. Due to the reform of education in 2017, students of the former lower-secondary schools (gymnasiums) now learn in the seventh and eighth grades of primary schools (former grades 1 and 2 of gymnasiums) and in grade 1 of secondary (high) schools (former third grade of gymnasiums). Education in a secondary school lasts four or five years and ends with an exam. Therefore, grades 7 and 8 are populated by teenagers aged 13–15 years, whereas students in secondary schools (four-year high schools or five-year technical schools) are aged 16–20 years. They are learners who can acquire and develop certain key competencies for anticipatory thinking. As shown by the results of our study, the differences in the frequency of endorsing certain statements between students at different stages of education are usually not statistically significant. The exception is the statement "*I wonder what problems/difficulties may arise in the future*". Students in secondary schools were slightly more inclined to engage in such reflections (Table 2).

Other specific statements were chosen by similar numbers of students in both primary and high schools. The mean value for primary school students was 6.76, and for high schoolers, it was 6.87, so the results are very similar.

Slightly more students in primary schools (11.7%) reported a low level of anticipatory thinking in the self-assessment test (low level in high schools—8.5%).

A high level was reported for similar numbers of respondents (45.09% for primary schools and 47.99% for secondary schools).

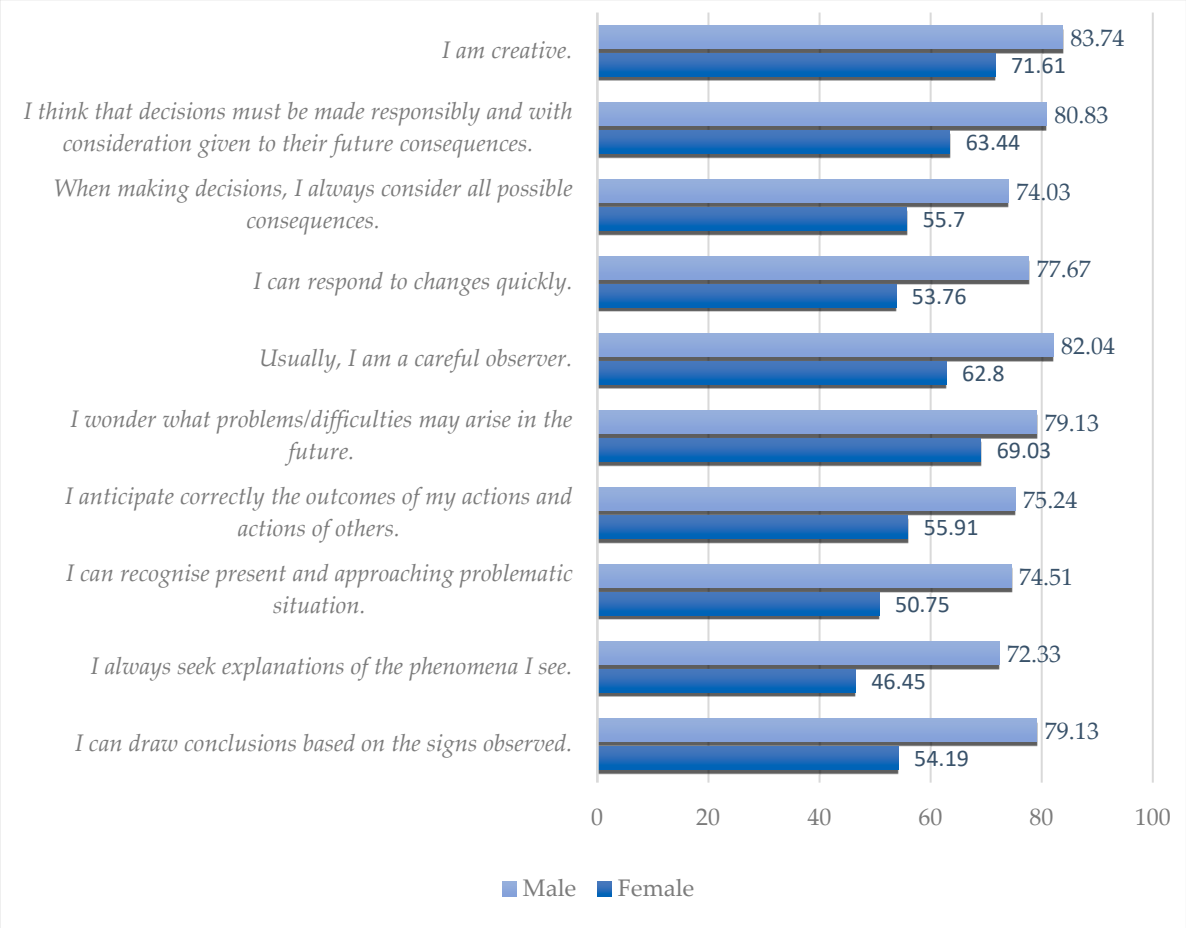

Figure 2. Anticipatory thinking—specific statements according to gender.

Table 2. Anticipatory thinking—specific statements according to school level.

Statement	Primary School (%)	High School (%)
I can draw conclusions based on the signs observed.	63.39	69.55
I always seek explanations of the phenomena I see.	57.03	60.89
I can recognise present and approaching problematic situation.	62.81	60.61
I anticipate correctly the outcomes of my actions and actions of others.	63.2	67.60
I wonder what problems/difficulties may arise in the future.	71.10	77.65
Usually, I am a careful observer.	73.60	69.27
I can respond to changes quickly.	62.81	68.16
When making decisions, I always consider all possible consequences.	63.78	65.08
I think that decisions must be made responsibly and with consideration given to their future consequences.	71.23	71.87
I am creative.	77.26	77.37

The greatest difference in declarations was noticed for the statement "*I can respond to changes quickly*", which was chosen by 62.81% of primary school students and 68.16% of secondary school students.

Aside from the two statements, "*I can recognise present and approaching problematic situation*" and "*Usually, I am a careful observer*", all were chosen more often by the respondents from secondary schools.

Place of living affected the results more often (Figure 3). The results of the Bonferroni test show that the relationship between living (1) in a village or (2) in a small town and the level of anticipatory thinking indicated in the self-assessment test was statistically significant. The average result for students living in rural areas was 7.24, while for those in small towns, it was 6.22, and in cities—6.77 points.

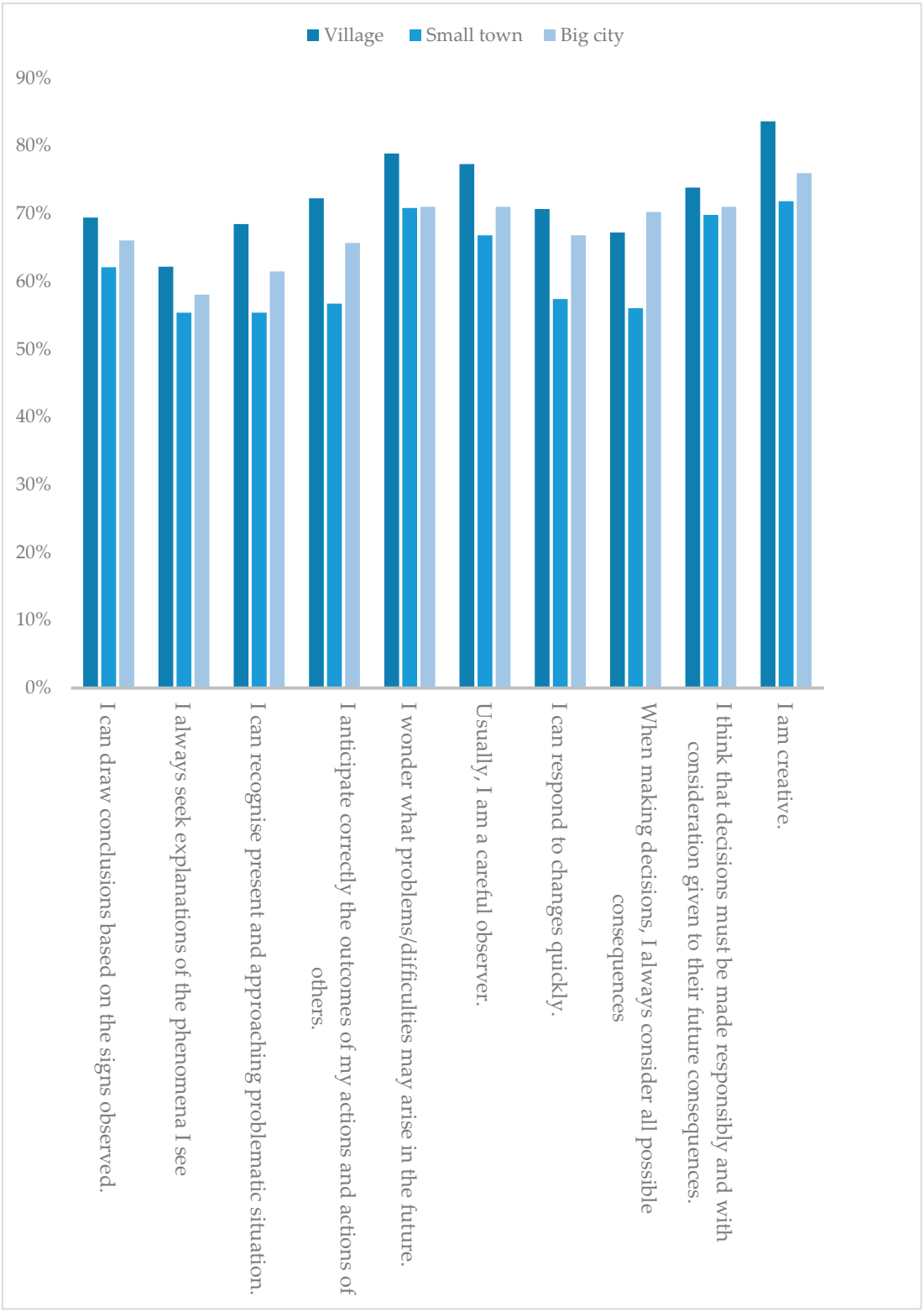

Figure 3. Anticipatory thinking—specific statements according to students' place of living.

A high level was reported for 51.1% of students living in a village, 33.26% living in small towns, and 47.72% living in big cities. A low level, in turn, was recorded for 6% of students from rural regions, 11.42% from small towns, and 14.89% from cities.

Almost all of the statements were more frequently endorsed by learners in villages. Only the statement "*When making decisions, I always consider all possible consequences*" was chosen more often by students from big cities. The chi-squared test was statistically significant for all of the statements except for the following three: "*I can draw conclusions based on the signs observed*", "*I always seek explanations of the phenomena I see*", and "*I think that decisions must be made responsibly and with consideration given to their future consequences*".

It is worth noting that for nine out of ten statements, students from rural areas were the largest group to consider these descriptions relevant. Only the declaration "*When making decisions, I always consider all possible consequences*" was chosen more often by students from big cities than students living in villages. The greatest differences can be observed in the statement "*I wonder what problems/difficulties may arise in the future*"—almost 80% of the respondents in village schools declared that it was true in their case. At the same time, this statement was endorsed by approximately 70% of respondents from small towns and big cities.

5. Discussion

In the context of challenges posed by the global world, anticipatory thinking is an extremely important competence. The experiences of the third decade of the 21st century highlight the critical importance of abilities such as analyzing all possible consequences of decisions and actions and using indicators to anticipate the future, even for distant phenomena and events and their consequences, both globally and locally. Young people, who are future change agents [55], must have the ability to anticipate with a future perspective and to recognize the symptoms of future events and phenomena to respond to them in time.

The analysis of the results presented herein showed that adolescent learners from southern Poland evaluate their abilities in terms of anticipatory thinking as good—almost half of the respondents reported that their level of this competence is high. The vast majority of the students declared that they could draw conclusions based on the symptoms observed and recognize future problems. They are also aware of the future consequences of their present actions.

However, the declared level of anticipatory thinking differed depending on gender. Girls evaluated their competence in this area as lower than boys. Many authors have noted that in many aspects, girls have lower self-esteem than boys [56–59]. The feeling of being less competent in anticipatory thinking may result from different attitudes of parents and teachers toward male students. Crowley, Callanan, Tenenbaum, and Allen, for example, argued that during shared scientific thinking, parents more often explain different issues between boys and girls [60]. In another study, teachers were described as more willing to encourage boys rather than girls to ask questions and create interactive comments and explanations [61–63].

Another factor that influences the level of anticipatory thinking is place of living. Students from rural areas evaluated their level of this competence as the highest. Perhaps in schools located in villages, where classes are usually less populated, teenagers have more opportunities to engage in discussions and other forms of teaching that facilitate the development of critical thinking. Students in smaller groups receive feedback from their teachers more often, which may translate into more developed anticipatory thinking. The teaching–learning process implemented in small village schools enables an individual approach for each student and the use of teaching methods and techniques that support the development of certain anticipatory thinking components.

Research has also shown that, generally, self-esteem is similar for both students from city and village schools [64].

The results of our study showed that the level of education (primary/secondary school) and, consequently, the age of students do not determine the level of anticipatory

thinking (no correlation). The students from primary and secondary schools who took part in the survey evaluated certain components of anticipatory thinking similarly: all of the components of anticipatory thinking competence were slightly more often endorsed as relevant by older students than those in primary schools. This is surprising because it may have been assumed that the higher the level of education, the more competent the students. This shows that students at both school levels feel similarly competent in anticipatory thinking. One must remember that, according to the concept of education for sustainable development, teachers at every stage should develop all key competencies for SD [65].

It is worth stressing that a deeper analysis of specific factors (like teaching methodologies, curriculum differences, and extracurricular activities) is needed in future research. In our exploratory study, we did not take these factors into account when analyzing the results. When we prepare a more complex tool for the next study, we will also take into account other factors related to the teaching–learning process. It is also worth planning a long-term study in the future, which will allow us to assess how the level of anticipatory thinking changes with age and correlates with other factors.

To summarize, the analysis of the results showed that the lowest competence in anticipatory thinking was declared by female primary school students living in small towns. According to other researchers, females are conditioned to suffer low self-esteem and inferior status [66]. However, one must remember that in today's world, in light of the challenges of the risk society, women can play an enormous role in transforming the development model, which should become sustainable. Thus, teachers and parents should support the development of key competencies for SD among girls and young females and ensure they have high self-esteem and feel competent in this area.

6. Conclusions

For many years, the principles of sustainable development have become increasingly popular as the growing number of people, including world leaders, politicians, teachers, decision-makers, and entrepreneurs, begin to understand that only this model can ensure the fulfillment of intra- and intergenerational fairness principles. The concept of key competencies for SD assumes that if modern societies have a high level of these competencies, development will be possible to ensure the survival of the next generations in conditions not worse than the present ones. Among the key competencies for sustainable development, anticipatory thinking plays a special role, particularly among young people. A high level of this competence helps one to analyze all of the future—less and more distant—consequences of present actions and to include the needs of others. One must bear in mind that in the globalized world, the decisions made and actions taken in one place may have far-reaching consequences.

Teachers are responsible for developing anticipatory thinking competence in the first grades of primary school and for showing their students how important it is to be able to foresee the short- and long-term effects of their decisions and actions. Living in a risky society [1], students need to cope with anxiety, fear of the future, and a sense of threat. Thus, they should have the competencies to help them assess their own situation and their surroundings and take actions that will make them feel more secure.

The methods and techniques teachers can use to support the students in developing anticipatory thinking include the Delphi rounds, structural analysis, and the future polygon [67]. The outcome is a narrative about events that might happen within 20, 30, 40, or more years. Once this narrative has been written down, students as "specialists" return to the present moment and, based on the current context, design tactics that together form strategies to bring about desirable future scenarios or avoid undesirable ones [68]. Other suitable methods to advance anticipatory thinking include different didactic games that require players to anticipate the consequences of actions and facilitate reflection on different solutions to problems. With the use of selected didactic games, students can learn that every decision should follow a "pros and cons" analysis. Moreover, SWOT analyses

and activating methods like evaluation or joint problem-solving techniques can also help develop anticipatory thinking.

Competencies are individual; they are learnable but not teachable, so teachers should support their students in the process of acquisition by creating such a learning environment (through, e.g., using problem-solving and activating methods of work) that will allow them to obtain knowledge and actively develop skills and attitudes. This is consistent with the principles of education for sustainable development, which aims, among other things, to shape a specific set of competencies for the future (key competencies for sustainable development). Competencies can be developed only in practice through facilitating the individual and group activities of children and adolescents.

We need to remember that the overriding principle of sustainable development is the principle of intra- and intergenerational justice, so we need to make sure that the future of the next generations is at least not worse than the present one. Therefore, it is necessary to involve leaders, decision-makers, and all citizens, including minorities and marginalized groups, in the process of acquiring and developing anticipatory thinking. These groups also have an obligation, in the context of sustainable development, to make decisions that will not have a negative impact on the well-being of current and future generations. This task may not be easy because socially excluded groups may have great difficulty in respecting the principles of sustainable development and anticipating the long-term consequences of their current actions. However, it is worth making this effort and reaching out to excluded and marginalized groups, both at and outside of school, to help these groups develop anticipatory thinking skills; in Poland, these groups are primarily Roma children and children from poor families. For sustainable development to become a possible and dominant development model, all social groups must be involved, and anticipatory thinking and actions consistent with this competence must become an educational priority.

7. Limitations of the Methodology and Further Studies

Like any other studies, our study, which implemented a self-assessment survey for data collection, has its limitations.

First, the results indicate that students' self-assessment may not necessarily translate into their actual level of anticipatory thinking competence. To assess the actual level, observational studies in the field must be carried out. In the future, research using a qualitative approach is needed. Furthermore, there is a need to create a more extensive tool for measuring anticipatory thinking competence. Our study aimed to estimate the declared level of six of the key competencies for sustainable development among young people.

Additionally, for the study results to be representative, subsequent studies should use random (and not convenience) sampling. There is an urgent need to investigate the level of anticipatory thinking in other cultural contexts. It should be remembered that due to the convenience sampling, our study was carried out among students of schools located in the well-industrialized southern part of Poland. In subsequent research, attention should be paid to the cultural context, and the research should be expanded, treating cultural specificity as a variable that may be correlated with the declared level of anticipatory thinking.

We believe that our study contributes to expanding the knowledge of key competencies for sustainable development. It is an introduction and inspiration for further research.

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