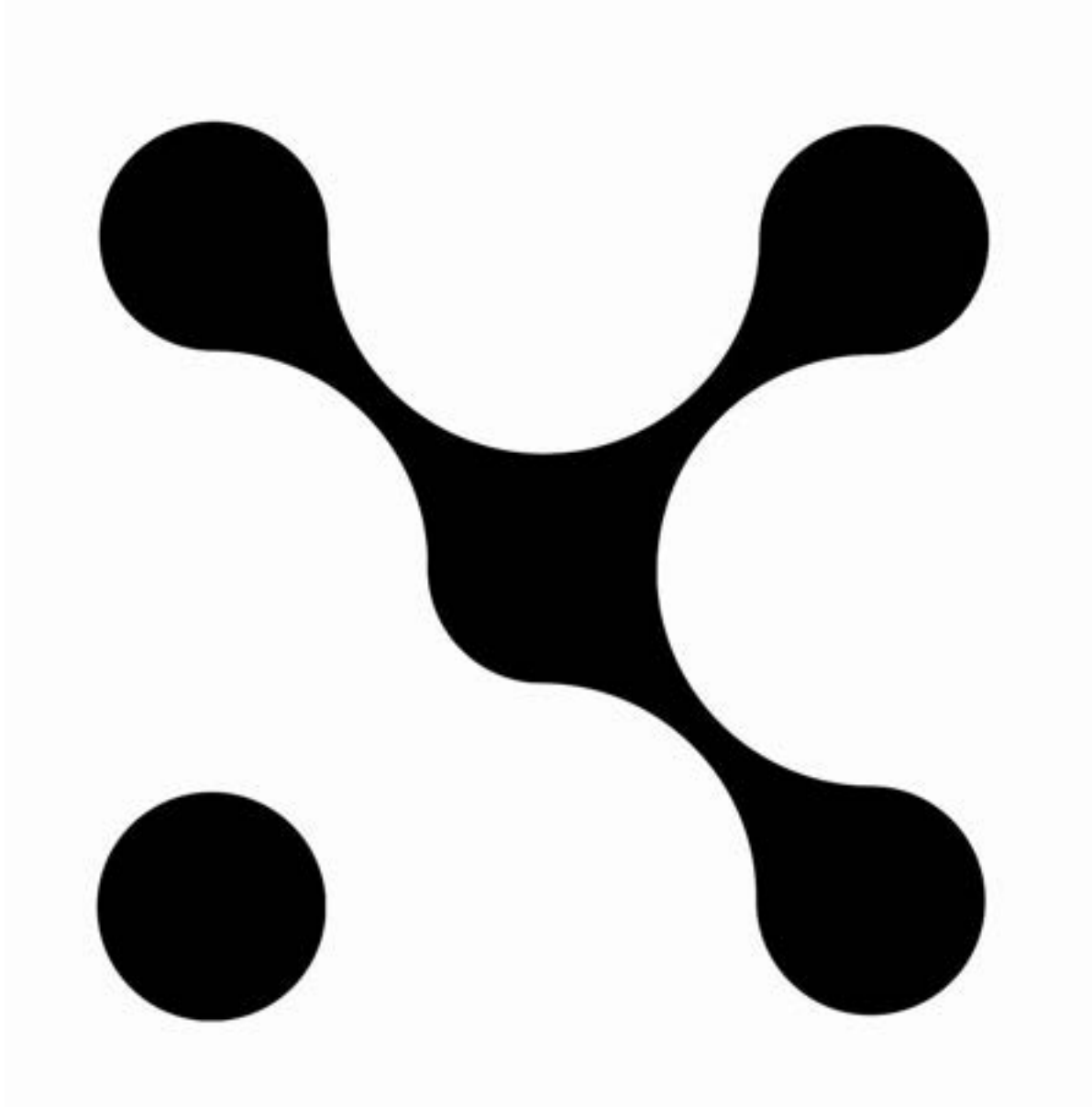




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**INTERACTIVE INTERIOR ARCHITECTURE WITH ARTISTIC ASPECTS
AS A SUPPORT FOR TEACHING EFFECTIVENESS AND FUNCTIONALITY IN SCHOOLS
WITH PROGRESSIVE EDUCATIONAL PROGRAMMES**

DOCTORAL THESIS IN THE FIELD OF ARTS IN THE DISCIPLINE OF FINE ARTS AND ART CONSERVATION

Supervisor: prof. Bartosz Jakubicki

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I would like to thank my supervisor, Professor Bartosz Jakubicki, for his kindness and professional support.
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Abstract

This dissertation focuses on key factors influencing the functioning and learning processes of contemporary adolescents within upper secondary school environments. The first two chapters outline the general characteristics of teenagers as the primary users of the proposed design, drawing on scholarly literature from the fields of neuroscience, cognitive psychology, pedagogy, philosophy, and contemporary educational discourse. The study provides a concise overview of the biological and psychophysical mechanisms, as well as the neurodevelopmental transformations, characteristic of adolescence. It presents scientific findings that identify factors which may either disrupt or support teaching and learning processes. These findings are analysed throughout the dissertation, and the conclusions derived from them inform selected design decisions undertaken within the project. The dissertation also examines the generational affiliation of students currently entering upper secondary education, namely Generation Alpha, together with the environmental, social, and technological conditions associated with this cohort. It discusses factors affecting the cognitive and mental condition of this age group. The study seeks to justify the necessity of considering the specific needs of adolescents in the process of designing educational interiors. Particular attention is given to factors influencing psychological well-being, learning efficiency, and the social functioning of students during adolescence.

The third chapter is devoted entirely to spatial considerations. It provides a detailed discussion of architectural and functional solutions, including the possibility of integrating architectural space with digital environments and artificial intelligence as an interactive tool supporting the work of teachers and students, as well as organisation and collaboration in the flexible adaptation of educational spaces. This chapter refers back to the conclusions formulated in the first two chapters and demonstrates the rationale behind the concepts proposed for individual spaces. Technological solutions are introduced into the design of interior architecture as a means of creating spaces that enable the multi-modal engagement of young people in the learning process. Such solutions may facilitate students' openness to educational content while also providing support for teachers. Most of the proposed interventions are intended to enhance teaching effectiveness and improve the overall efficiency of the educational process. The dissertation also explores solutions aimed at reducing school-related stress, as stress constitutes a significant barrier to learning. Furthermore, the dissertation presents possible methods for implementing various adaptive, technological, and organisational solutions within the architectural space of a school. It seeks to combine knowledge derived from the latest scientific and technological developments with the adaptation of a socialist-era school building and its transformation into a modern, student-friendly educational centre for young people. At the general planning level, the project employs a range of mobile and modular solutions intended to make the architectural space more open, spacious, and functionally flexible. The traditional functional layout of the classroom is reorganised, and interactive digital environments are introduced in order to improve educational performance. The design also includes spaces that allow task-based adaptation, as well as the transformation of both digital and physical zones dedicated to learning and relaxation.

Finally, the dissertation presents concepts for culture-forming, integrative, and creative spaces, as well as areas offering opportunities for active leisure. These are intended to support students' cognitive development and enhance the psychophysical comfort of all users of the general upper secondary school.

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INTRODUCTION

Designing school environments in the third decade of the twenty-first century is acquiring new and particular significance as a result of the unprecedented dynamics of technological, social, geopolitical, and environmental change. The scope of the designer's responsibility is expanding markedly in response both to these transformations themselves and to the accelerating tendency of their further expansion. I am convinced that many new generational and social variables must be taken into account when designing spaces dedicated to the education of young people.

In this dissertation, I attempt to demonstrate the rationale for introducing interactive interior architecture in order to improve the quality of teaching, learning, and everyday functioning in a modern general upper secondary school. I address the use of artistic and creative dimensions as a means of increasing the effectiveness of cognitive processes, promoting culture and the arts, and reducing the monotony and dehumanisation of secondary-school interiors.

In light of reflections arising from my experience in designing educational interiors and from my own teaching practice, I present theses that, in my view, justify several key design decisions. I discuss the factors that, according to scholars, disrupt the learning process of adolescents, as well as contemporary discoveries that point towards ways of mitigating those obstacles. I also indicate the legitimacy of employing modern technologies in order to modernise teaching and to provide multimodal support for students' cognitive apparatuses. On the basis of conclusions drawn from an interdisciplinary analysis of the current state of knowledge, I present solutions developed as an attempt to improve teaching effectiveness in the upper secondary school.

These issues are illustrated by a conceptual design for the educational spaces and common areas of General Upper Secondary School No. 2 in Oława. An important message conveyed by the school's management is its readiness for change and its interest in modernisation and innovation in the field of interior architecture in ways that support both education and students' well-being. It is also worth noting that the school admits students with disability certificates, which further emphasises the institution's openness and aspiration towards inclusivity. In my opinion, extending the standard adjustments made for persons with disabilities to include amenities addressing the sensory hypersensitivities that are increasingly common among young people should constitute one of the initial assumptions in school design. My dissertation is an attempt to answer the following question: what should the contemporary educational space for today's adolescents look like, how should it function, and what should it offer so that young people may engage in learning and perceive school as a place of encounter, integration, and self-development? I should also add that in developing new solutions I sought the views of teachers, therapists, and students from a private general upper secondary school in Wrocław, as well as the management of a public upper secondary school in Oława.

For the sake of semantic clarity, I would like to offer a few words of explanation regarding the terminology used in the title of this dissertation.

By the term ***interactive interior architecture***, I do not mean solely the use of electronic devices that enable interaction between the user and the device, although such devices do indeed appear here as didactic aids and supportive solutions facilitating both learning for upper-secondary students and functional convenience for teachers. What is crucial for this project is the meaning of interactivity in an expanded sense. I am thinking of the adaptive transformation of educational spaces, multifunctionality, modularity, and mobility available to both students and teachers. The notion also appears in the project as the reactive expansion of light and colour. It extends to the selection of furniture, seating, and elements designed to respond to, and to influence, the users' positions and movements. Moreover, the interactivity of certain solutions not connected with electronics, electricity, or network access is intended above all to support and promote social relationships, which, as I will attempt to demonstrate, influence students' effectiveness, concentration, and engagement in the educational process

By the phrase ***schools with progressive educational programmes***, I wish to underline the necessity, indicated by educators and researchers alike, of making changes to curricula and of abandoning many entrenched schemes concerning, among other things, what a classroom should look like. In the light of currently available knowledge and scientific discoveries that clearly point to the ineffectiveness of continuing a school model based on passive verbal transmission, such change appears necessary. I also wish to express my support for schools that are committed to improving the learning environment and pursuing related directions of progress, yet above all to the holistic support of student development with due respect for students' developmental needs and well-being.

CHAPTER I - THE USER: ADOLESCENTS, GENERATION ALPHA. ENVIRONMENTAL AND PSYCHOPHYSICAL CONTEXT

1.1. ADOLESCENCE - NEURONAL REVOLUTION, BEHAVIOURAL AND MENTAL CHANGES, AND THE SCHOOL

The beginning of design lies in asking questions. In my opinion, this stage cannot be omitted from any conscious creative process. The first question, for me, is: for whom? From that follow further questions: how? why? and others that require reflection, inquiry, knowledge, research, and doubt. In the hierarchy of concerns involved in designing a learning environment, the future user constitutes the primary question. I therefore consider who the principal addressees of the project are upper-secondary students. The age range of general upper secondary school students extends from fourteen to nineteen years of age. This period is a distinctive stage in human development. Young people at this age may appear distracted, not entirely rational, and at times emotionally unstable. The varied states of mind and psyche characteristic of each adolescent are a response to the radical biological developmental transformation that every individual undergoes, regardless of genetic or environmental determinants.

During adolescence, both the body and the brain change. Maturation is a psychophysical turning point and at the same time a highly sensitive period from the cognitive and emotional points of view. Before the neuronal processes in the adolescent brain assume a new and more complex form, they are preceded by a series of extremely dynamic transformations. Brain structures are reorganised on a scale that never again occurs in the course of human life, throughout the entire span of ontogenesis.¹ During one stage of this remodelling, neurons and whole neural networks are reduced. In his book *The Psychology of the Adolescent Brain*, the British clinical psychologist John Coleman refers to this process as pruning. He explains that certain regions of the child's brain shrink, and that grey matter may be reduced by as much as 17 per cent, which may lead adolescents to feelings of anxiety and disorientation. Coleman nonetheless reassures the reader by invoking an idea well known to designers: in this case, less means more. The process is intended to free space within the brain's structures for the formation of new, mature neural networks. I cite these findings because understanding what is happening in the brains of children during this period is of immense importance not only for the functioning and behaviour of adolescents, but also for their capacity to absorb knowledge effectively. It is precisely at this stage that children complete primary school and move on to upper-secondary education. New demands are placed upon them, and they are expected to process, understand, remember, and absorb knowledge and information more efficiently.

¹ J. Gilmour, B. Hohnen, T. Murphy, "Niezwyczajny mózg nastolatka", przeł. M. Guzowska, red. A. Kołacz, Wydawnictwo Naukowe PWN, Warszawa, 2023, rozdział 1, „Modernizacja neuronów”. epub.

This knowledge implies the need to treat, and to design, school space for upper-secondary students with particular attentiveness in the context of the future users' psychophysical and cognitive condition. I am not referring here to empathy in design as such, but rather to an awareness of scientific facts and of the immense biological upheaval during which new, albeit age-old and entirely natural, needs emerge in adolescents. In my conviction, these needs must be taken into account in the course of design decision-making, because ignoring them may lead to discomfort and aversion towards school. The period of adolescence has become attached to the epithet "difficult." Indeed, for a young person it is by no means an unequivocally easy time, among other reasons because they are usually unaware that their brain is undergoing a major modernisation. At school they may appear bored or unfocused during lessons. As adults, we often fail to grasp what distracts them so profoundly. In the second chapter I will point to scientifically grounded possibilities for reversing such states of distraction and redirecting them so that they work to the benefit of learning. I will also describe several natural factors that, according to researchers, may have a particularly significant influence on the effectiveness of learning in children during this period, and I will look for design solutions that may help them in that process. I would add in passing that, in my view, a further problem lies in adults' lack of understanding of what is truly happening during this stage. It seems to me that informational support for adults would also be valuable, enabling an empathic insight into the sphere of the specific emotions and behaviours of children during maturation. Knowledge about adolescence would be beneficial for parents, helping them understand how complex and not always situation-appropriate their children's emotional states can be. In the concept I am designing, the school is to have the character of a flexible adaptive space in which meetings among teachers, parents, and students, as well as lectures, individual conversations, and the reception of guests, can be arranged spontaneously. The possibility of interactively remodelling architecture in order to support interpersonal relationships is meant to constitute one of my design guidelines.

It is worth noting that, of all age groups, the highest levels of loneliness are recorded among young people between the ages of sixteen and twenty-four. Of all human beings, adolescents are the loneliest.²

² BBC.com, <https://www.bbc.co.uk/programmes/articles/2yzhfv4DvqVp5nZyxBD8G23/who-feels-lonely-the-results-of-the-world-s-largest-loneliness-study>, dostęp 3 marca 2026, dostęp 5 marca 2025.

1.2. THE FIRST DIGITAL GENERATION - ALPHA. CONDITIONS OF GROWING UP AND RELATIONSHIPS WITH NEW TECHNOLOGIES

Children born after 2010 are referred to as Generation Alpha. They are already adolescents and have reached the age of upper-secondary education, which means that it is to their needs, capacities, and distinctive characteristics that I will devote particular attention. Generation Alpha is unusual for many reasons and consequently attracts the interest of researchers. The term Generation Alpha was coined by Mark McCrindle, an Australian demographer, researcher of social change, and internationally recognised analyst of Generation Alpha. He estimates that Alpha will become the largest generation in the history of humankind. McCrindle calculates that its population will exceed two billion people..³

They will inherit the existing world and become the builders of humanity's future world.

Let us consider the general outline of the conditions under which this breakthrough generation has been formed. This cohort could be called the digital generation; it is the first in history to have grown up, from birth, with access to the internet and social media, and some of its members have experienced digital immersion from early childhood. From the earliest years they have been accompanied by tablets, smartphones, laptops, intelligent autonomous toys, touch screens, and similar devices. They therefore constitute the cohort most deeply affected in human history by the influence of digital and virtual technologies. Some five years before the birth of the first members of Alpha, Facebook was established in 2004 and Twitter two years later. Those five years were sufficient for these social media platforms to attain global reach. The scale of this phenomenon tells us much about ourselves. I would venture the thesis that it reflects our social needs and the easy opportunity to indulge the temptation to be noticed in the public sphere. The internet has become an international forum in which one may converse, externalise emotions, display creativity, vent frustrations, and construct a self-image that is not infrequently imaginary. One may also become dependent upon it. It is enough to recall that in December 2025 there were 6.04 billion individual internet users, representing 73.2 per cent of the global population, while 5.66 billion people - that is, 68.7 per cent of all people on Earth - were users of social media..⁴ The scale of this expansion constitutes quite literally a phenomenon the world has never before witnessed. From the earliest years, Alpha had access to streaming content, whether free of charge or available at relatively low cost, on platforms such as Spotify, YouTube, and Netflix. Attractive and easily accessible content began to compete with reality itself. Progress in digital technology is increasing at an exponential rate. Binary spaces constitute for Generation Alpha an obvious complement to reality.

³ M. McCrindle, https://www.researchgate.net/publication/342803353_UNDERSTANDING_GENERATION_ALPHA.

⁴ Statista.com, <https://www.statista.com/statistics/617136/digital-population-worldwide/>, 3 marca 2026, dostęp 5 marca 2025.

The first members of Alpha grew up in turbulent times. They experienced fear and isolation associated with the coronavirus pandemic, which began in 2019. These were precisely the children who were compelled to study online from home during the primary-school stage. It is worth noting that for many of them this event contributed to the development of the ability to communicate in digital environments. Barely three years later, the war in Ukraine escalated once again. Once more young Alphas observed a wave of anxiety, and at times even fear, among adults. Again, they were exposed to an atmosphere that unquestionably affected their emotions. They received information that people were dying just beyond Poland's eastern border, including children. Even today one cannot speak of calm. Adolescents constantly hear about new crises and anxieties around the world, as well as the polarisation of societies. They are continually confronted with information about climate change, about the uncertainty and even endangerment of the planet's future, and about weather anomalies, some of which they themselves have already had the misfortune to experience. Most members of Alpha in Poland have access to the internet ⁵ - a sphere in which children, adolescents, and older people are particularly exposed to radical views, pathological livestreams, hate phenomena, clickbait, deepfakes, the influence of bots, AI hallucinations, and many other developments that cunningly evade control and rational assessment. Alphas have never known another, calmer, or more ordered world.

For the shaping of school interiors dedicated to Alpha adolescents, I considered their relationship with new technologies to be particularly important, especially issues connected with the impact of digital technologies on students in the context of the quality and efficiency of teaching and learning. I came across a very interesting and broad study conducted in India in 2024. A group of one hundred students from Generation Alpha, randomly assigned either to a cohort taught by traditional methods or to a cohort using digital tools, were observed and subjected to detailed testing. The study, which lasted half a year, was conducted by the psychologist and educator Khritish Swargiary, a recognised author in the field of educational development. The results of the analysis proved surprising: the digital group outperformed the traditional group by 9.4 per cent in comprehension, by 11.9 per cent in problem-solving, displayed 23.7 per cent longer concentration spans, and demonstrated a creativity level 22 per cent higher. The only indicator found to be troubling was the level of physical activity, which was 13 per cent lower than in the traditional group. While some of the results confirmed earlier research, others challenged prevailing convictions in the previous scholarly literature regarding the harmfulness of digital tools in educational use ⁶. The described research exploration proved to be a direct indication of - and a confirmation of what I had intuitively sensed as - Generation Alpha's need for interiors equipped with access to digital environments, as well as the necessity of supporting the physical condition of future students by ensuring that school offers more space and more objects enabling physical activity than the obligatory physical-education classes provided in general upper secondary education.

⁵ M. Niemczyk, "Dostęp do Internetu w Polsce", ILAB, <https://raportstrategiczny.iab.org.pl/dostep-do-internetu-w-polsce/6>.

⁶ K. Swargiary, "The Impact of Digital Learning Environments on Cognitive, Social, and Emotional Development in Generation Alpha Children: A Comparative Analysis", 2024, https://www.researchgate.net/publication/382510647_Digital_Learning_Environments_on_Cognitive_Social_and_Emotional_Development_in_Generation_Alpha_Children, dostęp 24 marca, 2026.

1.3. THE PSYCHOPHYSICAL CONDITION OF CONTEMPORARY ADOLESCENTS - DESIGNING FOR THE REDUCTION OF SCHOOL STRESS

Also worthy of emphasis is the deeply alarming tendency towards the deterioration of adolescents' mental health. The problem is global in character; however, given the location of the project, I cite data relating specifically to Europe and Poland. The National Consultant in Child and Adolescent Psychiatry reported that in 2025 one in five adolescents was struggling with a mental-health crisis. The situation had worsened compared with the previous year, when difficulties affected one in seven adolescents.⁷ These and the following statistics scarcely require comment. I should state here that I feel obliged to design with a view to reducing anxiety, stress, and tension among upper-secondary students. In designing school interiors, I cannot ignore UNICEF's most recent report, *Children's Rights in Poland 2024*. Among many statistics relating to school, the one I found most disturbing concerns school-related stress, which is listed as the first and most pressing issue requiring attention. Seventy-three per cent of children and adolescents stated that school stress was the greatest problem in their lives. At the same time, as many as 51 per cent of teachers considered students' emotional issues to be extremely important, mentioning anxiety and a lack of motivation to live.⁸ It is worth knowing that cortisol, the stress hormone, physically blocks human cognitive efficiency, which means that it impedes learning.⁹ These facts reveal an alarming picture of the mental state of maturing youth. They indicate the necessity of designing upper secondary schools as spaces responsive to students' age-specific psychological and developmental needs. I address these problems not only as matters of welfare but also as significant obstacles to teaching effectiveness.

⁷ "Konsultant ds. psychiatrii dzieci i młodzieży: placówek zdrowia psychicznego przybywa, ale miejsc brakuje", Niepełnosprawni.pl, 2025-11-06, <https://w.niepelnospawni.pl/zdrowie/konsultant-ds-psychiatrii-dzieci-i-mlodziezy-placowek-zdrowia-psychicznego-przybywa-ale-miejsc-brakuje>, dostęp, 5 marca 2026.

⁸ "Prawa dziecka w Polsce 2024. Raport z badań." Unicef.pl, <https://unicef.pl/o-nas/baza-wiedzy/raporty-unicef/prawa-dziecka-w-polsce-2024>, dostęp 5 marca 2026.

⁹ R. Hubert, I in. "The stress hormone cortisol blocks perceptual learning in humans", Science Direct 2017, <https://www.sciencedirect.com/science/article/pii/S0306453016305315?via%3Dihub>, dostęp 5 marca 2026.

I believe that neglecting these issues in the design process would run counter to the very intention of designing a school that supports learning. I therefore attached considerable importance to zones for rest, social integration, relaxation, and activities requiring movement on the part of students. Such spaces may help preserve harmony and psychophysical balance and may support the reduction of school-related stress. It should be recalled that the upper secondary school in Oława also admits students with disability certificates, including neurodivergent adolescents who not infrequently display increased sensory sensitivity. With their needs in mind, I incorporate into the project places of quiet retreat and the possibility of regulating light intensity throughout the school.

Finally, I would add one more significant fact. According to researchers, adolescence is the period of greatest susceptibility to the development of mental disorders in the whole of human life.¹⁰

¹⁰ J. Gilmour, B. Hohnen, T. Murphy, "Niezwykły mózg nastolatka", przeł. M. Guzowska, red. A. Kołacz, Wydawnictwo Naukowe PWN, Warszawa, 2023, rozdział 6, „Przytłoczone nastoletnie mózgi”, epub.

CHAPTER II - GENERAL UPPER SECONDARY SCHOOL, TEACHING AND LEARNING EFFECTIVENESS, AND SENSITIVE AREAS

2.1. GENERAL UPPER SECONDARY SCHOOL - THE STUDENT'S COGNITIVE CAPACITIES AND THE CONTEMPORARY EDUCATIONAL SITUATION

In this chapter I examine issues connected with education, factors that significantly influence students' cognitive efficiency, and the course of teaching processes. I cite scientific findings and my own reflections which I have regarded as important in creating a concept for upper-secondary-school interiors that support teaching effectiveness and everyday functioning in the school. Since the subject of the design study is the interior of a general upper secondary school, I focus chiefly on characteristics specific to adolescents, although many of the issues discussed may also be related to younger and older age groups.

According to educational law, an upper secondary school is "a post-primary school, the completion of which makes it possible to obtain a maturity certificate after passing the matura examination."¹¹ This brief description seems to correspond to the way the school actually functions: it is meant to be a school whose purpose is the matura. The matura, in turn, is a means of reaching the next goal, namely higher education. Verification of knowledge is obviously indispensable, yet in my opinion it should not overshadow the quality of education itself. Passing examinations or solving tests should not determine either the method of development or the educational experience. Nearly a century ago, this approach to education was already criticised by the American philosopher John Dewey, an initiator of progressive education. He pointed out that the educational process is an end in itself and that, as such, it is a process of constant reorganisation, change, and transformation.¹² He pointed out that the educational process is an end in itself and that, as such, it is a process of constant reorganisation, change, and transformation. He also maintained that it is impossible to establish a universal aim for education, because such an aim will always be dictated by the requirements of a particular era and will, by definition, limit the student's development.¹³ This criticism appears to me to remain entirely valid. Treating the goal as the overriding value may divert attention from the educational process itself, from its duration, and from its quality. Studying for tests has little in common with students' experience of learning and transgression. Much less frequently do we speak about students' self-development, sensitivity, interpersonal relationships, the formation of personality, autonomy, and the capacity for independent thought.

¹¹ "Pojęcia stosowane w statystyce publicznej", Stat.gov.pl, <https://stat.gov.pl/metainformacje/slownik-pojec/pojecia-stosowane-w-statystyce-publicznej/4021,pojecie.html?pdf=1>.

¹² J.Dewey, "Democracy and Education: An Introduction to the Philosophy of Education", The Macmillan Company, New York, 1930. s. 59.

¹³ Ibidem, s. 119-129.

The time spent in upper secondary school coincides with adolescence. It is a highly particular moment in life - a time of metacognition and crystallising identity, a time of biological, psychological, social, and intellectual transformation. The literature offers estimates of many thousands of hours spent at school. It is difficult to imagine this vast amount of time spent in an atmosphere of haste, overloaded curricula, test pressure, teacher burnout, and student overload. Yet this is precisely the image of school described by today's teachers. Amidst these burdens, on the horizon there looms the goal: the "maturity certificate," measured in points.

I would like to cite one further thought by John Dewey:

"Our tendency to take immaturity as mere lack,
and growth as something which fills up the gap
between the immature and the mature
is due to regarding childhood comparatively,
instead of intrinsically"¹⁴

As the source of many of the difficulties faced by the contemporary school, scholars point to the influence on education of neoliberalism, a current that emerged in the 1930s and reduced education to an institutionalised instrument of teaching, oriented towards shaping profitable human capital. In this context, schools become economic entities requiring control. The productivity of both students and teachers is assessed by means of ubiquitous points and tests borrowed from the world of business.¹⁵

¹⁴ J.Dewey, op.cit.. s. 49.

¹⁵ A. Gromkowska-Melosik, "Jednostka, neoliberalizm i redukcjonizm edukacji współczesnej", Adam Mickiewicz University Press, Poznań 2016, <https://repozytorium.amu.edu.pl/server/api/core/bitstreams/416cf093-bb6e-4b19-9472-223b803fa07a/content>, dostęp 5 marca 2026.

When I wrote about the time spent at school, I did not mean that there is too much of it. Quite the opposite: in my view, it would even be better if the school could offer students more time and more opportunities beyond classroom lessons, and share with them spaces that provide access to technology, advanced educational content, and recreation. It is worth remembering that not all students have their own room at home or possess an individual space of their own. I therefore asked myself what the school might be able to offer them over the course of four years. In my conviction, a reformulation of the school's physical environment may bring the educational experience, as well as individual and social development - the foundations of effective teaching - back out of the shadows.

In designing the concept for the school interior, I attempted to take into account the fact that throughout the upper-secondary period there is a continuous and dynamic process of formation affecting the adolescent person. The upper-secondary student has much to learn, understand, and remember, all while his brain is undergoing major reorganisation and its paradigms and needs are shifting. I am convinced that the perspective of education as a process unfolding over time, as a possibility of searching, discovering, and reflecting, is learning in its pure form and, as Dewey wished, a value in itself. What is needed is a school space in which that value can be realised. I refer to Dewey's thought because, in my opinion, it represents a philosophy of conscious education in a natural, disinterested, and ideologically unburdened form. Many of his groundbreaking views have today been transformed into modern currents in world education, for example *learning by doing*, *project-based learning* (the thesis that knowledge arises through action and reflection on action), *Responsive Classroom* (the school as a micro-society in which students learn democracy, cooperation, and responsibility), and *Philosophy for Children* (P4C), in which students engage in dialogue, learn argumentation and critical thinking, and jointly construct meanings.¹⁶

Dewey's influence also confirms my conviction that the spatial standard of the school must be raised, and reminds us that we too, as designers, influence the shape of teaching in the future.

In Poland, in the 2024/25 school year, the number of students attending general upper secondary schools amounted to 863,000; this represented a decline of 4.6 per cent compared with the previous school year. There are currently more than 3,000 such schools in operation.¹⁷

¹⁶ K. Williams, "John Dewey in the 21st Century", *Journal of Inquiry & Action in Education*, [9] 2017, <https://files.eric.ed.gov/fulltext/EJ1158258.pdf?utm>, dostęp 5 marca 2026.

¹⁷ "Polska szkoła w liczbach: jak wygląda edukacja w roku szkolnym 2024/2025", Statgov.pl, <https://stat.gov.pl/dla-mediow/informacje-prasowe/polska-szkola-w-liczbach-jak-wyglada-edukacja-w-roku-szkolnym-20242025,36,1.html?pdf=1>, dostęp 5 marca 2026.

2.2. TEACHING AS A PROCESS - THE SCHOOL AS AN ENVIRONMENT OF EXPERIENCE, ENGAGEMENT, AND COLLABORATION

The French neurobiologist, mathematician, and cognitive psychologist Stanislas Dehaene, in his book *How We Learn*, argues that four fundamental conditions must be met in order for teaching and learning to be effective. He refers to them as pillars:

- *Attention**, which highlights the information on which we concentrate.
- *Active engagement**, or the algorithm otherwise called curiosity, which mobilises the brain to test new hypotheses tirelessly.
- *Error feedback**, which enables us to compare predictions with reality and to correct our models of the world accordingly.
- *Consolidation**, which leads to the full automatisisation of acquired skills and knowledge, with sleep as one of its essential components.¹⁸

Learning is a process that shapes a range of abilities. I mean by this a training oriented towards intellectual and task-based proficiency, towards attaining competence and acquiring fluency. It involves the performance of practices based on individual or collective action for the sake of development, the experience of learning, and the discovery and expansion of one's own capacities. We often use the phrase "acquiring knowledge." Yet my impression is that, at present, knowledge is not really acquired, pursued, explored, or discovered; rather, it is received. The teacher, compelled to keep pace with the curriculum, distributes "knowledge" as a ready-made set of transmissible facts, propositions, dates, rules, and similar elements. The supply of information often takes place *ex cathedra*, usually through passive verbal transmission supported by writing on the board in chalk or with a digital pen. The child is showered with information for which there is no time in school to understand or process. According to Dehaene, a teaching method that fails to activate the student is both ineffective and unnatural.¹⁹ It prevents an intersubjective approach, mutual recognition, and shared experience within the learning process. It enforces social isolation. The nearly total absence of direct interaction among the participants in the educational event is imposed by a schematic educational situation that does not activate students and often leads to their weariness. I will return later to adolescents' particular orientation towards social relations.

¹⁸ S. Dehaene, "Jak się uczymy", rozdział 3, "Cztery filary uczenia się", Przekł. D. Rossowski, wydawnictwo Copernicus Center Press, Kraków 2021, epub.

¹⁹ Ibidem, rozdział 8, "Aktywne zaangażowanie".

Collaboration between teacher and student, and access to information drawn from the existing intellectual, scientific, technological, cultural, artistic, philosophical, and historical resources of civilisation, are, in my view, flattened into the signalling of a large number of issues that may appear to students as deprived of individual meaning amid such abundance. Teachers often lack the space and time necessary to create an interpersonal sphere with students. Without doubt, the asking of questions, the receiving and also the critical examination and rejection of certain contents - but above all the student's experience and inner processing of knowledge within the broadest possible interdisciplinary, contextual, or general frame - make the learning process appear incomplete when absent. From a cognitive point of view, it is most beneficial if that frame is also activating. Interactivity is crucial in the mutual relations between student and teacher, between student and subject matter, among students themselves, and between students and the learning environment - the classroom, which could support these values. Certainly, a traditional classroom that forces one to look for forty-five minutes at the back of the classmate seated in the previous row offers little encouragement to engagement and active group learning. Dehaene also points out that there is no effective learning without making mistakes. What is essential, however, is that the student receive feedback on an ongoing basis.²⁰

Such a luxury is hardly possible within the contemporary educational situation. Perhaps a digital assistant - a well-programmed AI algorithm - could, in this respect, support both teacher and student.

²⁰ S.Dehaene, op.cit., rozdział 9, "Zaskoczenie siłą napędową procesu nauki".

2.3. CURIOSITY AND KNOWLEDGE - SCIENTIFIC AND ARTISTIC ASPECTS OF DEVELOPMENT AND INDIVIDUAL REFLECTION

One of the feelings frequently associated with school is boredom. It may arise from a student's lack of engagement with the topic under discussion, or simply from a lack of interest. As I mentioned earlier, one-sided verbal transmission conducted by the teacher is ineffective in the process of learning. Even an interesting topic may come to seem monotonous. It is very difficult to become engaged in subjects that do not interest us at all. One of the foundations of effective teaching is active engagement.

Dehaene argues that curiosity - the desire to learn, the hunger for knowledge - is the foundation of teaching. He claims that awakening curiosity constitutes fully half of didactic success.²¹ The unveiling of knowledge should engage students and show that learning can be fascinating and beautiful, not merely difficult and tedious. In my conviction, such an educational point of departure would help change students' attitude towards school effort. The correlations between aesthetics and science are highly interesting. I had already explored aspects of beauty in science while writing my master's thesis. I was struck by the multitude of examples indicating the great significance that eminent scholars attributed to the beauty of science. I found myself deeply moved while reading about data gathered by neurobiologists in studies on the reception of the particular beauty of scientific theories, formulae, and similar constructs by mathematicians. When these scholars were shown, for example, beautiful formulae or elegant theorems, researchers observed a similar pattern of neuronal activation in the same regions of the brain as those activated in persons who were shown works of art.²² The fact that the perception of beauty in science and beauty in art leads to the same neural reactions and to very similar affective responses suggests a certain conclusion to me. I think that the sciences are not sufficiently promoted in a multisensory, visual, or acoustic context. In other words, it seems to me that the presentation of knowledge encoded in numbers, symbols, and abstract concepts may simply appear inaccessible to some students. Dehaene indicates that an excessively high degree of complexity is demotivating.²³

Very few people achieve a level of theoretical understanding high enough - or indeed outstanding enough - to perceive scientific beauty, for example through the perception of mathematical notation itself. Perhaps showing students the beauty of scientific phenomena during lessons by acting upon the senses would help them understand better; perhaps it would awaken their curiosity, and perhaps it would even encourage some of them to explore a given field of knowledge more deeply. Subjects such as mathematics, chemistry, and physics have many reflections in objects made by human beings or created by nature. Conversely, many scientific codes represent natural phenomena. It seems to me that a change of perspective might prove fruitful.

²¹ S.Dehaene, op.cit., rozdział 8, "Ciekawość - jak ją wzbudzać".

²² S. Zeki, "Piękno jest najważniejsze", Miesięcznik Znak, nr 736, (9/2016), s.13.

²³ S.Dehaene, op.cit., rozdział 8, "Pragnienie wiedzy - źródło motywacji".

Paradoxically, teachers of various subjects - especially perhaps those in the sciences, with their particular commitment to scientific truth - often do not possess the conditions necessary to make use of the guidance provided by contemporary science in order to improve the quality of learning in general upper secondary schools. In my view, many teachers would enthusiastically welcome the opportunity to teach in classrooms that enable interactive effects, experimentation, and visual projection. They would certainly like their subjects to be perceived by students as more attractive and, as a consequence, teaching itself to become more efficient. The awakening of curiosity and the capture of attention are closely linked. Without doubt, curiosity is an ally of learning and memory. It belongs to all of us; it is part of our evolutionary endowment.

The activating force of curiosity is linked to the dopaminergic circuit, the reward centre of the brain. It turns out that new information - knowledge - activates dopaminergic neurons. What is more, even the mere prospect of new information activates this circuit.²⁴ Educationally stimulating curiosity and appetite for knowledge may therefore bring students a benefit - a tangible reward as real as, for example, eating chocolate.

Michał Heller, the first Pole ever to receive the Templeton Prize, asks in his essay on scientific curiosity, *A Study of Curiosity*: "Can curiosity be dammed?"²⁵

I hope not. Without it we would neither learn efficiently nor discover many of the world's astonishing phenomena.

In Chapter III, section 3.3.1, I present an example of an educational interior that I call the *Immersive Classroom*. It is an educational space offering multimodal perceptual influence through image, light, and sound in order to complement the teacher's message. This classroom is conceived as a unified experiential whole encompassing both space and students, linked to the subject of the lesson through the interior's thematic characterisation.

²⁴ S.Dehaene, op.cit., rozdział 8, "Ciekawość - jak ją wzbudzać".

²⁵ B. Brożek, M.Heller, J.Stelmach, "Ciekawość", wydawnictwo Copernicus Cen-er Press, Kraków, 2023, rozdział Michał Heller, "Eskapady ciekawości", epub.

2.4. PEER RELATIONSHIPS AND IDENTITY - AN ENVIRONMENT CONDUCTIVE TO SELF-REFLECTION AND ENCOURAGING ENCOUNTERS, INITIATIVE, AND COOPERATION

As I described in the first chapter, the biology of the maturing brain determines the adolescent's needs and affects actions and emotional states. It is a natural process bound up with the evolution of our species, during which the adolescent strives to establish and consolidate social relationships. A strong need emerges to participate in a group and to be accepted by it. Peer relationships in particular are fundamental for adolescents. The brain responds to social failure by using the same neural mechanisms that are activated in the case of physical pain. For maturing individuals, the absence of relationships or social rejection is especially painful and can significantly and lastingly lower mood.²⁶

It is difficult to reconcile this powerful social instinct with the entrenched and still dominant concept of spatial arrangement in the school classroom. It seems that in secondary schools the pressing need for communality, cooperation, and shared experience is ignored, even though there are scientific grounds for supporting it and even for using it to enhance cognitive efficiency. In *The Amazing Teenage Brain*, the authors cite the latest research in order to indicate adolescents' evolutionary orientation towards five key areas of learning: **integration with peers, taking risks and gaining new experiences, learning through emotion, forming one's own identity, and achieving independence and autonomy.**²⁷

It is worth noting that integration with peers appears first on that list. The social environment is indispensable for the maturation of the brain. What is more, cognitive and social skills develop simultaneously and can be shaped together.²⁸ Relationships influence learning and also affect the development of future interpersonal contacts. Matthew D. Lieberman, Professor of Psychology, Psychiatry, and Biobehavioural Sciences at the University of California, argues that from a neurological point of view there is a significant problem affecting the learning process: an antagonism between two major neural networks in the brain. One is responsible for social thinking, or mentalising, and the other for working memory. The two networks influence each other and are inversely correlated. This means that social inclinations interfere with learning. This is precisely what I had in mind when writing about students' distraction or lack of focus during lessons. Lieberman argues that contemporary education, instead of fighting against the competition between teaching and adolescents' social orientation, should make use of that orientation. He demonstrates that we can, and indeed should, use the "social brain" to inform the "analytical brain" of students at school. He proposes introducing social activation into the learning process and believes that this alone suffices to engage adolescents' memory systems.²⁹

²⁶ J. Gilmour, op.cit., rozdział 5, "Nastoletni mózg kocha ludzi".

²⁷ Ibidem, rozdział 1, "Niezwykły nastoletni mózg".

²⁸ J. Coleman, op.cit., rozdział 5, "Mózg społeczny".

²⁹ M. D. Lieberman, "Education and the social brain", Science direct, 2012, <https://www.sciencedirect.com/science/article/abs/pii/S2211949312000051>, dostęp 6 marca 2026.

In response to Lieberman's argument, in Chapter III, section 3.3.2, *School Project Using Artificial Intelligence as an Image-Generation Tool*, I present the concept of a classroom-space that is at once interactive, creative, and exhibition-oriented. It is a space intended for group projects and for the creation of multisensory presentations and lectures delivered by students to their peers. This solution implements group-work methods, coaching, and learning-by-teaching. These three forms of activity correspond to the social activation described above within the learning process. The interior allows the classroom to be configured for three different stages of work by teacher and students:

1. the introduction and opening of the task;
2. discussion, inquiry, and collaborative creative work;
3. presentation, in which both authors and audience stand within the centre of the projected environment.

The specific orientation of adolescents towards peer relationships, already mentioned above, implies a drive to act in groups and strengthens engagement. Robert Sapolsky, Professor of Biology, Neurology, and Neurosurgery at Stanford University, refers to this tendency - visible in neuroimaging studies - **as a feverish need to belong to a group**. He also points to certain similarities between some social traits of human adolescents and the ethology of maturing baboons.³⁰ This may suggest that the contemporary needs of youth for socialisation are a very old mechanism of evolutionary adaptation. In the case of schools for adolescents, architecture of a prosocial character is therefore justified directly by biological phenomena. In the other classrooms I have designed, spatial formations also appear that enable space to affect students and that allow students and teachers to affect space in order to promote relationships and shared educational activities.

In the 2025 report of the Organisation for Economic Co-operation and Development on global trends and the future of education, the authors indicate that in the coming years ever more people will be working together with intelligent machines. They emphasise the role of education in supporting socio-emotional learning and in strengthening the sense of community..³¹

³⁰ R. Sapolsky, "Zachowuj się, Jak biologia wydobywa z nas to co najgorsze i to co najlepsze", rozdział 6, tłum. P. Szymczak, Wydawnictwo Media Rodzina, Poznań 2021 r., epub.

³¹ "Trends Shaping Education 2025", OECD.org, https://www.oecd.org/en/publications/trends-shaping-education-2025_ee6587fd-en/full-report/global-trends-and-the-future-of-education-in-2025_7358e77a.html, dostęp 6 marca 2026.

Social relationships exert a significant influence on the learning process. It is relationships that create a field for the exchange of views, for joint activity, for the emergence of emotions, for the formation of bonds and interdependencies, and finally for learning critical thinking, expressing one's views, and presenting one's own point of view. They teach the construction and defence of one's own theories, while also enabling teamwork. In my opinion, the platform for all these activities can, and indeed should, be the school. This is all the more important because contemporary knowledge points to a very significant fact: during adolescence, a young person discovers, builds, and strengthens identity.³² Once again it would seem that the upper secondary school may be an excellent testing ground for trying out one's newly emerging identity.

Within the project, I introduce individual solutions and entire spaces that enable joint action and are intended to foster the building and development of integration. Without it, the process of identity formation, the emergence of independence and autonomy, and learning itself may be seriously disrupted. For this reason, I consider the design of school spaces that do not obstruct peer relationships to be justified.

Architects increasingly design schools not only as closed educational institutions but also embed them within a social context open to the surrounding environment. An example is the primary school in Warsaw's Ursynów district designed by the architects of WWAA and opened at the beginning of the 2025 school year: an architectural complex assimilated into the fabric of a large housing estate.³³

All relationships and shared experiences serve development and will also co-create the character - the identity - of the school's interior architecture; I hope they will allow students to identify with it. In architecture we use the notion of common spaces or common zones. It denotes spaces for co-participation without division into user categories. As such, they should be places free from exclusion - places where two or more persons, not necessarily from the same class, may talk and experience the unique phenomenon of a direct relationship. I am a strong advocate of emphasising the importance of inclusive spaces. At the same time, in the case of educational interiors - especially in an era of digital communication and social division, and particularly in relation to adolescents - I believe we should broaden the scope of our attention and build spatial arrangements conducive to integration.

³² Gilmour, op.cit., rozdział 11, "Autorefleksja".

³³ A. Cymer, "Szkoła w mieście", Culture.pl, <https://culture.pl/pl/artykul/szkola-w-miescie>, dostęp 6 marca 2026.

2.5. AI - INTERACTIVE DIGITAL CONTENT MANAGEMENT SKILLS AS COMPETENCIES IN THE TWENTY-FIRST CENTURY SCHOOL

In September 2025, the Prime Minister of Albania, Edi Rama, announced the appointment of a new minister. Diella, the name of the new member of the government, is a natively digital entity managed by artificial intelligence. She has the avatar of a young woman dressed in traditional Albanian costume. It is the first case of its kind in the world.³⁴ Eight years before that event, Saudi Arabia announced - again for the first time in human history - the granting of citizenship to an anthropo-morphic robot named Sophia, who, like Diella, operates on the basis of artificial-intelligence algorithms.³⁵

Both events are unprecedented. Whereas granting citizenship to a robot could still be explained in terms of publicity and the popularity of a machine imitating a human being, entrusting artificial intelligence with the management of an entire sector of public procurement is a serious step that can be regarded as a symptomatic sign of the arrival of a new era.

The technological revolution 4.0 and the emergence of an entire range of new tools that follow from it are facts. Current tendencies point to-wards their further development. I do not believe that young people would wish to cease using them, regardless of the polarised opinions and anxiety that have arisen among many people in connection with the widespread dissemination and accelerated development of artificial intel-ligence, as well as its increasing efficiency, its lights and shadows. My aim is not to take the side of any particular opinion on AI. Rather, it is to search for solutions that combine traditional and new approaches to the design of educational interiors while also making use of the latest scientific resources in order to improve didactic and developmental effectiveness, with particular regard to cognitive science and the growth of human intellectual potential. Like Jobst Landgrebe and Barry Smith, I believe that artificial intelligence, as a mathematical entity - and doubt-less in the near future a partly quantum one - cannot in itself be ontologically or axiologically evil, nor can it possess evil intentions. It may, however, be badly trained, badly used, or disseminated by human beings for harmful purposes.³⁶

³⁴ A. Taylor, "Albania appoints world's first AI-made minister", Politico.eu, <https://www.politico.eu/article/albania-appoints-worlds-first-virtual-minister-edi-rama-diella/>, dostęp 6 marca 2026.

³⁵ R. Sini, "Does Saudi robot citizen have more rights than women?", BBC.com, 26 października 2017 r., <https://www.bbc.com/news/blogs-trending-41761856>, dostęp 6 marca 2026.

³⁶ J. Landgrebe, B. Smith, "Why Machines Will Never Rule the World: Artificial Intelligence without Fear", second edition, Routledge. New York, 2025, s. 191.

It is useful to realise that artificial intelligence is a potential entity, which is to say that it becomes, or exists, only at the moment of interaction. In contact with human beings, this concerns various kinds of communication that should lead to efficient, desirable, and rational effects. I therefore regard it as purposeful to teach young people at school about artificial intelligence and to make it possible for them to test and critically understand this technology. I am convinced that professional teachers and the school are the best setting for undertaking this task, difficult though it may be.

The contemporary upper secondary school can and should draw upon scientific and technological achievements in such a way that contact with the latest solutions is not separated from the educational situation itself. I think that if we bring about such a separation, we deprive students of the possibility of learning sceptical evaluation, safe use, and the ability to make conscious choices among contemporary technological tools. Put differently, I believe there is a risk of limiting students' knowledge, skills, and competencies. In my view, isolating students at school from an internet-saturated and media-shaped reality does not help to solve problems. On the contrary, outside school young people will still use social media and artificial intelligence, only in a thoughtless manner and often without any support or guidance whatsoever. Naturally, I also recognise the necessity of teaching the ethics of using particular technologies. I believe that the architectural space of the upper-secondary-school interior, coupled with contemporary solutions, will enable interactive cooperation between new systems, teachers, and students. I believe that it will support both educators and young people, while also contributing to improved teaching effectiveness. I also perceive the potential of artificial intelligence as a tool that may help facilitate contact among shy students who lack the courage to approach a peer group and initiate conversation.

When I speak of contemporary education, I also take into account the important needs, identified by specialists, for the development of education in the direction of shaping new sets of skills and competencies for future professions, metacognitive abilities, and proactive attitudes among young people. There is also growing emphasis on the need to expand knowledge and skills in the operation and responsible use of digital devices and artificial intelligence.³⁷

³⁷ „Poland 2025 Digital Decade Country Report”, <https://digital-strategy.ec.europa.eu/en/factpages/poland-2025-digital-decade-country-report>, dostęp 26 marca 2026.

CHAPTER III – SPACES

3.1 GENERAL ASSUMPTIONS

The educational environment of today's youth is a matter of fundamental importance. By environment I mean both environment in the sense employed by environmental psychology and neurocognitive research, and environment in the context of the relationship between the human being and architectural space. In my view, both understandings of this concept should be considered together in the creation of educational interiors; they should resonate with one another. I endeavour to ensure that the design of reactive school interiors and the findings of the disciplines just mentioned complement one another in order to improve learning effectiveness, while artistic and creative aspects fill what I perceive as an existing gap in education in the spheres of culture and art - without which education in the upper secondary school remains, in my opinion, glaringly incomplete. I therefore introduce solutions that allow the teacher to expand the range of perceptual influence exerted upon students during lessons. I reorganise the traditional character of the school interior and of the classroom so that these spaces cease to block the natural need for integration and cease to impose a schematic model of behaviour that, in my view, may lead to dehumanisation. I place within the school spaces linked to artistic, creative, and culture-forming issues because I regard them as natural civilisational needs of the human being. Perceiving students in a way that ignores such needs may be one of the factors that discourages adolescents from educational institutions. At the same time, I seek to combine the message carried by interior architecture with forms of communication in the world of new technologies that are intelligible to adolescents. I extend classroom architecture through digital content carriers which, for Generation Alpha, constitute a natural interactive extension of the human being and of reality - a kind of useful portal. I employ them as tools supporting engagement, capturing attention, and providing sensory completion for more effective teaching. An example appears in the subsection entitled Immersive Classroom.

An interdisciplinary approach is one of the foundations of design for me. The strategy of understanding scientific perspectives reveals a broader plane. It facilitates comprehension of the user and of the entire series of relations and connections in which that user will participate within the designed space. These relations concern, among other things, the mutual influence between the human being and the surroundings, atmosphere, relationships, factors of psychophysical well-being, and the perceptual reception of architectural space. In the design of a school, the correlation between the user's multisensory reception of the architectural environment and the process of learning is especially important. Interactivity inscribed into interior architecture makes it possible to grade and intensify this reception so as to improve the effectiveness of didactic action. The teacher may use it to support the comprehension of specific content and issues under discussion, and to engage students more strongly. In the final analysis, the point is to create such interior conditions that the relations described above may have a chance to emerge and the effectiveness of learning may be strengthened. In my conviction, these contexts are, or can become, a series of feedback loops that co-create and complement one another. The way spaces within the school look, function, and what they are able to offer genuinely matters to students.

I had the opportunity to create similar connections and observe reactions during the design and implementation of a private general upper secondary school in Wrocław.³⁸ The fact that, of all age groups, adolescents are the most strongly affected by their environment³⁹, inclines me to interpret this particular environmental sensitivity as applying also to school interiors, and to offer adolescents educational spaces responsive to their cognitive and sensory needs and, what is particularly important, appropriate to their developmental stage.

When we look at the interiors of public-use buildings, it is easy to notice the effort designers make to turn them into spaces created with the human being in mind - spaces that consider functional and aesthetic values, offer comfort of use, and ensure well-being. Even task-oriented interiors, for example offices, are designed so that working and spending time in them is pleasant. Meeting zones, rest areas, and in some cases even the possibility of eating a meal or undertaking physical exercise are made available. I am convinced that adolescents in schools deserve spaces that are equally well considered and equally appropriate. I have already indicated that in designing the school, I was guided by the idea of supporting the efficiency of education by creating favourable conditions. I also emphasise that interiors should not disrupt cognitive processes, that classrooms should be comfortable, healthy, and appropriate to intellectual effort, and that they should not force students to remain in one position for forty-five minutes of instruction. I paid attention to sensory susceptibility and to supporting the psycho-physical well-being of users. In addition to forms intentionally designed by me, I employed ergonomic seats and other ready-made, certified pieces of furniture that support users' posture and make comfortable, safe use and movement easier. I tried to operate in a balanced manner with the complexity of textures in furnishings, upholstery, and finishing materials. I removed architectural barriers and, wherever possible, barriers to natural light. I equipped lighting fixtures with micro-polarising coatings - used by a Polish lighting manufacturer - in order to minimise the risk of uncontrolled light reflections. All lighting systems permit reactive task-oriented adaptation or adjustments aligned with the circadian cycle. The advantages of circadian lighting are described in greater detail by Marta Promińska in her book *Healthy Architecture: A New Standard of Sustainable Building*.⁴⁰ Reactive lighting in the corridors activates and smoothly follows users. I used a balanced colour palette based on natural tonal ranges of neutral colours so that neither the effects of screen exposure and projection, nor lighting intensity, colour temperature, or daylight would produce adverse effects resulting from colour mixing or colour relativism.

³⁸ A. Semrau-Lech, "Wizualne cechy percepcyjne ucznia jako ważne aspekty w architekturze wnętrz szkół", Wrocław, 2024
https://re-forma.weebly.com/uploads/1/2/8/2/128276547/re-forma_2022-2023.pdf s. 166-176, dostęp 26 marca, 2026.

³⁹ J. Gilmour, op.cit., rozdział 1, "Właściwe środowisko jest teraz naprawdę ważne".

⁴⁰ M. Promińska, "Zdrowa architektura. Nowy standard budownictwa zrównoważonego" Wydawnictwo Naukowe PWN, Warszawa 2021, rozdziały 2.4., 2.3. "Jakość oświetlenia wewnętrznego", "Cykl cyrkadiany".

The design of every educational building requires a particular approach. The work of the interior architect must take into account a wide range of detailed recommendations and restrictions. The building must satisfy many conditions, norms, and regulations in the fields of building law, sanitary requirements, safety, lighting, acoustics, access to daylight, vertical and horizontal circulation, the use of certified materials and equipment, and many others. In the case of school design, it is additionally necessary to observe educational regulations. These legal determinants are, obviously, the starting point for the correctness and adequacy of the design proposal; yet they relate only to a limited degree to questions concerning the identification and ordering of factors connected with perceptual influence and the impact of various stimuli on human beings. What I have in mind here is the multisensory reception of space, which not only creates a particular atmosphere but may also affect different users to different degrees. It shapes their well-being and their evaluation of the quality of space. In this project, the interactivity of architecture is inscribed into the semi-open structural arrangement of interiors, the transmission of colour, and the action of light - interactivity understood as a means of building an immersive atmosphere and a subjective awareness of the passing of time, changing in accordance with the students' degree of engagement under exposure to stimuli.

Oxford Languages gives two meanings of the adjective interactive:

1. involving people or things influencing one another;
2. allowing a two-way flow of information between a computer or other device and the user; responding to the user's input.

The prefix *inter*, according to the PWN dictionary, signifies: between, among, together.

This semantic field is filled - and at the same time constituted - by a number of solutions employed in my project. It defines the interactions between students and various forms making use of screens and digital technologies; the possibilities for students and teachers to use adaptive spatial forms of furniture for active, task-oriented reorganisation of classrooms; the interactions between light, space, and the colours of projections and screen content; the interactions between student and haptic elements of space; the interactions between student or teacher and reactive creative and learning-related solutions; an interactive room for remote meetings as an encouragement to establish external relationships and learn together with young people both in Poland and abroad; interactive reading through following books and the sharing of literature; the sharing and collective listening to music; dynamic spatial elements that respond to users' movements; and, finally, decorative and functional elements into which games and plays requiring cooperation and social interaction are inscribed. The number of such interventions may seem considerable; however, I attempt to balance it by means of material continuity, coherent circulation routes, and the operational clarity of the proposed solutions. All the interactive applications are intended to facilitate the organisation of the multitask character of learning in upper secondary school, to support the well-being of students and teachers in learning, work, and rest, and to offer a diversity of didactic interiors with the possibility of fluid visual transformations. They are also meant to satisfy creative, culture-forming, and social needs. The common denominator of all these assumptions is development and support for the effectiveness of educational activity. I see space and interactivity - as physical, measurable states and as temporary mental situations experienced by users - as mutually influencing perspectives of the school building understood as a whole.

3.2. ADAPTING THE “MILLENNIUM SCHOOL”: ARCH, CIRCLE, STRAIGHT LINES, RHYTHMS

The seat of General Upper Secondary School No. 2 in Oława is a so-called tysiąclatka - one of the schools constructed as a result of the socialist campaign of mass school building under the 1958 initiative entitled “1,000 Schools for the Millennium of the Polish State.” It is worth noting that the tysiąclatki of the People’s Republic of Poland were intended to be inexpensive, functional, and flat-roofed. They were erected as adaptations for every locality on the basis of a single design scheme. They were built at an extraordinary pace through voluntary social labour⁴¹ and from social funds collected through public subscriptions under the slogan “The Nation for Its Youth,” contributed by society and institutions not linked to the state budget, together with a levy collected from income and created for the needs of this mass investment.⁴²



Figure 1. Photograph of the western elevation of General Upper Secondary School No. 2 in Oława, photograph by the Author, 2025.

⁴¹ P. Semczuk, "Szkolne tysiąclatki. Cała Polska żyła wtedy wielką akcją propagandową budowy szkół", *Newsweek*.pl, 25.09. 2018, <https://www.newsweek.pl/historia/szkolne-tysiaclatki-cala-polska-zyla-wtedy-wielka-akcja-propagandowa-budowy-szkol/z4jxs7k>, dostęp 7 marca 2026.

⁴² J. Gołota, "Social construction of schools In the Warsaw voivodeship 1959-1972 (authority, society, press)", *Zeszyty Naukowe Ostrołęckiego Towarzystwa Naukowego*, XXXI, 2017, s. 311-328, <https://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.ojs-issn-0860-9608-year-2017-volume-Zeszyt-issue-XXXI-aticle-b8131f1f-bdbe-3cb2-bbd1-ea3e30353f2e>, dostęp 7 marca 2026.



In adaptive design, we move between utility and rules, recommendations, and structures of meaning in order to find a way - a plastic language - through which the object may be given, or may reveal, an aesthetic identity. In the case of this rather unequivocally defined and formally consolidated space, it was clear to me that one had to step back to a moment preceding the functional solidification of the school's interiors. As is not difficult to imagine, the relatively simple structure of the upper-secondary-school building and the quality of its finishes reflect the specific socio-political circumstances of its construction. After inventorying the building and reconstructing it as a digital 3D model, I was able to examine more closely the conditions, the relations among forms, the existing proportions and sense of spaciousness, as well as the operation of light and the susceptibility of the interiors to possible change.

I decided to eliminate as many barriers to daylight as possible. I should add that during thermal modernisation carried out in 2015, the building's façades were thickened by about 30 cm, thereby reducing access to natural light. I removed part of the partition walls, which allowed me to perceive the uncompromising structure marked by columns - a raw rectangular relic in need of transformation. Rather than building over and concealing the columns once again, I decided to expose them as a potential identifying motif of the space. The right-angle favours construction. Rectangular forms have much to offer: their power, structural stability, even distribution of force, and modularity stand up remarkably well to terrestrial gravity. I understand the presence of orthogonal aesthetics in utilitarian architecture, and I also appreciate its own peculiar beauty. I did not, however, want the project to be inscribed in the visual unification typical of secondary schools. I therefore decided to intervene in the appearance of the columns by adding a uniform architectural detail to them - an element with the character of moulding in the shape of an arch. This change is visible throughout the educational, task-oriented, administrative, social, and relaxation spaces of the building as a visual indicator of the differentiation and function of these areas.



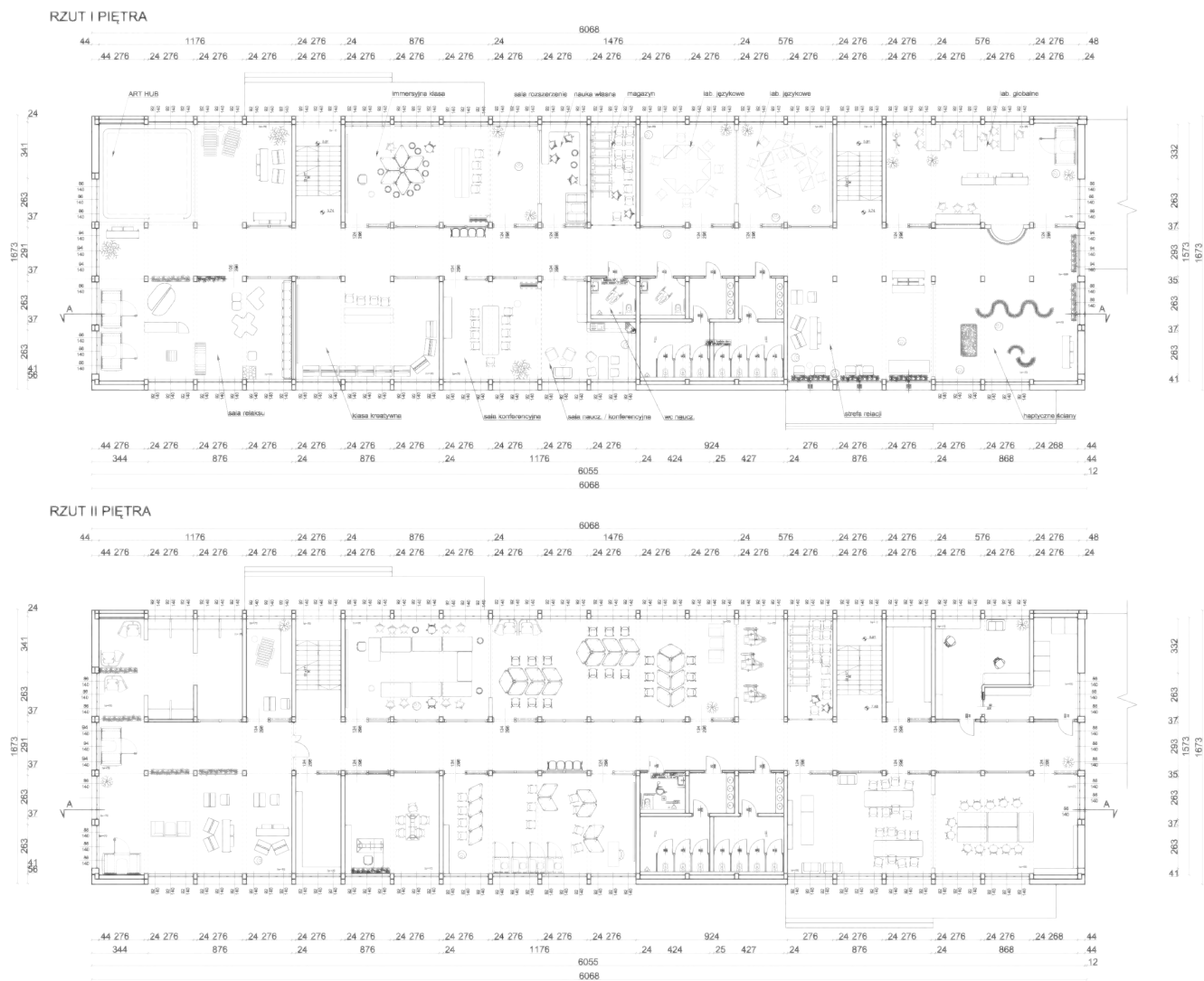


Figure 5. First- and second-floor plans, technical drawing, author's own elaboration.

The addition of arch ornaments in selected parts of the space is intended subtly to distinguish zones without resorting to their physical isolation. The arch is meant to integrate and unify the structural elements, turning them into coherent forms - an expression I repeat after Janusz Żórawski, who in his book *On the Encasement of Architectural Form* suggested that there exists in the human being a tendency precisely towards such coherent forms.⁴³ I would also note that the German art historian Wilhelm Worringer distinguished between regularity, which does not contain a priori expression, and unity, which does.⁴⁴ Intuition tells me that this statement touches upon a truth concerning human perception of abstraction. The sense of sight serves to detect and integrate information from the realities surrounding us - it is in forms that we seek coherent meaning.

A further specific feature of this space is intended to be the possibility of mixing colours within the classrooms. This intention carries functional pragmatism within itself. If the teacher adjusts the classroom's colouring through RGB light towards blue tonalities, this will reinforce students' concentration; if greater activity is desired, red may be used. In addition, the changing colouration of the illuminated walls and columns will introduce variety and may also become a distinguishing sign of, for example, a lesson or a meeting, or a form of communication. I imagine a teacher sending students information about a lecture: "...second floor, turquoise code..." I had already had the opportunity to implement successfully a similar solution involving light and its effect on students and school architecture in a project realised for the bilingual general upper secondary school Cogito - New Experience High School in Wrocław.

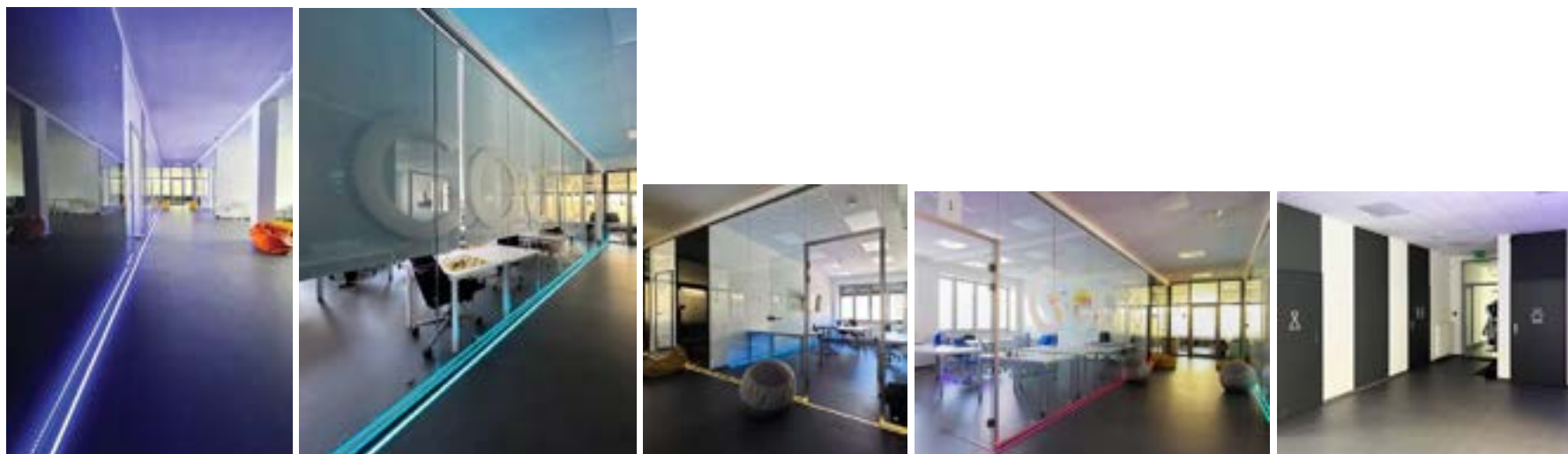


Figure 6. Series of example photographs showing different lighting settings in the Bilingual General Upper Secondary School Cogito - New Experience High School, photograph by the Author.

⁴³ J. Żórawski, „O obudowie formy architektonicznej”, wydawnictwo Arkady, 1973 r., s.21

⁴⁴ W. Worringer, „Abstraction and Empathy. A Contribution to the Psychology of Style”, Elephant Paperbacks, Ivan R. Dee, Publisher, Chicago, 1997 r., s.66.



Figure 7. Visualisation, entrance zone.



Figure 8. Visualisation, entrance zone, glazing with the interactive animation entitled *Molecules*.

Each level contains a specific functional arrangement. Only the highest level is distinguished by a particular behavioural principle. I conceived it as an area of sensory quiet, including digital quiet. The attributes distinguishing the storeys from one another are the different shapes of the lighting fixtures selected for each floor. For the ground floor I chose circular lamps; for the second and third levels respectively, square lamps and triangular lamps with rounded corners. Since large luminous surfaces would be needed to achieve the appropriate quality of light, I considered it worthwhile to give them distinct shapes as well. The greatest change, encompassing the solutions already described, is the enabling of spatial reconfiguration, the possibility of gradated influence on students' sensory experience in individual zones, and access to various types of interaction supporting both learning and users' well-being. These adaptations are also an attempt to break the standardisation of the school's internal structure and of what Rob Imrie and Peter Hall, with reference to modernist architecture, described as an engineering aesthetic promoting the intellectual purism of rational geometric forms and mass industrial production.⁴⁵

In my conviction, schools should not be anonymous, monogenic seats of homogeneous educational practices. For this reason, I attempt to give the institution distinguishing features that emphasise its individuality. My intention is also a less obvious, indirect effect: supporting users' identification with the space. In other words, I want students and staff to treat the school as their own and, as a consequence, as a place conducive to belonging, integration, and safety.

The main entrance zone is planned as an informational space with a waiting function, for example for students waiting for one another, for guests, or for parents who do not wish to wait for their child in the car. It also fulfils the role of a reception area and meeting place. It is separated from the cloakroom by glazing covered with projection film, allowing projected images or animations to be displayed with a graded level of transparency.

I wanted the school's task-oriented interiors to be built on the plan of spaces that remain partially open and allow changes and adaptations, such as sliding walls, screens, and mobile furniture. The corridors are visually distinguished, with lowered ceilings, different lighting, and different floor surfaces. I also proposed changing the floors to more uniform, certified acoustic vinyl coverings imitating natural materials: in the corridors, a darker microcement-like finish, and in the remaining spaces a light-concrete colour. To intensify the impression of spaciousness, the ceilings received a semi-matt finish - satin paint and acrylic panels, depending on the floor.

⁴⁵ R. Imrie, P.Hall, „Inclusive Design Designing and Developing Accessible Environments”, Taylor & Francis e-Library, 2004, s 25.



Figure 9. Visualisation, entrance zone, view directly opposite the staircase.



Figure 10. Visualisation, corridor.

Apart from the already mentioned rounding of the columns, the arch appears in the project as curves visible in furniture and other design elements, as well as in their development into the circle, square, rectangle, and triangle with rounded corners. Examples include the lighting fixtures already described. They are intended to provide a counterpoint - a softening element - to the rhythmic rectangular forms and rough textures of the finishing materials. They also correspond to the name-nickname I selected for the Oława school and to the logotype designed for it.



Figure 11. Logotype, graphic design by the Author.

The logo is a synthesis of the shape of molecules - reduced to the form of the circle - entering into ceaseless interactions in the formation of the complexity of matter and DNA. As a sign, it is meant to symbolise the fusion of distinctness and integration.

The design includes modular partitions - mobile sliding walls made either of matt glass or of opaque panels. Both versions may be parked beside the columns when not in use. This is one of the solutions inscribed into the idea of flexible task-based adaptation of individual classrooms. Most elements of the equipment are mobile: tables, chairs, multi-person seating units, acoustic screens, and multifunctional stands are fitted with wheels or rollers, whether single-directional or omnidirectional, all with locking mechanisms. On every level, storage rooms are planned containing mobile folding tables on wheels and various types of seating. They also contain movable acoustic panels and screens.



Figure 12. Visualisation, open space.



Figure 13. Visualisation, modular partitions.

All glazing in the building is equipped, for safety reasons, with signs derived from the logotype in various configurations; this principle also applies to glazed elements made of frosted glass.



Figure 14. Visualisation, integration zone.

Comfortable sofas, armchairs, pouffes, and other seats have felt upholstery in order to improve the acoustics of the space and to function as part of sensory differentiation within the diversity of textures used throughout the school.



Figure 15. Visualisation, immersive classroom, mobile elements.

The glazed walls separating adjacent classrooms directly from one another are designed to have variable transparency. This effect can be achieved either through the installation of SmartGlass or by applying a film with similar properties to the glass. In both cases the degree of transparency is changed by remote control.



Figure 16. Visualisation, view of classrooms from the corridor, glazing.

3.3. IMAGE - LEARNING EFFECTIVENESS, REACTIVITY, ENGAGEMENT, GENERATIVE AI

Image is mentioned, alongside verbal resources, as one of the foundations of multimodal learning.

This is hardly surprising: visual perception accounts for approximately 80 per cent of all stimuli received by the human being⁴⁶ Visual communication is one of the foundations of effective learning and acts as a catalyst in the process of remembering. The simultaneous use of image and speech during lessons engages the senses of sight and hearing and thereby activates more than one area of the brain. In other words, multimodal learning adds visual content as a significant resource to the process of long-term synaptic potentiation - that is, to the process of learning itself. The result is greater variety together with enhanced learning effectiveness..⁴⁷.

Researchers have also confirmed the hypothesis that in the construction of a mental model, text and image perform independent yet mutually complementary functions. The combination of word and image improves the effectiveness of teaching, learning, and memory. It is regarded as one of the best indirect strategies in pedagogy.⁴⁸

⁴⁶ S. Nolen-Hoeksema, B. L. Fredrickson, G. R. Loftus, W. A. Wagenaar, „Introduction to psychology”, Cengage Learning EMEA, United Kingdom, 2009, s.150.

⁴⁷ J. Coleman. op.cit., rozdział 4, "Uczenie się, uczenie się, uczenie się".

⁴⁸ F. Zhao, W. Schnotz, I. Wagner, R. Gaschler, "Texts and pictures serve different functions in conjoint mental model construction and adaptation", Springer.com, 2019, (<https://link.springer.com/article/10.3758/s13421-019-00962-0>, dostęp 31 marca, 2026).

3.3.1. Immersive Classroom - Interactive Sensory Activation During Learning. Image, Permeation, and Glow as Elements

Supporting the Experience of Learning

The French philosopher Jean-Jacques Rousseau was an advocate of naturalistic pedagogy, which placed the human being - with due regard for developmental stages and needs - at the centre of educational concern. His views and his approach to education were groundbreaking in relation to the eighteenth-century convictions prevailing in the wake of Calvinist doctrine, according to which the child, as a kind of necessary evil, was expected to behave like a small adult: obedient, quiet, seated, and not disturbing anyone. I would like to recall one passage that drew my attention in Rousseau's *Émile, or On Education* (1762). In it Rousseau invoked the validity of the thought of ancient teacher-philosophers. The fragment I have chosen from this modern Enlightenment treatise on upbringing and learning contains, across the distance of many centuries, the words of the Greek philosopher Plato and the Roman philosopher Seneca concerning educational approaches current in their own times. Rousseau writes:

*“Plato, in his Republic, so often considered austere, has children educated only amid games, festivals, songs, and entertainments; it would seem that he had done everything by teaching them well how to rejoice; and Seneca, speaking of the youth of ancient Rome, says: they were always on their feet; they were never taught anything they would have had to learn while sitting. Were they any the worse for this once they reached manhood?”*⁴⁹

This brief entry, a glimpse from the distant past, casts light on two different situations within ancient education. I understand perfectly why Rousseau chose these examples. It is worth noticing how different the attitudes of these teachers from centuries past are from the order of the present-day classroom: education enclosed within four walls, with immobilised children seated in rows of desks, one behind another.

One of the guiding ideas of my project is the redefinition of the notion of the classroom as an interior in which one may sit, listen, write, and speak only rarely - a room with a rigidly specified and consolidated arrangement of spatial relations, and therefore also of interpersonal relations. In order to disrupt this pattern, I introduce classroom equipment that can be arranged freely according to need, allowing different configurations for lectures, discussion, team learning, brainstorming, and similar forms of activity.

⁴⁹ J.J. Rousseau, w „Emil, czyli o wychowaniu”, tłum. W. Husarski, Wydawnictwo Naukowego Towarzystwa Pedagogicznego, 1930, s.116.

I see classrooms as sensitive, reactive spaces in which all participants experience learning multisensorially, immerse themselves in the subject, explore, and actively seek answers. The role of the educator and the educator's own engagement remain the foundation of didactic success.

I have already written that teachers, like students, are often overloaded. They frequently lack access to modern tools that would enable them to expand their own means of expression. The possibility of increasing perceptual influence within the classroom is no longer a utopian song of the future. Technologies and diverse tools already exist; they are available and are being dynamically improved. In my view, it is worth making use of them. I believe that embedding them in classroom architecture creates a chance to improve conditions, may influence teaching effectiveness, and may liberate teachers' creativity. Education might thereby become, also for them, a less monotonous and more inspiring and pleasurable experience. From my own teaching practice I know that good cooperation with students and their engagement raise the teacher's professional competence, which, in a feedback loop, conditions professional satisfaction. Contemporary science points to yet another premise for improving the effectiveness of teaching and learning: experience and depth of processing, both of which are crucial for remembering, understanding, and taking an interest in the subject..⁵⁰ Educational engagement, through the addition of images, the transformation of atmosphere, and the flexible following of the teacher's shaping narration by interactive visual content, may become more direct and deeper thanks to multisensory influence. I searched for a way in which the interiors of the school and the classroom might themselves become tools of this influence supporting learning effectiveness as a basis for experience. I concluded that the starting point should be the image and the means of its display. Until relatively recently, the word image was interpreted as meaning an object. We are accustomed to calling an image a physical object hung on a wall, often a valuable artefact or a reproduced or printed exhibit. Graphic expression has always constituted a vehicle for the transmission of diverse kinds of information. The power of the image is undeniable. From prehistoric times human beings have sought methods of preserving and later disseminating images: from engravings in bone and stone, cave painting, and papyri, through the wealth of representations in mosaics, frescoes, drawings, icon painting, easel painting, and printmaking, to more modern forms such as photography, moving images and film, screen printing, animation, digital graphics, and three-dimensional virtual imagery. Today we are capable of creating images in previously unimaginable ways. Since the second half of the twentieth century we have been able to intervene reactively in different properties of the image in real time. In my concept, time is an important factor, because the immersive classroom will evolve visually over time and react actively to users' actions, affective states, and concentration. The transformation of the classroom will have a task-oriented character, which is bound up with the temporary nature of its metamorphoses. In other words, the teaching space may change its appearance and create, over time, a plastic identity proper to the subject under discussion. Education is characterised by a considerable demand for large quantities of visual content. It is impossible to fit onto school walls the full diversity of images - atlases, charts, theorems, formulae, and many other forms of graphic information required by schools. The attempt to select those most necessary for classroom display has always constituted a challenge for teachers and has rarely made students' concentration easier. I myself remember how, during mathematics lessons, I used to look at the faces of Polish kings gazing down from a long row of framed portraits on the wall.

⁵⁰ S.Dehaene, op.cit., rozdział 8, „Głębsze przetwarzania – lepsza nauka”.

This is certainly not a memory of educational engagement.



Figure 17. Visualisation, immersive classroom.

The migration of images into digital media has opened a field for the search for innovative applications. I see here a chance to capture attention and regulate students' concentration. In the case of the interactive classroom, transferring the image to screens or projections makes it possible to present selectively the illustrations required for the topic discussed during a lesson. But not only that: my intention is also to unify the image with the classroom space over time. The classroom is to become a multimedia environment of educational experience, optically transforming the architecture of the interior and endowing it with the character of a specific visually flexible task-based scenography, adapted to a particular lesson, a specific topic, or an individual problem discussed by the teacher. Such scenographies are to be built through projections that reactively follow the teacher's intentions and words, radiating throughout the whole space. Additional support for the interior's influence is to be provided by rotating transparent screens placed along the windows - contemporary atmospheric stained-glass surfaces filtering daylight in order to unify impressions and allowing students to co-create, together with the teacher, the displayed visual content. When switched off, they would not block daylight or the view through the windows. The transparent screens could also easily be detached from sockets mounted in the floor and ceiling, moved, and installed in any other room. Decisions concerning the appearance and range of their influence would be made by the teacher, supported by artificial intelligence if necessary. It is already possible to use a domestic product for this purpose. A language model called PLLuM (Polish Large Language Model) is available - an artificial-intelligence system developed by Polish researchers and capable of operating comprehensively in Polish. There is also an educational version prepared for teachers. The project is led by Wrocław University of Science and Technology.⁵¹

In the second chapter I wrote about the beauty that scientists perceive in theoretical issues, in theorems, formulae, and scientific constructs. It is nevertheless worth noting that many theories are the result of research or the description of natural phenomena. At school we are taught the results of research and theories, whereas many of them are in fact representations of phenomena existing in the world. Yet we still teach on the basis of theory, reversing the order of things. Since science indicates the usefulness of working with images during teaching, I think that such an approach would help create a mental model of the idea and open the student's perceptual apparatus. The scholars of earlier centuries were forced laboriously to describe phenomena and, in order to present them to others, often tried to draw them themselves or had them drawn by artists.⁵² Today we have access to many tools, including three-dimensional simulations, virtual laboratories, films, and photographs. There truly exists a great abundance of material by means of which an atmosphere and a perceptual rhythm can be created for a lesson topic. Even abstract subjects such as mathematics possess representations in nature or in artefacts.

Digital content is, of course, not without reason associated with excess, and it is rightly regarded as a source of sensory overload. I have the impression that we all experience saturation and the intrusive presence of digital noise, particularly in urban spaces. In order to avoid such an effect in the upper-secondary-school project, I considered solutions that might help control the chaos that could arise from virtual projections present in some rooms.

⁵¹ pllum.clarin-pl.eu, https://pllum.clarin-pl.eu/pllum_8x7b, dostęp 31 marca, 2026. „Polska sztuczna inteligencja działa i każdy może z niej korzystać”, 27 luty 2025, <https://pwr.edu.pl/uczelnia/aktualnosci/polska-sztuczna-inteligencja-dziala-i-kazdy-moze-z-niej-korzystac-13635.html>, dostęp 31 marca, 2026.

⁵² „Gessner: Conradi Gesneri medici Tigurini Historiae animalium”, [Nim.nih.gov](https://www.nlm.nih.gov/exhibition/historicalanatomies/gesner_home.html), „Historical Anatomies on the Web”, https://www.nlm.nih.gov/exhibition/historicalanatomies/gesner_home.html, dostęp 1 kwietnia 2026.



Figure 18. Immersive classroom.



Figure 19. Immersive classroom.

Bearing in mind the differing susceptibility of students to overstimulation, I considered various ways of preventing such a risk - for example, using colour only in the space itself while projecting monochrome images. Yet this would run counter to the concept of flexible, multifunctional spaces. At the same time, colour in digital educational presentations may itself carry important information or serve to distinguish it. I also wanted the action of colour to function as a means of identifying the topic under discussion and, to some degree, of enveloping the space for a more immersive reception. Coloured equipment or walls could, however, diminish the educational value of the room, and overlapping effects were not an option. I therefore examined different variants of mixing complementary colours, working within a single colour range, layering colours, eliminating materials with high reflected luminance, reducing the range of the screens or projections, and a series of other solutions. In the end, I concluded that coloured glows passing through the glass partitions into the corridor, and in some cases through matt-glass partitions between rooms, could become a changing visual motif characteristic of the entire school - a distinctive sign marking the mutable boundaries of the classrooms. They could perform two functions: an interactive element improving the school's functional efficiency and a factor helping to organise space.

Following this line of thought, I arrived at the idea of how to balance an excess of stimuli within teaching spaces. Since artificial intelligence is to serve a range of functions, one might entrust generative AI with one further specific - and, it would seem, relatively easy - task. Its role would be the gradated chromatic unification of projected content, the selective reduction of excessive detail, the control of over-fragmentation within the image, and the removal of aberrations, noise, and impurities from the displayed visual utterance. In other words, it would ensure that the projected images and colours, or colour schemes, formed a coherent and unified whole visually without impairing the substantive content. This proposed option of visual-integration control would allow the teacher to use several flexible levels of nuance in the AI's intervention, along with the obvious possibility of switching the unifying function on or off.

I also assume the possibility of reactive control over lighting and its task-based adjustment. This pragmatic solution is meant to give the teacher the option of using a programmed range of possibilities for manipulating the intensity and colour temperature of light according to the subject of the lesson - during a lecture or projection, for example - or according to the type of activity required, such as adaptation to the degree of difficulty or the precision needed for a task performed by students, their level of concentration, and even their mood. Contemporary technology also makes it possible to tune lighting and to adapt classroom interiors to students' emotional states by means of affective computing, a technology already successfully used in psychology, medicine, and in the interiors of facilities intended for space travel.^{53 54}

⁵³ Affective Computing group, MIT Media Lab „Advancing human wellbeing by developing new ways to communicate, understand, and respond to emotion”, <https://www.media.mit.edu/groups/affective-computing/overview/>, dostęp 1 kwietnia 2026.

⁵⁴ R. Tchakerian, R. Morais, S. V. Patel, S.J. Cropper „A study of ambient sensing as a strategy against monotony and boredom in space”, Researchgate.net, 2022, https://www.researchgate.net/publication/361403670_A_study_of_ambient_sensing_as_a_strategy_against_monotony_and_boredom_in_space, dostęp 1 kwietnia 2026.



Figure 20. Immersive classroom, view from the corridor.

3.3.2. School Project Using Artificial Intelligence as an Image-Generation Tool. Exhibition Classroom, Critical Thinking, and Student Autonomy in the Co-Creation of Images

“Why do we make drawings at all - for example on a blackboard or, once upon a time, with a sharpened stick on the wall of a cave? We do so because by re-representing information in another format, we make it more accessible to one or another special-purpose perceptual competence.”

D. C. Dennett ⁵⁵

Images arise autonomously in our minds or reach the retina of the eye from the outside; they leave memory traces and remain specific to each individual. Our imagination is an unlimited generator of images. We are capable of visualising dreams, and we possess an immense library of remembered representations of beings, objects, and artefacts known to us. Even our dreams often carry visual content. Yet many of us have difficulty describing an imagined image in a way that reflects its meaning, detail, or mood. Just as few people are able to sketch, paint, or animate their vision despite rich imagination or even an intense mental representation of what they envision. At the same time, images exert a powerful influence upon us. By means of the image we are able to illustrate even highly suggestive content. In the twenty-first century, visual presentations are extremely common: almost every article, social-media post, event, festival, scientific conference, blog, webinar, or advertising initiative is announced by some form of graphic device. Today we possess tools that enable the creation of images with the help of artificial intelligence. It seems to me that such technologies could level the playing field for persons who lack manual or artistic skills in tasks requiring the attractive presentation or visual supplementation of information. However, to achieve even a basic level of aesthetic quality and digital safety, it is decidedly better when a young person knows how to use such tools.

⁵⁵ D. C. Dennett, „Natura umysłów. Jak zrozumieć świadomość”, rozdz.5, „Wytwarzanie narzędzi do myślenia”, przekł. W. Turopolski, Copernicus Center Press, 2021, epub.

I admit that when I began working on the doctoral dissertation three years ago, I had never before used generative artificial intelligence. I needed to explore the subject both theoretically and practically. I familiarised myself with the scholarly literature and had to verify many pieces of information and confront different viewpoints among researchers and specialists. Artificial intelligence is a completely new phenomenon for humanity. Although we have been researching and developing AI, intermittently, since Alan Turing's famous question, "Can machines think?",⁵⁶ it has only now become available to everyone. In scientific circles and in society it arouses strong and sharply polarised emotions - from extreme enthusiasm to technophobia. The very use of the term artificial intelligence, first employed by John McCarthy in 1956 at the Dartmouth College conference⁵⁷ has generated many semantic controversies. I would like to cite the original definition - the goal of the participants in that conference - because it seems semantically exhaustive to me: "to create a machine capable of learning and adaptation"⁵⁸ Keeping abreast of the subject requires following the development of AI and constantly updating one's knowledge.

I began testing the possibilities of three different generative artificial-intelligence tools in order to understand the technology in the context of image-making: Photoshop's image-generation tool, the online application Midjourney, and Vmake for improving image quality and resolution. I quickly learned that both useful and absurd surprises await the user.

At this point, for the sake of clarity, I should add that throughout the dissertation artificial intelligence was used solely to create hypothetical didactic boards and equally hypothetical student works as screen content visible in the visualisations of the Oława upper secondary school, as well as generated figures of children used as staffage in some visualisations in order to show the architectural proportions of the project.

I asked Photoshop's generative AI to create a black-and-white teaching image. It was supposed to depict a nineteenth-century scientist with a beard and glasses holding, in an outstretched hand, a Petri dish on which Koch's bacilli would be visible. Only the hand and the dish were to be in sharp focus, while the rest of the image, including the scientist himself, was to be blurred. I should add that I issued the instruction in Polish. The artificial intelligence generated an image that followed my guidance in certain respects: it had a dark background and a blurred scientist. However, the scientist's hand was wearing a contemporary latex surgical glove, while on the dish there appeared chopsticks - hashi - and rather unsuccessful variations on the word "love." (I explain that for the name of Koch's bacillus, we use the idiom in Polish „*Pałeczki Kocha*”, it so happens that the word "*Kocha*" also means to love and the word "*Pałeczki*" means stick-like, curved bacteria) Changing the phrase "Koch's sticks" to "Koch's bacilli" worked, but the scientist's hand was still clothed in a different glove each time - there was even a knitted mitten with a single finger. In one attempt I used the phrase "naked hand," which the AI classified as prohibited content, as though the system's filters were banning any trace of nudity. In the end I generated the hand in Midjourney. I realised that AI identifies the meaning of words in a way quite different from that of a human being.

⁵⁶ A. M. Turing „Computing Machinery and Intelligence”. Mind 49, Academicwebsite.com 1950, <https://turing.academicwebsite.com/publications/21-computing-machinery-and-intelligence>, dostęp 1 kwietnia 2026.

⁵⁷ K. Clarkson „AI bez tajemnic. „Sztuczna Inteligencja od podstaw po zaawansowane techniki”, rozdz. 1, „Wstęp do sztucznej inteligencji”, tłum. Ridero, wydawnictwo Ridero IT Publishing, Kraków, 2024 r., epub.

⁵⁸ Ibidem.



Figure 21. Teaching board created with the use of GenAI.



Figure 22. Koch's bacilli, GenAI.

I recount this brief description of my first amateur attempts at generating images with GenAI because I wish thereby to demonstrate the pitfalls awaiting an unprepared user of this technology. The most dangerous of them, in my view, is the uncritical acceptance of content proposed by artificial intelligence - in this case, visual content. I also find dangerous the tendency to anthropomorphise algorithms. Without entering into ontological speculation about whether artificial intelligence is, or may become, an intelligent or even conscious being, I would suggest a method of limited trust. I would treat AI as a relational linguistic entity with great utilitarian potential, but one that requires supervision.

At the same time, I wish to point to the legitimacy of introducing into secondary schools the learning and understanding of tools connected with artificial intelligence, so that students may avoid potential errors and the acquisition of undesirable habits while using these highly advanced technologies.

I should also note that during those first attempts I did not yet know the concept of the prompt, which in relation to GenAI means an input instruction or query given by the user to a language model in order to obtain an interaction; nor did I understand how large language models operate. This and later, more informed experiences with GenAI made me aware that it is worth allowing upper-secondary students to use such tools purposefully and thoughtfully at school, and worth supporting them in this field. This is all the more important because 43 per cent of European adolescents do not reach even a basic level of digital skills..⁵⁹ Generative AI makes it possible to create images, photographs, and films on the basis of users' words - prompts - as well as reference images such as one's own sketches, graphics, or photographs. It does not require computer-science knowledge or coding skills and is relatively easy to use. In my view, it is already becoming one of the tools of the future.

Questions therefore arose: can image generation with the use of artificial intelligence become a useful creative tool within the architectural spaces of the upper secondary school? Can it also possess educational value and influence the quality and effectiveness of learning? In my opinion, these questions may be answered affirmatively.

I will begin by underlining once more the fundamental roles of engagement and experience in the process of absorbing knowledge. I would also stress that the point here is not the creation of art or masterpieces, but rather offering students the possibility of documenting the states of their imagination. To create an image with the help of GenAI, software is needed, but equally indispensable are the idea itself and the creation of a prompt - a textual instruction describing the object or scene to be co-created with GenAI. Writing an effective prompt requires a certain kind of knowledge which, in my view, could be taught at school.

According to specialists, precisely formulated prompts consume less computational power, yield better results, and are processed more quickly by artificial intelligence.⁶⁰ Keith Mansfield, a British writer and publisher associated with scientific literature, advises that when creating an instruction for AI one should use phrases such as "think for a moment before you answer me" or "be accurate," and similar formulations.⁶¹ Such and many other tips would be useful for students.

⁵⁹ „Lagging digital literacy among 14-year-olds across the EU, study finds”, Education.ec.europa.eu, 13 Nov 2024, <https://education.ec.europa.eu/news/lagging-digital-literacy-among-14-year-olds-across-the-eu-study-finds>, dostęp 2 kwietnia 2026.

⁶⁰ J. Berryman, A. Ziegler, „Prompt engineering. Projektowanie aplikacji z wykorzystaniem LLM”, tłum. Piotr Rajca, Wydawnictwo Helion, 2025 r. s 126.

⁶¹ K.Mansfield, „AI sztuczna inteligencja. 50 idei które powinieneś znać”, rozdział „Przełomy, które przyspieszyły AI”, podrozdział 37 „Inżynieria promptów”, przekł. A. Adamczyk-Karwowska, Wydawnictwo Naukowe PWN, 2025 r., epub.

At this point, a further educational potential appears - learning to formulate coherent, logical, transparent, and precise statements. In order to generate images effectively from text, it is necessary to use language skilfully, to choose words purposefully, to express content precisely, and to expand one's vocabulary. To describe an object, for instance, it is necessary to define in detail its shape, colour scheme, structure, material, texture, characteristic features, and degree of complexity. In the case of creating a scene, concentration, visualisation, and the discipline required to translate one's mental image into the language of the image become necessary, which may serve as a good exercise in abstract thinking and imagination. A chance appears here for students to expand their lexical resources actively. It may also become a plane for practising correct expression in foreign languages. In order for artificial intelligence to "understand" instructions properly, the student must avoid ambiguity and vagueness. Any content that remains unclear will be processed by the algorithm in its own way, resulting in random or nonsensical objects appearing in the scene. The more detailed the instructions students provide, the less room the algorithm will have for improvisation or hallucination.

Learning to communicate with artificial intelligence may prove indispensable in the near future, for example in professional life. In my view, such learning may also contribute to improving the ways in which students communicate within society. Moreover, enabling students to enrich their verbal or written statements by adding an image to them could be useful for those who do not possess artistic skills or manual dexterity. A task that supplements an educational project with a visual element co-created with AI could contribute not only to improving the hygiene of the native language but could also be used by teachers of foreign languages as a means of motivating and engaging students.

I also consider it important to make students aware of some troubling features of AI, especially those connected with publicly accessible AI generators. Among the significant potential dangers, I would mention the risk of plagiarism, violations of privacy and user data, infringements of copyright, disinformation, bias, and hallucinations on the part of artificial intelligence. Fortunately, methods already exist - and are being intensively developed - to prevent many inconveniences and risky “behaviours” of AI. An example would be HHH solutions, from helpfulness, honesty, harmlessness. In simplified terms, HHH alignment consists in the control - even censorship - of one artificial-intelligence agent by another artificial-intelligence agent.⁶²

Making young people aware of the existence of various dangers together with possible countermeasures may possess substantial educational value and seems to me highly desirable in itself.

Designing interiors that make it possible to create large-format aesthetic visual content seems to me a good way of compensating for a deficit in the upper-secondary curriculum, namely the neglect of subjects related to the culture of the image. In my view, the lack of interest shown by general upper secondary education in aesthetics constitutes a failure to fulfil the promise of a comprehensive education implied by the very name general upper secondary school. Teaching the critical use of GenAI in order to achieve good-quality results, to obtain visual material of a satisfactory standard, and to ensure the adequacy and conformity of that material with the instructions given by students could broaden the range of students’ skills and competencies, while also supporting learning effectiveness in various subjects. All that would be needed is appropriate classroom equipment in the form of mobile vertical screens enabling the creation, correction, movement, transfer, joining, or isolation of individual contents, as well as their display.

⁶² A. Askill, i 22 inn., „A General Language Assistant as a Laboratory for Alignment”, Reseachgate.net, Grudzień 2021, DOI: 10.48550/arXiv.2112.00861, https://www.researchgate.net/publication/356746860_A_General_Language_Assistant_as_a_Laboratory_for_Alignment, s. 44, dostęp 2 kwietnia 2026.

The Exhibition Classroom, contrary to the provisional name I have given it, is also a multifunctional space. It is an interior prepared for the comprehensive execution of group tasks such as the following:

What will the world - life on Earth - look like in fifty years?*

Seek an answer in the context of scientific, environmental, philosophical, social, political, or other problems with which, in your view, contemporary human beings and their environment are struggling. Students divide themselves into several groups. The members of each team choose and describe the problems they would like to address. After stages of research, discussion, brainstorming, and analysis, they organise the collected material and describe it in order to create an accessible presentation - a scientific lecture for students from other teams. Together they choose imagined images that best characterise the topics of the presentation. They formulate prompts for GenAI and begin generating visualisations illustrating the potential consequences for the distant future.

Such a multi-stage task would require students to examine facts, understand possible dangers or benefits, engage interdisciplinarily, and eventually use various means of expression in order to show their reflections to their peers. The very act of presenting the results of their work before fellow students and teachers would become an additional incentive.

Sharing with peers the scientific knowledge that forms the starting point of the task corresponds to the method of learning by teaching, enhancing educational performance through adolescents' social engagement. I referred to this method already in the second chapter when describing the conflict between learning and social distraction in adolescence.

In the visualisations of the Exhibition Classroom, I present three speculative visions of the future created by hypothetical students in cooperation with GenAI:

1. a vision of a world without oxygen, inhabited exclusively by anaerobic organisms;
2. a vision in which, on a desertified Earth, people must fight for every drop of water;
3. a vision in which almost the whole planet has been engulfed by water as a result of rising ocean levels and humanity struggles to adapt to new conditions.



Figure 23. Visualisation, Exhibition Classroom, vision 1: a world without oxygen.



Figure 24. Visualisation, Exhibition Classroom, vision 2: desertification.



Figure 25. Visualisation, Exhibition Classroom, vision 3: global flood.

Naturally, the classroom project described here is only one example in which imagination is to be stimulated and the issue of prospectivity and possible future consequences arising from the actions of contemporary human beings is to be addressed. In 1930, John Dewey emphasised the fact that in the traditional school students do not identify with the problems under discussion.⁶³

The identification highlighted by Dewey is crucial for effective learning. In his view, dealing with themes that have counterparts in reality and concern genuinely existing problems strengthens students' engagement. The creative classroom is intended to be a space enabling the independent activity of students, their deeper interest, and their own development of a topic.

In the situation outlined by the example task, students are encouraged to look methodically into the future, to ask questions of the kind: what will happen if...? Offering adolescents even partial independence in performing tasks also actively increases learning effectiveness. An additional aim is the learning and practice of generative artificial intelligence as the newest tool of visual creation. I have the impression that the role of generative AI in our activities is often demonised. Its flaws and potential dangers are emphasised. I agree that generative AI tools are imperfect and not fully stable. Yet it seems to me that this is all the more reason to educate and train children and young people in the knowledge and creative use of these tools, rather than to avert our eyes from them and leave children without adult support.

The fact that young people treat the possibility of using contemporary technologies and tools as part of their natural environment, as I mentioned earlier, is nothing new. The use of tools, like the ability to create and store information, belongs to the human condition. Daniel C. Dennett writes in *Kinds of Minds*:

*"...the habit of off-loading onto the environment as many cognitive tasks as possible - of 'exporting' our minds (that is, our mental enterprises and activities) into the surroundings, where a whole array of peripheral devices we construct can store, process, and re-represent the sense of what we are doing, thereby improving and safeguarding the transformational processes that constitute our thinking. This widespread tactic of off-loading frees us from the limitations of our animal brains."*⁶⁴

⁶³ John Dewey, op.cit., s. 183

⁶⁴ D. C. Dennett, op.cit.



Figure 26. Visualisation, Exhibition Classroom.

3.4. TEXT, LANGUAGE, AND THE FOLLOW-ME BOOK - READING AS AN EDUCATIONAL *SPIRITUS MOVENS*. THE ACTIVE DISSEMINATION OF LITERATURE AND ITS COMMUNICATIVE AND COGNITIVE BENEFITS IN THE STUDENT ENVIRONMENT

Reading books teaches, supports learning effectiveness, and stimulates the imagination. It makes it possible to immerse oneself in literary realities and initiates, in the reader's mind, an exploration of new worlds and ideas. This phenomenon takes place through the use of one ancient medium - written language and the ability to decode symbolic signs, namely letters. It cannot be ruled out that we are the only species in the universe that communicates through this quiet method, which makes it possible to preserve and transmit information over time. In my view, nothing can replace the reader's relationship with the author and the author's thought. The experience of encountering the written word is developmental and unique in kind; at times it also brings an exceedingly valuable effect - the crossing of the limits of the reader's conceptual apparatus.

Unfortunately, reading as a form of activity among Poles remains at the level of 41 per cent. At first glance that might seem quite a lot, but research published in March 2025 shows that only part of that figure concerns the reading of books. Moreover, in villages and small towns with up to 20,000 inhabitants, the result falls to 36 per cent. Oława - the town in which the upper secondary school is located - is considered, according to these criteria, a small town, with a population slightly above 15,000.⁶⁵

From the perspective of designing educational spaces, the question that interests me is whether literary text can become an important complement to the school's interior architecture. Is it possible to disseminate reading through the use of electronic devices that belong to the everyday toolset of contemporary upper-secondary students? In urban spaces, at bus stops, in waiting rooms, shops, and elsewhere, we often read written or electronic advertisements, posters, or leaflets even when they do not interest us. One might venture the thesis that the written word exerts a pull. Bearing in mind that adolescents are so important to one another, I searched for a way in which the school space might promote reading by turning it into a prosocial activity. I asked myself whether reading might be given a communicative function in school - for example, through the sharing of literature and communal reading.

Reading is a cognitive activity and, in itself, an individual one. Yet its social value is evident. It may prompt conversation or discussion, the sharing of impressions or reflections after reading a book. This means that an added value to the pleasure of reading may be the emergence of a platform for conversation with another reader.

⁶⁵ „Stan Czytelnictwa Książek w Polsce 2024”, Bn.org.pl, 14.04.2025, <https://www.bn.org.pl/aktualnosci/5611-stan-czytelnictwa-ksiazek-w-polsce-w-2024-roku.html>, dostęp 3 kwietnia 2026.

The problem is that a book put back on the shelf - even one left unfinished - is often forgotten. But perhaps it could be otherwise, for example if a book could move together with students and accompany them.

I conceived of follow-me books: mobile medium-format display devices placed in different parts of the school. These devices would continually display previously selected passages from various books. The intention would be to intrigue the student through a fragment and awaken curiosity. It seems to me that an impulse of this kind might motivate further reading. I looked at the idea through the prism of the everyday tools of the upper-secondary generation. Several pages of any literary work displayed on a specially prepared reading screen, for example in the school library, could be continued in any other place in the school. The book would move together with the student and would appear without the need to activate portable devices; it could remind the student of itself discreetly. The book would therefore make it possible to check whether someone else is reading or has read it, to send another person a short excerpt as encouragement, or to convey a dedication to another student with whom one would like to establish contact or conversation. It could become a good pretext for beginning or deepening an acquaintance. The large format of the follow-me book would also allow a certain variation: simultaneous reading and the exchange of impressions. One could ask a wider group of students whether they might recommend another work by a given author or a book dealing with similar topics. If the book were written by a foreign-language author, one could request the original version of the fragment that interested them. All such requests or commands would be carried out by an artificial-intelligence-managed library system integrated with the school system.

Reading from a luminous screen may cause fatigue and thereby lead to discouragement from reading itself. I still remember the euphoria connected with purchasing my first e-book reader equipped with e-ink technology - virtual paper.⁶⁶ The possibility of travelling with a large number of books in one's pocket impresses no one today, but e-ink technology, combined with the possibility of adding one's own annotations, truly was a breakthrough from the point of view of reading comfort. It enables reading anywhere, regardless of lighting conditions, without reflections or glare, and it is safe for the organ of sight.⁶⁷

⁶⁶ „How it works”, E Ink.com, https://www.eink.com/tech/detail/How_it_works, dostęp 3 kwietnia 2026.

⁶⁷ K. Yuan, H. Zhu, Y. Mou, Y. Wu, J. He, X. Huang, X. Jin, „Effects on the Ocular Surface from Reading on Different Smartphone Screens: A Prospective Randomized Controlled Study”, *National Library of Medicine, National Centre for Biotechnology*, 2021, <https://pmc.ncbi.nlm.nih.gov/articles/PMC8212737/>, dostęp 3 kwietnia 2026.

The advantages of virtual paper are, in my opinion, obvious. It resembles real paper and print very closely - those remarkable achievements of humankind. The key advantage of this solution lies in the possibility of flexibly adjusting the contrast and legibility of the text to the reader's individual preferences and to the lighting conditions of the room. The reduction of visual fatigue during prolonged reading, already mentioned above, is in itself a value encouraging the act of reading. Until recently, however, digital paper was available only in devices roughly the size of tablets. Today it is also available in large-format screens.⁶⁸

The screen of the mobile book would itself be mobile, attached to a wheeled base, and could therefore easily be moved if necessary. No cables would need to trail behind it, because e-ink screens are characterised by low energy demand despite high resolution and the ability to display 4,096 colours. One could therefore use wireless and safe battery charging based on another new technology, for example Wi-Charge, relying on directed infrared beams emitted by small devices mounted in the space, for instance on the ceiling.⁶⁹

The concept of the project is intended to encourage students to remain at school not only during lessons but also after them: to take part in courses, to learn, to develop, and to make use of intelligent spatial solutions such as the follow-me books. Comfortable, personalised reading volumes are meant to make the reading of literature not only a pleasant habit, but also a way of creating a community of literary and intellectual exchange among students.

⁶⁸ „Samsung 75" Color E Ink Displays and 32" at ISE 2025: 1-Second Update vs. High-Color Spectra 6", Youtube.co., 09.02.2025, <https://www.youtube.com/watch?v=1zHJCGDfX8o>, dostęp 3 kwietnia 2026.

⁶⁹ Wi-charge.com, <https://www.wi-charge.com/aircord-technology>, dostęp 3 kwietnia 2026.



Figure 27. Visualisation, follow-me book.

A further aspect that arises in organising architectural space for reading is time. I mean here the time during which reading takes place. As is well known, reading can last for a considerable period, while the reader's subjective awareness of time, especially when absorbed in a book, may be entirely different. The follow-me-book application would be linked to the main school system; it would know the timetable and might notify the student that, for example, a class begins in ten minutes.

The creation of favourable conditions for reading should take ergonomic considerations into account, and spaces adapted to this purpose should be dedicated to it. The book is a large object that might otherwise obstruct or inconvenience other users and contribute to the cluttering of space. For that reason, reading zones would be linked both to the possibility of wirelessly charging the book and to the comfort of sitting. Students themselves would be drawn towards these specific places marked by a book icon. They would have a choice and could therefore develop their own preferences. In the book zones, located in different parts of the school, upholstered sofas with one- or two-directional backrests would be placed for communal reading, along with acoustically hushed reading armchairs to which the book could be wheeled. These measures would limit the places in which one can read to those in which one can sit comfortably; they would also initialise the automatic loading of the page at which the student last interrupted reading and the automatic charging of the device. The book, like the tablets mentioned earlier, would recognise the user, remember and load individual settings and selected fonts, font size, personal bookmarks, notes and references to the text, highlights, sharing histories, and underlined passages to which the student wished to return. In my view, a traditional yet at the same time modern library should also be present within the school. For this reason, I also included such a space within the design study. Some people still prefer paper books.



Figure 28. Visualisation, library.

3.5. MUSIC AND SOUND ZONES - FOR SONIC COGNITION, THE SHARING OF MUSIC, AND LISTENING TOGETHER

Johann Wolfgang von Goethe once described architecture as “frozen music” (die Baukunst eine erstarrte Musik).⁷⁰ Many years later an anonymous author inverted this beautiful metaphor and formulated the sentence: “Music is liquid architecture.” The metaphor makes sense, all the more so because each of these two fields of human creativity has its own language; both are connected with mathematics; and in both, the works created by musicians and those constructed by architects represent a scale embracing the whole human body. The world of sounds forms the acoustic background of reality: it surrounds us at every moment and in every situation. There is no unequivocally established moment at which humankind began to make music. We do know that the oldest discovered musical instruments - simple flutes made of animal bone - are at least thirty-two thousand years old.⁷¹ Hearing is a highly sensitive sense, the capacity to detect changes in air pressure caused by acoustic waves of varying frequency reaching the ear. It requires a complex and delicate mechanism for encoding sensory modality.⁷² The sound surrounding us is so factual and so obvious that at times we barely notice it. In urban spaces we have learned not to hear it.

We all experience music as well. It has been with us since prehistory and is present in every culture, yet upper-secondary education largely ignores it. Teenagers readily listen to music, but they do not learn music or learn about music. The upper-secondary curriculum defines a framework of compulsory subjects among which music does not appear. The group of optional subjects - from which the school head chooses one - includes philosophy, visual arts, music, Latin, and classical culture. One additional subject is then taught for one hour per week. The deficit of subjects promoting culture is therefore conspicuous.

What we hear is one of the most diverse and immersive states of sensation. We may ignore visual objects, fail to notice them, or simply turn our eyes away from them. Sound cannot be touched and seems immaterial, yet when it is sufficiently loud it cannot be ignored: acoustic waves tightly fill the space and become part of our bodily experience. At the same time, our level of knowledge about sound and music - here I am speaking of European societies - appears unfortunately rather low.⁷³

⁷⁰ J.P. Eckermann, „Gespräche mit Goethe”, Insel Verlag, 1981, <https://www.projekt-gutenberg.org/eckerman/gesprache/gsp2026.html>, dostęp 4 kwietnia 2026.

⁷¹ C. Drösser „Muzyka... daj się uwieść”, przeł. D. Serwotka, Wydawnictwo Naukowe PWN, 2021, s. 28.

⁷² S. Nolen-Hoeksema, op. cit., s. 130-137.

⁷³ One possible reason for this disturbing fact may be cross-cultural differences in the sound articulation of speech. For example, when we speak in Poland, the frequency of our voice does not change; what matters is the tone of the sound, which allows us to distinguish individual sounds. The situation is different in many Asian languages. The same spoken word can have several different meanings, depending on the pitch of the sound used,” points out. Drösser, (C. Drösser „Muzyka... daj się uwieść”, przekł. D. Serwotka, Wydawnictwo Naukowe PWN, 2021, s.43).



Figure 29. Visualisation, music and sound zones.

In 2007, researchers at Stanford University School of Medicine made an interesting discovery. They observed that while participants listened to Baroque music composed in several sections, they displayed distinctly focused and fluid attention during the musical sequence, but lost concentration immediately during the brief pauses of a few seconds between sections. It turned out, moreover, that the brains of all participants worked in an identical, synchronised manner. The scientists concluded that listening to music supports the brain's ability to process situations that will occur in time.⁷⁴ This confirms earlier work by the psychologist of music David Huron, according to whom music trains the brain in situations in which we imagine or predict coming tones and then have to face the fact that the sounds arriving do not correspond to those expectations - thus learning to experience surprise in a safe way.⁷⁵

Research conducted by the National Centre for Culture in 2021 showed that only around 4 per cent of adolescents listen to classical music. I suspect that a considerable proportion of young people have very few opportunities to listen to, talk about, or understand the context in which musical works from different epochs and different cultural spaces were created. The situation is worsened by the existence of marketing music and by the fact that children and young people may fall victim to algorithmic selection in online environments and music distribution services. Without the ability to choose critically what they wish to hear, they may be targeted automatically.⁷⁶ This may narrow their musical horizons to random content or content similar to what they have already selected before.

A music library could constitute a valuable resource. I have in mind selected collections of music revealing the richness and complexity of the musical multiverse - an educational phonotheque, a polyphony of human artistry, condition, and sensitivity.

I believe that a space dedicated to music would help deepen perception and teach adolescents how to listen attentively. It might also contain catalogues of sounds and noises together with on-demand information about them. The audio spheres are intended to be relatively quiet places. Apart from acoustic booths where one can listen to music loudly, headphones are necessary. For people who like to jump, dance, or move while listening to music, wireless headphones would be available; for students who listen more quietly, it would be possible to connect headphones to dedicated stations or seats. As in the case of the follow-me book, the system would be operated through a tablet or through Bluetooth and voice recognition. After verification, a student could ask for a work to be saved in their notebook, invite someone to listen together, send the piece to another person, or recommend a composer or performer. Several people could listen to the same composition at the same time. Naturally, the headphones would need to be equipped with microphones in order to allow communication with the sound library and the issuing of voice commands or questions. Spaces for the interactive sharing and experiencing of music could become a relaxing and cognitively valuable way of integration and of spending free time at school, not only for adolescent music lovers.

⁷⁴ Med.Stanford.edu, <https://med.stanford.edu/news/all-news/2007/07/music-moves-brain-to-pay-attention-stanford-study-finds.html>, Dostęp 4 kwietnia 2026.

⁷⁵ C. Drösser, op. cit., s. 200.

⁷⁶ S. Trzciński, „Zarażeni dźwiękiem, rynek muzyczny w czasach sztucznej inteligencji”, Wydawnictwo Naukowe PWN, 2023, rozdział 4, epub.



Figure 30. Visualisation, music and sound zones.

3.6. GLOBLAB - AN INTERDISCIPLINARY GLOBAL LABORATORY

The Global Laboratory is an unusual educational space. It is a room that might be called an encyclopaedia of almost all fields. Unlike typical digital encyclopaedias, however, it enables the independent association of facts and information from an interdisciplinary perspective. In addition, all the information contained within it is situated in concrete places - insofar as such places exist and are known to science. These locations may be found on Earth, under water, inside glaciers, underground, in the atmosphere, or in orbit; in fact, almost anywhere - even in the most extreme environments of our planet, but also on planets and moons within the Solar System and in more distant outer space.

I think that learning conceived in this way would make it easier for students to understand phenomena, render many of them more visible, and enable the discovery of links among different contexts previously known only in fragmentary form as separate topics associated with different school subjects. The possibility of seeing the extent of different ecosystems or of the seafloor topography together with deep-sea species in the Pacific, or the movements of the armies led by Mehmed II during the siege of Constantinople in 1453, would allow information on interactive maps, images, and texts to reveal to students the scale and proportions of phenomena, events, tendencies, distributions, population densities, forecasts, and many other questions from fields discussed at school. It would also allow them to explore and develop their own interests.

I believe that the inverted globe would help students make associations - to "connect the dots" (which, in this solution, is literally possible) - and to perceive relations among issues thanks to the possibility of operating flexibly with perspective from the micro-scale to the macro-scale. I also believe it would help establish a hierarchy of significance among facts or issues within the theme being studied.

Here I refer to an understanding of the term holism which, in my view, is extraordinarily important in education. Holism is the opposite of educational reductionism - a narrow, fragmentary educational method with subjects and problems separated from one another, rooted in the neoliberalism already mentioned in Chapter II. I refer once more to the term general upper secondary school, which should not denote the teaching of generalised or superficial knowledge. On the contrary, I repeat after the philosopher Jan Christiaan Smuts, who introduced the notion of holism into scientific discourse in 1926, that the whole is something more than the sum of its parts; and the synthesis of those parts determines how they relate to, and function within, the whole. In *Holism and Evolution*, Smuts defended holism as an open way of thinking about phenomena in which, even while carrying out scientific analysis of constituent parts, one does not lose perception of broader connections, including conceptual and mental ones.⁷⁷ The interdisciplinary laboratory Globlab is an object that represents this idea well. I treat holism as a very universal concept, one that finds application not only in science and education, but also in design.

⁷⁷ J. C. Smuts, „Holism and Evolution”, MacMillan and CO., limited St. Martin's street, London, 1927, s.88.



Figure 31. Visualisation, interdisciplinary global laboratory.



Figure 32. Visualisation, interdisciplinary global laboratory.

I would also like to emphasise that in this example I employ digital technology as one of the tools for restoring a more humanistic face to education. This may seem internally contradictory as a rhetorical figure, yet in my intention it constitutes precisely a holistic gesture. Artificial intelligence is certainly better suited to tasks involving the ordering of extensive and complex structures and the finding of connections within very large quantities of data. Once again I stress that Globlab is meant to raise learning effectiveness and to offer students an intuitive and understandable journey between smaller contexts and broad thematic planes. It would also help reveal networks of interdisciplinary links. The operation of the elements of the classroom-laboratory would be simple and would rely on already existing technological solutions familiar to young people, such as voice commands, gesture control, and high-resolution projection. What would be required is the gathering of a relatively extensive and educationally appropriate database. The central element of this space is a hemispherical niche in the wall into which one can step. There a concave globe is projected. The interface of the projection application contains options for choosing different fields. It can be called up by means of a two-handed gesture resembling a broad clap or by a voice command. The selection bar is a semi-transparent digital band fitted to the inner shape of the niche. It is operated by a hand movement to the right or left. After a topic or issue has been selected, the bar displays expansions, information, QR codes, and may also serve as a notebook. It can be switched off by a gesture opposite to the clap. If the student does not know how to find the problem of interest in the default categories, they may simply ask a contextual question.



Figure 33. Graphic, navigation bar of the interdisciplinary global laboratory.

The concave globe is a form primarily dedicated to planets, stars, moons, and any other spherical forms such as black holes, cosmic binary systems, ball lightning, organic and geological structures, skylscapes, or galaxies. Naturally, most information would concern Earth itself. The globe might also be used for other purposes, such as creating a map of the brain, gaining insight into the topology of organic, inanimate, or human-made structures, or even functioning as a field for dexterity games. Manipulating the projected globe itself would also be possible through intuitive gesture control and voice commands, for example “show the North Pole” or “rotate by twenty degrees to the south-west.”

I chose this form because it permits large-format exploration with the possibility of magnification and easy movement in every direction, as well as the convenient participation of several students at once. Users may feel themselves to be part of the projection, because the display of colours and content activates their minds while also visually marking their bodies. I designed the installation at a scale appropriate to the human body so that students may discover and investigate, dictate notes, mark, and connect important points on the globe in a flexible way, all in human scale. Interaction requires conscious and purposeful movement on the part of students, and its construction is partly immersive: it is meant to absorb students, but in an open way that does not sever their contact with reality. The solution may be helpful in deepening engagement with the subject and, consequently, in enabling more effective learning. On a screen located near the concave globe there is, by default, a magnified fragment of the map with which the students inside the niche are currently working. It is, however, a separate station with a three-part touch table at which other tasks may be performed, or information and notes from the globe session stored in the cloud may be arranged and refined.

It seems to me that this concept, as a specific educational perspective, would not only improve learning effectiveness through engagement, but might also simply arouse curiosity and perhaps prompt reflection. I chose the concave form for the globe deliberately: apart from its already mentioned immersive and integrative features, concavity does not limit the visibility of elements over the full span of the projected surface and enables projections covering the entire range of the inner curvature without aberration or stretching. The classic convex globe would require the installation of advanced equipment for rear projection inside the globe. Yet an even greater inconvenience would arise from the peripheral limitation of visibility - content disappearing towards the poles beyond the rounded horizon - as well as the fact that users would lose sight of one another beyond that horizon. The installation would lose its value as a device for integration and direct cooperation among students, or among students and teachers, and would in addition become relatively very large. For these reasons, a recessed globe appears more optimal for the integrated didactic purpose, while also expanding the interior architecture by a niche into which one can step and work together.

In design, every enlargement of one separated area occurs at the cost of reducing adjacent space. The concave globe is a large object; for this reason, I decided to use the convex outer side of its rear surface as part of another installation in the neighbouring relaxation room.



Figure 34. Interdisciplinary global laboratory, view from the corridor.

3.7. HAPTIC WALLS - INTERACTIVE HAPTIC EXPERIENCE OF FOCUS, RELAXATION, CONCENTRATION, AND ATTENTION

“All knowledge unfolds within horizons opened by perception,” writes Maurice Merleau-Ponty in Phenomenology of Perception ⁷⁸.

I remember the discomfort and feeling of confinement during lessons at primary school and later at upper secondary school. I was probably fidgeting, because I can still recall the reproachful glances of teachers. I also remember children who, in some way incomprehensible to me, had mastered complete stillness during lessons, although they did not in fact learn very well. Perhaps it was simply tactical stillness.⁷⁹

It seems that the school stress mentioned earlier may intensify the feeling of discomfort and tension all the more. The situation becomes worst when the educational setting adds to this the requirement to sit still and silent in a forced position for forty-five minutes. In my conviction, such perceptual restriction is a restriction of experience leading towards effective learning. Yet prolonged desk work is often unavoidable at the upper-secondary stage. A deficit of tactile cognition may therefore arise. I think that a wall offering massage might compensate the body for the enforced discomfort.

The word haptics derives from the Greek haptesthai, meaning touch or contact.⁸⁰ The etymology points to the elemental feature of haptics: interaction. We experience the sense of touch constantly - by touching objects and, for example, the floor while standing, a chair while sitting, or the bed and bedding while lying down. In this very direct and comprehensive manner we communicate with the world surrounding us. We do not have to learn this communication; our brain teaches it to us instinctively and below the level of consciousness. We rarely realise that certain activities - for example long hours bent over books - may lead to deprivation of the sense of touch. Intellectual effort produces a kind of fatigue that does not concern muscles and differs entirely from work or any form of physical activity. Some individuals, especially children, compensate for a deficit of touch and movement by fidgeting, tapping a pen on the desk, and similar behaviours. Yet even the furniture I selected - which requires balance control or allows different ways of sitting, offering a little movement together with proper upright posture - provides only limited tactile sensations.

Haptics accompanies the human embryo already in the first weeks after conception. For many centuries, however, science ignored the tactile sense. Only now are we beginning to study this human capacity more precisely, made possible by receptors specialised for different tasks and distributed over almost the whole body. The impact of haptic and tactile stimuli significantly affects human cognitive abilities and development up to the age of twenty-four. Haptic sensitivity is an individual feature of every person, yet the perception of touch functions in a similar way in almost all organisms ⁸¹

⁷⁸ M. Merleau – Ponty w „Fenomenologia percepcji”, M. Kowalska, J. Migasiński, wydawnictwo Fundacja Aletheia , Warszawa 2001 rok, str.227.

⁷⁹ The term refers to the ability of some animals to freeze, for example in the face of danger, and go into a state of tanatosis – tonic immobility, own note.

⁸⁰ Oxfordreference.com, <https://www.oxfordreference.com/display/10.1093/acref/9780199569922.001.0001/acref-9780199569922-e-1853>, dostęp 14 kwietnia 2026

⁸¹ M. Grunwald, „Homo hapticus” rozdział 1., Wydawnictwo Uniwersytetu Jagiellońskiego 2019, epub.



Figure 35. Visualisation, haptic walls.



Figure 36. Visualisation, haptic walls, view from the corridor.

The haptic walls are meant to massage, improve well-being, stimulate blood circulation, calm users, and compensate the need for touch on different levels. The wall generates tactile sensations in the user. The interaction consists in the fact that stronger pressure on the wall produces stronger vibration. In other words, the more firmly a student leans against the wall, presses it with the hand, or applies another part of the body to it, the stronger the tactile stimuli received in response. This gradation of stimulation intensity would allow students to adapt the experience to individual needs, from barely perceptible sensations to stronger ones. It is a highly intuitive solution, because the feedback between pressure and sensory feeling forms part of our everyday experience of touch.

For the outer layer of the haptic wall, I proposed a fabric reminiscent of fur, with soft antibacterial fibres enabling easy cleaning. Even the gentle brushing of the hand against the wall-installation is intended to produce a pleasant tactile sensation. Naturally, the haptic wall must be prepared in accordance with safety norms and an appropriate specification concerning numerous parameters, including the two most important: maximum force measured in newtons and vibration dynamics measured in hertz.⁸²

Awareness of one's own body is important for the young person's general functioning and - what is of fundamental significance in the context of this upper-secondary-school project - it influences the development of cognitive functions. Massage builds and supports such awareness. Multisensory stimulation is used in various fields, and many studies confirm the legitimacy of using haptic stimulation in the therapy of disturbances in body perception.

I have no basis for claiming that adolescents possess a weak sense of embodiment. Nevertheless, support for bodily awareness in the form of massage may prove useful. This awareness is also linked to the capacities of the human cognitive apparatus. It is worth remembering that a subjective discrepancy in the perception of one's own body may lead to serious mental and physical health consequences, including extremely dangerous eating disorders.⁸³

⁸² T. A. Kern, „Engineering Haptic Devices 3rd ed. 2023”, Chapter 5, „Identification of Requirements” J. Reisinger, T. A. Kern, C. Hatzfeld, Springer 2023, s 153.

⁸³ M. Górski, R. Polaniak, B. Całyniuk, J. Garbicz-Kata, M. Buczkowska, J. Fojcik, J. Nowak, J. Domagalska, „Anorexia nervosa—the frequency of occurrence in Polish youth, the connection with stress, auto-aggressive behaviors and the abuse of psychoactive substances”, *Frontiersin.ogr.*, 25.05.2025, <https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2025.1574136/full> , Dostęp 4 kwietnia 2026.

3.8. CREATIVE HUB - GRAFFITI AND OTHER FORMS OF VISUAL EXPRESSION AVAILABLE TO STUDENTS

The influence of creative training on the neuroplasticity of the brain, on the activation of connections in the frontal circuits responsible for cognitive abilities and for enhancing learning effectiveness, and on the strengthening of emotional and sensory capacities, has been scientifically confirmed.⁸⁴

I asked myself whether, if adolescents were given the chance to express their thoughts and emotions autonomously at school, they might transpose their inner representations into creative expression and make use of such an opportunity. As I mentioned earlier, art as a subject is not available in most upper-secondary schools.

It seems to me that making available a place with a wide variety of tools for different artistic techniques could constitute an invitation - or a challenge - to experiment and seize an opportunity. Public spaces are full of inscriptions, images, confessions, expressions of support or rebellion, and, finally, graffiti. Naturally, some of these contents are vulgar or are simply acts of vandalism.

But only some of them. For a long time, I have been observing street inscriptions on walls. I am also aware that they may be the result of a single adrenaline-fuelled act. Yet many of them look sincere and highly deliberate; they seem to be messages that could not be expressed in any other way. Such actions are illegal and may even lead their creators to prison for several years.⁸⁵ Why, then, do they take such a risk? Probably because they seek recognition, satisfy an instinctive need to express themselves, to participate in a social group, to display a worldview, or perhaps simply to show themselves to the world or impress someone, even under the cover of a pseudonym. All these needs are characteristic of adolescents. Banksy points to yet another motivation:

*“Graffiti does not always destroy buildings. In fact, it is the only way to improve many of them. In a few hours, with a few hundred spray cans, we can, I hope, transform a dark, forgotten, dingy hole into an oasis of beautiful art - in that same dark, forgotten, dingy hole.”*⁸⁶

⁸⁴ C. E. Strang, „Art therapy and neuroscience: evidence, limits, and myths”, *Frontiers in Psychology*, 02.11.2024 (<https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2024.1484481/full>), dostęp 4 kwietnia 2026.

⁸⁵ R. Jarzab, „Dla jednych to sztuka, dla innych zwykły wandalizm... 19-letni 'artysta' odpowie z pewnością za to drugie!”, *Wrocław. Policja.gov.pl*, 29.01.2025, <https://wroclaw.policja.gov.pl/dwr/aktualnosci/bieza/137095,Dla-jednych-to-sztuka-dla-innych-zwykly-wandalizm-19-letni-quotartystaquot-odpow.html>, dostęp 4 kwietnia 2026.

⁸⁶ P. Poter, „Banksy”, E. Gorzadek, przekł. A. Krasoń, *Arkady* 2018, strony nienumerowane.



Figure 37. Visualisation, creative hub, exterior view.

Adolescence demands autonomy; it looks for circumstances enabling authorial expression. Adults too are by no means strangers to similar desires. Different kinds of content of this sort have been placed by people of various cultures throughout the centuries, from antiquity onward, in the form of epigraphs and drawings. The very term *graffiti* was coined in the nineteenth century to describe inscriptions of an official character discovered in excavations at Pompeii. Yet there are many examples of informal ancient carvings of this kind in different parts of the world.⁸⁷ Contemporary unofficial graffiti in urban space usually does not last long; it is simply painted over. Once transferred into social media, however, it also loses any kind of control. As I mentioned earlier, peer relationships are especially important for adolescents, and relationships require communication. Yet not every maturing young person finds it easy to externalise themselves or engage in direct contact with peers. We are a species equipped with many modalities enabling interpersonal communication. Through images, non-verbal messages may arise, rich among other things in semantic resources. Psychologists use drawings made by children and by adults who do not speak in order to better understand the mental states of their patients.

Clinical research has demonstrated a correlation between the practice of mindfulness and art therapy, indicating important aspects of stress and fatigue reduction during activities such as drawing or writing. The Hub is intended as an unembarrassing and partly secluded place for expression in any format and colour, with the possibility of choosing diverse backgrounds and painting, drawing, and writing tools, as well as signs and symbols. It should permit both broad and expansive gestures and quiet, intimate testing of colours, textures, and even the consistencies of selected paints, brushes, sprays, crayons, pencils, and markers. One can experiment without limitation and without fear that something will “go wrong.” If the student is satisfied with the result, it may be saved, exhibited, sent to someone, or not - according to preference.

I wanted the space to be constructed as an open, roofless enclave enclosed by matt glass with rounded shapes and entered through one broad opening. On three of its four walls I placed connected screens making it possible either to choose ready-made dimensions or to trace the shape on which the student would like to work. Inside there are ergonomic stools with adjustable height and small tables with pens - digital brushes used for more precise work on detail - as well as broader brushes, spatulas, and markers.

⁸⁷ Edycja: . C.Ragazzoli, Ö.Harmanşah,C. Salvador, E. Frood „Scribbling through History Graffiti, Places and People from Antiquity to Modernity”, Bloomsbury Publishing, London, 2018, s.102.



Figure 38. Visualisation, creative hub, interior view. "Monika, can we talk?"



Figure 39. Visualisation, creative hub.

Art has accompanied us since prehistory. It is an integral part of humanity. Denis Dutton writes of the art instinct as an evolved, chaotic combination of skills, impulses, and pleasures. According to him, this particular synthesis can be neither immaculate nor fully rational.⁸⁸

The Creative Hub is not intended to be a classroom in which imposed art content is taught, although it can of course also be used as a workshop or laboratory for school projects. Here there is no requirement of rationality or perfection. One may act and experience intuitively, in search of personal, subjective aesthetic values, or simply give expression to one's emotions. The student may invent or choose a technique in which to create an image - an oil painting, comic strip, sketch, collage, 3D image, or anything else. One may paint with hands or fingers, impress the shape of the body, or even record the movements of the body. The resulting image may be the shared work of several people or an individual statement. The screens are open to every gesture and support controllers - electronic pens constituting a set of artistic tools with graduated degrees of precision and pressure sensitivity.

Young people in the process of growing up deserve the possibility of confronting artistic material, form, and visual experiment. The British neurobiologist Semir Zeki, founder of the relatively new scientific field of neuroaesthetics and a researcher into the neural correlates of visual perception, argues that beauty is a biological phenomenon - a need that, like every other, demands satisfaction.⁸⁹

If the general upper secondary school is, by definition, meant to discover the student's strengths, then I believe it is worth equipping such a school with spaces-instruments capable of revealing students' potential talents. Outside school, such an opportunity may never arise. At the same time, I think that every student might gain from the type of experience made possible by the Creative Hub.

⁸⁸ D.Dutton, „Instynkt sztuki”, przekł.J.Luty, Copernicus Center Press, Kraków, 2019, Wprowadzenie, epub.

⁸⁹ S. Zeki, op.cit, s.7.

3.9. RELAXATION ZONES - PARTICIPATORY INTEGRATIVE SPACES FOR REST, PHYSICAL ACTIVITY, AND PLAY. THE PARTICIPATORY CHARACTER OF SHARED SPACES AS A SOURCE OF IMPROVED SOCIAL RELATIONS

The Relaxation Zone is a place built by the students themselves; one may rest there passively or actively. Students are given access here to a large modular form composed of elements that can be taken out and assigned different functions. It is a large-format arrangement of letter-bearing modules made up of five kinds of geometric pouffe forms of different shapes and sizes. The basic and smallest module is a cube measuring 53 cm x 53 cm x 53 cm. Each subsequent larger shape is a combination of the initial module into a bigger form. The largest consists of five such cubes connected in the shape of an isosceles cross. All of them can be treated as pouffes - seats, small tables, or loungers. They may be played with like blocks, and they may also form elements of a game. I envisaged making the pouffes from fire-retardant and highly elastic upholstery foam covered with felt. If the pouffes are not in use, the wall may be moved towards the southern windows, thereby freeing additional space when needed for individual exercise or yoga classes. One can sit on the pouffes, build a small table with seats around it, kneel, lie down alone or with several others, or build with them as though with large blocks. Only imagination, or the laws of physics, can limit such play. The elements can be arranged in numerous spatial configurations, but restoring them to an ordered arrangement within the wall requires cooperation and thought, because they themselves form a puzzle. They may also function as a verbal word puzzle. To place letters on the pouffes, I propose the use of templates together with the application of a phosphorescent acrylic coating which, once dry, will be durable and will emit no harmful substances. The letters will glow when the lighting intensity is lowered. Depending on the shape of a given pouffe, the number of letters or punctuation marks applied to it may vary from six on the smallest cube to twenty-two graphemes on the largest form.

An extension of physical activity in this space is the possibility of building goals, barricades, and enclosed openings for various ball games out of felt blocks. These may support either team-based or individual activities - for example a collective ball battle, target throwing, or shooting at a goal. The balls, made of foam in different colours, are easy to catch, and their softness and light weight encourage intensive activity without risk of causing harm.



Figure 40. Visualisation, relaxation zone.

In the second part of this zone there are also resilient forms conducive to rest. They are much larger, and once again their arrangement can be adapted to individual or shared needs. They consist of two modules that can be combined freely according to preference. They can be used to build partitions in order to screen oneself from others, have a private conversation, or remain alone. In a horizontal arrangement the large module may serve as a stable platform on which one can sit or take a nap. Turned vertically, it may function as a rocking element; reversed, it becomes a long bench ending in semicircular arches running downwards, making possible simple exercises such as stretching the muscles of the spine and limbs. They may therefore be dynamic or static elements. Depending on their arrangement, they will partly determine the users' behaviour. The second module is a rectangular segment of a circle. It can, for example, be used to build a round table with a diameter of 130 cm, or it can serve as an independent seat or backrest positioned according to one's wishes.



Figure 41. Visualisation, relaxation zone.

In the previously mentioned integration zone there is also another game making use of three-dimensional patterns based on a motif drawn from the school's logo. They function as cut-out elements placed on both sides of a sheet of glass and requiring adjustment in such a way that their reverse sides, covered with magnetic material, attract one another through the glass. The elements must be matched on both sides of the glazing as mirror images. The game therefore requires cooperation between at least two persons in order to arrange new variations of these magnetic blocks.

All these games incorporate the possibility of autonomous spatial creation, the activation of imagination, visual differentiation of zones, language play, physical dexterity, and students' sensory integration. I attempted to focus all of these activities around an equally important aim: motivating students to spend time together, to cooperate, and to rest.



Figure 42. Visualisation, integration zone, game.

Conclusion

Designing spaces for education is a complex process of interdisciplinary analysis requiring an empathic understanding of users. It also constitutes an area of overlap between architecture, the social sciences, and reflection on the experience of the young person in the built environment. The literature on the subject is extensive in the field of design for children; by contrast, in the area of interior design for upper-secondary schools, scholarly debate appears to remain somewhat in the shadows. Adolescents are a particularly demanding age group because of the intensity of their biological transformations and the simultaneous process of identity formation. In a dynamically changing and geopolitically unstable reality, school environments should constitute a stable and friendly enclave for conscious development.

The dissertation presented here - an idea for the transformation of the general upper secondary school - is a search for multi-aspect ways of creating school interiors as tools supporting learning and emotional and social development. The proposed concept assumes a departure from the static classroom model in favour of multifunctional, flexible zones of learning, collaboration, and creative exploration. I draw upon new technologies in order to transform architectural space into partly digital environments enabling teachers to exert multimodal influence so as to raise the quality and effectiveness of teaching. Most zones are equipped with mobile, modular furniture and other elements allowing students and teachers to create diverse task-based spatial arrangements. The design decisions were based on current research in neuroscience, psychology, pedagogy, philosophy, and the evolutionary conditions of learning. I sought ways of reducing stress and satisfying the social and psychophysical needs of adolescents. I also searched for interactive methods of integrating culture and art into school space. I tried to balance the environment in the context of the sensory hypersensitivities that appear increasingly often among students, in the visual, acoustic, and tactile dimensions of architecture. In view of the very rapid pace of technological development, I avoided permanently integrating devices and media with fixed architectural structures so that the school would be ready to replace them when necessary. The review of scientific literature led me to conclusions concerning the need to include in the school design spaces for learning how to move consciously within the digital environment and, analogously, spaces for rebuilding - or perhaps building from scratch - social competencies in the real world. My goal was to create reactive interiors that support learning and remain sensitive to the cognitive potential and the mental and physical well-being of students and teachers. I sought to create school spaces with which users can identify, and within which they can build relationships free from stereotypes, monotony, and dehumanisation - spaces that become active participants in the educational process.

School design does not take place *ad hoc*; it requires considerable concentration on issues connected with applicable regulations, norms, and guidelines. These, important though they are, are further extended by the need to comply with educational law. They constitute determinants in the making of design decisions. Yet legal requirements, however inconvenient or occasionally helpful they may prove for the designer, cannot be treated as a method or methodology of school design. In Poland, a number of valuable publications have appeared, such as *A Well-Designed School*. Works of this sort constitute important support and guidance.

Following that example, I believe that what is needed is an interdisciplinary scientific debate on the design of schools that takes into account extensive knowledge concerning students' perceptual and cognitive characteristics, as well as school projects incorporating the latest technologies for contemporary generations of students, often referred to as digital citizens.

Epilogue

As interior architects, we create within an architectural *prolepsis*. We build spaces within which the human being will function. The human being is the most important variable. Design is, in essence, a prediction of what is yet to come. The design of educational interiors poses a special challenge. I must admit that I call, provisionally, to the initiation of school design as *Project Pythia*.

Educational guidelines and curricula change over time. Generational change, the diversity of children and adolescents themselves, and the variety of potential behaviours suggest the need to forecast different scenarios. Adolescence is, by its very essence, the opposite of staticity. Moreover, in contemporary design, during a period of dynamic change, extraordinary discoveries and development, but also crises and threats, multiple images of the future impose themselves - even those taking into account the popular version of Murphy's Law, according to which if something can happen, it will happen. Education is an inter-scientific responsibility. My intuition offers me an image of the school as a safe and benevolent place that will help protect humanistic reflection and scientific thought and also serve as a remedy for the self-destructive tendencies of contemporary humanity. The contemporary creation of educational spaces should keep pace with modernity, draw on scientific discoveries, and consciously follow technological development, implementing solutions in an open yet prudent and critical manner.

The new digital environment I propose, together with advanced multimedia and artificial intelligence as a supportive tool integrating architectural space with educational content and experience, may constitute one of the first steps - a fusion of scientific and technological thought with education and with thoughtful design for upper-secondary schools. I hope that the proposals and reflections presented here will contribute to a bold yet reflective approach to the design of school spaces for young people - persons who find themselves at one of the most important moments in human development. In the most dynamic period of the formation and expansion of intellectual capacities and new cognitive qualities, in the time of emergent identity and grounding self-awareness, in the formation of social consciousness, in the period of consolidating vital forces, of the desire to experiment, and of unrestrained curiosity, young people deserve a sensitive and reactively friendly learning environment. Interiors that follow cognitive capacities and respond to students' needs, while delivering scientific and artistic content in a balanced way, may simultaneously become places for the holistic development and maturation of today's adolescents within an interdisciplinary atmosphere of humanistic thought.

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