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Nature and freedom in education - Findings from a qualitative study on school leisure time in natural settings

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Abstract

Nowadays, more and more educational methods are being used to raise students' environmental awareness. At the same time, however, young people have fewer opportunities to spend leisure time in nature (in other words, to do free exploration in nature), the importance of which has been confirmed by numerous studies. This paper presents the results of a qualitative research that investigated the effects, implementation aspects and integration potential of free exploration in nature in the Hungarian school system. A total of 15 interviews were conducted in five schools. Data processing based on Grounded Theory was used to isolate the relevant aspects of the issue. The most important categories include positive aspects (e.g. pedagogical, psychological, social and physical benefits), negative aspects (e.g. accident factors; students put themselves, others and the environment at risk; negative feelings of students, parents and teachers), implementation aspects (e.g. degree of teacher control and education; preparation; link to school operations; role of age), barriers (e.g. weather; school environment; attitudes of students, teachers and parents; specific features of the education system; lack of time; risk of accidents; financial constraints) and facilitating dissemination (e.g. changing the education system; changing the mindset of teachers and policy makers; patronage; exchange of experience). These results can promote the conscious and appropriate use of free exploration in nature in education systems.

Keywords: environmental education, free exploration in nature, qualitative pedagogical research, Grounded Theory

1. Introduction

The pedagogical innovations of recent decades have multiplied the number of available outdoor environmental education (EE) methods, which are increasingly being used to develop environmental awareness. At the same time, however, a number of studies have highlighted the environmental pedagogical importance of leisure time spent in nature (e.g. Martin et al., 2020; Richardson et al., 2018; Wells and Lekies, 2006; Bixler et al., 2002; Tarrant and Green, 1999; Kals et al., 1999; Palmer, 1993) and the declining trend in this type of activity (e.g. Luís et al., 2020; Louv, 2008). In this study, the concept of free exploration in nature has been used to describe these experiences. In school context, it means that teachers have a passive role, they only supervise students' free activities in green areas (e.g., climbing, playing, exploring)

therefore students spend their time freely and do not participate in special tasks or organized programmes.

This paper presents the results of a qualitative research project, which investigated the effects, implementation aspects and integration possibilities of free exploration in nature in the Hungarian school system. However, before presenting the research, it is important to clarify the previous research findings in this field.

Csonka (2023) pointed out that nearly 90% of school leaders (N=35), science and PE teachers (N=76), class teachers (N=29) and school programme organisers (N=25) believe that free exploration in nature can have a significant positive impact on students or is an indispensable pedagogical element. Another important finding is that 80% of school leaders (N=35) believe that there is a need to increase the proportion of this programme element in their institution (Csonka, 2023). The importance of research on free exploration in nature is also underlined by the fact that 55% of students (N=423) associated the dominant nature related school experience they recalled with too many compulsory programmes, too much discipline and/or lack of free time (Csonka, 2023). These findings all warranted this qualitative research which is presented below.

2. Focus of the qualitative research

As mentioned in the previous chapter, the focus of the qualitative research was on the effects, implementation aspects and integration potential of free exploration in nature. This meant examining the following questions:

- How do students respond to free exploration in nature?
- How free exploration in nature can be integrated into school work?
- What positive impact can free exploration in nature have?
- What are the negatives, dangers and obstacles to the use of free exploration in nature?

3. Research sample and methodology

The qualitative research involved five educational institutions, each of which conducted semi-structured interviews with one or two head teachers and 2-3 other teachers. In the latter case, teachers were selected who were involved in some way in the implementation of outdoor programmes (e.g. programme organisers or teachers of environmental subjects). A total of 15 interviews were conducted, in the form of individual and pair interviews. 17 people participated

in the research due to the paired interviews (there were schools where two leaders or three teachers participated). The schools were selected on the basis of previous questionnaire surveys. Among the questionnaire result, strength of the students' nature connectedness, attitudes of the teachers (including school directors) and the frequencies of implementation of free exploration in nature was taken into account. The sample was selected from schools where some of the values of the questionnaire were close to the extreme ranges. Both ends of the ranges were considered in order to obtain a heterogeneous sample. The diversity of the sample is also reflected in the size and location of the schools, as well as the mixed primary/secondary school and eco-school/not eco-school status.

In the case of eco-school/not eco-school status, it is important to know that *an eco-school differs from an ordinary school in that it applies the principles of environmental education and sustainability pedagogy not only in teaching, but in all aspects of school life, from running the school to providing meals for children and organising camps (*Source: Hungarian Institute for Educational Research and Development, web: https://ofi.oh.gov.hu/mi-az-az-okoiskola). In addition, the local environment and its problems are always part of the pedagogical work in eco-schools (also based on the previous source).

The characteristics of each school are summarised in Table 1 below:

Table 1. Characteristics of the schools participating in the research

Institution	Type	Status	Settlement
1.	primary school	eco-school	village
2.	primary and secondary school	eco-school	big rural city
3.	6 grade secondary school	not eco-school	capital (Budapest)
4.	primary and secondary school	not eco-school	big rural city
5.	primary school	eco-school	village

The heads of the institutions interviewed in each school were teachers of biology, geography, history, English, art and digital culture. The other interviewees were day-care teachers and teachers of environmental studies, biology, mathematics, history, ethics, Hungarian language and literature, English and physical education.

4. Processing the data

Grounded Theory methodology (Glaser and Strauss, 1967) was followed in the data processing. In Grounded Theory based data processing, the empirical data is broken down into different codes during the coding process and then used to create abstract categories for conceptual analysis (Charmaz, 2006; Glaser, 1978, 1998; quotes: Charmaz, 2011). This is done in a three-step process involving open, axial and selective coding. In open coding, appropriate concepts are assigned to text segments and then used to create categories, in axial coding, subcategories are created within each main category, and in selective coding, relevant categories are compared according to the theoretical background of the research (Gelencsér, 2003; Sántha, 2009; quotes: Sántha, 2012). Thus, it can be seen that in the application of Grounded Theory, the categories of analysis are formed and compared during the process of coding. For the purposes of this analysis, content categories have been distinguished. Data were analysed using the MAXQDA software package. The reliability of the results was increased by intracoding. This means that the text corpus is encoded twice or more by the same person (in this case the author) at different times. To check the reliability of the intracoding, the cohen kappa was calculated, which quantifies the extent to which the encodings differ from each other (Sántha, 2012). According to Greve and Ventura (1997), coding above a kappa value of 0.6 is acceptable (quotes: Sántha, 2012), which was taken as a guideline in the present research. As Sántha (2012) points out, in the case of Grounded Theory based data processing, only open coding can be reliably applied to intracoding. Keeping this in mind, the data processing included intracoding of the main categories (open coding), which was performed within a few days after the first coding. The kappa value for the interviews was 0.64, so the data could be reliably processed based on the intracoding codes.

5. Results and discussions

5.1. Description of the main categories

In the case of the interviews, five main categories were most relevant to the focus of the research, and these are presented below. The main categories and their definitions are summarised in Table 2 below:

Table 2. Interpretation of the main categories

Main category	Interpretation
Positives	The positive effects of free exploration in nature.
Negatives	The negatives associated with free exploration in nature.
Implementation aspects	What should you look out for when implementing free exploration in nature? How to organise this programme well? How can it be integrated into the school curriculum and organisational structure?
Barrier factors	The obstacles that prevent free exploration in nature.
Facilitating dissemination	How can the spread of these programmes be helped?

5.2. Code matrix for the main categories

5.2.1. The results of the code matrix

The results were also interpreted using a code matrix, which shows the number of codes (number of mentions) belonging to each category. Using the code matrix generated by MAXQDA, it was also possible to examine the code numbers for each category broken down by school. The code matrix below (Table 3) shows the number of codes per school for each main category:

Table 3. Code matrix for the main categories

Main categories	Not eco-school in Budapest	Not eco-school in big rural city	Eco-school in big rural city	Eco-school in village	Eco-school in village	SUM
Positives	**66**	**65**	**69**	**48**	**55**	**303**
Negatives	**22**	**16**	**8**	**8**	**10**	**64**
Implementation aspects	**40**	**64**	**47**	**39**	**29**	**219**
Barrier factors	**80**	**64**	**61**	**54**	**46**	**305**
Facilitating dissemination	**40**	**26**	**21**	**16**	**10**	**113**
SUM	**248**	**235**	**206**	**165**	**150**	**1004**

From the code matrix it can be seen that a total of 1004 codes were assigned to the different main categories, as each text fragment that carried information related to a main category was

counted as a separate code. Some information could therefore appear in several codes. Based on the results, eco-schools provided less information on the topic than not eco-schools. In addition, it can be said that the village schools provided the least information, followed by the two schools of big rural cities and the one in the capital. The not eco school in Budapest provided the most information, while one of the village eco schools provided the least. Of the main categories listed, teachers most often talked about the positives and the barrier factors. The least frequently reported topic was the negative impact of the programme. It can be seen that in the case of the school in Budapest, the barrier factors, the negatives and the ways of dissemination are more pronounced. These three categories are less prominent in rural schools, especially in schools in villages. The number of positive aspects mentioned showed less variation between schools and was a popular topic in all institutions. In the eco-school/not eco-school context, no marked differences in the pattern are apparent, apart from the number of mentions of negatives, which was higher for not eco-schools.

An interesting result is that the low mention of negatives and the high mention of positives were accompanied by a high mention of barrier factors. The reason for this is that the category of negatives refers specifically to information related to the negative impacts of the implementation of the programme. These were relatively less mentioned by respondents, with positive impacts being more typically mentioned. In contrast, the category of barrier factors included information relating to obstacles to the implementation of the programme. These partly included negative impacts during the programme (negative category), but in many cases other impacts were also mentioned (e.g. organisational or financial issues, see Chapter 5.3.4.). Overall, therefore, respondents mentioned positive impacts of the programme more than negative impacts, but a lot of information has also been coded into the barrier factors of implementation.

5.2.2 Discussing the results of the code matrix

The results suggest that attitudes towards the topic differ more in the rural/urban context than in the eco-school/not eco-school context. The responses collected in the school of the capital reflect more negative attitudes in terms of barriers, but in addition to the negative aspects of the issue, there is also a strong emphasis on facilitating dissemination, linked to changes in teacher attitudes and the education system. In contrast, a less critical attitude emerges from the rural eco-school interviews. It is important to note, however, that all five schools provided a lot of information on the positive effects of these programmes which outnumbered the negative

aspects for all institutions. This confirms the results of the questionnaire survey (see: Csonka, 2023), which showed that teachers' attitudes towards these programmes are basically positive.

5.3. Detailed description of each main category and subcategory

5.3.1. Positives

The subcategories within the positives, with their corresponding mention numbers and key information, are summarised in Table 4 below:

Table 4. Subcategories of the positive main category and their characteristics

Subcategories of the positive main category	Number of mentions	Important information
Learning	**61**	acquiring practical knowledge of the environment; deeper and more complex learning through observation of nature; more differentiated and monitorable development, including skills and competences; preparing for later independent learning processes; promoting voluntary involvement in different themes and projects; motivating students to do their homework, since in many cases the day care centre allows students to go out after writing their homework; changes in student attitudes also affect parents
Feelings, experiences	**54**	sense of wonder, freedom, happiness; children get excited and enthusiastic during the game, and at the end they get tired, which makes them more manageable; parents and teachers may also have good feelings about the program (e.g. parents are happy that their child is benefiting from it)
Psychological	**39**	students are better able to pay attention to themselves; developing other competencies than in traditional education; development of decision-making, discovery and emphatic skills; development of openness; recognition of own limits; getting to know the issues of responsibility, care, respect, separation, farewel; strengthening of creativity, sense of beauty, respect for nature and sensitivity to nature; students recognize the calming effect of the program; development of creativity (students give meaning to natural objects during the programme); the programme can be an antidote to digital addiction (e.g, the popularity of the program among students increased after the restrictions during the Covid period)
Environmental protection	**38**	the programme teaches environmental awareness, as students have to respect certain rules in order to protect the environment; students' knowledge about nature increases; students develop a sensitivity to a clean environment and may become interested in certain natural creatures; exposure to environmental pollution during the program can inspire environmentally conscious behavior later on (teacher's help is also important for this); as a result of the program, students can also get involved in

		environmental protection topics; environmental protection activities can also be carried out during the program, which can strengthen students' environmental attitudes
Social	**27**	getting to know each other; building friendships; experiencing communitiy; building community; informal conversations (even with teachers); psychological support among students; teachers get to know students better and can provide psychological support; students' behaviour can be better observed during the programme; social skills development such as cooperation, listening to each other, asserting one's own will, ability to play with children of different ages
Health and physical	**19**	fitness, coordination, fine motor, sense of touch development; helps to develop a healthy lifestyle later on
Others	**65**	puts less burden on teachers and can be implemented with less financial expenditure; solves the monotony of structured programs; helps students to better assess the possibilities and dangers of their living environment; the risk of human-to-human infections can be reduced because it takes place outdoors

The Table 4 shows that teachers most often highlighted positive aspects of learning and positive feelings/experiences within this main category.

5.3.2. Negatives

The subcategories within the negatives, with their corresponding mention numbers and key information, are summarised in Table 5 below

Table 5. Subcategories of the negative main category and their characteristics

Subcategories of the negative main category	Number of mentions	Important information
Feelings of students	**16**	feeling of boredom; feelings of discomfort, fear (students are becoming more fearful of nature), stress, anxiety, phobia and trauma about nature; experience of failure, because students need different competences than in the classroom; discomfort in the community; negative feelings that the environment used is not natural enough
Risks of accidents	**15**	endangering each other and themselves (e.g. falls, jostling, climbing on dangerous places); asthma symptoms, rotten trees, splinters, stinging plants, ticks, insect stings (e.g. wasp, bee)
Students' behiviour	**8**	not listening; using mobile phones; fooling around; behaving wildly; lack of interest; lack of self-control; destruction of objects; isolation from nature; many students are not aware of the positive effects of the programme; endangering peers; direct and indirect confrontations between students; disturbing strange people in the area; self-harming behaviour; environmentally harmful behaviour
Conflicts between children	**5**	see previous point

None or few negatives	**5**	the programme has no negatives or far fewer than positives
Feelings of pedagogists	**4**	tiring, stressful and time-consuming to teach in this way; fear of accidents (and parental reactions to them) and that students are not mastering the material what is needed for further studies; feeling of discomfort that the location is not natural enough
Parental attitudes	**4**	fear of accidents; bad feelings about soiling and worn clothes
Its usefulness is questionable	**3**	it is questionable whether the program is useful from a pedagogical point of view
Environmental degradation	**2**	students can damage the environment
Others	**2**	it does not help further education; special attention must be paid to traffic and students' disruptive behaviour towards strangers

Table 5 shows that the most frequently mentioned negative aspects of the programme were related to the feelings of students and risk of accidents.

5.3.3. Implementation aspects

The subcategories within the implementation aspects, with their corresponding mention numbers and key information, are summarised in Table 6 below:

Table 6. Subcategories of the implementation aspects main category and their characteristics

Subcategories of the negative main category	Number of mentions	Important information
Organisation (management and control issues within the programme)	**96**	a certain degree of teacher control is important to protect against accidents (e.g. student doing dangerous activities, going too far) and to protect children who are afraid; the age of the students is important when determining the level of control; swimming, rowing, winter sports require increased control to protect against accidents; weather conditions must be monitored; care must be taken that students do not disturb strangers and that they are careful not only with nature but also the tools they use; educators need to find the right balance between structured and unstructured programmes; it is important for teachers to avoid unnecessary control; teachers must be careful to exercise little control over the development of social relationships; it is important to clarify with students what they need to be aware of before starting the programme; teacher control can also play a role in encouraging students to participate in the programme; optional organized programs can be added to free exploration in nature as well as semi-organized programs such as talking in nature, grilling or finding natural places on your own and spending time there; with regard to day care and breaks, it is basically worth focusing on free pastime (unless the children require control or are bored); it can be an alternative version of the program if the students vote on what and how they want to do; it is important for teachers to take parents' requests into account when organizing the programs;

		the control applied during the program can also serve an educational purpose: it is possible to direct students' attention to certain things; smaller tasks can be given to the students (e.g. in relation to nature education, PE education, sensory education, fear reducing) or smaller knowledge can be transferred; in forest schools, the program can be organized in such a way that it complements what is learned at school; it is important for teachers to reflect on students' comments during the programme; with the help of the control, it is also possible to get time for everyone during the games; educational activities can be carried out not only during the program, but also before and after
Preparation	**31**	it is important to prepare for the programmes in advance: students should be given instructions before the programme (e.g. expected standards of behavior, risk factors, prohibited activities with an explanation of the reason for the prohibition, description of the location of the program); gradual practical preparations and exams could be necessary (e.g. for rowing, swimming, cycling, winter sports); students need to acquire orientation skills and learn how to ask for help; students need to get to know the natural places in the living environment; preparing parents for risk factors (e.g. accidents, danger of ticks, colds); it is important for teachers to assess students' needs before the programme; teachers should walk and check the routes before the tour and they must ensure the possibilities of reversal; adequate food, drink and tools should be provided for students; students should turn off their mobile phones before the program, although the use of some apps can have an educational effect; preservation and creation of green areas suitable for the program; teachers need to learn to trust children
Link to institutional operations	**16**	schools should have an environmental education plan that focuses on experiential learning; providing educational elements in the curriculum of schools (and teachers) that enable the program (e.g. forest schools, active tourism programs, class trips, excursions); the programme can be integrated into comprehensive school education models (e.g tourism model with different programmes); there are more opportunities for the programme during free time but it can also be done during lessons (rather in lower secondary school), day centres and breaks; these programmes should be addressed by teachers' working groups with dedicated teachers; specific meetings can be organised on the subject; it is important to have a large and committed team of science teachers in schools who can also deal with these programmes; the organisational culture of schools should be supportive of the programme
Age	**10**	the age of the students is important when organising these programmes; it is worth starting the programme for children at an early age; students in grades 1-4 need more guidance; it is important that the characteristics of the programmes (e.g. duration, distance from the site) vary gradually with age; students

		are able to decide what to do by about 3-4th grade, and their interest in the programme tends to wane after 8th grade
Others	**66**	teachers should consciously organise time outdoors as often and as varied as possible; students need to go more often, but for shorter periods to natural places outside school; in the case of the forest school 5-day implementation is appropriate; lessons on the environment should include taking children outside the four walls; there should be a lesson in the woods every week where possible; on weekdays, Fridays may be more suitable for these activities; muddy weather is not necessarily an obstacle to the organisation of the programme; the more natural the implementation site, the better; even if the schoolyard has good facilities, it is still worth taking walks outside the school; nature-based programmes are also important for children in rural areas; the curriculum for the programme should incorporate local specificities and take into account the eco-school label and other environmental programmes where relevant; preference should be given to closer locations; students should have the opportunity to talk to the teacher during the programme, who should be interested in the students; children should be reminded to check themselves after programmes to reduce the risk of ticks; if students become overheated or wet, they should be moved to a safe place; students should be encouraged to be aware of strange people and traffic; programmes should be organised in accordance with the legal requirement of 1 teacher for every 10 children in outside schools

The most frequently raised implementation aspect was the level of organisation of the programme. A large number of responses were received on how and for what purpose these informal programmes could be made more controlled and managed.

5.3.4. Barrier factors

The subcategories within the barrier factors, with their corresponding mention numbers and key information, are summarised in Table 7 below:

Table 7. Subcategories of the barrier factors main category and their characteristics

Subcategories of the barrier factors main category	Number of mentions	Important information
Environment, weather	**54**	lack or elimination of green areas; extreme weather conditions (with flu epidemic is particularly problematic)
Students	**51**	students' negative behaviours and feelings (see negatives/students' behaviour); age-related factors (see implementation aspects/age); in addition: students' possible physical abilities and personalities; students can bring the dirt inside the school after the programme

Curriculum, education system	**34**	traditional education system can be a barrier to the implementation, from which it is difficult to exit; the programme is not included in the National Core Curriculum (NCC); the NCC contains unnecessary teaching materials (which takes time away from the programme) and does not focus on learning about the local environment; the NCC changes rapidly; the opinion of educators takes a back seat when the NCC is created; too much emphasis on digital education; the school leaving certificate system does not support the organisation of such programmes; large amounts of homework; 45-minute lessons are too short; too few double lessons; there is rarely suitable lessons for the programme at the beginning or end of the day (which could help to increase the duration); project days and lessons are not harmonised; outdoor programmes are organised too infrequently but are often too long
Teachers, heads of institutions	**34**	see: negatives/feelings of pedagogists In addition: adherence to traditional pedagogical methods (e.g. strong emphasis on information transfer); questioning the usefulness of the programme; shying away from new methods; the need to comply with curricula; lessons may be cancelled because of the programme, which could lead to conflict between teachers; both the presence of an accompanying teacher and independent team leadership can cause problems; most teachers need a little managerial pressure to organise such programmes, but many are not motivated to do so; the programme often requires licences and administrative procedures; implementation of the programme requires cooperation between teachers, which can be a source of conflict (e.g. clashes with lessons and programmes; joint organisation); teachers must prepare for the programmes and assess students' needs; not all teachers are able to sufficiently suppress their own will during the programme; the frequency of the programmes is also determined by the attitude of the heads of the institutions; some teachers may be distracted by the responsibilities of the programme or may not be able to manage or find it difficult to manage children
Lack of time	**32**	both students and teachers have little time for the programme; reasons: too many lessons; compulsory programmes for students in the afternoon (e.g. trainings, extra lessons), more opportunities at day care, but not all students participate; other day care tasks (e.g. homework writing); as activities outside the schools require one teacher for every ten pupils, the time of the accompanying teacher must be freed up
Money	**17**	many teachers do not take on the extra work involved in the programme because they believe their salaries are too low and their overtime is not paid; schools' autonomy to fund these programmes is limited; there is no public funding for these programmes and related trainings, physical environment transformations; the lack of public funding also affects forest schools, which find it difficult to promote themselves
Risks of accidents	**16**	see negatives/risk of accidents

Parents	**14**	some parents are not supportive of these programmes, e.g. they think it takes time away from writing homework, dangerous to to their child, their child gets dirty, their child's clothes get ruined; some parents prioritise the use of digital tools or doing other types of programmes; parents can instil fears in children about nature or fail to resolve past bad experiences; some parents cannot afford the programme or do not want to pay for it; parents often have to arrange transport down to the programme site which may cause difficulties; families are hiking less than in the past
Others	**53**	some programmes require a more organised form (e.g. swimming, rowing, skiing); high performance expectations for students (loss of free time); children are released from lessons at different times; children start and leave day care at different times; few people teaching teachers new pedagogical methods; possible epidemiological regulations may also complicate implementation, as additional safety aspects need to be taken into account

Table 7 shows that the most frequently cited barriers were related to school environment, weather and student behaviour.

5.3.5. Facilitating dissemination

The subcategories within the facilitating dissemination, with their corresponding mention numbers and key information, are summarised in Table 8 below:

Table 8. Subcategories of the facilitating dissemination main category and their characteristics

Subcategories of the facilitating dissemination main category	Number of mentions	Important information
Education structure, professional content, decision-makers	**27**	reducing NCC constraints and removing unnecessary learning materials; increased communication between decision-makers and teachers; change of mindset of decision-makers (recognition of the importance of the programme); elimination of time pressure; reducing the burden on students; more age-appropriate education; move towards project-based and experiental education; better harmonisation of curriculum and project days; a baccalaureate system that supports experiential learning; greater consultation of teachers when the NCC is drawn up; inclusion of the method in the NCC (if the majority of teachers agree); slowing down the pace of change in the curriculum; effective blocking of lessons; more frequent but shorter outdoor programmes; compulsory forrest schools
Teachers' change of mindset	**13**	trainings and discourses can help teachers to change their attitudes towards free exploration in nature; fostering the development of supportive teacher communities

Exchange of experiences	**12**	publishing and online sharing these programmes; sharing teacher portfolios; creating online platforms and databases to share experiences and make recommendations; field leaders should be involved in the training and further training of teachers
Mecenature	**9**	removing financial obstacles (see barrier factors/money)
Others	**52**	educating students about the learning impact of the programme; preparing students for nature and its dangers; familiarising students with suitable sites for the programme; focus on semi-organised activities (e.g. talks in nature, bonfire lighting); assessing and making better use of the environment around schools; creation and reclamation of green areas; installation of outdoor toys; providing schools with their own natural area for education; implementing schoolyard animal husbandry with student involvement; fostering a supportive parental environment; putting mild pressure on teachers to implement these programmes; sharing and routinising the paperwork involved in the programmes; establishing links with external actors involved in the organisation of such programmes (e.g. friends, volunteers, organisations); strengthening the links between schools and local authorities; better use of forest schools, possibly propagating them; better teacher communities at institutional level; presence of enthusiastic teachers in school communities who are involved in organising the programme; implementation of the programme as a leisure activity; research and surveys on the subject

It can be said that a wide range of ways of facilitating dissemination were mentioned by the interviewees, a significant number of which were so diverse that they were not listed as a separate subcategory (they were listed in the subcategory 'other', which had the highest number of mentions).

6. Conclusions

The qualitative study helped to isolate important aspects of free exploration in nature in school context. The programme have several positive impacts, which relate to educational and, as part of this, EE effects (e.g. experiential knowledge, learning about the local environment, development of competences, strengthening of environmental attitudes, development of environmentally conscious behaviour). In addition, the information mentioned within this main category was linked to the positive feelings (e.g. happiness, freedom, wonder), psychological effects (e.g. development of openness, decision-making, creativity; recognition of own limits), social effects (e.g. community building, development of social skills such as cooperation) and the development of physical health (e.g. fitness, coordination, fine motor skills). There are also negative aspects of the programme, such as negative feelings of students (e.g. boredom, fear),

students' behaviour (e.g. endangering others, themselves and the environment), conflicts between students, risk of accidents, negative feelings of teachers and parents (e.g. students not learning the material; fear of accidents). One of the most important categories was the implementation aspects, within which the teacher control (e.g. in order to avoid accidents, control bored children, offer activity options, use semi-structured activities, draw children's attention to certain phenomena, provide small tasks during, before or after the programme) was a key issue. Within the category of implementation aspects other topics were also raised such as the preparation for the programme (e.g. pre-education of students, pre-touring of hiking routes, provision of food and drink for students), the integration of the programme into school life (e.g. integrating implementation support elements in the schools' curricula; involving school working groups in the work of the programme) and age related topics (e.g. organising age-appropriate programmes, starting the programme at an early age). A large number of teachers also mentioned obstacles to the implementation of the programme, such as environmental and weather conditions (e.g. lack of green areas near schools; extreme weather conditions), student-related factors (e.g. negative feelings and behaviours, age, physical abilities, personalities), factors related to the educational system (the programme is not included in the NCC; redundant curricula; inadequate graduation system; 45-minute lessons), factors related to teachers and directors (e.g. adherence to traditional teaching models; fears among teachers, conflicts between teachers, administrative and preparation difficulties, attitudes of the directors), time constraints (both for teachers and students, e.g. afternoon programmes; too many lessons), financial factors (e.g. lack of autonomy of schools; lack of subsidies; combination of low salaries and lack of overtime payments), risk of accidents, parental attitudes (e.g. fear of accidents; preference for other activities; transfer of fears to children; negative attitudes towards costs). Respondents also talked about how these programmes could be disseminated. This can be achieved by changing the approach of the education system and policy makers (e.g. reducing NCC constraints such as removing unnecessary curricular units, enhancing experiential and project learning; eliminating time pressure and overload; better communication between policy makers and teachers), changing teachers' attitudes (e.g. organising trainings, discussions; strengthening teacher communities), sharing experiences (e.g. sharing programmes and teacher portfolios; creating online platforms and databases) and removing financial barriers.

This research has also opened the door to future representative sample studies, which can be extended to a more comprehensive analysis of the information contained in each subcategory.

A quantitative study of the topic could involve not only teachers and heads of institutions, but also students and parents. It would also be important to raise awareness in the community of educators that free exploration in nature can be seen as a pedagogical tool with a specific place and role in education. Finally, it would be important to inform teachers about the positive and negative aspects of the programme, its implementation aspects and possibilities, and ways of promoting its dissemination.

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Investigation of a Museum Education Workshop of Széchenyi Zsigmond Hungarian Hunting Museum of Carpathian Basin, with a Focus on Education for Environmental Awareness

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Abstract: *More and more museums are offering environmental education programmes, and museum education activities are providing more and more learning and experiences for people of all ages. This study aims to find common ground between promoting sustainability and museum education activities. We investigate the role of museums in the development of environmentally aware attitudes in the framework of a doctoral research. One of our research sites is the Széchenyi Zsigmond Hungarian Hunting Museum of the Carpathian Basin. As part of the research, primary school students participated in museum education workshops. The aim of the surveys conducted at the Hunting Museum of Hatvan was to develop the natural science skills of the third to sixth grade pupils participating in the programmes by providing them with the broadest possible scientific basis and to increase their knowledge of our living and non-living natural resources. We observed the effects of environmental education about the museum workshops, documented changes in students' knowledge and tested their short- and long-term memory (179-172-163 students participated). In the second survey, the students achieved better results in terms of changes in knowledge than in the first questionnaire (our hypothesis was confirmed). The results of the third survey exceeded the results of the second survey in most cases (except one question) (the hypothesis was partially confirmed or overturned).*

Keywords: *environmental education; museum; museum education; environmental awareness; efficiency evaluation*

1. Introduction

Today, training for sustainability plays an increasingly important role. In sustainable development education (museum education) projects, training for environmental awareness can be made even more effective by the means and methods of forest pedagogy. For the theoretical

substantiation of this study, we examine the relationship between museum pedagogy and environmentally aware education in a non-exhaustive manner.

1.1. The concept of museum and museum pedagogy

According to Act CXL of 1997 on the Protection of Cultural Property and Museums, Public Libraries and Public Culture, *"The museum is responsible for the permanent collection, recording, preservation and restoration, scientific processing and publication, as well as exhibition and other forms of presentation of specific material of cultural property."* (Act CXL of 1997).

Museums enrich us with informal knowledge and valuable experience obtained in a voluntary environment (Lord, 2007). In addition to exhibitions, museums can enhance their programmes with tools, activities and activities that can contribute to shaping the museum visitor's perception of nature and the environment (Dominek, 2021). Museum programmes are catching up with the needs of the current generation, and museum pedagogy sessions are becoming increasingly popular among educational institutions. In Western Europe and the United States, they have long been used in school education. From a pedagogical point of view, museum pedagogy has its roots in the Enlightenment and the reformist educational trends of the early 20th Century. John Dewey and Jean Piaget played a major role in its development (Tanóczky, 2019).

Nowadays, museum education is both an educational and a pedagogical activity, while taking into account the specificities of each age group, since a museum educator's responsibilities include dealing with the broadest generations of visitors. Exhibitions can be sequences of several sessions and multiple visits, providing a greater immersion in the subject than a single experience (Foghtűy, 1993).

1.2. Understanding environmental education, education for sustainable development and forest pedagogy

The concept and content of environmental education is very complex. It can be understood as the transmission of environmental culture, which includes awareness of the living and non-living environment. Environmental education should prepare people to deal with environmental problems and conflicts, to take action to improve the environment, and to point out the harmonious relationship between man and nature (Lehoczky, 1999). Environmental education involves an integrated approach to various disciplines (Lükő, 2003). Environmental education is characterised by thinking in terms of systems (Kováts-Németh, 2010).

In the process of education for sustainable development, we establish links between the three components of sustainability: we need to examine the interrelationships between the environment, the economy and society in a holistic way (Havas, 2001; Havas-Varga, 2006). One of the key issues of education for sustainability is to develop a sense of responsibility towards the environment (Mónus, 2020). One of the objectives of education for sustainable development is to enable participants/students to develop their own vision of sustainability (Varga, 2020).

The forest pedagogical project is inherently complex in its thematic scope, contains adapted knowledge and is practice oriented (Kovátsné Németh, 1998). The significance of the project method is outstanding due to its multidisciplinary nature, it provides the opportunity to develop environmentally conscious behaviour. It links different disciplines into a single unit.

2. The emergence of environmental education and forest pedagogy in museums

The emergence of environmental education and forest pedagogy in museums

Nowadays, museums, zoos and botanical gardens have become prominent areas of environmental education in Hungary (Halászné Szakács, 2017; Fodor, 2015).

It is an important step for museums, which opens up a wide range of opportunities for museum educators. A work of art can also serve an educational function, and an entire exhibition even more so. Exploiting this, the themes of an exhibition can be designed to include environmental education (Csákiné Dobos, 2020). Museums can become privileged actors in environmental education since one of their fundamental missions is to create a link between science, heritage and society.

Several international 'best practices' demonstrate the link between environmental education and museums: in France, a new type of museum has been developed that puts the relationship between humankind and its environment at the centre of its programme: the ecomuseum (Waidacher, 2011), and over several decades, a number of Anglo-Saxon exhibitions have started to focus on the impact of humanity on the environment (Zwang, Girault, 2019).

In 2012, Elekes, in the context of writing her doctoral dissertation, investigated whether functional knowledge that leads to the protection of nature can be developed in children through planned education in museum pedagogy. Her research confirmed that through conscious education, children can develop the mental structure necessary to deal with environmental problems (Elekes, 2012).

Forest pedagogical methods can also be excellently integrated into museums. The emphasis is on learning through experience and on individual or group activities. We give priority to exploratory, investigative work. In museum sessions, pupils learn about the exhibitions and through them, about living and non-living natural assets. Educational institutions may not have the opportunity (due to lack of time or money) to participate in forest school sessions, but they certainly need environmental education or forest pedagogy sessions. In such cases, museums can provide students with authentic, interesting and relevant natural and environmental knowledge and provide a basis for sensitization by introducing new things (Csákiné Dobos, 2020). There is also a strong emphasis on visual demonstrations, which students can experiment with themselves. These illustrative experiments are a great way to promote cause and effect relationships in nature. These physical experiments are also safe to use.

The success of the interdisciplinary projects tested between 2018 and 2019 in a small municipality, in the Museum of Pásztó, is illustrated in *Table 1.*

1. Table 1. Number of museum education sessions and their participants at the Museum of Pásztó (2018-2019)

	Number of museum education sessions	**Number of participants in museum education sessions**
Museum education sessions without environmental education	16	259
Sessions with only environmental education purposes	49	1179
Museum education sessions with environmental education elements	172	3442

3. Research Objective and Method

We aim to investigate the role of museums in the development of environmentally conscious behaviour in a doctoral research project. The aim of the doctoral research, based on previous research and experience, is to analyse the efficiency of museums in Hungary in the field of environmental education. The aim is to develop the environmental awareness skills of third, fourth, fifth and sixth grade students participating in museum workshops by providing them with the broadest possible scientific basis and increasing their knowledge of our living and non-living natural resources. In the context of museum workshops, we monitor the impact of

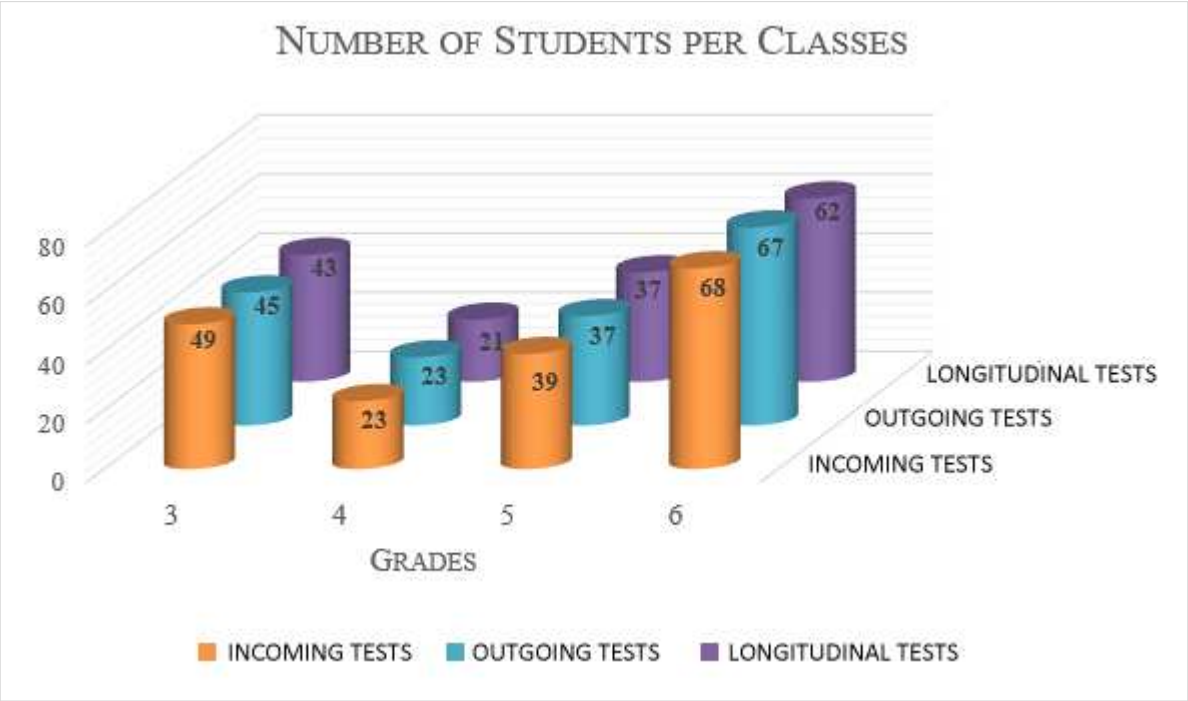
environmental education, document changes in students' knowledge and assess short- and long-term memory ("efficiency evaluation").

One of the sites of the surveys was the Széchenyi Zsigmond Hungarian Hunting Museum of Carpathian Basin in Hatvan, which is part of the "One with Nature" World Exhibition of Hunting and Nature. In the present study, we analyse the results of this survey. As part of the research, museum education workshops were held for primary school students. In addition to the museum educational workshop, a hunting dog show was presented by members of the Heves County Institute of Kynology of the National Hungarian Hunting Chamber. We planned to have 179 students participate in the longitudinal study, which was intended to last for 1 year. An empirical measurement tool (questionnaire + test) was designed to assess the students' opinions and changes in their knowledge, linked to the session "Aladár Dandelion and his friends". The test questions used in the pre- and post-tests differed only in their sequence, in order to ensure equivalence. We expected a significant difference between the first and second measurements in the case of the museum education workshop, i.e. we assumed that there would be a detectable improvement in students' performance following the workshop. One year after the experiment, we repeated the surveys, expecting a deterioration in long-term memory performance.

In addition to the written questionnaires, in the course of self-monitoring pedagogical experiments, we monitored the changes in students' knowledge level (knowledge level measurement) (longitudinal study) (Falus-Ollé, 2000). The results were evaluated using descriptive statistical methods.

4. Research Outcomes

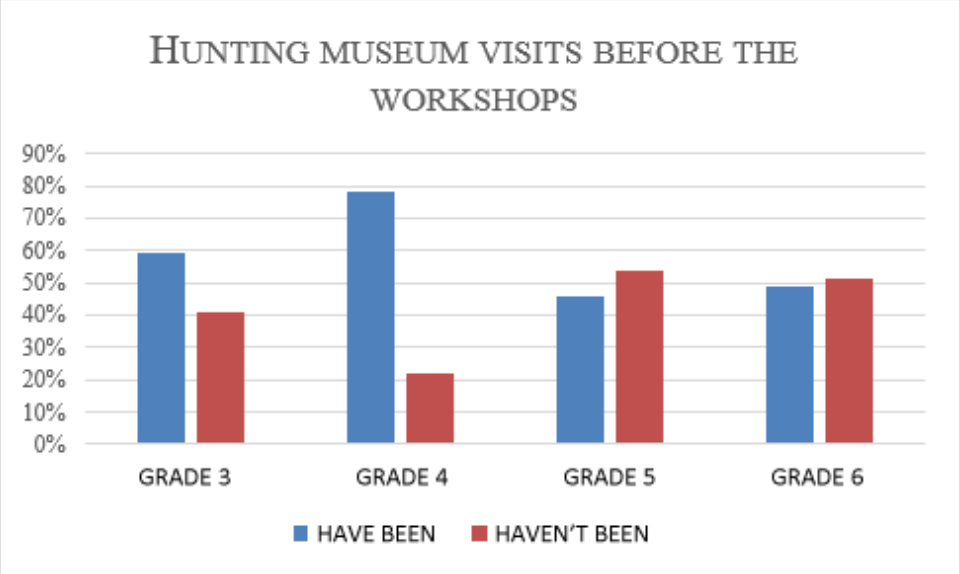
The first two samples were collected from September to October 2021 using paper-based data collection. A total of 179 primary school pupils in grades 3 (N=49), 4 (N=23), 5 (N=39) and 6 (N=68) completed a questionnaire and a test before the workshop. After the session, a total of 172 tests were returned to us by students in grades 3 (N=45), 4 (N=23), 5 (N=37) and 6 (N=67) from the same classes after the workshop. The last part of the efficiency evaluation was conducted in September 2022, one year after the museum education workshop, in the same population. This test was completed by 163 students in grade 3 (4) (N=43), grade 4 (5) (N=21), grade 5 (6) (N=37) and grade 6 (7) (N=6) *(Figure 1)*.



1. *Figure 1.* Distribution of the number of students per classes
Respective edit, 2023

The current evaluation assesses one multiple-choice test item, 4 multiple-choice items, one matching item and one answer construction item. Using the written questionnaire method, in addition to the opinion questionnaires, self-controlled pedagogical experiments were used to measure knowledge levels and to monitor changes in students' knowledge levels (longitudinal study). Our study aimed was to explore the traces left by the workshop and to measure the long-term effects on the students. We hypothesised that there would be a deterioration in the efficiency of recall. However, we were pleased to see that instead of deteriorating, the longitudinal study produced better results than the second survey conducted immediately after the session.

Our first questions were directed towards the knowledge acquisition opportunities regarding the animals, tools and concepts presented in the session. The answer to the question " Have you ever been to a hunting museum" shows that the majority (98 people) of the respondents (179 people) had already visited a hunting museum, while 45% (81 people) had not *(Figure 2).*



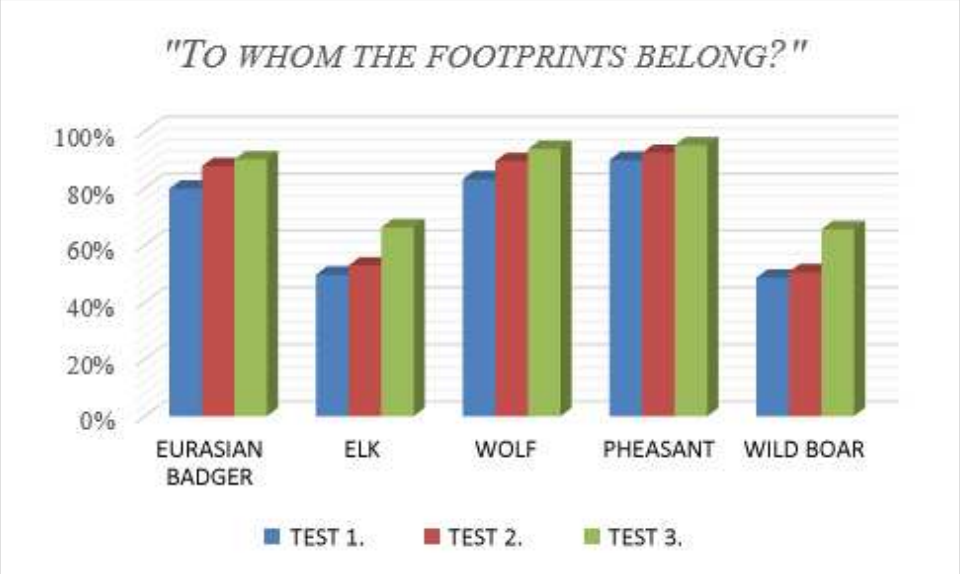
2. *Figure 2.* Distribution of the answers given to the question *„Have you ever been to a hunting museum?"*

Respective edit, 2023

In the following, we examine the results of the answers given to the questions regarding the effectiveness of knowledge acquisition from the completed tests before, after and one year after the workshop.

The first task was ***"Group Hungarian dog breeds according to their activities."*** Before the sessions, an average of 76% (135 participants) knew that the "puli", "mudi" and "komondor" belonged to the herding dogs, while the Transylvanian "kopó" and the Hungarian short-haired "vizsla" belonged to the hunting dogs. After the workshops, the average number of correct answers was 80% (137 people) and 1 year later 81% (132 people) were correct.

Regarding the pairing task ***"To whom do the footprints belong?"***, the longitudinal survey had the highest number of correct answers overall, and more correct answers were obtained in the second round than in the first one. One year after the session, on average 82% (134) of the children associated the footprints with the corresponding animal species correctly, while on average 70% (125) did so the first time and 75% (129) the second time. The distribution of correct answers by species regarding the three different testing sessions is clearly shown in *Figure 3.*



3. *Figure 3* Distribution of correct answers to the question *"To whom do the footprints belong?"*

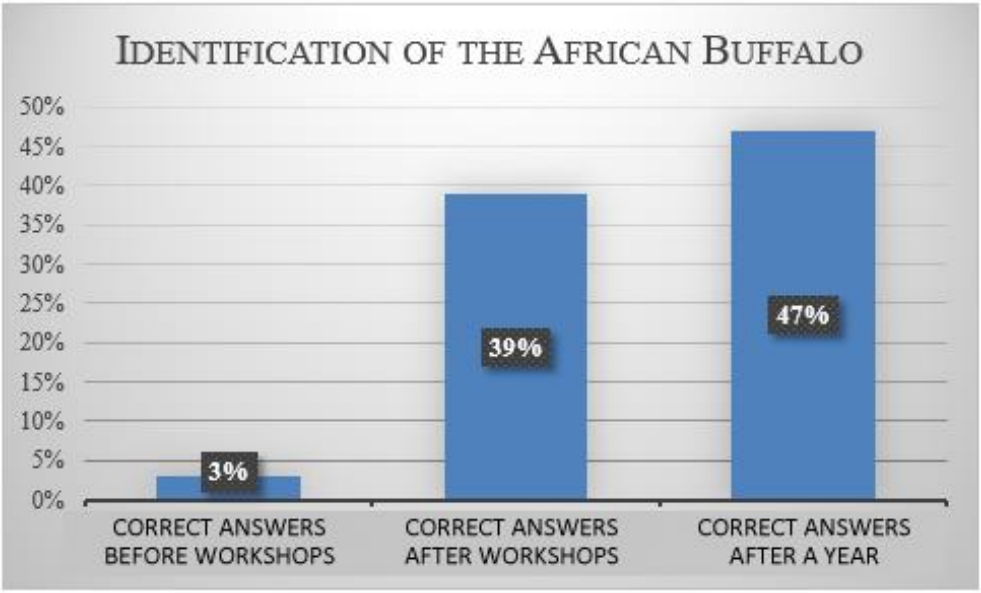
Respective edit, 2023

We were eager to get the children's full attention, so we asked them to "***Mark one of the great figures of our Hungarian hunting culture below!"*** Before the session, 125 (70%) pupils identified Zsigmond Széchenyi out of 5 possible names, while after the session 72% of the pupils knew the correct answer, and after a year the recollection dropped and only 106 (65%) answered correctly.

For our question ***"Which of these is not used in falconry?"*** 43 students (24%) picked the correct answer (whistle) before the workshop. In the post-test, there were 52 (30%), and after one year, there were 81 (50% of respondents) correct answers.

In the ***"Identify our daytime birds of prey"*** exercise, 33 (18%) identified the daytime birds of prey from the list ("sparrow hawk", "hawk" and "buzzard") at the first attempt, 104 (60%) at the second attempt and 130 (80%) at the third attempt.

In response to our question ***"Which of these species lives only in Africa?"***, only 6 respondents (3%) were able to identify the correct species out of the five listed, while 67 (39%) were able to correctly mark the species of the African buffalo in the second test, and 76 children (47%) did the same in the long term memory questionnaire *(Figure 4)*.

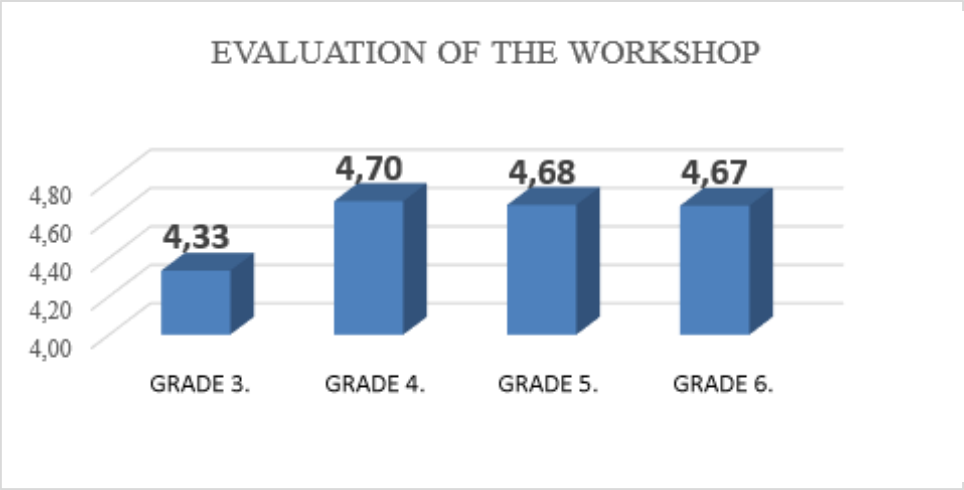


4. *Figure 4* Correct identification of the African buffalo

Respective editing, 2023

We also asked the question ***"Do you know of any printed media products (newspapers, magazines) with a hunting-related theme? What is the title?"*** Not surprisingly, there were only 10 correct answers out of 179 submitted for the first time, but following the workshop, 96 children named the correct press products for our question, accounting for 56% of the total number of completed tests. However, we were surprised to find that after a year, 107 out of 163 students (66%) could name a newspaper or magazine with a hunting elated topic.

For the second test, we asked them to rate the session they had attended to give us some feedback on their perception of this optional programme *(Figure 5)*.



5. *Figure 5.* Evaluation by the pupils attending the workshop

Respective edit, 2023

5. Summary, Conclusion

We need to find the common links in the complex system of environmental education (education for sustainable development), museum education and forest education. Through action-oriented methods, conscious planning, experiential programmes and authentic models, we can lay the foundations for an environmentally aware approach and contribute to the development of attitudes that are understanding and sensitive to sustainability. We need well-trained professionals, well-developed and secure resources, a support system, appropriate and useful information, events, joint reflection, workshops and conferences (Csákiné Dobos, 2018). The scope of awareness-raising cannot be limited to educational institutions but must also extend to children's everyday lives. This is particularly important today-when human lifestyles are becoming increasingly distant and alienated from nature. Environmental education is essential to make future generations aware that mankind is inseparable from nature. We must endeavour to educate the next generation so that, with the inevitable and necessary acceleration of technological progress, they have the vision and the heart to halt the irresponsible destruction of nature. With perseverance, and with the cooperation of national parks, forestry, various associations, and educational and cultural institutions, we can keep environmental education alive.

In our doctoral research, we examine the role of thematic museums of natural history in environmental education. We assess the changes in the knowledge of students participating in museum education workshops in both the short and long term. Before the surveys related to the "Aladár Dandelion and his Friends" presentation in the Zsigmond Széchenyi Hungarian Hunting Museum of the Carpathian Basin, we assumed that the post-tests following the learning sessions would show a much better result than the pre-tests. Following the study, we repeated the surveys after one year, where we expected to see a deterioration in long-term memory performance. Overall, the analysis of the results suggests that our first hypothesis, in which we assumed that students would perform better in terms of change in knowledge at the second interview, was confirmed. However, the results of the longitudinal study only partially confirmed our second hypothesis, and based on the proportion of results obtained, we can even say that it was disproved, since generally speaking, the effectiveness of remembering did not deteriorate, but the knowledge acquired deepened, and the results of the third survey exceeded those of the second survey in most cases (except for one question).

The development of students' knowledge is the first step in the process of environmental education/ training for sustainable development, as one of the necessary conditions in the

process of environmental education is the development of environmental/natural knowledge, which later induces a change in attitudes and, in the long term, environmentally conscious behaviour. The long-term retention of the knowledge acquired during the session is presumably linked to the successful stimulation of interest in the subject, which encouraged the students to acquire further knowledge on hunting topics (as evidenced, for example, by the surprising increase in knowledge of hunting magazines). Although no attitude survey was carried out, we assume that the positive results suggest a change in attitude towards the topics learned during the experiential session.

In our opinion, the results of the survey conducted at the site in Hatvan (in the National Hunting Museum) prove that museum pedagogy sessions have a positive effect on the expansion of students' knowledge.

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Using HyperDocs to develop scientific competence in elementary and high schools

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Abstract: *The purpose of this study is to show how student competencies can be developed purposefully with the help of HyperDocs in both elementary and high schools. It is a specialized lesson designed to provide students with a blended learning experience. During the processing of the curriculum, students communicate, collaborate, think critically, create (4C) in both real and virtual space. The new method helps to constantly maintain the interest and curiosity of students. Through exploratory learning, they receive answers to their questions, expand their knowledge, apply new knowledge. The methodology is based on the own-made HyperDocs illustrations and text, which are related to the Discovery of Mars.*

Keywords: *key competences, lifelong learning, HyperDocs, methodology, learning outcomes;*

1. Introduction

Every day, people of today's modern age are confronted with the development of information technology, software, and applications measurable at the speed of light. It is in this environment that present and future students socialize, and not only students but also the teachers teaching them have to adapt to this accelerated, information-saturated digital and virtual world. According to Szűts (2020), digital pedagogy is a unit of classroom or distance learning methodologies embedded in the information society, in which the teaching and learning process is based on infocommunication tools, screens, databases, and digital content (Szűts, 2020).

Digital pedagogy makes it possible to extend the role of the teacher and classroom and students' cognitive abilities. By augmenting the representation and perception of reality with digital technology, it provides new ways of illustrating educational processes. However, the use of tools alone is not a guarantee of effectiveness. There is a need for solutions that form an integral whole with the methodological practices of traditional education (Pajtókné, 2007.; Farkas, 2015.; Fegyverneki and Aknai, 2017.; Fegyverneki, 2018.; Szűts, 2020).

According to Szalay (2002), algorithmic thinking is characteristic of both real humanities subjects, which facilitate the acquisition and interpretation of information from data, and skills - which facilitate the informative, enjoyable presentation of our thoughts to others, the preparation of appropriate visual and sound effects - are interconnected and appear in a complex way during the application of digital pedagogy in all subjects (Szalay 2002.; Adey and Csapó, 2012.; Farsang, 2020.; Racsko and Révész, 2021).

In line with the challenges of the modern age, it is essential that students possess skills, abilities, attitudes, and key competencies that strengthen literacy, numeracy, and digital competences. At the same time, creativity, participation in teamwork and the ability to innovate are also key to building a career (Council of the European Union, 2018).

Key competencies are the knowledge, skills and attitudes that enable EU citizens to adapt effectively to the rapidly changing modern world and actively influence the direction and content of changes (National Core Curriculum, 2012) (Table 1).

Table 1: Comparison of the key competencies in different regions (the table was modified after Deißinger and Hellwig, 2005).

Australia	UK	USA	EU	Hungary
Key competences	Core skills	Workplace know-how	Key competences	Key competences
Collecting, analysing and organising information	Communication	Information, foundation skills (basic skills)	Literacy competence	Communication competences (mother tongue as well as foreign language)
Communicating ideas and information	Communication, personal skills (improving own learning and performance)	Information, foundation skills (basic skills)	Cultural awareness and expression competence	Creativity, creative creation, self expression and cultural awareness competences
Planning and organising activities	Personal skills (improving own learning and performance)	Resources, foundation skills (personal qualities)	Personal, social and learning to learn competence	Learning competences
Working with others and in teams	Personal skills (working with others)	Interpersonal skills	Citizenship competence	Personal and interpersonal competences
Using mathematical ideas and techniques	Innumeracy (application of number)	Foundation skills (basic skills)	Mathematical competence and competence in science, technology and engineering	Mathematical and thinking competences
Solving problems	Problem solving	Foundation skills (thinking skills)	Entrepreneurship competence	Employee, innovative and entrepreneurial competences
Using technology	Information technology	Technology systems	Digital competence	Digital competences
	Modern foreign language		Multilingual competence	

Key competencies are crucial: personal fulfillment and lifelong learning - cultural, active citizenship and integration into society-social, employability-human capital. Key competencies should be acquired during the period of compulsory education or training. These competences

form the basis of all subsequent learning in lifelong learning. Key competencies are prerequisites for good individual performance, work and later learning throughout life (OFI, 2009).

New Skills Agenda for Europe (Council of the European Union, 2018) makes recommendations on competence in lifelong learning. In the United States, Rotherham and Willingham (2010) see the novelty in how the possession of known abilities, the ability to apply them significantly affects collective and individual success. They draw attention to the importance of the interdependence and interweaving of knowledge and skills (Rotherham and Willingham, 2010).

Strop and Carlson (2010) believe that today's accelerated multimedia, a multimodal world in virtual space requires complex education that uses diverse information sources and text forms. The aim is for students to be able to analyze, synthesize, think critically, and form opinions about different content (Strop and Carlson, 2010).

Software development and wider access to the worldwide internet network and digital tools and platforms provide new types of teaching-learning experiences for teachers and students alike. Students can take virtual tours, create videos, infographics, websites, blogs, vlogs, podcasts, try out simulations, and build virtual worlds using online tools available for free on the web. Using effective teaching methods, access to content and learning experience can be changed and expanded. With its help, students' interest and classroom activity can be increased, and their knowledge can be presented more widely and diversely (Makádi, 2009, 2011a, 2011b, 2015, 2019.; Pajtókné, 2009, 2011a, 2011b.; Teperics et al, 2015.; Lengyelné 2021.; Szűcs, 2022).

2. Hyperdocs as a new teaching-learning method

The term HyperDoc was first used by Lisa Highfill, Kelly Hilton and Sarah Landis, a new method introduced in their book such as The HyperDoc *Handbook*, published in 2016 (Highfill et al., 2016). Hyperdocs is neither a simple online worksheet with hyperlinks, nor is it a Multi-Media Text Sets (MMTS), which is a collection of teacher-selected content related to the curriculum that is available on the Internet (Fig. 1).

Figure 1: Discovery of Mars HyperDocs – Characteristics (MMTS)

The HyperDocs is a specialized lesson designed to provide students with a blended learning experience. During the processing of the curriculum, students communicate, collaborate, think critically, create (4C) in both real and virtual space. The new method helps to constantly maintain the interest and curiosity of students. Through exploratory learning, they receive answers to their questions, expand their knowledge, apply new knowledge (Clark, 2020).

HyperDocs offers a system for powerful lesson design that guides students through the learning process, with students as the focus of document design. Free access to HyperDoc Systems is available for teachers to create and manage these worksheets. HyperDocs is completely web-based. Teachers will explore using HyperDocs as a pedagogical method by completing content assignments in previously created documents during the semester and designing their HyperDocs around content related to their area of certification (Gaffner, 2019).

The advantage of this method is that the available internet content provides a lot of opportunities to process a particular topic and in creating form and content, teachers' creativity can be with wings. Such a HyperDocs worksheet is also excellent for developing competence. The nature of the teacher or the lesson determines what competencies we want to develop. In the course of applying in teacher training, in connection with the compilation of such a worksheet, prospective teachers learn the "dry" curriculum much faster and easier, and

colleagues who are already practicing learn to consciously use and apply it in their daily teaching practice. The worksheet created in the genial.ly interface further expands the possibilities of applying HyperDocs and its visual appearance, with the additional advantage that it can be shared in both Google Classroom and Microsoft Teams (Kárpáti, 2023).

The purpose of using the new method can be of several types:

1. competence development, knowledge expansion and learning support for students,
2. mastering the theory and practice of competence development for university students,
3. In the case of practicing teachers, conscious application of competence development.

3. Discussion

3.1 HyperDocs in general

Mars HyperDocs covers 5 main themes (Fig. 2)

1. Characteristics
2. Survey
3. Morphology
4. Maps
5. Terraforming

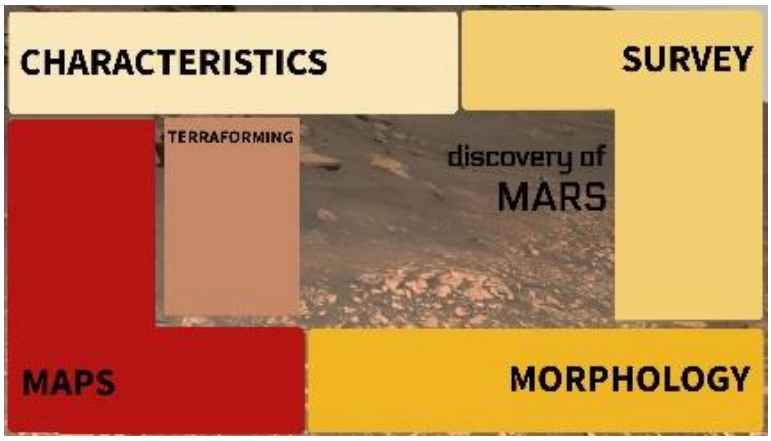

Figure 2: Discovery of Mars HyperDocs

The 5 HyperDocs worksheets process the different units based on the - Explore - Explain – Apply activities (Highfill et al., 2016). Several themes were further enhanced by Engage and Extend actions.

In the Hyperdoc home interface, in addition to the user guide, topics and teacher, student and technical information are indicated. Technical information is a collection of online tools and applications that you can use in your solution (Fig. 3.).

Figure 3: Discovery of Mars Hyperdocs

On the students' information page, you can find downloadable Google Slides worksheets related to all 5 topics, as well as the related thematic page created on the WAKELET interface for uploading finished works (Fig. 4).

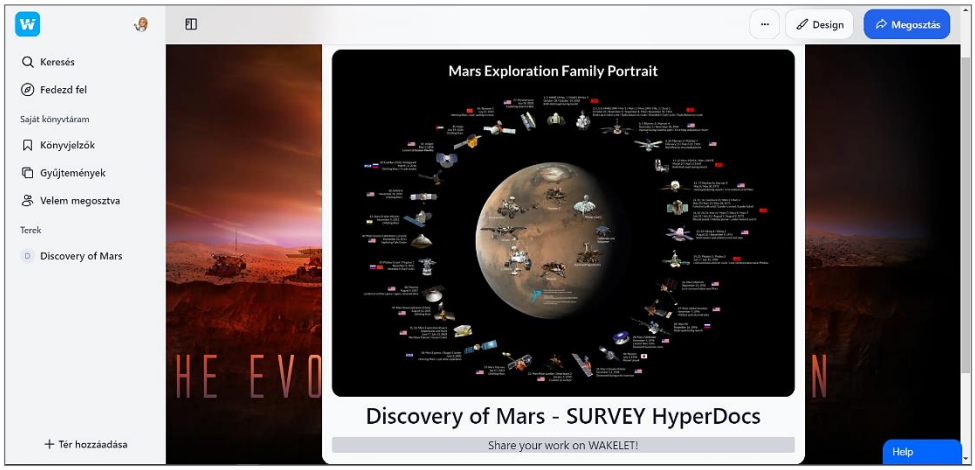

Figure 4: Discovery of Mars Wakelet Choice Board

When compiling the downloadable interactive worksheets, I tried to present knowledge transfer in as diverse forms as possible: read, view, compare, deduce, search for analogies, use simulation, use experiments, use artificial intelligence. Students can present the knowledge acquired during the processing of the curriculum not only with the help of various online

applications in digital form, but also submit creative, handmade creations during their work (Kárpáti, 2023).

3.2 HyperDocs topic tasks

1. topic tasks:(Appendix A)

- Compare the most important properties and characteristics of the planets Earth and Mars (size, structure, motion, moons) make a graphic organizer about it (lapbook, infographic)!
- Create narration for the Mars transition video, which shows the evolution of the planet.
- Based on the videos, the recognition of Martian atmospheric phenomena, the explanation of their formation, their consequences.
- Listing similar examples on Earth, highlighting and explaining differences.

2. topic tasks: (Appendix B)

- Create a timeline of space probes landing on the planet Mars. Indicate: (name, year, nation, success-failure).
- The task of Mars explorer, rover finder (Hargitai, 2023).
- After watching the video, design a landing unit for the future landing Mars probe. Experiment!
- Make a rover out of paper! Print Martian probes in 3D!

3. topic tasks: (Appendix C)

- Look on Earth and Mars for examples of the following surface forms: volcano, canyon, polarice, river valleys, meteorite crater. Determine the geographical position of their central part (Bérczi et al, 2015, 2016).
- The Mars Explorer book is tasked with: Pair map and photo details with the naming of surface shapes (Hargitai, 2023).

4. topic tasks: (Appendix D)

- On the website provided, place a map of the United States and your state in the Valles Marineris. Compare their areas! Take screenshots!
- On the website specified in the previous task, use the application to measure the total length of the Valles Marineris. How long would it take to travel the distance, for an

astronaut and a Martian and Lunar vehicle? Convert the given data to Martian day!

- Mars explorer tasked with -Making a planetary map (Hargitai, 2023). Put the pictures in the correct order.
- The task of the explorer on Mars - Topography colorist, Pixelizer (Hargitai, 2023).
- Use papermase technique with your groupmates to create a Mars surface from the Tharsys ridge (Elysium-Amazonis, Chryse Basin, Vallies Marineris).
- Use the models created by the groups to create a Mars field table.
- On Earth, in your country, where do we find an environment similar to Mars?
- Search for photos, videos and create a Google Earth project from the selected locations. Share it!

5. topic tasks: (Appendix E)

- Based on videos, collect what difficulties the first settlers on the planet Mars will face!
- What technical novelties can help terraforming?
- Make a comic book about Martian life!
- How will humanity affect our lives if humanity becomes a 2-planet species?

3.1. Create a space base model! Mark the components.HyperDocs and its relationship to the competations

Mars HyperDocs developed a competation, which is based on the competations of Makádi (2019), as follows (Fig. 1):

Communication Competation:

- Effective linguistic communication
  Based on the videos, the recognition of Martian atmospheric phenomena, the explanation of their formation, their consequences. List similar examples on Earth, highlight and explain differences (Topic 1: Apply & Share 3).
- Use of information skills (Fig. 5).

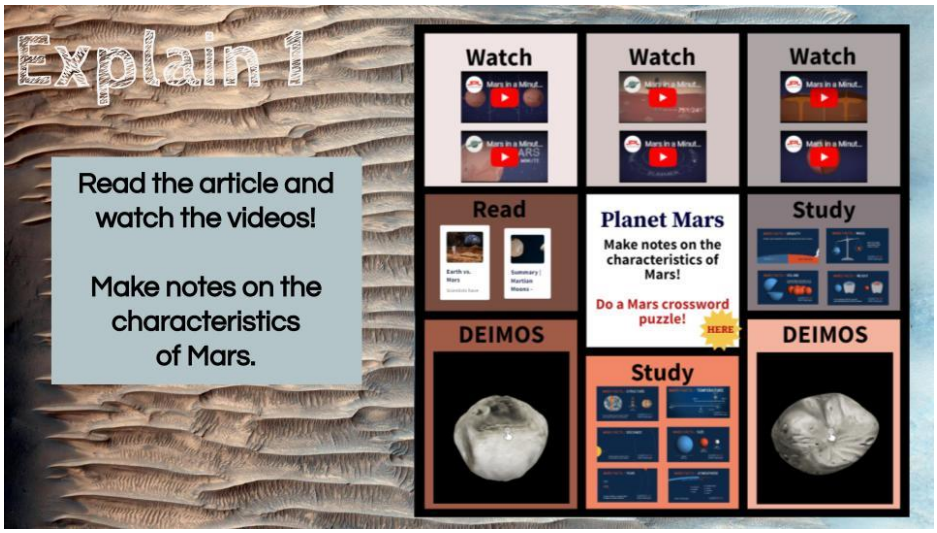

Figure 5: 1. topic, Explain 1.

- Digital communication

  Create a timeline of space probes landing on the planet Mars. Indicate: (name, year, nation, success-failure) (2. topic, Apply & Share 1).

- The mass media

  Create narration for the Mars transition video, which shows the evolution of the planet (1. topic, Apply & Share 2).

Intelectual Competation:

– Skills of combination

  Link them! (Hargitai, 2023) (Fig. 6)

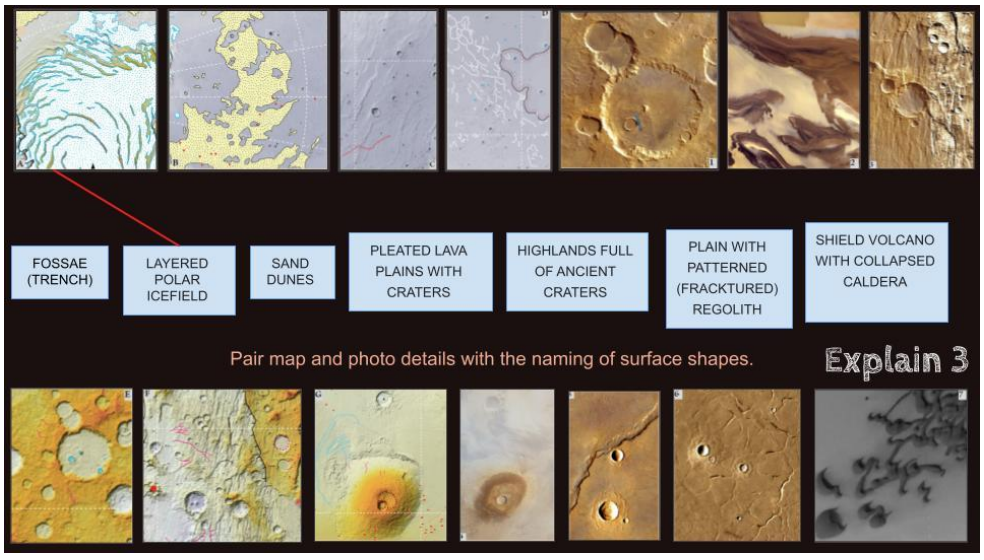

Figure 6: 3. topic, Explain 3.

A Bear on Mars? - Development of critical thinking (Fig. 7).

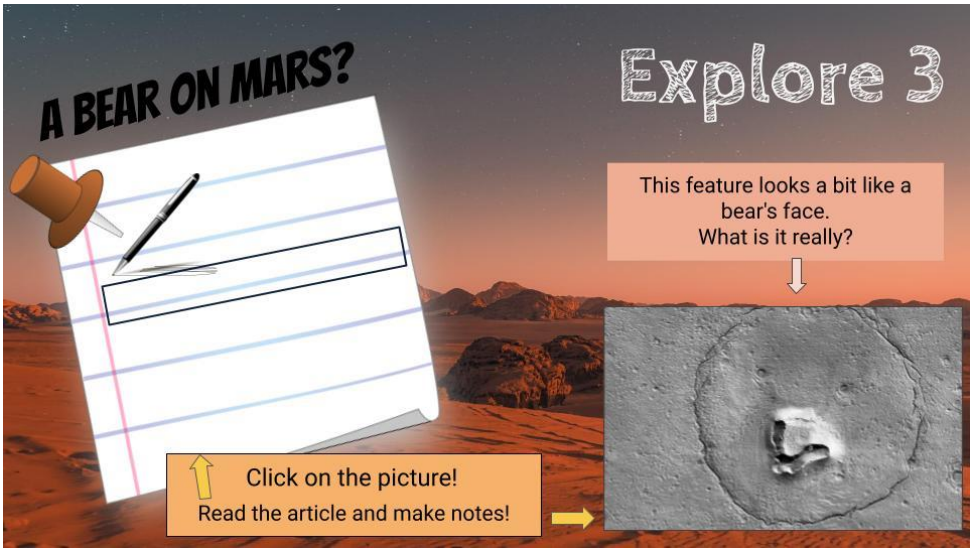

Figure 7: 3. topic, Explore 3

– Effective learning

  Based on video, collect what difficulties the first settlers on the planet Mars will face!

  Write it down on the notebook! (5. topic, Explore 2.)

Scientific Competations:

– Skills of how to solve problems

  Experiment**!** Watch the video! Design a landing unit for the future landing Mars probe.

  Experiment! (2. topic, Apply & Share 3)

  Ask NASA Mars! Every question you ask helps it learn. If it doesn't know the answer yet, Mars scientists and engineers will teach it more answers for you (Fig. 8).

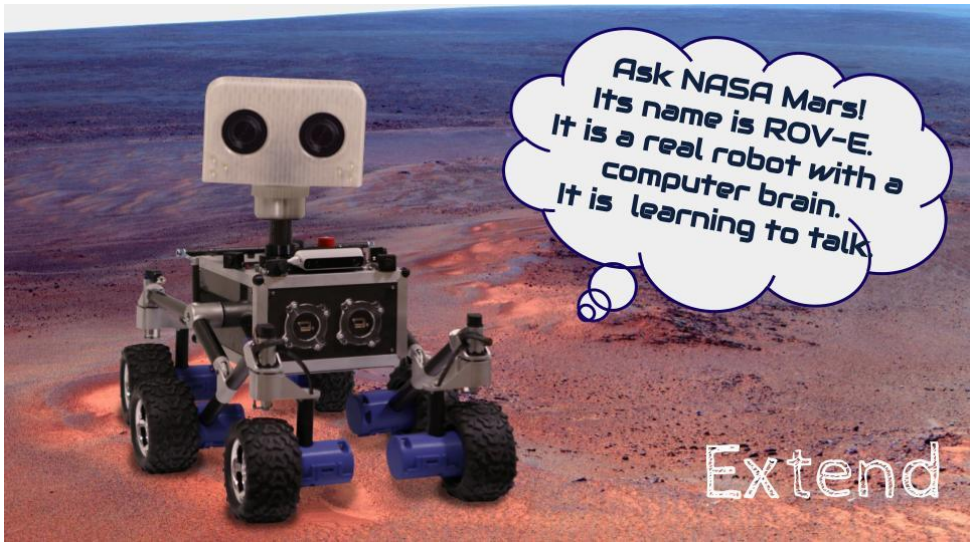

Figure 8: 1. topic, Extend

- Skills of the research

  Find an example! On Earth, in your country, where do we find an environment similar to Mars? Search for photos, videos and create a Google Earth project from the selected locations (4. topic, Apply & Share 4).

- Mathematics

  What is your weight on another planet? Record your weight in pounds. To calculate your "new weight," multiply your weight by each of the gravitational factors for each planet. Fill in the table! (1. topic, Explain 2)

  Measure it! On the website specified in the previous task, use the application to measure the total length of the Valles Marineris. How long would it take to travel the distance, for an astronaut and a Martian and Lunar vehicle? Convert the given data to Martian day! (4. topic, Apple & Share 1)

- Technology and Natural Sciences

  Terraforming! Technological developments on Mars (Fig. 9)**.**

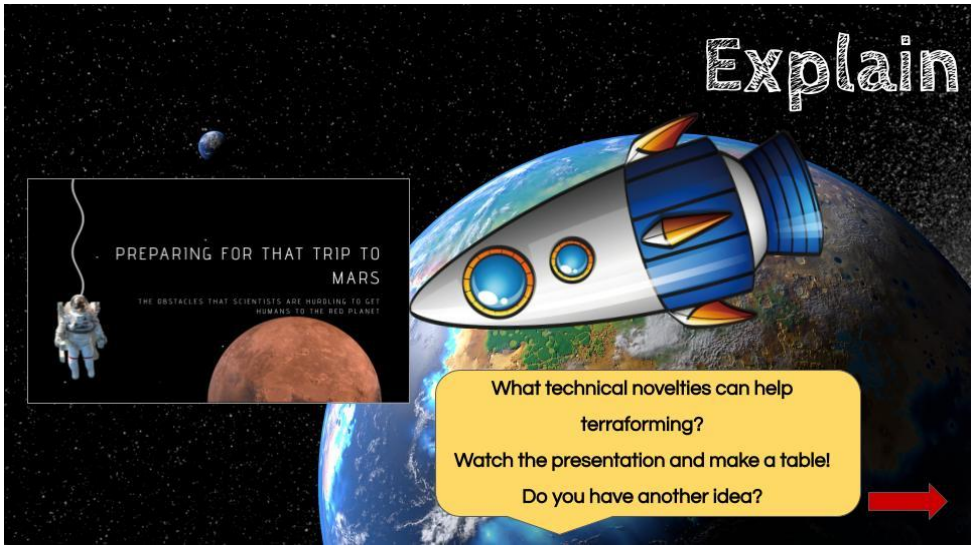

Figure 9: 5. topic, Explain

Social Competations:

- Responsibility and Participation of a Society
- Labor, Innovation as well as Business
- Intercultural
- Social

Terraforming**!** Create a space base model with paper mache technics! Mark the components (5. topic, Apply & Share 4).

– Make a travel brochure! (Fig. 10)

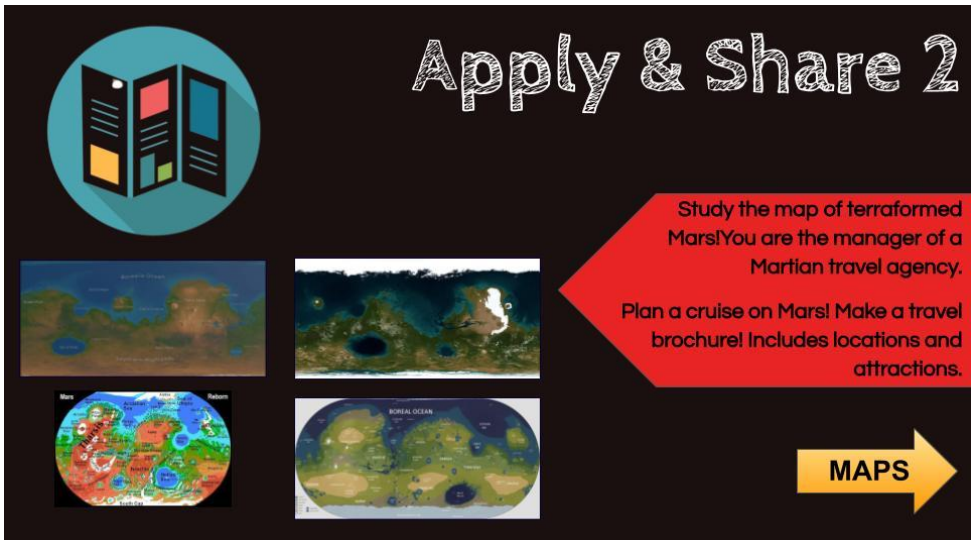

Figure 10: 3. topic, Apply & Share 2.

Watch the video! Form groups and describe the landscape of Mars!

I. Tharsis II. Hellas III. Polar Regions

Characterize the surface of Mars based on the given aspects. The groups should make a poster together (Fig. 11).

Figure 11: 3. topic Explain 1.

Personal Competations:

- Individual

  Find your favorite Mars image! Why did you choose this? (3. topic, Explore 3)

Click on the image, open the application and answer the questions! I assigned questions to the video uploaded to the Edpuzzle app. They can be set to proceed only if they have answered the question correctly.

- Identity
  How will humanity affect our lives if humanity becomes a 2-planet species? Write it! (5. topic, Apply & Share 2)
- Creation and Self-Expression
  Make a comic book about Martian life! (5. topic, Apply & Share 1)

4. Conclusions

Consequently, the study above has demonstrated the HyperDocs would play a key role in the teaching methods of not only at the primary but also high schools. There is a high ability for the further development of the above-mentioned method with Artificial Intelligence.

5. Summary

With HyperDocs, we can develop students' abilities, skills and competencies in a complex way, while teacher competencies develop during the preparation of worksheets. When solving HyperDocs tasks, students follow individual learning paths at their own pace, their interests are content-driven and motivated. This provides an excellent opportunity for differentiation, catch-up and talent management. During the work they collaborate, discuss and evaluate their ideas.

Through the World Wide Web, teachers use current, up-to-date information and diverse resources, which they can use, update, expand, transform, personalize and group later. Information sources represent multiple points of view, thus developing students' critical thinking and problem-solving skills through research. The completed works are no longer only seen and evaluated by the teacher, but are shared with each other in the virtual space, and presented in the form of an exhibition to school or out-of-school communities in real space. The works of teachers and students are also presented on social media sites, promoting cooperation and networking beyond the borders of schools and national borders. Applied digital pedagogy also rearranges teacher roles, so the teacher becomes a curator, influencer, mediator, tutor, mentor, facilitator and game master in one person (Nagy and Beck-Zaja, 2020.; Nyitrai, 2021).

According to Marshall (2021) by giving students the roadmap for their learning, I have become a passenger on their journey. They are no longer sitting in the back seat, staring blankly out the window and asking, "Are we already there?" With my lesson plan as the schedule and HyperDoc as the vehicle, learning for students became a series of epic road trips. When was the last time someone said that about a textbook (Marshall, 2021)?

In future work, it is intended to examine how digital pedagogy as well as HyperDocs would be affected by Artificial Intelligence (AI).

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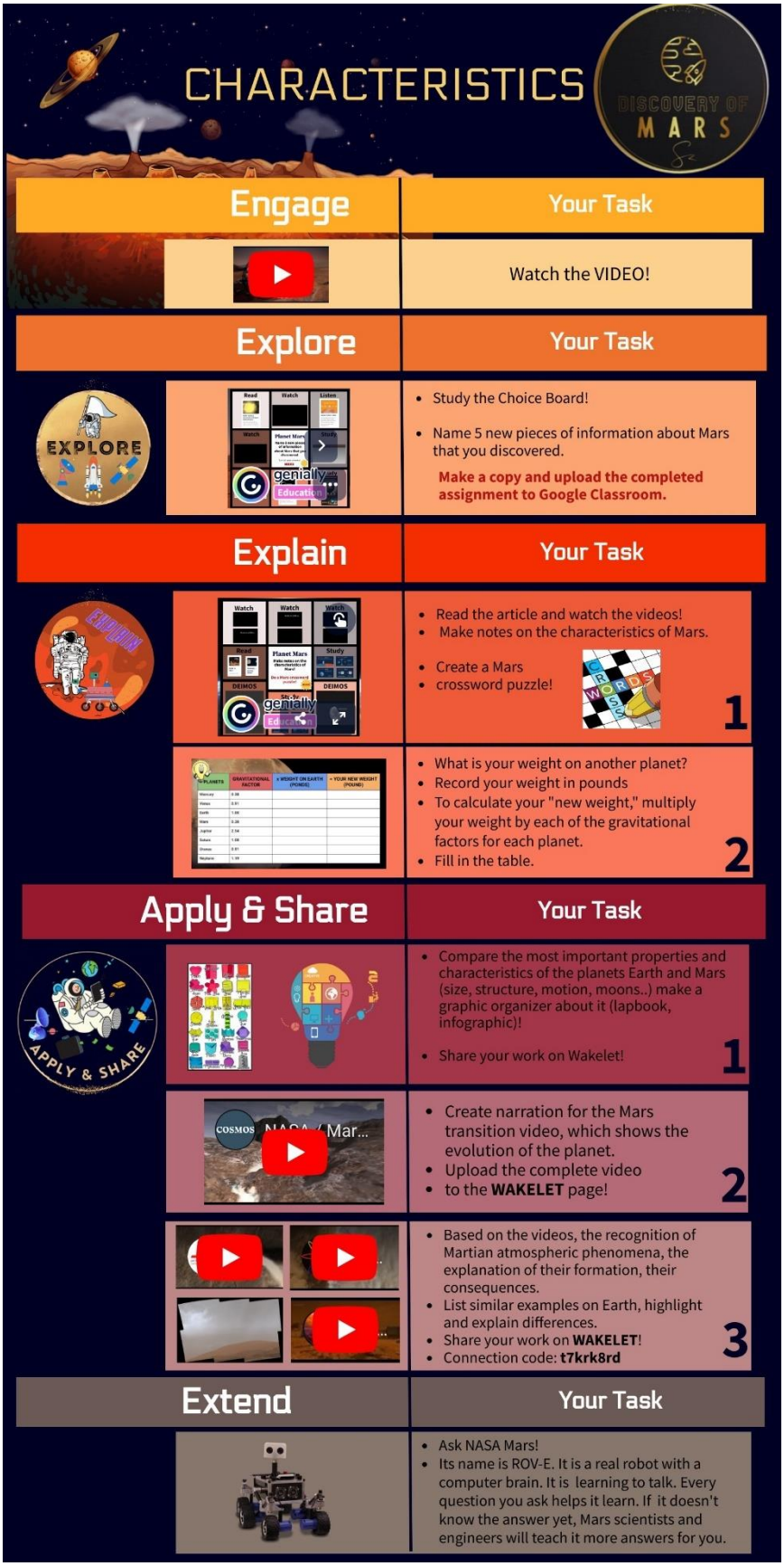
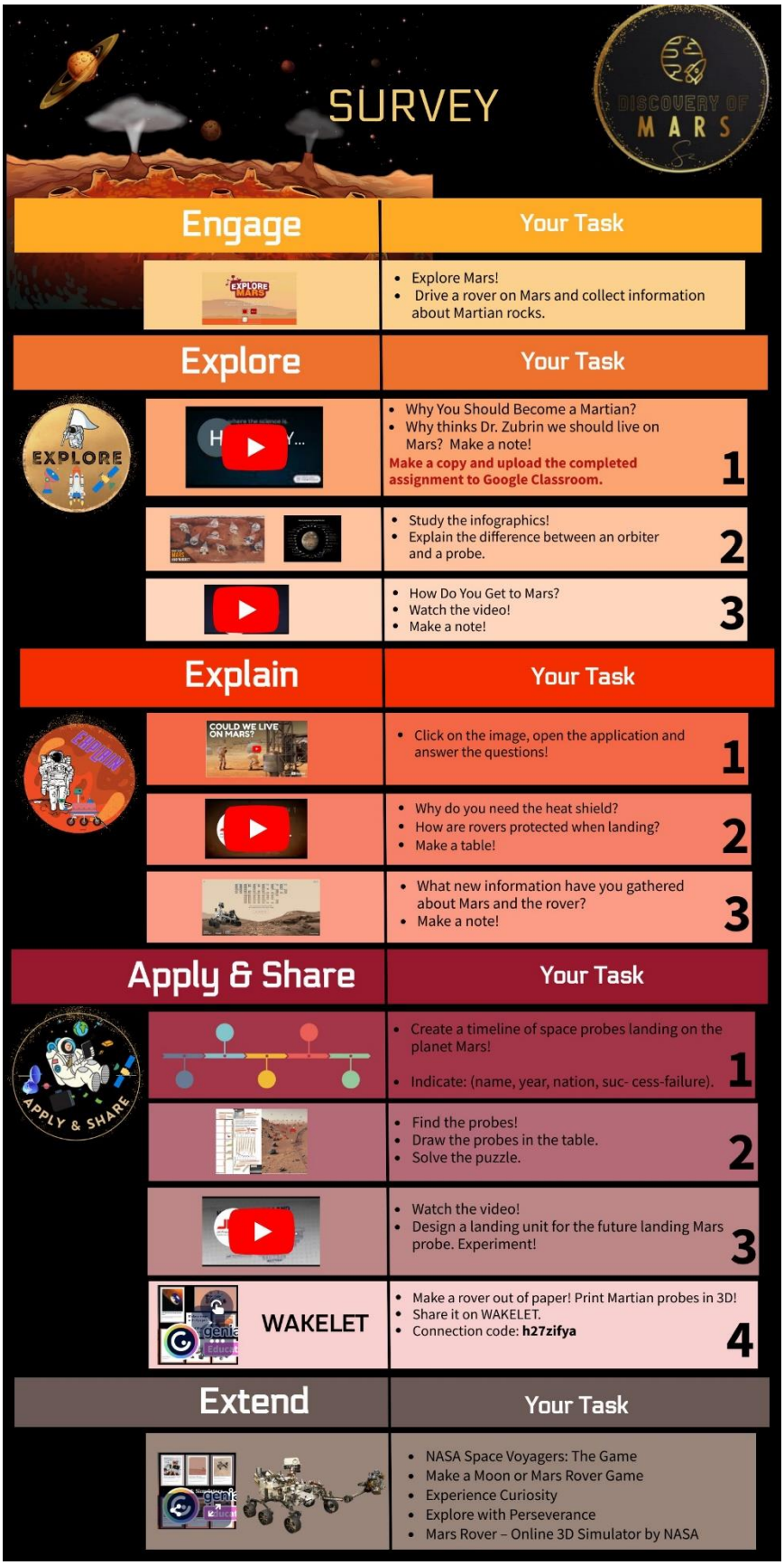
Short professional biography

Szilvia Kárpáti is the teacher of Petőfi Sándor Roman Catholic Elementary and High School in Vecsés, majoring in geography and sport. She completed her higher education at Lóránd Eötvös University (BSc) and Károly Eszterházy Catholic University (MSc). Her scientific field is the innovation and methology for the teaching lectures at primary school as well as higher educational level. Therefore, she gives teaching lectures in Geography at Károly Eszterházy Catholic University. Among her short-term goals is to enter the Doctoral School of Education at Károly Eszterházy Catholic University and start his academic studies.

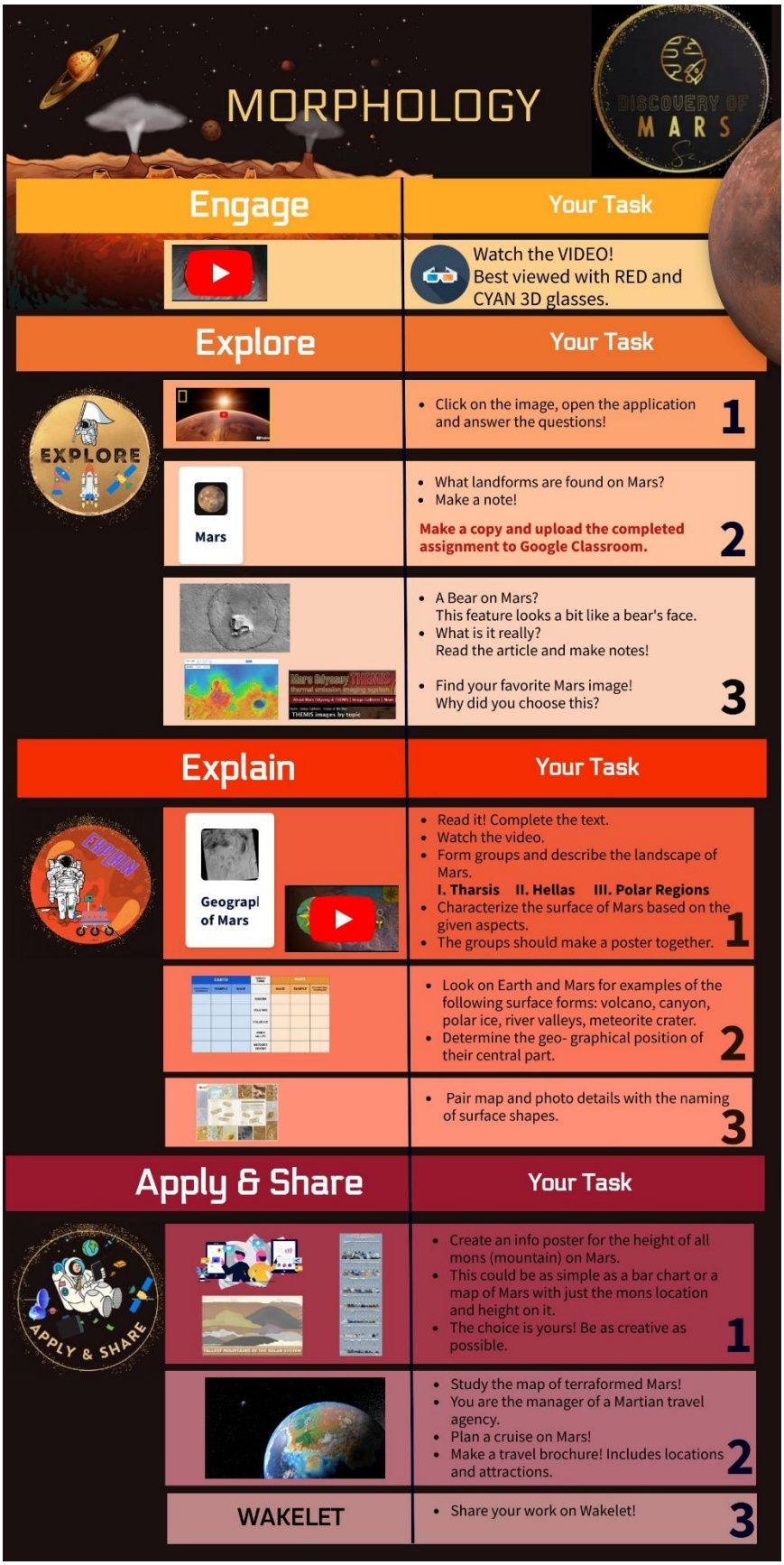
Appendix A


CHARACTERISTICS
DISCOVERY OF MARS
Engage
Your Task
Watch the VIDEO!
Explore
Your Task
EXPLORE
Study the Choice Board!
Name 5 new pieces of information about Mars that you discovered.
Make a copy and upload the completed assignment to Google Classroom.
Explain
Your Task
Read the article and watch the videos!
Make notes on the characteristics of Mars.
Create a Mars
crossword puzzle!
1
What is your weight on another planet?
Record your weight in pounds
To calculate your "new weight," multiply your weight by each of the gravitational factors for each planet.
Fill in the table.
2
Apply & Share
Your Task
APPLY & SHARE
Compare the most important properties and characteristics of the planets Earth and Mars (size, structure, motion, moons..) make a graphic organizer about it (lapbook, infographic)!
Share your work on Wakelet!
1
COSMOS
Create narration for the Mars transition video, which shows the evolution of the planet.
Upload the complete video
to the WAKELET page!
2
Based on the videos, the recognition of Martian atmospheric phenomena, the explanation of their formation, their consequences.
List similar examples on Earth, highlight and explain differences.
Share your work on WAKELET!
Connection code: t7krk8rd
3
Extend
Your Task
Ask NASA Mars!
Its name is ROV-E. It is a real robot with a computer brain. It is learning to talk. Every question you ask helps it learn. If it doesn't know the answer yet, Mars scientists and engineers will teach it more answers for you.

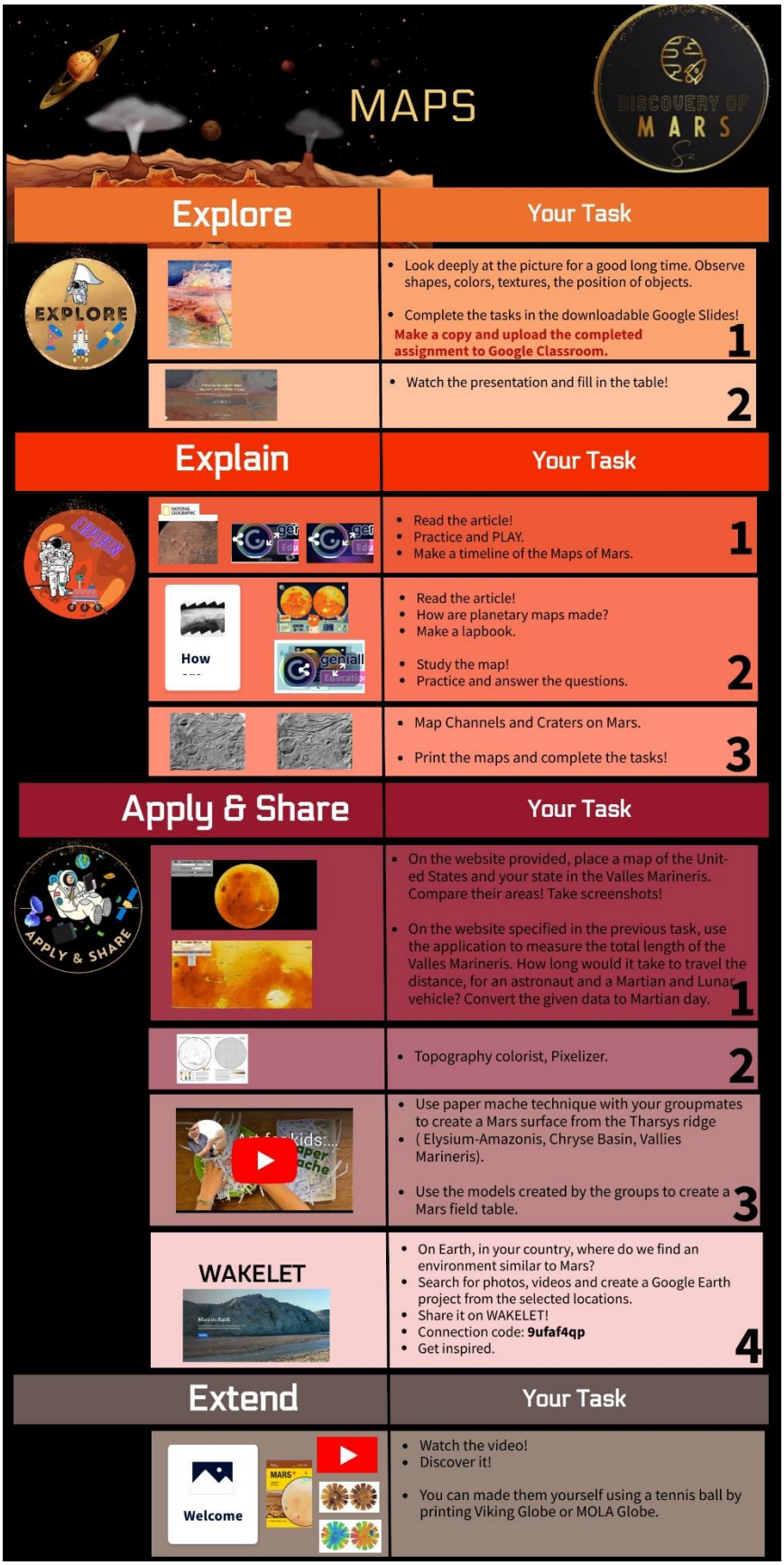
Appendix B



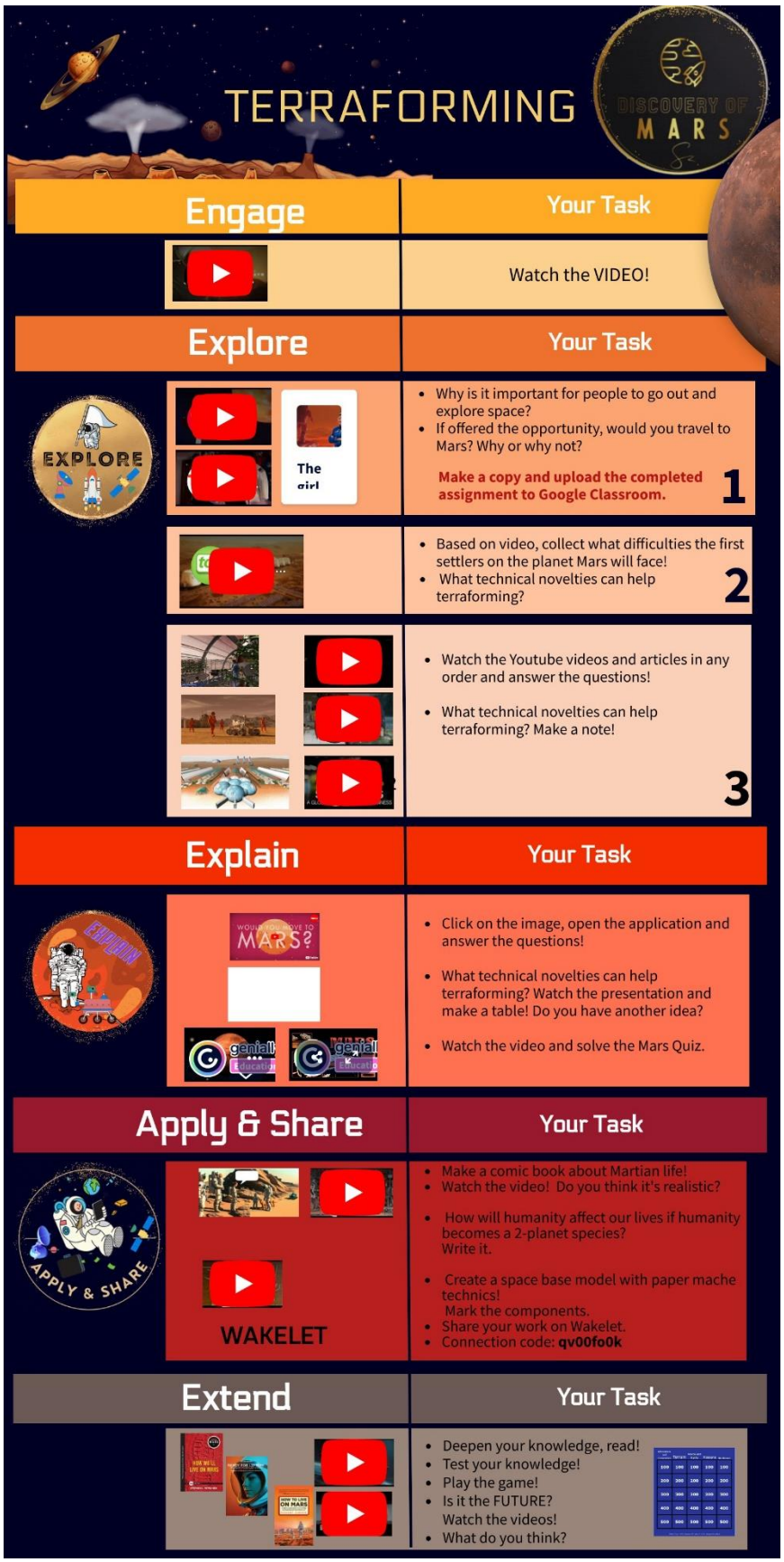
Appendix C


MORPHOLOGY
DISCOVERY OF MARS
Engage
Your Task
Watch the VIDEO!
Best viewed with RED and CYAN 3D glasses.
Explore
Your Task
EXPLORE
Click on the image, open the application and answer the questions!
1
Mars
What landforms are found on Mars?
Make a note!
Make a copy and upload the completed assignment to Google Classroom.
2
A Bear on Mars?
This feature looks a bit like a bear's face.
What is it really?
Read the article and make notes!
Find your favorite Mars image!
Why did you choose this?
3
Explain
Your Task
EXPLORE
Geograpl of Mars
Read it! Complete the text.
Watch the video.
Form groups and describe the landscape of Mars.
I. Tharsis II. Hellas III. Polar Regions
Characterize the surface of Mars based on the given aspects.
The groups should make a poster together.
1
Look on Earth and Mars for examples of the following surface forms: volcano, canyon, polar ice, river valleys, meteorite crater.
Determine the geo- graphical position of their central part.
2
Pair map and photo details with the naming of surface shapes.
3
Apply & Share
Your Task
APPLY & SHARE
Create an info poster for the height of all mons (mountain) on Mars.
This could be as simple as a bar chart or a map of Mars with just the mons location and height on it.
The choice is yours! Be as creative as possible.
1
Study the map of terraformed Mars!
You are the manager of a Martian travel agency.
Plan a cruise on Mars!
Make a travel brochure! Includes locations and attractions.
2
WAKELET
Share your work on Wakelet!
3

Appendix D


MAPS
DISCOVERY OF MARS
Explore
Your Task
EXPLORE
Look deeply at the picture for a good long time. Observe shapes, colors, textures, the position of objects.
Complete the tasks in the downloadable Google Slides!
Make a copy and upload the completed assignment to Google Classroom.
1
Watch the presentation and fill in the table!
2
Explain
Your Task
EXPLAIN
Read the article!
Practice and PLAY.
Make a timeline of the Maps of Mars.
1
How
Read the article!
How are planetary maps made?
Make a lapbook.
Study the map!
Practice and answer the questions.
2
Map Channels and Craters on Mars.
Print the maps and complete the tasks!
3
Apply & Share
Your Task
APPLY & SHARE
On the website provided, place a map of the United States and your state in the Valles Marineris. Compare their areas! Take screenshots!
On the website specified in the previous task, use the application to measure the total length of the Valles Marineris. How long would it take to travel the distance, for an astronaut and a Martian and Lunar vehicle? Convert the given data to Martian day.
1
Topography colorist, Pixelizer.
2
Use paper mache technique with your groupmates to create a Mars surface from the Tharsys ridge
(Elysium-Amazonis, Chryse Basin, Vallies Marineris).
Use the models created by the groups to create a Mars field table.
3
WAKELET
On Earth, in your country, where do we find an environment similar to Mars?
Search for photos, videos and create a Google Earth project from the selected locations.
Share it on WAKELET!
Connection code: 9ufaf4qp
Get inspired.
4
Extend
Your Task
Welcome
Watch the video!
Discover it!
You can made them yourself using a tennis ball by printing Viking Globe or MOLA Globe.

Appendix E


TERRAFORMING
DISCOVERY OF MARS
Engage
Your Task
Watch the VIDEO!
Explore
Your Task
EXPLORE
The girl
• Why is it important for people to go out and explore space?
• If offered the opportunity, would you travel to Mars? Why or why not?
Make a copy and upload the completed assignment to Google Classroom.
1
• Based on video, collect what difficulties the first settlers on the planet Mars will face!
• What technical novelties can help terraforming?
2
• Watch the Youtube videos and articles in any order and answer the questions!
• What technical novelties can help terraforming? Make a note!
3
Explain
Your Task
EXPLORE
WOULD YOU LOVE TO MARS?
• Click on the image, open the application and answer the questions!
• What technical novelties can help terraforming? Watch the presentation and make a table! Do you have another idea?
• Watch the video and solve the Mars Quiz.
Apply & Share
Your Task
APPLY & SHARE
WAKELET
• Make a comic book about Martian life!
• Watch the video! Do you think it's realistic?
• How will humanity affect our lives if humanity becomes a 2-planet species? Write it.
• Create a space base model with paper mache technics! Mark the components.
• Share your work on Wakelet.
• Connection code: qv00fo0k
Extend
Your Task
• Deepen your knowledge, read!
• Test your knowledge!
• Play the game!
• Is it the FUTURE? Watch the videos!
• What do you think?

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Meaning, concept and taxonomy of metaverse

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Abstract: *The article examines the meaning, concept and taxonomy of metaverse in detail. The metaverse is a complex digital environment that exists by blurring the boundary between the physical and virtual worlds. The paper overview the different aspects of the metaverse, including its social, economic, educational and technological dimensions, and explains the origins of the term and the philosophy behind it. By presenting a taxonomy of metaverse, the article aims to provide the reader with a clear framework for understanding the structure and categories of metaverse. Touching on the role of cryptocurrencies and blockchain technology, the article also provides a comprehensive picture of the current state and future prospects of the metaverse.*

Keywords: *metaverse; concept; taxonomy; VR; AR; society; economy; cryptocurrency;*

1. Introduction

The metaverse is an online, three-dimensional world that encompasses multiple virtual spaces. It could be a next level, a future version of the Internet. In this 3D environment, people can work together, meet, chat or even play games. Although the metaverse is not yet fully available, there are platforms that already include similar features. Current video games offer the most authentic metaverse experience, where developers bring the gaming experience ever closer to the metaverse by staging in-game events or creating virtual economies.

The metaverse does not yet exist, but the metaverse will be driven primarily by augmented reality, with each user embodied as a character or avatar in the system. There are some games that are somewhat similar to the metaverse, such as Second Life, Fortnite or Roblox, but they do not yet implement the metaverse. Players are now using it not only as a game, but for different activities and experiences in the digital space. The gaming platform Roblox not only

offers traditional gaming experiences, but also provides a space for virtual concerts and gatherings. In Fortnite, a popular multiplayer game, 12 million users participated in Travis Scott's virtual concert in the game world (Tidy, 2020).

The financial, digital and real worlds are increasingly intertwined. With the tools we use in our everyday lives, we can access virtually anything with a single click. The crypto world is following this trend. NFTs, blockchain-based games and cryptocurrency transactions are already easily accessible within an evolving metaverse.

This article presents and summarizes the meaning, concept and taxonomy of metaverse, taking into account several aspects. Readers can gain a deeper understanding of what metaverse is and what role it plays in the digital world, what are the different aspects of metaverse such as society, economy, education and culture, privacy, technology and infrastructure. The article also briefly discusses the economic and technological opportunities that the metaverse creates.

The article was prepared based on the synthesis and summary of several previous publications: (Dwivedi et al, 2023) (Han et al 2022) (Hollensen et al 2022) (Kim, 2021) (Kraus et al, 2022) (Park & Kim, 2022) (Wang et al., 2022).

2. Meaning of metaverse

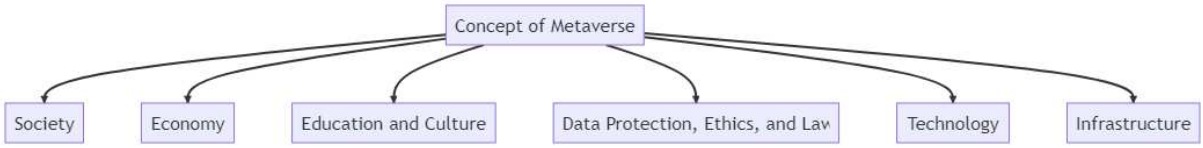
The term metaverse is derived from the words "meta-" (beyond, beyond) and "universe" and can be understood as a collective virtual space that combines physical reality, augmented reality, virtual reality and the internet. The term metaverse is often used to describe virtual worlds in which people exist as avatars and interact with each other and their environment. The meaning of metaverse:

A metaverse is an interconnected, immersive virtual world or universe in which people exist as avatars and interact with each other, their environment, and digital devices.

3. Concept of metaverse

The metaverse is the concept of a digital, three-dimensional virtual world that connects people in many aspects of their daily lives. The metaverse will bring together the economy, digital identity, decentralised governance and other applications. It can also be thought of as a connected platform system that, like the internet, brings together different websites under a single browser.

The concept is significant in several aspects, as illustrated in Figure 1.



- Society: the metaverse is a virtual social space where people can connect, communicate, work, play and learn. The metaverse has the potential to create new social dynamics and interactions. People can form new communities, communities, groups and circles of friends in virtual space, building new relationships and new experiences. Avatars and environments can be customised according to users' individual tastes, thus providing a means of personal expression.
- Economy: the Virtual Economy is the financial foundation of the metaverse, where digital assets such as NFTs (non-fungible tokens) and cryptocurrencies create new economic opportunities and enable transactions and value exchange. In addition, the metaverse offers new job and career opportunities, where people can pursue different professional activities and learn new skills in the digital space. In addition, commerce and business play an important role: virtual shops, marketplaces and services can be created within the metaverse, where users can buy, sell or exchange goods and services. People can buy, sell and trade these assets in the virtual world.
- Education and culture: in the field of entertainment, metaverse offers the possibility to virtually display concerts, performances, films and other artistic events, so people from all over the world can attend these events. In education, metaverse offers new platforms and tools for learning and education, where users can participate in courses, lectures and workshops. Last but not least, creativity is at the heart of the metaverse, where people can create and share artworks, designs and other creative projects, enriching the digital community and culture.
- Privacy, ethics and law. It is therefore essential that user data is properly protected and managed to preserve people's privacy and security. The issue of ownership also comes to the fore, especially of digital devices and content. It is important to define who owns the rights to a digital device or content and how these rights can be transferred or shared. Finally, ethical standards set out the basic principles for behaviour and interaction within the metaverse. These guidelines help ensure that communities in the digital space interact harmoniously and respectfully.
- Technology: Virtual Reality (VR) allows people to fully immerse themselves in a digital environment where experiences and interactions feel as if they are real. Augmented

Reality (AR) represents the bridge between the digital and physical worlds, where digital information and objects are integrated into our real environment, enriching it. Artificial Intelligence (AI) represents the intelligent aspect of the metaverse, where avatars and the environment are able to respond autonomously and intelligently to user interactions. Last but not least, blockchain technology ensures the security and transparency of the metaverse, especially for transactions and digital assets such as NFTs.

- Infrastructure: Servers and networks are essential for the metaverse to function, as they ensure the storage, processing and transmission of data between users. Developer tools are critical for creating metaverse content and applications. These tools and platforms enable developers to create applications, games and other content that enrich the metaverse experience. Finally, the user interface is where users enter and interact with the metaverse. It includes the tools and technologies that allow users to access, navigate and interact with the metaverse.

These aspects together form the concept of the metaverse and must be balanced to make the metaverse successful, attractive and sustainable for users.

3.1. Cryptocurrencies in the metaverse

Cryptocurrencies are digital or virtual assets that are protected and controlled by cryptographic techniques. The metaverse, as an online, three-dimensional world, naturally accepts digital transactions, making cryptocurrencies ideal as the basis for a metaverse economy. In this way, cryptocurrencies, while not essential, can be perfectly integrated into a metaverse. They can be used to create digital economies with various unity tokens and virtual objects such as NFTs. Digital economies created in metaverse allow users to exchange real value for virtual assets. For example, a player can sell a rare item to another player for cryptocurrency. Utility tokens are a special type of cryptocurrency that can be used within a specific platform or application. These tokens give access to various services or products. NFTs (non-fungible tokens) are unique digital assets stored on a blockchain. As each NFT is unique, they are often used to represent works of art, collectors' items or other rare virtual assets.

Crypto wallets, such as Trust Wallet and MetaMask, allow users to store and manage their cryptocurrencies securely. These wallets can be integrated with the metaverse, allowing users to perform transactions and exchange assets in the metaverse.

A blockchain is a decentralised database that stores transactions in blocks. Since the transactions in the blockchain are transparent and immutable, this ensures transaction integrity and reliability. In the metaverse, blockchain technology can enable users to transact securely and transparently.

The integration of cryptocurrencies and blockchain technology into metaverse systems can help to create a new type of digital economy where users can exchange value securely and transparently.

4. Taxonomy of mataverse

The metaverse is a complex and dynamically evolving environment that blurs the boundary between the digital and physical worlds. As technology and the Internet evolve, understanding and categorising the metaverse becomes increasingly important. The following taxonomy is intended to provide a comprehensive overview of the different aspects of the metaverse and to help users, developers and researchers to gain a deeper understanding of the metaverse.

The taxonomy in Table 1 is structured according to the following aspects, which include:

- Types: different types of metaverse serve different purposes. Simulated worlds create reality or a whole new imaginary world, while social platforms allow people to meet and communicate. Games and educational platforms offer users a variety of activities and experiences.
- Modes of interaction: interactions within the metaverse can take many forms, from simple social interactions to complex work and leisure activities.
- User Experience (UX): the experience of the metaverse is highly dependent on the depth of immersion, interactivity and customisability.
- Communication Modes: Communication within the metaverse can take many forms, from avatars to gestures and motion capture to voice and speech communication.
- Content: metaverse content can be static or dynamic, and can come from a variety of sources, including user-generated content and content generated by algorithms.
- Technology: The hardware, software and network infrastructure required to make the metaverse work.
- Technology infrastructure: The way in which the platforms of the metaverse operate, whether centralised, decentralised or hybrid.
- Community and social structure: The different levels of communities and social structures within the metaverse.

- Social impacts: the social and cultural impacts of the metaverse, including community formation, forms of identity and expression, and ethical and normative issues.
- Economic environment: economic aspects of the metaverse, including transactions, digital tools and virtual marketplaces.
- Economic Model: the economic models of the metaverse that determine how revenues are generated and transactions take place.
- Security and Privacy: the metaverse's security and privacy protocols that guarantee the protection of users' data and the authenticity of their identity.
- Access: types of access to the metaverse, whether public, private or anonymous.

Table 1. Metaverse taxonomy

Category	**Description**
Types	
Simulated worlds	Virtual environments that try to imitate reality or create a completely new imagined world.
Social platforms	Virtual spaces where people can meet, communicate and interact with each other.
Games	Virtual environments where users compete or cooperate to achieve different goals.
Educational and workplace platforms	Virtual classrooms, meeting rooms and workspaces.
Interaction modes	
Social Relations	How people build and nurture relationships within the metaverse.
Work and Professional Activities	How the metaverse is used to work, negotiate or discuss projects.
Fun and Games	Games, concerts, movies and other entertainment activities within the metaverse .
User Experience (UX)	
Immersion depth	Depth of Immersion: How much the user feels "present" in the metaverse: - Full immersion (e.g. VR) - Partial immersion (e.g. AR) - Non-immersive (e.g. 2D browser-based platforms)
Interactivity	To what extent the user can interact with the environment and other users.
Customizability	How well the user can customize the environment, avatar or experience.
Communication methods	
Avatars	Virtual representations of users in the metaverse.
Gestures and motion detection	Detecting and transforming the physical movement of users into virtual interaction.

Sound and speech	Communication with voice-based interactions.
Content	
Static	Content that doesn't change or update frequently.
Dynamic	Constantly changing or updated contents.
User generated	Content created by the community.
Algorithm generated	Automatically generated content, such as by AI.
Technology	
Hardware	What tools do people use to access the metaverse (e.g. VR glasses, AR devices).
Software	The applications, platforms and systems that power the metaverse.
Network	How the servers of the metaverse are connected and how they ensure a fast and smooth user experience.
Technological infrastructure	
Centralized	Platforms controlled by a single organization or company.
Decentralized	blockchain or other peer-to-peer technologies.
Hybrid	A combination of centralized and decentralized elements.
Community and social structure	
Individual	Custom User Experiences and Activities.
Small group	Groups of friends, teams or smaller communities.
Large communities	Larger groups, clans or guilds.
Global	the entire metaverse.
Social influences	
Communities	Communities and cultures formed within the metaverse.
Identity and Expression	How people represent and express themselves within the metaverse.
Ethics and Norms	Codes and norms of behavior within the metaverse.
Economic environment	
Transactions	How purchases and sales are made within the metaverse
Digital Tools	cryptocurrencies, NFTs and other digital assets.
Virtual marketplaces	Where users can buy or sell virtual items and services.
Work and Wages	How they create value and get paid for working within the metaverse.
Economic Model	
Transaction based	Models based on individual purchases or transactions.
Subscription	Access for a monthly or annual fee.
Free (freemium)	Basic features are free, but premium features require payment.
Crypto economy	cryptocurrencies and tokens for economic transactions.
Security and Data Protection	
Data Protection Protocols	How they protect users' data and privacy.
Authentication and Identification	How to ensure the authenticity of users' identities.
Legal and Regulatory Issues	the metaverse: - User rights and data protection: Protection of users' data and activities.

	- Ownership Rights: Ownership rights of virtual objects and territories.
Access	
Public	Data and content accessible to everyone.
Private	Only available to specific users.
Anonymous	User data is anonymous and non-identifiable.

This taxonomy provides a comprehensive view of the metaverse and its various aspects. As technology and society evolve, so does the metaverse, so it's important to keep updating and refining this taxonomy.

5. Discussion

We have encountered many challenges and questions in the development of the metaverse taxonomy. One of the key questions was how best to categorise a complex and dynamically evolving environment such as the metaverse. The categories and descriptions chosen are not exclusive and may change and expand as technology and society evolve.

Another important aspect was to understand the social and cultural impact of the metaverse. The metaverse is not only a technological platform, but also a social space where people can communicate, connect and express themselves. In developing the category of community and social structure, we have sought to show the diversity of communities and social dynamics within the metaverse.

In developing the categories of economic environment and economic model, it was important to understand that the metaverse is not just an entertainment platform, but also an economic space where transactions take place, value is created and new economic models emerge. Given the growing popularity of cryptocurrencies and NFTs, it was particularly important to show how these technologies are integrated into the metaverse.

Last but not least, in developing the category of security and privacy, we have sought to illustrate the challenges and opportunities for the metaverse in this area. Protecting users' privacy and ensuring the authenticity of their identity are key issues for the future of the metaverse.

Overall, the development of the metaverse taxonomy is an evolving process, shaped by changes in technology, society and culture. As the metaverse continues to evolve and grow, there will be a need to further refine and expand the taxonomy.

6. Summary

The metaverse is a combination of the words "meta-" and "universe", and refers to a collective virtual space that combines physical reality, augmented reality, virtual reality and the internet. In this space, people exist as avatars and interact with each other and their environment. The concept of the metaverse is a digital, three-dimensional world that connects people in their daily lives, including the economy, digital identity and decentralised governance. Different aspects of the metaverse include society, economy, education, privacy, technology and infrastructure. Cryptocurrencies, such as NFTs and crypto wallets, play an important role in the metaverse economy, enabling digital transactions and value exchange. The taxonomy of the metaverse helps to understand and categorise this complex and dynamically evolving environment.

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Metaverzum jelentése, koncepciója és taxonómiája

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Absztrakt: *A cikk a metaverzum jelentését, koncepcióját és taxonómiáját vizsgálja részletesen. A metaverzum egy összetett digitális környezet, amely a fizikai és a virtuális világ közötti határvonalat elmosva létezik. A kifejezés eredetét és a mögötte rejlő filozófiát bemutatva a cikk áttekinti a metaverzum különböző aspektusait, beleértve a társadalmi, gazdasági, oktatási és technológiai dimenziókat. A metaverzum taxonómiájának bemutatásával a cikk célja, hogy egyértelmű keretet adjon az olvasó számára a metaverzum struktúrájának és kategóriáinak megértéséhez. A kriptovaluták és a blokklánc technológia szerepét is érintve a cikk egy átfogó képet ad a metaverzum jelenlegi állapotáról és jövőbeli kilátásairól.*

Kulcsszavak: *metaverzum; koncepció; taxonómia; VR; AR; társadalom; gazdaság; kriptovaluta*

1. Bevezető

A metaverzum egy online, háromdimenziós világ, amely többféle virtuális teret foglal magába. Akár lehet az internet egy következő szintje, jövőbeli változata. Ebben a 3D-s környezetben az emberek együtt tudnak dolgozni, találkozni, beszélgetni vagy akár játékokat játszani. Bár a metaverzum még nem áll rendelkezésre teljes mértékben, vannak platformok, amelyek már tartalmaznak ehhez hasonló funkciókat. A jelenlegi videojátékok kínálják a legautentikusabb metaverzum élményt, ahol a fejlesztők a játékokon belüli események megrendezésével vagy virtuális gazdaságok létrehozásával hozzák a játékélményt egyre közelebb a metaverzumhoz.

A metaverzum még nem létezik, azonban a metaverzumot elsősorban a kiterjesztett valóság fogja vezérelni, és minden felhasználó egy karakterként vagy avatárként testesül meg a rendszerben. Vannak egyes játékok, amelyek némileg hasonlítanak a metaverzumra, például Second Life, Fortnite vagy Roblox, de még nem valósítják meg a metaverzumot. A játékosok immár nem csak játékként használják, hanem különféle tevékenységekhez és élményekhez a digitális térben. A Roblox című játékplatform nem csak a hagyományos játékélményeket kínálja, hanem virtuális koncerteknek és összejöveteleknek is helyet biztosít. A Fortnite, egy népszerű többszereplős játékban, 12 millió felhasználó vett részt Travis Scott virtuális koncertjén a játék világában (Tidy, 2020).

A pénzügyi, digitális és valóságos világ egyre szorosabban fonódik össze. A mindennapi életünkben használt eszközökkel gyakorlatilag bármit elérhetünk egyetlen kattintással. A kripto világ is ezt a trendet követi. Az NFT-k, a blokklánc alapú játékok és a kriptovalutás tranzakciók már ma is könnyedén hozzáférhetőek egy fejlődő metaverzum keretein belül.

Jelen cikk a metaverzum jelentését, koncepcióját és taxonómiáját mutatja be és foglalja össze többféle aspektus figyelembevételével. Az olvasók mélyebb megértést kaphatnak arról, hogy mi is a metaverzum és milyen szerepet játszik a digitális világban, mik a metaverzum különböző aspektusait, mint például a társadalom, gazdaság, oktatás és kultúra, adatvédelem, technológia és infrastruktúra. A cikk röviden kitér arra is, hogy a metaverzum milyen gazdasági és technológiai lehetőségeket teremt.

A cikk több korábbi publikáció szintetizálása és összegzése alapján készült: (Dwivedi et al, 2023) (Han et al 2022) (Hollensen et al 2022) (Kim, 2021) (Kraus et al, 2022) (Park & Kim, 2022) (Wang et al, 2022).

2. Metaverzum jelentése

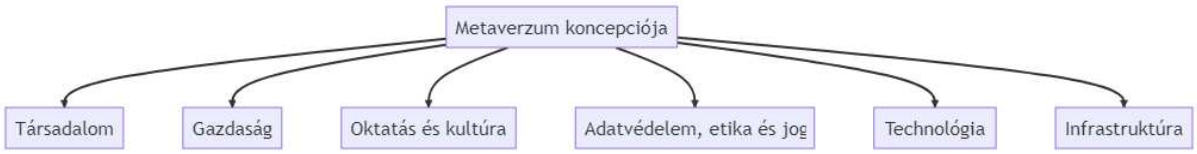
A metaverzum kifejezés a "meta-" (a túl, azon túl) és az "universe" (univerzum) szavak összevonásából származik, és egy olyan kollektív virtuális térként értelmezhető, amely a fizikai valóságot, az augmentált valóságot, a virtuális valóságot és az internetet ötvözi. A metaverse kifejezés gyakran használt azokra a virtuális világokra, amelyekben az emberek avatárokként léteznek és interakcióba lépnek egymással, valamint a környezetükkel. A metaverzum jelentése:

A metaverzum egy összekapcsolt, immerszív virtuális világ vagy univerzum, ahol az emberek avatárokként léteznek és interakcióba lépnek egymással, a környezetükkel és a digitális eszközökkel.

3. Metaverzum koncepciója

A metaverse egy digitális, háromdimenziós virtuális világ koncepciója, amely az embereket a mindennapi tevékenységük számos területén összekapcsolja. A metaverzum egyesíti majd a gazdaságot, a digitális identitást, a decentralizált kormányzást és más alkalmazásokat. Ezt a koncepciót úgy is elképzelhetjük, mint egy összekapcsolt platformrendszert, ami az internethez hasonlóan különböző webhelyeket egyesít egy közös böngésző alatt.

A koncepció több aspektusból is jelentőséggel bír, melyet az 1. ábra mutat be.



1. ábra Metaverzum koncepciójának aspektusai

- Társadalom: A metaverse egy olyan virtuális társadalmi tér, ahol az emberek kapcsolatokat építhetnek, kommunikálhatnak, dolgozhatnak, szórakozhatnak és tanulhatnak. A metaverse potenciálisan új társadalmi dinamikákat és interakciókat hoz létre. Az emberek új közösségeket alapíthatnak, közösségeket, csoportokat és baráti köröket alakíthatnak ki a virtuális térben, új kapcsolatokat építhetnek és új élményeket szerezhetnek. Az avatárok és a környezet testreszabása a felhasználók egyéni ízlése szerint, így a személyes kifejezés egy eszköze is.
- Gazdaság: A Virtuális Gazdaság a metaverzum pénzügyi alapját képezi, ahol a digitális eszközök, mint például a NFT-k (non-fungible tokens) és a kriptovaluták, új gazdasági lehetőségeket teremteneké s lehetővé teszik a tranzakciókat és az értékcserét. Ezen kívül a metaverzum új munka- és karrierlehetőségeket kínál, ahol az emberek különböző szakmai tevékenységeket végezhetnek és új készségeket sajátíthatnak el a digitális térben. Emellett a kereskedelem és az üzleti tevékenység is fontos szerepet játszik: a metaverzumon belül létrejöhetnek virtuális boltok, piacterek és szolgáltatások, ahol a felhasználók termékeket és szolgáltatásokat vásárolhatnak, eladhatnak vagy cserélhetnek. Az emberek vásárolhatnak, eladhatnak és kereskedhetnek ezekkel az eszközökkel a virtuális világban.
- Oktatás és kultúra: A szórakozás terén a metaverzum lehetőséget kínál a koncertek, előadások, filmek és más művészeti események virtuális megjelenítésére, így az emberek a világ bármely pontjáról részt vehetnek ezeken az eseményeken. Az oktatás területén a metaverzum új platformokat és eszközöket kínál a tanuláshoz és az

oktatáshoz, ahol a felhasználók részt vehetnek kurzusokon, előadásokon és workshopokon. Végül, de nem utolsósorban, a kreativitás a metaverzum lényegi része, ahol az emberek létrehozhatnak és megoszthatnak művészeti alkotásokat, designokat és egyéb kreatív projekteket, így gazdagítva a digitális közösséget és kultúrát.

- Adatvédelem, etika és jog: Az adatvédelem kiemelten fontos, mivel a metaverzum rengeteg személyes és érzékeny adatot tartalmazhat. Ezért elengedhetetlen a felhasználói adatok megfelelő védelme és kezelése, hogy megőrizzük az emberek magánéletét és biztonságát. A tulajdonjog kérdése is előtérbe kerül, különösen a digitális eszközök és tartalmak terén. Fontos meghatározni, hogy ki rendelkezik a jogokkal egy-egy digitális eszköz vagy tartalom felett, és hogyan lehet ezeket a jogokat átruházni vagy megosztani. Végül az etikai normák meghatározzák a metaverzumon belüli viselkedés és interakció alapelveit. Ezek az irányelvek segítenek abban, hogy a digitális térben a közösségek harmonikusan és tisztelettel működjenek együtt.
- Technológia: A Virtuális Valóság (VR) lehetővé teszi az emberek számára, hogy teljes mértékben belemerüljenek egy digitális környezetbe, ahol az élmények és interakciók olyanok, mintha valóságosak lennének. Az Augmentált Valóság (AR) a digitális és a fizikai világ közötti hidat képviseli, ahol a digitális információk és objektumok beépülnek a valós környezetünkbe, így gazdagítva azt. A Mesterséges Intelligencia (AI) a metaverzum intelligens aspektusát képviseli, ahol az avatárok és a környezet képesek önállóan és intelligensen reagálni a felhasználói interakciókra. Végül, de nem utolsósorban, a blokklánc technológia biztosítja a metaverzum biztonságát és átláthatóságát, különösen a tranzakciók és a digitális eszközök, mint az NFT-k terén.
- Infrastruktúra: A szerverek és hálózatok létfontosságúak a metaverzum működéséhez, mivel ezek biztosítják az adatok tárolását, feldolgozását és továbbítását a felhasználók között. A fejlesztői eszközök kritikusak a metaverzum tartalmának és alkalmazásainak létrehozásához. Ezek az eszközök és platformok lehetővé teszik a fejlesztők számára, hogy alkalmazásokat, játékokat és egyéb tartalmakat hozzanak létre, amelyek gazdagítják a metaverzum élményét. Végül a felhasználói felület az a pont, ahol a felhasználók belépnek és interakcióba lépnek a metaverzummal. Ez magában foglalja azokat az eszközöket és technológiákat, amelyek lehetővé teszik a felhasználók számára a metaverzumhoz való hozzáférést, navigációt és interakciót.

Ezek az aspektusok együttesen alkotják a metaverzum koncepcióját, és egyensúlyban kell lenniük ahhoz, hogy a metaverzum sikeres, vonzó és fenntartható legyen a felhasználók számára.

3.1. Kriptovaluták a metaverzumban

A kriptovaluták digitális vagy virtuális eszközök, amelyeket kriptográfiai technikákkal védenek és ellenőriznek. A metaverzum, mint egy online, háromdimenziós világ, természetesen fogadja a digitális tranzakciókat, így a kriptovaluták ideálisak lehetnek a metaverzum gazdaságának alapjául. Ezzel a kriptovaluták, bár nem elengedhetetlenek, kiválóan integrálódhatnak egy metaverzumba. Segítségükkel digitális gazdaságokat hozhatunk létre, amelyek különféle unity tokenekkel és virtuális tárgyakkal, mint az NFT-k, rendelkeznek. A metaverzumokban létrehozott digitális gazdaságok lehetővé teszik a felhasználók számára, hogy valós értéket cseréljenek virtuális eszközökért. Például egy játékos eladhat egy ritka tárgyat egy másik játékosnak kriptovalutáért. A utility tokenek speciális típusú kriptovaluták, amelyek egy adott platformon vagy alkalmazáson belül használhatók. Ezek a tokenek különféle szolgáltatásokhoz vagy termékekhez adnak hozzáférést. Az NFT-k (nem-fungibilis tokenek) egyedi digitális eszközök, amelyeket blokkláncon tárolnak. Mivel minden NFT egyedi, ezeket gyakran művészeti alkotások, gyűjteményi tárgyak vagy más ritka virtuális eszközök képviseletére használják.

A kriptotárcák, mint a Trust Wallet és a MetaMask, lehetővé teszik a felhasználók számára, hogy kriptovalutáikat biztonságosan tárolják és kezeljék. Ezek a tárcák integrálhatók a metaverzumokkal, lehetővé téve a felhasználók számára, hogy tranzakciókat hajtsanak végre és eszközöket cseréljenek a metaverzumon belül.

A blokklánc egy decentralizált adatbázis, amely tranzakciókat tárol blokkokban. Mivel a blokklánc tranzakciói átláthatóak és megváltoztathatatlanok, ez biztosítja a tranzakciók integritását és megbízhatóságát. A metaverzumokban a blokklánc technológia lehetővé teheti a felhasználók számára, hogy biztonságosan és átláthatóan végezzenek tranzakciókat.

A kriptovaluták és a blokklánc technológia integrációja a metaverzumokba elősegítheti egy új típusú digitális gazdaság létrehozását, ahol a felhasználók biztonságosan és átláthatóan cserélhetnek értékeket.

4. Mataverzum taxonómiája

A metaverzum a digitális és a fizikai világ közötti határvonalat elmosó, összetett és dinamikusan fejlődő környezet. Ahogy a technológia és az internet fejlődik, úgy válik egyre fontosabbá a metaverzum megértése és kategorizálása. A következő taxonómia célja, hogy átfogó képet adjon a metaverzum különböző aspektusairól, és segítséget nyújtson a felhasználóknak, fejlesztőknek és kutatóknak a metaverzum mélyebb megértésében.

Az 1. táblázat szerinti taxonómia az alábbi aspektusok szerint épül fel, mely az alábbi szempontokat tartalmazza:

- Típusok: A metaverzum különböző típusai különböző célokat szolgálnak. A szimulált világok a valóságot vagy egy teljesen új, elképzelt világot teremtenek meg, míg a szociális platformok lehetővé teszik az emberek számára, hogy találkozzanak és kommunikáljanak. A játékok és az oktatási platformok különféle tevékenységeket és élményeket kínálnak a felhasználóknak.
- Interakciós módok: A metaverzumon belüli interakciók sokféle módon történhetnek, az egyszerű szociális kapcsolatoktól kezdve a komplex munka- és szórakozási tevékenységekig.
- Felhasználói Élmény (UX): A metaverzum élménye nagymértékben függ az elmerülés mélységétől, az interaktivitástól és a testreszabhatóságtól.
- Kommunikációs módok: A kommunikáció a metaverzumon belül sokféle módon történhet, az avataroktól kezdve a gesztusokon és mozgásérzékelésen át a hang- és beszédkommunikációig.
- Tartalom: A metaverzum tartalma lehet statikus vagy dinamikus, és különböző forrásokból származhat, beleértve a felhasználók által generált és az algoritmusok által létrehozott tartalmat is.
- Technológia: A metaverzum működéséhez szükséges hardverek, szoftverek és hálózati infrastruktúrák.
- Technológiai infrastruktúra: A metaverzum platformjainak működési módja, legyen az centralizált, decentralizált vagy hibrid.
- Közösségi és társadalmi struktúra: A metaverzumon belüli közösségek és társadalmi struktúrák különböző szintjei.

- Társadalmi hatások: A metaverzum társadalmi és kulturális hatásai, beleértve a közösségek kialakulását, az identitás és kifejezés formáit, valamint az etikai és normatív kérdéseket.
- Gazdasági Környezet: A metaverzum gazdasági aspektusai, beleértve a tranzakciókat, a digitális eszközöket és a virtuális piactereket.
- Gazdasági Modell: A metaverzum gazdasági modelljei, amelyek meghatározzák, hogyan generálódnak a bevételek és hogyan történnek a tranzakciók.
- Biztonság és Adatvédelem: A metaverzum biztonsági és adatvédelmi protokolljai, amelyek garantálják a felhasználók adatainak védelmét és az azonosságuk hitelességét.
- Hozzáférés: A metaverzumhoz való hozzáférés típusai, legyen az nyilvános, privát vagy anonim.

1. táblázat Metaverzum taxonomiája

Kategória	**Leírás**
Típusok	
Szimulált világok	Olyan virtuális környezetek, amelyek a valóságot próbálják utánozni vagy egy teljesen új, elképzelt világot teremtenek.
Szociális platformok	Olyan virtuális terek, ahol az emberek találkozhatnak, kommunikálhatnak és interakcióba léphetnek egymással.
Játékok	Olyan virtuális környezetek, ahol a felhasználók különböző célok eléréséért versenyeznek vagy együttműködnek.
Oktatási és munkahelyi platformok	Virtuális osztálytermek, tárgyalók és munkaterületek.
Interakciós módok	
Szociális Kapcsolatok	Hogyan építenek és ápolnak kapcsolatokat az emberek a metaverzumon belül.
Munka és Professzionális Tevékenységek	Hogyan használják a metaverzumot munkavégzésre, tárgyalásokra vagy projektek megbeszélésére.
Szórakozás és Játék	A metaverzumon belüli játékok, koncertek, filmek és egyéb szórakoztató tevékenységek.
Felhasználói Élmény (UX)	
Elmerülési mélység	Elmerülési mélység: Mennyire érzi magát a felhasználó "jelen lévőnek" a metaverzumban. - Teljes elmerülés (pl. VR) - Részleges elmerülés (pl. AR) - Nem elmerülő (pl. 2D böngésző alapú platformok)
Interaktivitás	Milyen mértékben tud a felhasználó interakcióba lépni a környezettel és más felhasználókkal.

Testreszabhatóság	A felhasználó mennyire tudja személyre szabni a környezetet, avatárját vagy élményét.
Kommunikációs módok	
Avatarok	A felhasználók virtuális képviseletei a metaverzumban.
Gesztusok és mozgásérzékelés	A felhasználók fizikai mozgásának detektálása és átalakítása virtuális interakcióvá.
Hang és beszéd	Kommunikáció hangalapú interakciókkal.
Tartalom	
Statikus	Olyan tartalmak, amelyek nem változnak vagy nem frissülnek gyakran.
Dinamikus	Folyamatosan változó vagy frissülő tartalmak.
Felhasználó által generált	A közösség által létrehozott tartalom.
Algoritmus generált	Automatikusan generált tartalom, például AI által.
Technológia	
Hardver	Milyen eszközöket használnak az emberek a metaverzum eléréséhez (pl. VR szemüveg, AR készülékek).
Szoftver	A metaverzumot működtető alkalmazások, platformok és rendszerek.
Hálózat	Hogyan kapcsolódnak a metaverzum szerverei és hogyan biztosítják a gyors és zökkenőmentes felhasználói élményt.
Technológiai infrastruktúra	
Centralizált	Egyetlen szervezet vagy vállalat irányítása alatt álló platformok.
Decentralizált	Blokklánc vagy más peer-to-peer technológiákra épülő platformok.
Hibrid	A centralizált és decentralizált elemek kombinációja.
Közösségi és társadalmi struktúra	
Egyéni	Egyéni felhasználói élmények és tevékenységek.
Kiscsoportos	Baráti társaságok, csapatok vagy kisebb közösségek.
Nagy közösségek	Nagyobb csoportok, klánok vagy guild-ek.
Globális	Az egész metaverzumot átfogó események, trendek vagy mozgalmak.
Társadalmi hatások	
Közösségek	A metaverzumon belül kialakult közösségek és kultúrák.
Identitás és Kifejezés	Hogyan képviselik magukat az emberek és hogyan fejezik ki magukat a metaverzumon belül.
Etika és Normák	A metaverzumon belüli viselkedési kódexek és normák.
Gazdasági Környezet	
Tranzakciók	Hogyan történnek a vásárlások és eladások a metaverzumon belül
Digitális Eszközök	Kriptovaluták, NFT-k és egyéb digitális értékek használata.
Virtuális piacterek	Ahol a felhasználók virtuális tárgyakat és szolgáltatásokat vásárolhatnak vagy értékesíthetnek.

Munka és Bérezés	Hogyan teremtenek értéket és kapnak fizetést a metaverzumon belüli munkavégzésért.
Gazdasági Modell	
Tranzakcióalapú	Egyedi vásárlásokon vagy tranzakciókon alapuló modellek.
Előfizetéses	Havi vagy éves díj ellenében történő hozzáférés.
Ingyenes (freemium)	Alapvető funkciók ingyenesek, de prémium funkciókért fizetni kell.
Kriptogazdaság	Kriptovaluták és tokenek használata a gazdasági tranzakciókhoz.
Biztonság és Adatvédelem	
Adatvédelmi Protokollok	Hogyan védik a felhasználók adatait és magánéletét.
Hitelesítés és Azonosítás	Hogyan biztosítják a felhasználók azonosságának hitelességét.
Jogi és Szabályozási Kérdések	A metaverzummal kapcsolatos jogi kihívások és szabályozások: - Felhasználói jogok és adatvédelem: A felhasználók adatainak és tevékenységeinek védelme. - Tulajdonjogok: Virtuális tárgyak és területek tulajdonjogai.
Hozzáférés	
Nyilvános	Mindenki számára hozzáférhető adatok és tartalmak.
Privát	Csak meghatározott felhasználók számára hozzáférhető.
Anonim	A felhasználói adatok névtelenek és nem azonosíthatók.

Ez a taxonómia egy átfogó képet nyújt a metaverzumról és annak különböző aspektusairól. Ahogy a technológia és a társadalom fejlődik, úgy változik és bővül a metaverzum is, így fontos, hogy folyamatosan frissítsük és finomítsuk ezt a taxonómiát.

5. Diszkusszió

A metaverzum taxonómia kialakítása során számos kihívással és kérdéssel találkoztunk. Az egyik legfontosabb kérdés az volt, hogy hogyan lehet a legjobban kategorizálni egy olyan összetett és dinamikusan fejlődő környezetet, mint a metaverzum. A választott kategóriák és leírások nem kizárólagosak, és ahogy a technológia és a társadalom fejlődik, úgy változhatnak és bővülhetnek.

Egy másik fontos szempont a metaverzum társadalmi és kulturális hatásainak megértése volt. A metaverzum nem csak egy technológiai platform, hanem egy társadalmi tér is, ahol az emberek kommunikálhatnak, kapcsolatokat építhetnek és kifejezhetik magukat. A közösségi

és társadalmi struktúra kategória kialakítása során arra törekedtünk, hogy bemutassuk a metaverzumon belüli különböző közösségek és társadalmi dinamikák sokféleségét.

A gazdasági környezet és a gazdasági modell kategóriák kialakítása során fontos volt megérteni, hogy a metaverzum nem csak egy szórakoztató platform, hanem egy gazdasági tér is, ahol tranzakciók történnek, érték teremtődik, és új gazdasági modellek alakulnak ki. A kriptovaluták és az NFT-k növekvő népszerűsége miatt különösen fontos volt bemutatni, hogyan integrálódnak ezek a technológiák a metaverzumba.

Végül, de nem utolsósorban, a biztonság és adatvédelem kategória kialakítása során arra törekedtünk, hogy bemutassuk a metaverzum kihívásait és lehetőségeit ezen a területen. A felhasználók adatainak védelme és az azonosságuk hitelességének biztosítása kulcsfontosságú kérdések a metaverzum jövője szempontjából.

Összességében a metaverzum taxonómia kialakítása egy folyamatosan fejlődő folyamat, amelyet a technológia, a társadalom és a kultúra változásai formálnak. Ahogy a metaverzum tovább fejlődik és növekszik, úgy lesz szükség a taxonómia további finomítására és bővítésére.

6. Összegzés

A metaverzum a "meta-" és az "universe" szavak kombinációjából ered, és egy kollektív virtuális teret jelent, amely a fizikai valóságot, az augmentált valóságot, a virtuális valóságot és az internetet egyesíti. Ebben a térben az emberek avatárokként léteznek és interakcióba lépnek egymással és környezetükkel. A metaverzum koncepciója egy digitális, háromdimenziós világ, amely az embereket összekapcsolja a mindennapi életükben, beleértve a gazdaságot, a digitális identitást és a decentralizált kormányzást. A metaverzum különböző aspektusai közé tartozik a társadalom, a gazdaság, az oktatás, az adatvédelem, a technológia és az infrastruktúra. A kriptovaluták, mint a NFT-k és a kriptotárcák, fontos szerepet játszanak a metaverzum gazdaságában, lehetővé téve a digitális tranzakciókat és az értékcserét. A metaverzum taxonómiája segít megérteni és kategorizálni ezt az összetett és dinamikusan fejlődő környezetet.

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Rövid szakmai életrajz

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