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Science fiction and fantasy in general education

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Abstract

This article deals with the possible application of the genres of science fiction (SF) and fantasy – novels, short stories, films, dramas, spectacles etc. in secondary schools as part of the programme of general education. The discussion concerns both the production and the reception of such works by the students. The purpose of this educational proposal is to introduce in the system an opportunity for the students to coordinate and consolidate creatively the knowledge and the skills acquired in the classes of all the other disciplines of the curriculum. The basic assumption of the thesis is that the characteristic features of these genres, i.e., their appeal to the imagination, curiosity, and the natural need of the students for their own artistic creation, may prove effective to elevate the educational targets beyond the pragmatic level of absorbing information for the sake of the formal requirements of the school programme. These aims, which transcend the level of the practical utility of existential and psychosocial needs, concentrate on the search for objective knowledge about the world through the development of the skill of critical thinking in the domain of cognition, the search for the artistic talents and predispositions of all the students in the domain of creation, and on the essential issues of educating the need for harmonious and peaceful coexistence with other people and

with the environment. The article presents the essential features of the theoretical grounding of this conception, the pedagogical implications of its introduction into the system and suggestions for its practical realization illustrated with examples of possible activities for students and teachers. The essay is concluded with a speculation on the future perspectives of a reciprocal reinforcement of the quality of general education and the development of the literary genres of SF and fantasy.

Keywords

SF and fantasy, general education, educational domains of cognition, creation and coexistence, critical thinking, verification and falsification, cognitive appeal of the teaching materials, creative aspect of the mind

Literatura SF i fantasy w systemie edukacji ogólnokształcącej

Abstrakt

Tematem tego eseju jest możliwość zastosowania gatunków literackich SF i fantasy – powieści, nowel, opowiadań, dramatów, widowisk, itd. w szkołach średnich jako elementu programu edukacji ogólnokształcącej. Dotyczy to zarówno produkcji tych utworów przez uczniów jak i ich odbioru. Celem tej propozycji edukacyjnej jest wprowadzenie do tego systemu okazji do skoordynowania i twórczego utrwalenia wiedzy i umiejętności nabytych podczas nauki we wszystkich pozostałych dyscyplinach programu szkolnego. Podstawą teoretyczną jest tu założenie, że charakterystyczne cechy tych gatunków literackich, czyli wyobraźnia, ciekawość, oraz naturalna potrzeba uczniów do własnej twórczości artystycznej mogą okazać się skuteczne do wyjścia ponad pragmatyczny poziom wchłaniania informacji na potrzeby formalnych wymagań szkolnych. Cele, które wykraczają ponad poziom praktycznych potrzeb egzystencjalnych i psychospołecznych wiążą się z docho-
dzeniem do wiedzy obiektywnej o świecie poprzez rozwijanie umiejętności krytycznego myślenia w dziedzinie poznania, z poszukiwaniem talentów i predyspozycji artystycznych u wszystkich uczniów, oraz

z kształceniem naturalnej potrzeby harmonijnej koegzystencji z innymi ludźmi i ze środowiskiem. Przedstawia ona zasadnicze cechy podejścia teoretycznego, implikacje pedagogiczne jej zastosowania i sugestie jej realizacji w praktyce, które są ilustrowane przykładami możliwych działań uczniów i nauczycieli. Esej zamyka spekulacja na temat przyszłych perspektyw wzajemnego oddziaływania edukacji ogólnokształcącej i utworów SF i fantasy z wzajemną korzyścią dla ich rozwoju.

Słowa kluczowe

SF i fantasy, edukacja ogólnokształcąca, edukacyjne dziedziny poznania, twórczości i koegzystencji, myślenie krytyczne, weryfikacja i falsyfikacja, atrakcyjność poznawcza materiałów nauczania, twórczy aspekt umysłu

1. The approach

The educational targets of this proposal are based on a system whose principles transcend the pragmatic level of general education (Janczukowicz and Wenzel 2021, Wenzel 2020). The main idea of this system is that general education first of all should deal with phenomena which make it possible to search for truth about the nature of the world and people, to develop sensitivity to the beauty of artistic creation through the production of works of art, and to educe the natural need for peaceful and harmonious coexistence with other people and with the environment. Correspondingly, these general aims, which transcend the level of practical utility, are realized in the educational domains of cognition, creation and coexistence. Since this system precedes the university level of specialization or other forms of education which deal with professional training and instruction, its pedagogical issues and suggested activities are valid for all forms of general education at secondary school level (Wenzel 2015). The educational targets and teaching points that are presented, concern the domains of cognition, creation and coexis-

tence, with frequent attempts to combine these domains in an interdisciplinary way. The point of this three-dimensional system of education is the possibilities it offers to balance the three major functions of general education, namely, helping to understand the nature of the world and approach the truth about it through cognition, developing sensitivity to the beauty of the world through artistic creation, and educating a natural feeling of empathy towards the fate of other people and of the world, which is realized in life practically through decent behaviour.

It should be noted that the proposed system of general education stands radically against the common practice of the early specialization of students in some chosen disciplines of the curriculum at the expense of others. The popular conviction that some students will succeed better in the 'sciences' while other students are 'humanists' may easily be falsified. There are a great number of factors; predictable, unpredictable and incidental, which may lead to gradual recognition by the student of which discipline suits best his or her natural talents and predispositions. Besides, the very idea of a difference between the 'sciences', i.e. disciplines in which mathematics is the working tool, and empirical evidence and data dominate the programme, and 'humanities', in which natural language and its higher, argumentative-poetic function is used as a tool for the acquisition of knowledge, has no justification in light of the development of critical thinking. Both of them equally require precision and logical reasoning to formulate ideas, statements, theories, opinions, assertions, etc. and therefore are equally 'scientific'. General education ought to help students to discover their individual predispositions, not to determine arbitrarily and mechanically, what they formally ought to become. In connection with this, the programme should move towards a synergy of the domains and favour an interdisciplinary approach to one which relies upon a choice of teaching points.

It seems, therefore, that the approach to the notion of what the function of general education should be in the domain of cognition needs to be reformulated. Instead of being the initiation of the process of educating a professionally prepared mem-

ber of a given social group, community, clan, tribe, nation, etc. and the determination of his or her place in it, as proposed by Dewey (1966), general education should be directed towards opening new fields of interest in the programmes of all the disciplines which are included in the curriculum (Wenzel 2015). Accordingly, syllabuses in the domain of cognition would change their character from being descriptive and informative vehicles for conveying knowledge, into becoming guides for teachers to work with adequate teaching materials in their search for particular teaching points. Thus, the content of teaching materials ought to become the source of problems for a debate in the classroom (Rychło 2008), whereas the informative element of the content should be used argumentatively in the ensuing discussion and the formulation of opinions, assertions or theories. Such procedures are characterized by a high degree of individual contact between the teacher and the students. They activate individually the minds of the students, so that they themselves discover things which may fascinate them beyond the official requirements, and prove worthy of specialization in future adult life.

The distinction between the pragmatic and 'beyond-pragmatic' levels of general education rests in different approaches to the phenomenon of learning motivation (Wenzel 2020). On the pragmatic level education is seen as training and instruction of offspring in order to develop their manual and intellectual skills, as well as social awareness, so as to prepare them to cope with matters concerning their existential and psychosocial needs. Accordingly, learning motivation is defined in terms of drives which push and prod individuals to actions in order to achieve goals which fulfil these needs (Reber 1985). According to this view, didactic activities focus on ways to evoke this kind of motivation. As long as the didactic activities are bound to natural and genuine needs, not artificially and formally invented for their own sake, e.g. 'to make the lesson interesting', they are effective in achieving the targets of teaching. The point is that there is an observable tendency of these activities to overuse the practical approach as a way of appealing to learning motivation.

For example, the teaching materials for second language teaching may be guided by the conviction that learners who are going to spend their vacation abroad will be motivated by the acquisition of a great number of lexical items denoting all possible elements of tourist equipment, gadgets, places, vehicles of transportation, etc. The effect of such procedures may be quite the opposite. Since genuine language interaction never consists of paradigms of semantically and structurally similar lexical items, the students are not able to make practical use of them in their own texts. The basic natural need of the learner to become able to shape thoughts in the second language so as to say what he or she means has been ignored. In effect, the great number of lexical items become an unnecessary burden to the memory and are promptly forgotten after passing the test or examination.

The necessity to cope with existential and psychosocial needs is obvious and natural, and didactic activities of the 'beyond-pragmatic' type also have to deal with them. However, the activation of the higher mental processes and creative aspect of the mind, greatly broadens the scope of what is possible. Consequently, teaching procedures and materials also have to become adequate to these new challenges. The three-dimensional system of general education, which is realised by the application of basic aims concerning the domains of cognition, creation and coexistence, attempts to evoke learning motivation which exceeds the level of existential and psychosocial needs and therefore may become capable of dealing with the new teaching targets (Janczukowicz and Wenzel 2021).

The domain of cognition is basically concerned with gaining knowledge in an objective sense through the constant challenge of theories about the phenomena and the laws of particular disciplines of cognition which appear in the curriculum as subjects of teaching, e.g. physics, chemistry, biology, history of civilization, geography, history of literature, social studies, philosophy, etc. These challenges are based on the empirical and informative knowledge available at the time of teaching and are carried out in the form of debate and discussion. The educational targets and teaching points should lead to the development of

critical thinking and an urge to improve current objective knowledge through its verification and falsification with the help of the teacher. The teacher's activities concentrate on evoking genuine interest in phenomena and the laws of nature, so that the learners become willing to transcend the knowledge which is required in the programme and the formal and obligatory elements of education such as grades, tests, examinations, homework assignments etc. Such forms of interest may be the result of the teaching materials, and the intuition and talent of the teacher to make use of the materials for the realization of the teaching points. The teaching materials and the teacher's activities to evoke such interest will be referred to as having *cognitive appeal* (Wenzel 1994, Rychło 2008).

The domain of creation is essentially focused on the discovery of the artistic talents and predispositions of the students. The educational treatment deals with the development of skills which are necessary for the creation of artefacts – dramas, music compositions, lyrics, paintings, novels, poems, films, sculptures, and various combinations of these artistic disciplines and their syntheses. The teacher's activities concentrate on the way of developing genuine sensitivity to the artistic value of these artefacts, and concerns the production and reception of the works by the students, resulting in a genuine aesthetic experience as described by Lakoff and Johnson (1980). The teaching points deal with the techniques of the artistic disciplines which are the subjects of teaching, e.g. counterpoint and tonal harmony in music, stylistic problems in relation to dialogues, descriptions and narration, the use of metaphors and symbols, etc. in literature classes, the use of perspective in classes connected with the art of painting, as well as operating the camera in film production, etc. These activities are realized with the help of the teacher and should be concluded with the award of a diploma for the production of an artefact of the chosen discipline, or performance of a work which has a well-established artistic reputation, e.g. a music composition. The teaching materials come from the outstanding works in the history of a particular discipline while the teacher is an artist in this discipline. A cha-

racteristic feature of this domain is the freedom of the teacher to choose the teaching materials and to make personal decisions concerning students' participation in the classes of a particular discipline. Such a system of the organization of the domain of creation implies a great flexibility in the formation of groups, namely, they are formed according to the level of the advancement of the students instead of the criterion of age. The formal requirements such as grading, examinations, etc. should be the same as in the domain of cognition.

The domain of coexistence deals with ways of preventing the learners from engaging in destructive behaviour in families, clans, tribes, nations and any other socially structured communities. The educational aims are concerned with educating the natural need for peaceful and harmonious coexistence with other people and the environment according to intuitively sensed universal moral principles. These principles consist of the ability to behave decently, i.e. not to kill, cheat, steal, lie, devastate nature, provoke social conflicts and wars etc. Such behaviour is motivated not only by fear of punishment or expectation of reward, but transcends such pragmatic motives, so that decent behaviour becomes the normal and natural characteristic of a human being. The educational aims focus on genuine understanding of the nature of the acts of destruction, their origin and ways of preventing their occurrence. The characteristic feature of this domain is the lack of an organized programme and the lack of formal ways of testing theoretical knowledge, which are part and parcel of the scope of the domains of cognition and creation. The teaching activities and the selection of the teaching materials are carried out by the teachers in the domains of cognition and creation. They do it through the form of spontaneous digressions while dealing with their own subjects. The targets concern current events which generate conflicts, social pathologies, devastation of natural environment, etc. They ought to be in some way connected with the subject matter of the class. The digressions should be brief. They take the form of debates and discussions with the help of the teacher who aims at eliciting from the students a genuine

understanding of the reasons why and in which sense these events have been destructive or pathological.

What these three domains have in common is the necessity of involving a form of motivation which makes it possible for the students to transcend the motivational drives which are characteristic of the usual pragmatic approaches to general education. In the domain of cognition it is the motivation to engage mentally in the teaching points beyond the requirements of the official programme, and is recognizable by the fact that the acquired knowledge is not forgotten after the required aim, i.e. test, examination, grade, etc. has been achieved. In the domain of creation it is the motivation to create works of art which transcend aesthetic pleasure and entertainment in their reception and aim at developing sensitivity to the beauty of the artistic value of such works. In the domain of coexistence it is the motivation to behave decently, notwithstanding the punishments and rewards of the regulations of law, social tradition, rituals, customs, habits, etc. In all these three domains the educational treatment aims at developing the imagination to see beyond the immediate and obvious advantages of the acquired knowledge, artistic skills and behaviour. The kind of motivation which triggers the learning processes characteristic of this level of education will be referred to as the 'cognitive-creative type of learning motivation'.

The genres which involve science fiction (SF) and fantasy works are in a position to deal with the educational targets and teaching points of all these three domains. These works include dramas, novels, short stories, films, spectacles or other forms of fiction which draw imaginatively on current scientific, psychological, sociological and philosophical knowledge, and then speculate in their plots, settings, themes, messages, etc. about their possible development and directions. The setting of these works typically takes place in the future, but may also concern the past and the present time. The range of scientific, psychological and social disciplines to be taken into account for such purposes is very broad, since the non-pragmatic pedagogical base transcends on principle the usual utilitarian objectives of

education, so as to open the way to imaginative thinking. In this way, SF and fantasy works provide an opportunity for the idea of 'general education' to become really 'general' in an interdisciplinary sense.

However, as far as the domain of cognition is concerned, the procedures which make use of SF works will be effective only on the condition that the scientific, psychological and sociological knowledge to which the works refer is reliable and credible. Thus, when the educational targets are concerned with objective knowledge in the domain of cognition, or with social relations in the domain of coexistence, the SF works should be clearly distinguished from such literary or film genres as fairy tales, horrors or thrillers in pseudo-scientific disguise. Works of this kind have their place in the domain of creation in their own right. As far as the genre of fantasy fiction is concerned, thanks to the literary conventions of symbolizing, allegory, the usage of metaphors and generalizations, it may realize specific functions in the domain of coexistence. Fantasy or scientifically unreliable works may also appear in the domain of cognition as a starting point for the development of critical thinking, i.e. finding the points which contradict current objective knowledge, so that the students themselves will place them among fairy tales, horrors or thrillers. Generally, the educational targets of teaching procedures with the application of science fiction and fantasy include the development of critical thinking, the acquisition of objective current knowledge of the disciplines which are represented by school subjects in the curriculum, and the development of sensitivity to current social problems connected with coexistence.

Issues which may trigger critical thinking appear when the students find in the teaching materials an opportunity to falsify the speculation of the author concerning the imagined situation, plot and action. The issues which are connected with the acquisition of knowledge may emerge while familiar problems from the classes are met with in an imaginative plot, setting and themes. In both these kinds of targets, the teacher may successfully search for the cognitive appeal of the content of the tea-

ching material. The issues which deal with the social problems of coexistence may appear in the artistic production of the students as the substance of creation.

An example of a SF work which may serve as teaching material in order to become a starting point for a critical debate could be its way of dealing with the problem of the relativity of time. In a class of physics, the students learn that the flow of time depends on the velocity of a moving object in relation to a definite point of reference, e.g. the Earth. According to current objective knowledge, the closer the velocity approaches the speed of light, i.e. about 300 000 km/per second, the slower the flow of time of this object in relation to the point of reference. This phenomenon is known in physics as time dilation. If the teaching material presents a character who in a special kind of vehicle comes back to his or her childhood, meets people who had died a long time ago, and then implies that this is the result of the relativity of time, the students may recall from the class that time is but one of the four dimensions of space-time, or space-curvature, not space in itself. They may also observe in a debate that one cannot travel in a dimension as if it were a form of space in which one can travel and stop wherever he or she wants. As a result of the debate the students may themselves place such works in the genres of fairy tales or fantasy.

Reliable teaching materials give the students an opportunity to consolidate their knowledge of various phenomena which are the subject matter of the scientific, psychological or social disciplines while developing the skill of critical thinking. For example, a SF work –a novel, a drama, a film, etc. may place its fictitious action on Mars. A reliable teaching material must have a setting which includes all phenomena with which the students are familiar thanks to the current knowledge gained from the probes equipped with instruments which have actually been sent there, and from which scientists have received information. When the characters of the work of fiction face a sand storm, the students must be able to compare the action of the work of art with real knowledge about such storms. When they have problems with moving on the surface of the planet, the students

should also have the opportunity to compare these problems with the knowledge about gravitation which they have acquired in a class of physics. On the one hand, the students may then consolidate their knowledge about the forces of gravity, on the other hand, the setting must be correct in every detail, so as to be convincing as a work of art. Thanks to the possible cognitive appeal of such teaching materials the students may remember the knowledge of sand storms, gravitation, etc. far better than the knowledge about the same phenomena presented to them in a class in the form of a lecture or information to be tested or otherwise formally graded.

Placing SF and fantasy works in general education is marked by the combined and cooperative action of the three educational domains as far as the disciplines and the teaching points are concerned. These relationships result from the fact that the teaching materials and the problems with which they deal may actually involve all possible subjects of the curriculum in an interdisciplinary way. Moreover, the scientific, psychological and social issues of the domains of cognition and coexistence may be used by the students in the domain of creation as elements to be used in analyses of the situation and the action of the produced work. The coordination of the three educational domains on the basis of the teaching materials implies strict cooperation and mutual consultations of the teachers of the engaged disciplines.

An example of such interdisciplinary requirements is the phenomenon of the origin and evolution of life in the universe. It involves the physical, chemical and biological processes which might have caused the appearance of life. Also, it deals with the question about the environment which is indispensable for the existence of life, e.g. whether life could exist without water, or what kinds of atmosphere, temperature, chemical processes, ecological conditions are necessary for living organisms to survive. The key problem of these processes is connected with the agencies of the evolutionary changes, e.g. natural selection, genetic mutations, adaptation to the environment and to its changes, hybridization, sexual selection, the social problems of sur-

vival, the emergence of civilizations, and the possible role of technology in the evolutionary processes, etc. Finally, there are questions about the emergence of the phenomenon of consciousness manifested by the self-consciousness of individuals and the higher mental processes which it generates, the potential role of education in evolutionary changes and speculations about its future development. SF and fantasy works are capable of dealing with all these problems thanks to the convention of creating fictitious situations, characters, plots and action.

2. Pedagogical implications

2.1. Procedures

The search for teaching points and the teaching materials for this educational proposal is carried out by the teachers of the particular disciplines which are in the school curriculum. Since they are determined by the synergy of the three educational domains and by an interdisciplinary approach to teaching procedures, the didactic suggestions are concerned simultaneously with a variety of issues which belong to the different subjects of teaching, e.g. they may deal with the issues of physics, chemistry, biology and ethics in one lesson unit. The teaching points are to be found in a chosen of source material, e.g. a SF novel or film. They may also be prepared by the teacher in the form of a text, e.g. a definition, a statement, information about a current theory of some phenomenon, and/or sensational news in the mass media, etc. which opens up the possibility for debate, argument and interpretation. The procedure begins with the introduction of the teaching point which is carried out in the form of a discussion that consists of the teacher explaining things that are new to the learners and eliciting from them what they already know or are able to interpret. The students are allowed to make wild guesses and suggestions, however, the teacher must, at this phase, control the situation, so that it is always to the point. Such introductory procedures are within the scope of the domains of cognition and coexistence.

The teaching procedures which are within the scope of the domain of creation are viewed in this proposal as a bond of the synergy of the three educational domains, in which the acquired knowledge and the skills of critical thinking are realized practically through the creative activities of the students. The natural disciplines which are in a position to deal with the issues of SF and fantasy are literature classes, e.g. the creation of novels, short stories, dramas, various kinds of spectacles and film production. The teaching points deal with the possible ways of establishing fictitious settings, themes, plots, action, metaphorical expressions, symbols, and satirical visions, etc. for the problems which have been discussed in the domains of cognition and coexistence. The students are free to choose the forms of expression, i.e. internal monologues, narratives, descriptions of places or actions, reminiscences, recollections or memoirs. Also, they should be allowed to make use of stylistic devices in order to achieve realistic and psychologically convincing dialogues, sardonic humour, emotions, moods, etc. The scientific, psychological, sociological or philosophical knowledge demonstrated in the students' works ought to be consulted with the teachers of the disciplines with which their creation is connected.

The products of creation which concern the domain of coexistence are not to be isolated from those of the domain of cognition because the social and psychological problems of decent behaviour in all socially structured communities and groups must be placed in a scientifically reliable context. The teaching points whose target it is to suggest the ways of developing sensitivity to these problems deal with these matters in an artistic way. The setting of such works is similar to any other setting of literary fiction or films, e.g. family life, social and political conflicts and satire, intrigues, comedies of manners, adventures, interstellar travels, meeting aliens, catastrophic predictions, etc. Attempts must be made, with the help of the teacher's suggestions, to overcome the usual tendency to focus solely on possible technological inventions, which limit the educational scope of the procedures to an obvious pragmatic level. Instead, they should encourage the students to imagine situations of peaceful

and harmonious coexistence between the members of the social groups, tribes, nations, or between people and aliens. In such attempts, the students should avoid direct didactic messages or suggestions of moral and ethical behaviour, but take advantage of their own personal characteristics, e.g. their sense of humour, interests, temperament, etc. in order to create convincing situations, in which such behaviour is natural.

The teaching points which develop critical thinking and which search for objective knowledge about the world may help the teacher to elicit from the students the observation that most of the present SF works manifest a lack of imagination as far as the development of the phenomenon of consciousness is concerned. The aliens, whether ridiculous monsters, or normal individuals, turn out to be aggressive conquerors who are going to enslave or exterminate mankind, explore new sources of energy or acquire supernatural mental powers which are used for the sake of imperial targets. The point is that the phenomenon of consciousness is definitely connected with the activation of such higher mental processes as reasoning, creation of metaphors, argumentation with the use of the higher language functions, artistic creation, poetic imagination, as well as mental development thanks to the changes of the cognitive structure of the mind (Janczukowicz and Wenzel 2021). These processes represent the creative aspect of the mind and are independent of biologically determined survival drives and psychosocial needs. A popular conviction connected with the nature of SF literature, is that evolutionary development is estimated by the development of technology, whereas people themselves, as well as aliens, do not show any real evolutionary changes. Actually, the usual vision of people in SF works is that they retain the same pathologies of the domain of coexistence which plague the world today, e.g. greed, corruption, cruelty, vanity, and a lack of sensitivity and imagination as far as the fate of other people and the environment are concerned. Such critical observations may result in a willingness to create SF works in which the decent behaviour of people, as well as aliens, is a natural charac-

teristic of any individual gifted with consciousness, whereas all these pathologies belong to an animalistic past.

2.2. The role of the teacher

The synergy of the three fundamental educational domains and the interdisciplinary approach to teaching procedures imply a special position for teachers. Their work is determined by a high degree of individual contact with the students, and by the necessity of constant self-education. These characteristics result from the broad range of engaged disciplines, themes, subjects, problems, fields of interest, etc. in the domains of cognition and coexistence, and by the obligation of the teacher, who is an artist of the discipline in the domain of creation, not to overlook and waste the talents and artistic predispositions of the students by a wrong choice of didactic activities. The disciplines engaged in the creation of SF works involve the teacher's interest in genetics, nuclear physics, classical music, literary criticism, history of art, philosophy, history of civilization, astronomy, evolution of life, technological inventions, theological dogmas, pop-culture, physiology and anatomy, language – its structure and functions, the relativity of time, the mass and velocity of movement, biological systems of the classification of organisms, statistics, politics, economics, ecology, etc. Such a universality of interests requires the teacher's constant self-education which becomes an essential element of the system of general education preceding vocational training and instruction in his or her chosen professional specialization.

The need for constant self-education is determined by the content of the teaching materials, i.e. SF and fantasy works, definitions, news, etc. and by the requirements of the themes of the works which the students plan to create and which the teacher must be able to control as far as their reliability and validity are concerned. This requirement is obvious on the descriptive and informative level, and the content of the themes may be easily verified and falsified. However, the involvement of the teacher in this subject matter is much deeper than just the

level of the information and description provided by the text of the teaching material or by the product created by the student. The teacher who intends to introduce SF in education must be prepared to deal with the knowledge of the disciplines which are not within the scope of his or her specialization and grasp the new knowledge in a way which is similar to that of a teacher who is a specialist in this discipline. The interaction based on the new themes, i.e. a discussion, debate, public speech, criticism or written composition, essay or novel, requires the teacher's full understanding of the basic issues of the text. For example, while working on sociological themes, the teacher must become acquainted with the problems of social order and social change, social conflicts and problems of social institutions such as the family, law, church, etc. as well as with the concepts of social norms, roles, culture and other issues characteristic of the study of people in their social environment. While working on popular psychological themes the teacher becomes interested in the roles of instinct, heredity, perception, learning, motivation, lower and higher mental processes, the functioning of thought, intelligence, language and the phenomenon of consciousness. Similar requirements concern the technological, biological, astronomical, physical, medical, and any other potential issues of the SF and fantasy works produced by the students. In a way, the teacher becomes a student of the rudiments of each of the scientific, social and psychological disciplines which are the subject matter of the SF and fantasy works used in general education.

3. Practical suggestions

The following examples are suggestions for ways of using SF and fantasy themes as sources for teaching points, teaching materials and the teacher's didactic activities with respect to the synergy of the domains of cognition, creation and coexistence. They deal with each of these domains or with all of them in an interdisciplinary way, so as to illustrate a variety of possible procedures. The commentary below addresses the reasons why they

were selected with regard to their educational capacity, their potential in terms of cognitive appeal, their possibilities for evoking a cognitive-creative type of learning motivation, and their value as a substance of creation.

The teaching materials – SF and fantasy novels, films, opinions, definitions, quoted fragments, etc. are used by the teacher as points of departure for a debate or discussion on a definite point, scientific, psychological or social, which may be compared with the knowledge gained at school (Chirlesan and Chirlesan 2014), develop the skill of critical thinking, or serve as the substance of creation for the student's own artistic production. They may concern all disciplines which are in the curriculum as subjects of teaching. It should be noted that the material is to be used by the teacher, whereas the students may or may not become acquainted with it. However, if the students do read or see the original material, it is advisable that they invent their own setting, theme, plot and action, so as not to repeat it from the original.

The following illustrations refer to several SF and fantasy works which deal with scientific, psychological, social, political, and philosophical problems. They represent a spectrum of various approaches to the idea of the function of the genres of SF and range from scientifically plausible predictions and speculations on the mental development of people, to social and political allegories, utopias and dystopias. Also, there are works which may be classified as fantasy as far as the scientific aspect is concerned, but are reliable as speculations on political and social relations or philosophical ideas.

3.1. Source material: *Project Hail Mary* by Weir (2021)

This example illustrates the possibility of finding teaching points for all three domains with references to a broad range of engaged disciplines of the domains of cognition and coexistence. The teacher's intention is to trigger the willingness of students to apply the encountered problems, themes and stylistic devices in their own SF works.

3.1.1. Summary of the content

The novel is about the threat of the extinction to life on Earth due to an invasion of special kinds of microbes which have come to our solar system in search of new sources of energy. In the millions of years of their evolution, the microbes have acquired the ability to move through space to neighbouring star systems in order to 'feed' on the energy of their suns. In this way, they have infected a whole cluster of stars, including our solar system. Scientists on Earth have formed an international committee to study the microbes in order to prevent the extinction. They have discovered a star, about twelve light years distant from our system, which has proved to be immune to these microbes. An international mission has been formed to find out what protected the star from infection. A spaceship suitable to undertake such a voyage is constructed and sent there in order to solve the problem and try to save life on Earth. The mission consists of an international crew of three astronauts, of whom only the main character awakens from the coma into which the astronauts were put to survive the journey. The reader learns about the organization of the mission from his fuzzily returning memories. The astronaut manages to recall what the purpose of the mission is and to navigate the spaceship so as to approach the target star system. When orbiting the star, he encounters an alien spaceship and rightly concludes that its aim is the same as his: namely, to save from extinction life on a planet from a different star system and cluster of stars infected by the same microbes. It turns out, however, that all but one of the crew of the alien spaceship has died of cosmic radiation. Notwithstanding the remarkable physical, anatomical, physiological, cultural and technological differences, they manage to communicate thanks to a similar level of intelligence and a knowledge of the universal laws of nature. They cooperate in their endeavours to find out what could possibly protect both their planets from the infection and discover that the microbes have a natural predator – a special kind of amoeba. They succeed in examining its life-cycle and find out how to 'farm' it. Finally, samples of the amoeba

and all the essential scientific information are sent to both planets so that life there is prevented from extinction.

3.1.2. Suggested procedures

The discussion concerning the domain of cognition may begin with the problem of the plausibility of an invasion of microbes which feed on the energy of the sun. The controversial point is the assumption that the microbes are able to approach the surface of the sun, whose temperature is about 5 500 degrees Celsius. Such high temperature makes it impossible for water to exist while, according to contemporary knowledge, no life-forms can exist without water, whereas after about 3 000 degrees Celsius the hydrogen and oxygen atoms, which constitute water, cannot stay bound to each other. Thus, when the SF work introduces microbes near the surface of the sun, either we deal with a life-form which is not water based, or this work should be classified as fantasy. Having introduced this debatable problem, the teacher of any of the engaged disciplines – chemistry, astrophysics or microbiology, elicits from the students their opinions on what should be done to make the SF work reliable. In this way, the teacher of the domain of cognition incites activities in the domain of creation, e.g. the students may be asked to write a composition, short story, essay, etc. in which this problem is framed in an imaginative way. For instance, it is possible that a student may write about a scientist who has discovered that the sun was invaded by microbes which in the course of their evolution have developed a mechanism which makes them resistant to such temperatures. Another possibility might be the idea that life in the environmental conditions of a planet of a different star system might have evolved without the need for water, some students may speculate that life might not have evolved on Earth at all but came in the form of single-celled organisms from other parts of our galaxy, while others may suggest that the terrestrial life-forms and the extra-terrestrial ones have a common ancestor etc.

The teacher's role is to help the students with the scientific aspects of their creation. For example, the teacher may explain to the students that the inside of the microbes was not much different from the inside of any other single-celled living organisms which may be found on Earth and which have to produce complex proteins required for DNA, mitochondria, and all the other parts of a cell. To produce such proteins the microbes would need carbon and oxygen. So, if the SF work which they are going to create deals with microbes which are water based, it must also deal with the supplies of carbon dioxide. Such details are essential to make the SF work plausible and reliable for the prospective reader.

The point which is of vital importance for the domains of cognition and coexistence is communication and the functions of natural language. In SF genres, it is connected with contacts between people of different nations or cultures, and, most frequently, between people and aliens. The plausibility of the work depends on the ways humans and aliens establish common platforms for the fundamental concepts of time, space, mass, energy, life, intentions, agreement, negation, civilization, intelligence, consciousness, artistic creation, etc. so as to become able to exchange messages and to coordinate activities. The source material deals with this issue through the establishment of contact between the human and the alien astronauts. Such contact is possible only thanks to the technological equipment of both spaceships, which, as it happens, is more or less at the same advanced level.

The teacher presents the main problem for the discussion, namely, how to establish the common platform for the fundamental concepts, which are indispensable for sending and receiving messages, and which on Earth are represented by human natural language. The planet from which the alien comes and the Earth have radically different environmental conditions. For example, the alien planet has an atmosphere which is poisonous to humans and is so dense that the light waves which reach its surface have frequencies invisible to any sense of sight in the human sense of this word e.g. ultraviolet. The only signal

of the fact that the alien can notice at least something is that he responds to gestures, e.g. waving hands, for greetings. Consequently, the intelligent creatures who have evolved on the planet have not acquired the sense of sight and live in complete darkness. However, they do not have any problems moving around and they perceive and understand the three-dimensional environment equally to humans. The human astronaut, thanks to his biological knowledge about bats and dolphins, in particular, their use of echolocation, rightly guesses that the alien noticed the gesture of hand waving because he was able to 'see' with sounds, and instead of electromagnetic waves used the various frequencies of sound waves to perceive and understand the world and to communicate. The alien produces sounds which the human can hear and makes it clear that he can hear him. There is no pronunciation or inflection of the sounds, just regular notes and chords which again remind the human astronaut of whale song. Indeed, in spite of coming from different planets and a totally different evolutionary line, they have compatible sound ranges. Both spaceships, the alien and the human, are also equipped with instruments which can 'translate' the frequencies of electromagnetic waves into the frequencies of sound waves and the other way round.

The introduction of the problem to the students is followed by a discussion during which the teacher elicits from the students their conceptions about the fundamental notions which should be chosen to start establishing a mutually shared 'vocabulary' and 'grammar' so as to be able to continue the further expansion of their acquisition. Simultaneously, the teacher elicits their suggestions concerning the medium which could function as the vehicle of meanings of such a kind of translations. Probably, the students would agree that a starting point could be the gesture of waving the hand with the meaning 'yes, I understand', which could then be followed by a different gesture with the opposite meaning 'no, I don't understand.' Some other students might suggest the gesture of holding up the thumb with the meaning of 'yes, OK' and suggest that the 'vehicle' of the meaning might be regular sound waves in the form of 'tap,

tapping' or in some form otherwise achieved. The suggestions of using the frequencies of sound waves which they both understand in the same way may be inspired by classes in the domain of creation where the students learn about rules which are universal, no matter in which part of the universe they appear. For instance, the rule that the octave means doubling the frequency of every note is not specific to humans but applies to any species which are able to produce sound waves, whether for artistic purposes or for communication. While eliciting from the students their ideas for expanding a mutually shared 'vocabulary' and suggestions of adequate 'grammar', the teacher has an opportunity to convince the students that language learning is an exponential system. The more words you know, the easier it is to learn new ones.

The discussion on establishing a system of communication between alien races coming from entirely different environmental conditions may prove a rich source of ideas for imaginative situations to be used in the students' own creative production. At this point, it would be advantageous to consult the teacher of literature classes, in the domain of creation, whose task it would be to carry out a workshop in which students would learn how to construct dialogues and narratives of everyday humorous situations in order to create a friendly atmosphere for contact. Types of exchanges and stories which might be expected from two intelligent creatures. The source material provides an example of humorous confusion in a typical everyday situation, one which results from the misunderstanding of particular phrases due to the lack of adequate extra-linguistic features of communication. The example illustrates the initiative to establish a common platform for the vocabulary items 'yes' and 'no' (Weir 2021: 201):

"Okay, we have 'yes' in our vocabulary now" I say.

Tap – tap – tap.

I look over. Once he knows he has my attention, he does jazz hands again and says the same chord as before, tap – tap – tap.

"Yes", I say. "We covered this."

He holds up a finger for a moment. Then he balls two of his fists and taps them together.

Tap – tap.

...What?

“Ohhh” I say. I am a teacher. What would I teach someone who just learned the word ‘yes’?

“That is ‘no’.

At least I hope so.

I ball my fists and tap them together. “No”

Tap – tap – tap he says. I check the laptop. He just said yes.

Wait. Does that mean it is not no? Is that another yes? Now I am confused.

“No?” I ask.

“No”, he says.

“So, ‘yes’?”

“No, yes”

“Yes?”

“No. No.”

“Yes, yes?”

“No!” He balls a fist at me, clearly frustrated.

Enough of this interspecies routine. I hold up a finger.

He unballs his fist and returns the gesture.

I enter the frequencies for what I think is “no” into my spreadsheet.

If I am wrong, I am wrong and we will work it out later.

The novel frequently deals with matters of the relations between the fundamental properties of matter, i.e. mass and energy in connection with the velocity of the moving object, which in the novel concerns the velocity of the spaceship. Since the knowledge of these relations is the subject matter of classes of physics, the solutions and explanations which the students find in the novel may be coordinated with the programme of the school subject and substantially reinforce it. For example, interstellar traveling depends on a supply of energy, which makes it possible for the spaceship to accelerate according to the needs of navigation. In the novel, this problem is solved by a reference to the rule of mass conversion into energy if the velocity of the spaceship approaches the speed of light. The internationally organised scientists of the Earth discovered, while studying the microbes

which invaded the sun, that they had evolved the capacity to take heat energy from the sun, converting it into mass and storing it in ATP, i.e. a coenzyme which is found in the cells of all organisms and provides a means of storage of energy for cellular activities. Then, when they need the energy back, they turn the mass back into energy in the form of light frequency. The microbes use this regained energy for interstellar travelling. In this way, the microbes, which threatened the existence of life on the Earth, turned out to have become a perfect medium for the storage of energy, and also an ideal supply of the energy necessary for the spaceship to navigate. Thus the students learn from the teaching material that the two fundamental properties of the physical world, namely mass and energy are inter-convertible. They also learn that this process is the source of energy in a nuclear reactor, or in an atomic bomb, called nuclear energy.

Knowledge about the inter-convertibility of mass and energy is reinforced in the class of physics by the usual programme which includes the first law of thermodynamics. The law states that when energy in one form disappears, an equivalent amount of energy appears in some other form and may be converted into work. The mutual reinforcement of the knowledge about the inter-convertibility of mass and energy which has been gained in the discussion of a SF problem, and the study of the relationship between heat and other forms of energy which comes from a class in school, is likely to evoke a cognitive-creative type of learning motivation and stimulate the willingness to search for other such relationships in other disciplines of the domain of cognition. Then, thanks to cooperation with the teacher in the domain of creation, e.g. in literature classes, the knowledge of such relations may become the inspiration for the student's own SF production.

3.2. Source material: *The Lost World and Other Stories* by Doyle (1995)

The teaching point of this example concerns the fundamental questions of the functions of science, namely, why people should gain objective knowledge about the nature of the world and about their existence in it. This issue appears in the source material in the form of a discussion between an eccentric science professor and a journalist who interviews him about his experiments. The subject matter of the discussion in the short story is the professor's fantastic notion that our planet is in itself a special kind of a living organism with circulation, respiration and a nervous system. The professor sets out to drill the earth's crust to reach the living matter of the planet. When the journalist asks what the object of so extraordinary an experiment is, the professor responds in the following way:

Raise your mind above the base mercantile and utilitarian needs of commerce. Shake off your paltry standards of business. Science seeks knowledge. Let the knowledge lead us where it will, we still must seek it. To know once for all what we are, why we are, where we are, is that not in itself the greatest of human aspirations? (Doyle 1995: 445)

With this quotation, the teacher initiates a debate which concerns the basic educational aims of the domain of cognition. The students are expected to establish a clear idea about the function of the non-pragmatic level of education. The students may exchange arguments which will focus on the advantages of the utilitarian targets of gaining knowledge as opposed to the fantastic and illusory search for the answers to general and philosophical questions. The source of the problem, i.e. the idea that the planet, which is in a geological sense is made up of inanimate matter, could possibly experience typical processes for animate matter such as circulation, respiration and a nervous system, may be easily falsified and therefore it indirectly supports

the arguments of the need for the utilitarian targets of education in the domain of cognition.

The key to change this line of reasoning is the teacher's explanation that there are two levels of targets, – utilitarian and non-utilitarian, which do not exclude each other and therefore should not be opposed in an 'either-or' relation. Actually, they may be related in a hierarchy of inclusion, i.e. any attempt to gain knowledge beyond the pragmatic targets naturally includes the practical ones, whereas attempts which focus on practicality are frequently limited to the pragmatic level. After this clarification, the teacher's task is to elicit from the students examples of scientific research which aim at approaching the truth about the nature of the world and simultaneously turn out to be useful for medicine, technology, space exploration, etc. The discussion may provoke some new ideas about possible fields of experimentation in various disciplines, e.g. biology, chemistry, physics, or psychology, with which the students are familiar from classes at school. Also, the students may invent fantastic notions which are not reliable or plausible from the scientific point of view. Both kinds of ideas may become an inspiration for the products of the students' own works in the domain of creation – the scientifically reliable ideas for SF works and the fantastic notions for fantasy works or fairy tales. In all the ideas which are suggested by the students, there should be attempts to see beyond the direct pragmatic targets, so as to deal in some ways with the nature of the world, the sense of the existence of people in it, and the acute problems of coexistence with other people and with the environment.

3.3. Source material: *The Songs of Distant Earth* by Clarke (1998)

The search for teaching points in this SF novel basically concerns the domain of coexistence. Its theme is envisaging the reaction of mankind in the wake of the inevitable death of the Earth due to the sun going nova, and the possible fate of humanity afterwards. From a scientific point of view, the novel is

created in a realistic and plausible vein, since it refers to known or foreseeable technology and current objective knowledge of the laws of nature. Thus, the novel also provides the teacher with an opportunity to search for teaching points in the domain of cognition. However, the essential problem posed in this novel is how to save humanity from complete extinction, which implies the need for a debate on various moral and ethical issues in the domain of coexistence. The solution to this problem is found in the idea of interstellar colonization which is realized in several stages in the span of approximately two thousand years. First, spaceships are sent to other solar systems with frozen embryos and automatic equipment to revive them in planets with acceptable environmental conditions. Then, spaceships are invented, which can store and carry millions of genotypes and replicating equipment. Finally, with the discovery of a source of energy labelled 'quantum drive', a giant spaceship is built which carries about a million people in hibernation, who escape from the Earth just before its end. The target of this spaceship is a planet five hundred years distant. In the meantime, the spaceship has to stop by a habitable planet to repair the drive mechanism. The planet turns out to be populated by people replicated from the genotypes which had been sent in one of the spaceships almost a thousand years previously. Thanks to the technology available at the time of leaving the Earth, the inhabitants of this planet formed a utopian social system. The setting of the novel, its plot and themes deal with the relations between the crew of the spaceship and the inhabitants of the planet.

Suggested procedures:

The teaching point in the domain of coexistence which the teacher may choose for a debate is the question whether it is possible to establish social relations devoid of any political, economic, or any other conflicts of coexistence by means of artificially superimposed decrees or rules. The teacher initiates the debate with the following quotation of the internal monologue of one of the major characters of the crew of the spaceship:

It is possible to build rational and humane culture completely free from the threat of supernatural restraints. Though in principle I don't approve of censorship, it seems that those who prepared the archives for the Thalassan colony succeeded in an almost-impossible task. They purged the history and literature of ten thousand years, and the result has justified their efforts. We must be cautious before replacing anything that was lost – however beautiful, however moving a work of art.

The Thalassans were never poisoned by the decay products of dead religions, and in seven hundred years no prophet has arisen here to preach a new faith. The very word 'God' has almost vanished from their language, and they are quite surprised – or amused – when we happen to use it.

My scientist friends are fond of saying that one sample makes very poor statistics, so I wonder if the total lack of religion in this society really proves anything. We know that the Thalassans were also very carefully selected genetically to eliminate as many undesirable social traits as possible. Yes, yes – I know that only about fifteen per cent of human behaviour is determined by the genes – but that fraction is very important! The Lassans certainly seem remarkably free from such unpleasant traits as envy, intolerance, jealousy, anger. Is this entirely the result of cultural conditioning? (Clarke 1998: 55–56)

The debate on the content of the quoted impressions may begin with encouraging the students to discover points which are either controversial or clearly fallacious. For example, the statement that someone does not approve of censorship and at the same time tacitly accepts and justifies purging the history and literature of ten thousand years of artistic and philosophical creation simply because of the appearance of some phrases, words or topics in texts which may suggest the destructive influence of 'supernatural traits', definitely shows inconsistency in their argumentation. In other words, the statement disapproves and at the same time approves of censorship. The observation of the fact that 'purging' is synonymous to 'censorship' may lead to the next point of the debate, namely, to the character's conviction that the very mention of religious matters is 'poisonous to the society'. The teacher might expect here that the

students would formulate ideas that convictions of this kind represent an illogical belief: that a given problem disappears when nobody mentions its existence.

However, what is more important for the debate at this point, is the fact that the issue of the ‘threat of the supernatural traits’ is much too complex to be simply ‘liquidated’ by purging it from history and literature and by the disappearance of ‘prophets preaching new faith’. It is the teacher’s task to elicit from the students the notion of the intuitively felt phenomenon which may be labelled “metaphysical inclination” (Janczukowicz and Wenzel 2021), and which people have evolved in the course of their evolution together with the phenomenon of self-consciousness. This phenomenon consists in the feeling of the possibility of the existence of a higher ordering of the world in which the search for the truth about its nature, the pursuit of its beauty through artistic creation and decent behaviour, are normal and natural characteristics of mankind. Within the framework of this higher ordering of the world, the familiar, recognizable and understandable universe of time and space is only a functioning part. Paradoxically, this feeling, although impossible to be scientifically verified and falsified, plays a positive role in the educational domains of cognition, creation and coexistence. It is the dynamic force which ‘pushes and prods’ individuals to discover the true nature of phenomena which seemingly are beyond the capabilities of the senses and of the mind of people to understand, but with the improvement of objective knowledge gradually become familiar to them. Thus, it turns out that it is possible for the ‘threat of supernatural traits’ to disappear, however, not by purging history and literature, but by an adequate and balanced education in the domains of cognition, creation and coexistence, which lasts from birth throughout the whole life of every individual human being. After such clarification the students are free to provide all kinds of examples of phenomena which in the history of civilizations changed their status from ‘supernatural’ to a ‘regular law of nature’, e.g. electricity, evolution, gravitation, origins of time and space, etc. Also, they are free to mention examples of myths, superstitions, misconceptions,

fallacies, references to magic in all kinds of rituals, miracles, etc. which can be easily verified and falsified.

Another debatable issue in the quoted impressions is the idea that it is possible to establish a rational and humane society by the application of a genetic selection of the people who have been chosen to survive. This opinion is supported in the novel by the fact that the inhabitants of the planet, thanks to this selection, are free from several traits which cause trouble in the domain of coexistence such as envy, intolerance, jealousy, or anger. The teacher may elicit from the students the observation that the traits which have been mentioned have psychological grounding entirely different from one another, and exert a different kind of influence upon the behaviour and coexistence of people. For instance, 'anger' may turn out to be advantageous when it motivates actions against the harmful decisions of rulers or acts of destruction, 'intolerance' depends on what is expected to be tolerated, e.g. there is nothing wrong when one does not tolerate crime, cheating, treachery, or devastation of nature, 'envy' and 'jealousy' are biologically motivated instincts of the equipment of survival, and any genetic manipulation with such instincts may have unpredictable, if not disastrous consequences for emotions or other lower mental processes, etc. Also the rhetorical question at the end of the quoted internal monologue, namely, whether the disappearance of socially unpleasant traits can be attributed solely to 'cultural conditioning', or perhaps to some extent also to genetic selection, may become a point of departure for a serious discussion on the nature of the phenomena of culture and education. The teacher may encourage the students to define these notions and elicit from them the observation that the author of these impressions, by contrasting the ideas of 'genetic selection' and 'cultural conditioning', evidently confuses the notion of 'conditioning' with the notion of 'education': 'conditioning' denotes the particular kind of education which deals with stimulus-response learning, which leads to the formation of habits, whereas the notion of 'education' has a much broader meaning and apart from S-R type of learning includes mental changes of the cognitive struc-

ture of the mind. These changes occur thanks to the activities of the higher mental processes and represent the creative aspect of the functions of the mind, namely, those functions which deal with critical argumentation, the creation of poetic metaphors, logical reasoning, and artistic production, etc (Bruner 1997). Mental changes of this kind are unpredictable and evade any kind of 'cultural conditioning'. The teacher's role here is to help the students to understand these ideas and to formulate them.

At this point of the debate, the teacher may suggest that the students become acquainted with a variety of classical dystopias, i.e. anti-utopian works which depict imaginary societies, whose purpose it is to warn against the social and political evils resulting from the manipulation of people. Works of this genre may be used as teaching materials in the domains of coexistence and creation, provided that the students read them of their own accord. Typical themes include: genetic selection, a pre-ordained caste system and obligatory use of narcotics (Huxley 1994), the menaces of increasing greed, territorial expansion, corruption, vicious behaviour, and inveterate hostilities which destroy the seemingly happy lives of utopian societies (Huxley 2005), massive political propaganda, total invigilation of individuals and depriving them of their privacy (Orwell 2021), the total oppression and misery of human beings (Aldiss 2008), absolute mistrust and suspicion in a society where everybody is a spy, agent, double or triple agent, informer, traitor, provocateur or denouncer but no-one knows what the purpose of his mission may possibly be (Lem 1976). Teaching points in the domain of coexistence would deal with such dystopias and the nature of all kinds of evils as well as the reasons they exist in society.

As far as the domain of creation is concerned, the students are free to invent settings for imaginary societies with allegoric references to the actual situation of the world, its wars, conflicts and devastation of nature. The themes of this creative production may also include the literature genre of fantasy with allegoric references to the history of civilizations, the collapse of empires, the restoration of democracies and spiritual revival. The

students are expected to make use of the technique of magic realism, i.e. they invent fantastic situations in which the teaching points of the domains of cognition and coexistence appear as constituents of the setting, themes and action, and are treated realistically in their own right. The teacher in the domain of creation, who is an artist in the discipline, should make it clear to the students that they should not confuse this literary genre with SF works. The subject matter of the content of fantasy fiction is first of all concerned with its artistic quality, whereas in SF works the content may be compared with current objective knowledge and can be evaluated according to its plausibility and credibility. In fantasy fiction, the setting, themes, characters and action function as the substance of creation of works in which the psychological truth of the motivational drives of the characters and the skill of telling a story play a decisive role for their estimation, no matter whether the action takes place in a pseudo-medieval setting full of monsters, ghosts, goblins, dwarves, wizards and people with supernatural mental capacity, or in galactic empires in which the characters travel in spaceships from one end of the galaxy to the other – a distance of seventy thousand light years in a couple of weeks.

3.4. Source material: *The Lord of the Rings* by Tolkien (1969: 45–47)

From the educational point of view, both SF works and fantasy fiction may be used as teaching materials, however, the students should, by no means, be forced to read them, since any artificial imposition of formal requirements will destroy the major principle of the domain of creation, namely, the spontaneous initiative of the student. The teacher's suggestions and encouragement may focus on the subject matter of the content rather, than on a particular work. For example, the teacher may use a definite quotation to illustrate an important point in a literary workshop, so that the students realize the complexity of the storytelling, dialogues and narratives. The following quotation manifests such a possibility:

‘Everything?’ said Gandalf. ‘The ring as well? You agreed to that, you remember’ ‘Well, er, yes, I suppose so,’ stammered Bilbo. ‘Where is it?’ ‘In an envelope, if you must know,’ said Bilbo impatiently. ‘There on the mantelpiece. Well no! Here it is in my pocket!’ He hesitated. ‘Isn’t that odd now?’ he said softly to himself. ‘Yet, after all, why not? Why shouldn’t it stay there?’ Gandalf looked again very hard at Bilbo, and there was a gleam in his eyes. ‘I think, Bilbo,’ he said quietly, ‘I should leave it behind. Don’t you want to?’ ‘Well yes – and no. Now it comes to it, I don’t like parting with it at all, I may say. And I don’t really see why I should. Why do you want me to?’ he asked, and a curious change came over his voice. It was sharp with suspicion and annoyance. ‘You are always badgering me about my ring; but you have never bothered me about the other things that I got on my journey.’ ‘No, but I had to badger you,’ said Gandalf. ‘I wanted the truth. It was important. Magic rings are – well, magical; and they are rare and curious. I was professionally interested in your ring, you may say, and I still am. I should like to know where it is, if you go wandering again. Also, I think you have had it quite long enough. You won’t need it any more, Bilbo, unless I am quite mistaken.’ Bilbo flushed and there was an angry light in his eyes. His kindly face grew hard. ‘Why not?’ he cried. ‘And what business is it of yours, anyway, to know what I do with my own things? It is my own. I found it. It came to me.’ ‘Yes, yes,’ said Gandalf. ‘But there is no need to be angry.’ ‘If I am it is your fault,’ said Bilbo. ‘It is mine, I tell you. My own. My precious. Yes, my precious.’ The wizard’s face remained grave and attentive, and only a flicker in his deep eyes showed that he was startled and indeed alarmed. ‘It has been called that before,’ he said, ‘but not by you.’

This fragment of the story shows the conflicting motivational drives characteristic of the internal struggles which usually accompany taking decisions which have great consequences for life. It introduces the main point of the trilogy, namely, the influence of the possession of absolute power upon an individual and the resulting addiction to it, even of individuals who are naturally immune to this influence, as was the case with the characters of the story, i.e. the hobbits. These struggles were expressed by gradual realization of the unwillingness to part with the Ring of Power which, in the trilogy, epitomizes the

possession of such power. The hobbit hesitates, then becomes determined to keep it, even fight for it, to be finally greatly relieved when, unwillingly, he gave it up. The setting of the story, the characters and the action are imaginative and fantastic, but the behaviour and reactions are true to life and psychologically credible in every detail.

Fantasy fiction of this kind may serve as teaching material in the domain of creation, first of all because of its artistic quality, which is achieved thanks to the skill of storytelling, the psychological truth of the motivational drives, the realistic language of the dialogues, vivid action, and colourful description of landscapes, objects and characters who express a variety of moods ranging from a subtle and robust sense of humour to that of the greatest panic. As far as the domains of cognition and coexistence are concerned, the teaching points must be selected spontaneously, in the form of casual digressions. For example, current events which have a negative impact on social, political or family life such as wars, revolutions, the destructive decisions of rulers, etc. may be compared with the negative characters of the story and the dramatic events of its content. However, such digressions should not dominate the discussion in the literary class, so as not to lose sight of the artistic aims of the creation of literary fiction and the skill of telling a story. The teacher's task here is to cooperate with the student in the act of discovering such analogies and relationships and in expressing them in the discussion.

4. The future

The general education of people meets the literary genres of SF and fantasy on the ground of their future perspectives. Education as such should be considered as a dynamic process, beginning at birth, which consists in the occurrence of behavioural and mental changes throughout the whole of life. These changes occur thanks to the learning processes which take place and concern both changes of the cognitive structure of the mind and social awareness, and changes of the behavioural and proce-

dural patterns which may be conditioned by causing responses to stimuli and then reinforcing them to form habits, procedures and patterns of behaviour. The characteristic feature of changes to the cognitive structure is the activation of the higher mental processes, which result in the emergence of the creative aspect of the mind (Janczukowicz and Wenzel 2021) and which are independent of the S-R conditioning processes. The general education of people, thanks to this capacity, becomes involved with the ways of developing critical thinking, imagination, sensitivity to the truth of the nature of the world and to its beauty, sensitivity to the fate of mankind, the urge to create artefacts, the capacity of discovering new and unpredictable phenomena, the capacity of formulating thoughts and ideas which have never been formulated before, and free will to make decisions about the future. The literary genres of science fiction and fantasy are in a position to deal with the same fields of interest by means of imaginative artistic creation – fictitious setting, characters, themes, action and plot, which are used to produce a complete work of art. Thanks to these common fields of interest and possible development, the works of art may influence the direction of general education, whereas the educational domains of cognition, creation and coexistence may become decisive factors in developing the scope and future direction of SF and fantasy.

In the domain of cognition the new directions of general education given above, may shift towards the potential force of the higher mental processes which are necessary to transcend the usual practical advantages of acquiring and collecting information. Thus, the direction of general education will focus on the skill of critical thinking with the application of logical falsification of theories or statements. Such broadening of the scope of educational targets may open the way to discovering new fields of interest for scientific research. For example, such a field could be the study of the creative aspect of the mind with references to the outstanding achievements of philosophers, artists, scientists, or teachers in the history of mankind. Naturally, the usual study of the functioning of the brain would continue with the same efficiency as it does today. However, the focus on pro-

ducts of the creative mind, transcending its neurological or physiological grounding, is likely to accelerate the search by mankind for objective knowledge of the world.

SF and fantasy works may help in discovering new fields of interest thanks to the imagination and intuition of their authors, who are not limited by the rigours of formal measurements and strictly controlled experiments. For example, in the domain of cognition, thanks to the focus of attention on the higher mental processes and the creative aspect of the mind, the new themes of SF and fantasy works may deal with possible evolutionary changes in the capacity of the mind towards increasing the intensity of self-consciousness (Janczukowicz and Wenzel 2021). Aspects of this phenomenon, such as the cognitive-creative type of learning motivation, the natural drive to search for beauty in artistic creation and the natural need for peaceful and harmonious coexistence with other people may provide new and unpredictable themes and ideas. At present, fantasy fiction mostly tends to deal with the issue of the evolution of the mind in terms of the emergence of the supernatural capacity of controlling the minds of others, enslaving them or otherwise manifesting fantastic powers, which rather qualifies this genre as a variety of fairy-tale. The advantage of the theme of increasing the intensity of self-consciousness is that it is feasible, even in the present system of general education, provided that the system becomes elevated beyond the pragmatic level.

In the domain of creation the reciprocal reinforcement of general education and SF and fantasy works may concern the consequences of its becoming a universal and obligatory element of the system at secondary school level. In other words, it means placing this domain in the system of general education on equal terms with the domain of cognition. The consequences of the introduction of a system that encompasses a universal search for artistic predispositions and talents may result in the appearance of unpredictable new directions of the art of the future. New forms of expression may be suggested, which are based on the synthesis of various artistic disciplines. Such attempts have already taken place in the history of art. For example, Richard

Wagner (1994) formulated and realized in practical terms, a conception of the synergy of various disciplines of art, e.g. music, setting and poetry, to form the genre of music drama, while Hermann Hesse (1972), in an allegoric novel, developed a theme in which there is a synergy of art, science and literature. The setting and themes of such works of art as Wagner's 'The Ring of the Nibelung' (Der Ring des Nibelungen) or Hesse's 'The Glass Bead Game' (Das Glasperlenspiel) have their setting and themes in the convention of fantasy fiction, whereas their form of expression manifests the discovery of entirely new ways of conveying their message in order to deal with the most serious matters of the fate of mankind, e.g. the evils of the greed for power and wealth, with the accompanying corruption of character and devastation of nature, which are part and parcel of the domain of coexistence. At the same time, they belong to the greatest achievements in the history of art in the domain of creation.

The future of the educational domain of coexistence depends on the effectiveness of educating the natural need of decent behaviour and the social awareness of the existence of such needs in others. Since the result of educating these features of character is observable as the growth of the intensity of self-consciousness, its teaching procedures have to be viewed in the context of the domains of cognition and creation and the synergy of all of them, which may have a beneficial influence upon the scope and themes of the genres of SF and fantasy at present and in the future. The works which serve as teaching materials should have as part of their focus artistic values and cognitive plausibility and reliability, therefore the reciprocal reinforcement of the domain of coexistence and the future perspectives of these genres will be indirect and carried out in a casual way. A major role should be granted here to the teacher's intuition and talent to make the moral and ethical problems that these works contain clear to the students without resorting to direct and didactically formalized 'moralizing'. The teacher's activities will concentrate on the practice of argumentative discussion and critical thinking, so as to take advantage of the potential of the teaching material to involve the students in discovering these problems

for themselves. For instance, they may discover them on the basis of a comparison of current social or political conflicts, events, wars, etc. with the themes of the material. The artistic quality of this material may help the teacher to trigger the cognitive-creative type of learning motivation. The following example illustrates the possibility of discovering a variety of issues which concern all three educational domains.

The procedures may begin with the introduction of a problem which is characteristic for the domain of cognition, in particular, of the discipline of social studies. It concerns the reasons for the inevitable outbreak of a new war, even though the aggressor of the previous war was defeated. Before the presentation of the material the teacher does not make any suggestions of an analogy to the situation before the outbreak of World War II, or to numerous recent aggressions and invasions.

Fruitless did I call the victory of the Last Alliance? Not wholly so, yet it did not achieve its end. Sauron was diminished, but not destroyed. His Ring was lost but not unmade. The Dark Tower was broken, but its foundations were not removed; for they were made with the power of the Ring, and while it remains they will endure (Tolkien 1969: 264)

The students may recall from history classes the situation in Europe after World War I and in a debate are likely to conclude that wars may be avoided when the direct reasons are removed. Also they may discover a similarity between the situation described in the quotation and the historical events. At this point, the teacher may suggest that the problem is much more complex, involving a great number of economic, psychological and sociological issues, and therefore recommend reading Tolkien's trilogy as an enjoyable way of combining these issues artistically. The themes of the One Ruling Ring which may be discovered in the novel are potential teaching points to be discussed informally with students. These themes include the ring's power to control the minds of those who desire to possess it, addiction to the Ring, immunity against its evil influence, the conse-

quences which the greed for absolute power has for the fate of people, the tacit social acceptance of the rulers responsible for the destruction of harmonious relations, and a great variety of other matters in the domain of coexistence. It may happen that the students themselves will discover that it is not enough to create fantasy novels peopled with strange magical creatures and make the novel 'action packed', but that it is possible for the setting, plot and action of fantasy fiction to become a great work of art. There is only one condition for such procedures to be realized practically – the students should read the teaching material of their own accord.

A promising field for providing new themes for SF or fantasy fiction is the way authors deal with the span of time between the present and the time of the setting, themes, plot and action of the work. They may be concerned with the near future, the span of centuries, millennia, millions of years or, rarely, milliards of years. The issue of time has important consequences for the activation of the imagination of the students. The closer the distance to the present time, the greater the influence of current objective knowledge and contemporary technological advancement upon the credibility and plausibility of the works, which makes them convenient teaching materials for the domain of cognition. The greater the distance, the more opportunities for the activation of imagination. For example, broadening the span to millions of years implies the necessity to imagine the likely directions of scientific disciplines, technological inventions or the development of the intensity of consciousness. On the other hand, if the works belong to the genre of SF, they must avoid the temptation to resort to the supernatural elements, e.g. magic, miracles, extraordinary powers of the mind, the supernatural capacity of 'artificial intelligence', or other forms that contradict the universal laws of nature.

An attempt to combine scientific plausibility with the activation of the reader's imagination may be found in the SF novel of A. C. Clarke (1973). Its action takes place in the future, at a time when men have colonized the planets of the solar system. The technological details of the story are realistic, based on credible

solutions to interplanetary communication. However, in spite of the Earth's technological advancement, when a strange object the size of a planetoid approaches the sun, nobody is able to guess who controls it and how it is controlled, where it comes from and what its purpose is. What is more, on the part of the possible crew of the object there is a complete lack of interest in any contact with people, their affairs, activities, intentions, culture, etc. Even the threat of a nuclear explosion does not make any impression on them and is treated as a slight and insignificant disturbance. It seems that mankind and its civilization is believed to be part of the natural environment and the animate matter of our planet, which is not worth any interest. When the mysterious object leaves the solar system, the only possible explanation for this event is that its purpose was to accumulate the energy of the sun to make interstellar travelling possible. This example shows the possibility of a great discrepancy between what people believe to be advanced technology and technological research which is beyond the scope of present-day imagination. Teaching materials of this kind may inspire the students to search for such discrepancies in other disciplines of cognition and the creation of a curriculum to be used in their own artistic creation.

A special position in future relations between the genres of SF, fantasy and general education may be expected from themes concerned with the directions of evolutionary changes in the world. Most importantly, they require the broadening of the span of time to millions of years, which entails unpredictable consequences and challenges to the imagination, e.g. the creation of a setting, environment, culture, behaviour, language, science, arts, philosophy, and, most intriguing, the possible changes of the intensity of consciousness. The students may realize that the biologically determined features of the evolution of living organisms like natural selection, genetic mutation, adaptation to the environment, hybridization, sexual selection, survival of the fittest, including all the social problems of survival, etc. are not in a position to deal with the phenomena activated by the emergence of the self-consciousness of people and the

higher mental processes which are generated by it. If such a notion appears in the debate, the teacher may find an opportunity to elicit from the students the observation that the creative aspect of the mind could become a new agent of evolutionary changes, which implies the introduction of an adequate system of general education. The educational advantage of discovering such notions could be the emergence of the cognitive-creative type of learning motivation.

Finally, it seems advisable to suggest that the genres of SF and fantasy should include the phenomenon of education itself and its predictable future among their fields of interest. Education, understood as a dynamic process, has to evolve together with the development of the creative aspect of the mind, so as to be adequate to the new challenges posed by it. The significance of this problem is apparent in the novel by P. Boulle (1964) who, in the convention of satiric dystopia, illustrates the discrepancy between a fossilized system of education and the new challenges generated by the creative aspect of the mind. The action of the novel takes place on a planet with environmental conditions similar to those of the Earth. However, the position of men and apes are reversed. The apes, who rule the planet, believe that they are the only intelligent creatures in the world and that their planet is the centre of the universe. They make scientific and exactly controlled experiments on people, who are degraded to the role of unintelligent animals and believed to be unable to learn a language. When a spaceship from the Earth with a human crew lands there, the main character of the story and the crew are taken prisoner and exposed to the same experiments which were carried out on the human inhabitants of the planet. It becomes apparent that the scientists amongst the apes, represented by orang-utans, are not able to accept the notion that men can speak, even though the main character demonstrates that he has learned their language quickly and effectively and is able to express the most complex and sophisticated ideas. In spite of this manifestation, the official scientific report classifies him as a man with particularly sharp instincts, but totally devoid of the capacity for thought.

The basic principle of the science of the apes, which has determined their education, is the conviction that if something can be explained in terms of higher mental processes and also operant conditioning based on the lower, biological processes, then science and the resulting system of education should apply the evidence given by the lower processes. In other words, only what has been learned due to conditioned responses to prearranged stimuli is considered to be reliable knowledge. Therefore, any instance of the manifestation of intelligence which evades such experimental techniques is ignored by the apes as unscientific or believed to be a pathological case.

The effect of such dogmatic principles on general education is that there is a serious limitation in the development of the creative aspect of the mind. The higher mental processes have the capacity of generating new and unpredictable ideas which it is not possible to measure statistically and control experimentally. SF and fantasy works are open and free to develop such ideas and in this way inspire educators to introduce in the system principles which could overcome such limitations. One of the characteristic features of such attempts is the transcendence of the pragmatic level of targets and ways of teaching.

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