State of Israel
Ministry of Education
R&D, Initiatives and Experiments Division

Future-Oriented Pedagogy

From Trends to Actions – A Flow Chart

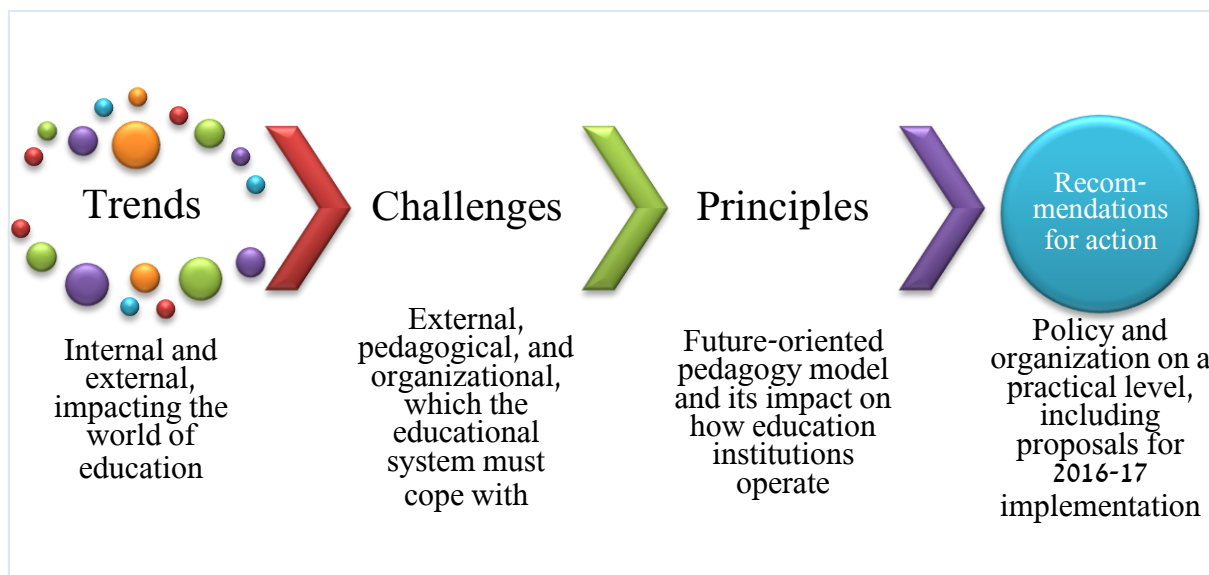Abstract based on R & D Policy Outline for Future-Oriented Pedagogy

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Dramatic changes in the fields of social science, technology, economics, environmental science, and political science are occurring at an accelerated rate. This has resulted in the transformation of a familiar and stable reality into one that is dynamic and turbulent. The answers of the past and present cannot provide solutions to the questions arising from a complex and obscure future; henceforth, individuals and organizations will need to cope with demanding, critical and - most significantly - unfamiliar challenges. Israel's education institutions and programs, like other organizations and systems in Israel and abroad, must provide solutions to the challenges they are facing while preparing for an unknown future that will be fundamentally different from the known present.

The R&D, Initiatives and Experiments Division was established in 2015-16 as a **Future Pedagogical Planning Unit** whose purpose is to meet these challenges. The division's activities will implement practices and techniques of organizational strategic foresight based on the academic discipline of futures studies. Past trends and patterns have been surveyed to serve as the basis for forecasts and scenarios for a desirable and sustainable future, and strategies and action plans have been formulated for implementation. In addition, large groups of stakeholders have been involved in the thinking processes through collective discourse. The final product of the Division's work is a position paper proposing a plan for **future-oriented pedagogy**. **Future-oriented pedagogy provides a pedagogical solution in the present for the requirements which derive from emerging trends and supports the preparation of students for life in the expected reality.** This paper is based on principles that promote new learning methods, required skills, and changes in the education system and implementation of enabling technologies, while taking into account the need for a support system that facilitates implementation processes and continuous updates. The first product to actualize the principles of future-oriented pedagogy in the R&D, Initiatives, and Experiments Division has been the identification of a list of experimental laboratories.

The present document traces the process of defining future-oriented pedagogy and its outcomes, with an emphasis on trends, challenges, principles, and recommendations. Further

and more detailed information regarding the process is available in the position paper: *Future-Oriented Pedagogy: Trends, Challenges, Principles, and Recommendations* **(August 2016)**.

Trends	Challenges	Principles	Recommendations for action
Internal and external, impacting the world of education	External, pedagogical, and organizational, which the educational system must cope with	Future-oriented pedagogy model and its impact on how education institutions operate	Policy and organization on a practical level, including proposals for 2016-17 implementation

Trends

Futures thinking includes three phases: identification of potential future scenarios, definition of the future best suited to the organization, and execution of actions in the present to shape and implement the predetermined desirable future. Identification of future scenarios requires an understanding of the future trends which are expected to create change throughout the world, while they are still in their developmental and formative stages. Education is influenced by reality, but beyond this it is also a major player that significantly contributes to shaping that reality. Today's educational mission is to prepare students for an unknown future in which the rules of the game will have changed. This requires a survey of expected trends which have a high probability of influencing the world of education. The identification of general and global trends beyond the field of education enables a systemic and comprehensive understanding of how future reality might shape and impact the education field.

With this in mind, the first phase of research included an inventory of expected general and global future trends that are highly likely to influence the field of education. This included a review of research literature using a "scan the scanners" approach, focusing on reports by recognized institutions on the topic of futures research in general and more specifically in

3

education. A survey was also carried out using the STEEP model (social, technology, economics, ecology, politics), and the mapping was completed using the OECD's innovative pedagogical model relating to future trends in the world of education and pedagogy. The outcomes of this phase include future trend cards that served as input for generating questions for the collective discussion and position paper.

The paper covers a time range of up to ten years forward. This period of time enables an identification of trends and the initiation of processes in the present with a vision of the future.

Social trends – The education system does not operate in a vacuum, but has reciprocal relationships in the socio-demographic context.

Generational change	The Baby Boomers (born 1946-1964) have reached or are approaching retirement age, while the children of Generation X (born 1965-1980) are taking their place as corporate leaders and executives. Generation Y (born 1981-1995) will by 2020 become the dominant element of the employment market, with among them the future teachers in the education systems, and Generation Z (born 1996 and after) represents the current population of students in the education systems. Each generation is characterized by different worldviews, objectives, values, and modes of action.
Range of "modern family" types	The "modern family" includes a broad range of family types. This includes those who live jointly as individuals or couples, married or not, with or without children, in a variety of combinations of single and divorced people, adoptive families and foster families. A family may have a single parent or same-sex parent, have fewer children to older parents, or after divorce and remarriage.
Population migrations	A global trend motivated by ideology (e.g. "Aliyah" immigration to Israel), by a search for opportunities in a globalized world, or as a result of war and poverty (in the case of refugees and migrant workers). In Israel, Aliyah has been a growing trend, with some 29,500 immigrants in 2015, one-quarter of them of school age.

Parents' education	The continuously-increasing educational levels of the parents boost their interest in investing in their children's education and encourage their involvement in the planning, support, and guidance of both formal and informal learning processes.
Entry of women to the labor market	The rising level of education among women and the increase in the cost of raising a family are stimulating the entry of women on the labor market. This has led to the increasing challenges in balancing home responsibilities and work commitments. Women are approaching equal representation in leading job positions and the wage gaps between the genders are narrowing. However, the education system currently lacks gender equality.
Lifestyle in affluent society	Living in an affluent society presents surprising challenges with significant consequences on the life of the individual and on that society. The growing phenomenon of **obesity** is harmful to the individual's health, leads to low self-esteem, anxiety, and depression, and impacts wage-earning ability. Shorter work weeks and longer lifespan result in more **leisure time**.
Values	Social change is accompanied by changes in values both globally and locally. Values such as **individualism and empowerment of the individual** have taken center stage, while the values of **social responsibility** are rising and swaying between the needs of individual and organizational material-economic growth and those of social and environmental welfare. Social responsibility stems from the business/corporate sector and includes rules of conduct perceived as appropriate and fair to all stakeholders involved.

Technological trends - Accelerated technological development is creating many opportunities for revolutionary change in the field of education and provides effective solutions to challenges deriving from future trends. The integration of technology in education is a complex and expensive process and these same prodigious opportunities also lead to significant hurdles that need to be overcome and ethical questions that must be addressed prior to their implementation in the classroom.

Infrastructure	**Advanced IT infrastructure** and a variety of inexpensive and readily-available computer applications will boost implementation of future learning and teaching practices. **Cloud computing technologies, the Internet of things, smart schools, readily-available mobile communications technologies and their accessories** (including advanced batteries and wireless electrical networks), and wearable **energy harvesting** devices will enable personal IT devices to be used anywhere and at any time.
Action spaces	**Virtual or augmented action learning spaces** will provide a powerful learning experience that does not exist in physical reality. Students will use **virtual** and **augmented** reality to learn and explore and will perform experiments in complex virtual laboratories, quickly and cheaply. Virtual tangible presence at a distance will become possible by way of an avatar, robot, or 3-D hologram.
Smart human-computer interfaces	**Smart interfaces based on human capabilities** will enable intuitive communication with the digital environment, including **touching objects** through a touch screen, and will be especially helpful for people with disabilities. Interfaces that integrate physical and virtual reality will enable the use of an augmented environment (e.g. dialing on a keypad projected by the user). **Voice recognition and real-time speech translation** technologies will facilitate content and media consumption in foreign languages. **Affective computing** technologies **and virtual assistants with personalities** will mentor, guide, and provide answers to users according to their needs and activities. **Specific** (weak) **artificial intelligence** applications will facilitate the development of ethical skills, self-learning abilities, and analytical and deductive skills which may make many white-collar jobs obsolete. There will be a greater human tendency to rely on artificial intelligence applications, despite the difficulty in understanding the machines' decision-making processes.

Social media	Social media technologies are being adopted by organizations who are implementing **intra-organizational social networks**, some of which are based on **public networks.** These support the creation and uploading of content and enable symbiotic relationships among stakeholders at the organizational, local, and global levels. **Crowd sourcing** tools will allow outsourcing of tasks such as problem solving, collecting suggestions for improvement, and formulating an organizational vision. **Social learning platforms and LMS systems**, real-time sharing and mutual evaluation, **and multiplayer computer games** will enhance group learning and achievement in various realms of content, as well as increase motivation, and assist in the achievement of scholastic and academic goals such as knowledge acquisition and skills development
3-D scanning and printing	**3-D scanning and printing** technologies that enable digitization of the physical world are leading the new Industrial Revolution. They facilitate the conversion of physical products into digital models that can be printed in the consumer's home with a 3-D printer. Such products include food, toys, clothing, products incorporating electronics, pharmaceuticals, and even live tissue. Any entrepreneur with ideas can easily and quickly become a global producer (the "Maker Movement"). This technology supports learning through creation and encourages students to design, plan, and make complex real-life products.
Brain-computer interfaces	**Brain-computer interface** technologies will come to maturity in the near future. This Technology will enable brain-based thought communication and control for computers, robots, bionic limbs, and even other people, and through computerized telepathy the reading of thoughts and dreams will become possible. A brain-computer interface is currently being implemented in the field of "adaptive learning" using educational software. The software monitors the learner's level of concentration and wakefulness and changes the teaching process accordingly, in real-time. Preliminary experiments with technologies for implanting artificial memories in the brain may in the future provide the basis for quicker and

	more effective alternative learning methods. **Cognitive augmentation technologies**, which produce electrical stimuli in specific regions of the brain, are already present in specific pharmaceutical applications as well as in headphones used by both video gamers and the US armed forces. However, the use of cognitive augmentation technologies raises complex ethical issues.

Economic trends - The global economy is evolving from local resource economies to a global knowledge economy based on a complex network and the breakdown of economic dependency between countries. The knowledge economy, which is based on intellectual capital, enables wealth and power to be achieved through sophisticated control of ideas and information. It is global, dynamic, technology-oriented and based on super-connectivity. The factors leading countries to economic success are an open and enabling regime, economic incentives, education, innovation, and information and communications technologies. The latter are 21st-century skills and are without a doubt the new "currency".

The rise of new economic superpowers	**New economic superpowers** such as China, India and Russia are now among the top 20 economies in the world and are changing the world's economic centers of gravity, despite the fact that in terms of per capita income they are at the lower end of the scale. Growth in GDP is usually accompanied by an evolution in the distribution of wealth within a society, and consequently there has been **a global rise in economic gaps** and inequality with respect to average per capita income. A transition to a knowledge economy widens the gaps as the wealthy are the major beneficiaries. These processes are also affecting Israel, which is predicted to be among the 20 most highly developed nations in the world by 2020. A consumption-based economy will lead to the **dominance of the consumer** and will promote standards of attentiveness, transparency, and the creation of robust consumer protection.
New models of economics and employment	The new technologies of the global knowledge economy enable **global online commerce, cooperative economics, and movement of manufacturing.** Knowledge workers are required to do their jobs at any

	time and in any place and to work in global **virtual teams** that include various specialists, employees and freelancers, from different geographic cultural, and time zones. Organizations are already making use of the **crowd sourcing** model in order to perform a range of research and development tasks that involve individuals or groups from among the public without creating employer-employee relationships. These new employment structures will enable organizations to exploit external resources in the most efficient way but will also create new challenges such as language and communication gaps, oversight and control capabilities, continuity and commitment, achievement of quality outcomes, and responsibility for the employees' health and safety risks.
Automation of labor, disappearance and creation of occupations	The penetration of advanced technology into the world of economics and employment leads to the **automation of labor, the disappearance of certain occupations, and the creation of new occupations.** It is expected that by the end of the 21st century 7 out of 10 human occupations will be performed by machines. The disappearance of some occupations and the creation of new ones will decrease job security while expanding time for leisure and family activities. Workers of the future will have to work in a **flexible labor** format and to constantly renew their skills. They will need to move often between a variety of job positions, careers, and employers. They will also have to simultaneously master a number of occupational fields, be required to function in a variety of employment types/categories/roles, and be obliged to continually acquire new knowledge and skills to keep up with the changing reality.
and diversity of populations	In recent years, new populations are being integrated into the employment world. In Israel, this includes women, Haredim (ultra-orthodox Jews), Arabs, Bedouins, immigrants, disabled people, youth, and seniors. These populations differ from each other in many respects: origin, gender, status, age, ability, beliefs, culture, etc. The concept of **employment of diverse workers** holds that heterogeneous workgroups featuring diverse points of view are instrumental in promoting

	organizational creativity and innovation and in creating good communication between the organization and its environment.

Environmental trends – The understanding of the scale of human impact on environmental processes, and the diversity of Earth's residents, highlights the need for implementing a policy of sustainability that can provide a balance between economic growth and potentially catastrophic consequences for the global environment. This sort of policy must come to fruition in every field, especially in the field of education.

Global warming	The expansion of the Western consumer economy contributes to **global warming** caused by increased greenhouse gases in the atmosphere. A balanced ecological system is vital to humanity with respect to health, economics, and social welfare. Ecological imbalance in Israel and the surrounding region is leading to a rise in sea levels and salinization of the aquifers, fewer and more intense days of rain, and a northward shift of the desert. Moreover, water shortage is detrimental to the nutritional security of the countries in the region and contributes to political unrest, violence, and population movement.
Sustainability	**Sustainability** is the potential for long-term welfare over environmental, economic, and social time. **"Broad sustainability"** highlights the need for **proper** human and economic sustainability that strives for happiness for the general public, a meaningful life, community interaction, democratization, and fair distribution of resources. Implementing a policy of sustainability is a societal challenge involving national and international laws, urban planning, clean energy and transportation, local and personal lifestyles, ethical consumerism, and controlled exploitation of resources.
Green Economics	**Green Economics** makes use of economic and financial regulations to encourage ecologically-sustainable growth engines and the use of tools to attribute economic value to resources and damage. This field represents a major engine for growth and the creation of a global economic-environmental regime. In this context, innovative products and services are being developed to create and strengthen **a variety of green high-tech**

	occupations in fields such as biology, chemistry and environmental engineering, climate science, environmental protection law, conservation, oceanography, metagenomics, etc. In the future, even more revolutionary green occupations will be sought to help reduce the consequences of global warming, overexploitation of resources, and pollution.

Political trends – These shape power structures, influence, and mindset and create challenges for education and the education system in Israel. The development of global institutions, laws, and measures impacts how countries function and creates the mindset of global citizenship alongside state citizenship. High-level institutions such as the UN Security Council, OECD and others, define policy, frameworks and measures that determine to a large extent how countries behave within the global community.

Globalization and "glocalization"	Accelerated **globalization** develops, especially among the younger generation, the sense of having a global identity as a **citizen of the world** and promotes global action to protect human rights and the environment. Along with the external pressure on a country, internal pressure is applied by national, ethnic, and cultural communities. This is the "**glocalization**" that reflects the constant conflict and tension between global identity and local/national identity.
Budgets, decentralization and privatization	A changing reality creates a requirement for more resources while at the same time affects the **country's budget** in a way that is directly detrimental to social entitlements in the areas of education, health, and retirement, the costs of which are rising due to population growth and increasing lifespan. The movement towards the processes of **decentralization and privatization** into the hands of "market forces" such as parents, NGOs, commercial entities, and **local authorities**, enables the private sector and the stakeholders to be involved in shaping the fields of health and education and to apply market rules to them.
Transparency of the governing establishments	In Israel and the around the world there is a growing demand for **transparency of the governing establishments** with respect to how they function. Western democratic organizations are demanding administrative

	transparency of information and accountability in order to ensure ethical conduct. A readily-available electronic form of governance is expected to become the norm in modern countries.
The death of privacy	Modern technology enables the collection of large amounts of information about the public. **Privacy** is under attack in the name of national security, marketing interests, and consumer convenience. In addition, the individual is willing to provide personal information in order to achieve connectivity, cooperation, and the feeling of belonging to a group.
Legalization of recreational drugs	There is an assumption that the legalization of drugs will end the violence that stems from the drug market's status as an illegal entity. This assumption is closely associated with the recognition of marijuana as a therapeutic drug and painkiller, the maturation of the Baby Boom generation with its extensive drug experience, and the consensus regarding the complete failure of the American "war on drugs".

Educational trends – The aforementioned trends naturally affect the world of education and motivate educational trends intended to create suitable and up-to-date solutions to the changing reality. The following section presents future trends in education derived from STEEP trends. An understanding of these trends will help formulate a solution and paths for action that will promote education and society in Israel in accordance with the needs of the 21st century. The trends in this chapter are divided according to the OECD's eight fields of innovative pedagogy and the same trend may be referred to in multiple pedagogical fields.

	Studies point to greater achievement in interdisciplinary learning and the integration of fields of knowledge as a tool for coping with problems of the real world. **A transition from *intra*disciplinary learning to *inter*disciplinary learning** will include certain fields of knowledge and support in the study, resolution of problems, and project management\ manufacturing. Future curricula must emphasize **trans-disciplinary fields of learning** and develop new fields of knowledge in general and the fields that support future-oriented pedagogy in particular. For example, the field of **information sciences** for development of new scientific theories (the
Content and curricula	

	"tools paradigm"); the field of **futures studies** for organizational or personal planning; **the field of sustainability,** especially **broad sustainability** which emphasizes proper human and environmental sustainability, and the fields of **multiculturalism and inter-culturalism.** Furthermore, **a transition from knowledge acquisition skills to information acquisition skills** is needed. Media diversity and the variety of interpersonal interactions require **social and interpersonal skills**. Making information accessible at any time and place demands stronger **learning skills and metacognitive skills**. Functioning effectively in a changing reality requires **personal skills,** while **foreign-language skills** are necessary in a global economy. Future fundamental skills include: **digital literacy and digital civics** which incorporates standards of conduct, skills in information and communication technologies, and **ethical literacy** which contributes to the identification of dilemmas, judgmental ability, and decision-making.
Evaluation	Technology provides effective methods with which to evaluate advanced learning and teaching practices: **self-evaluation** for personal study, **peer and expert evaluation** for group learning, **evaluation of abilities and skills** such as cooperation and problem solving, and **evaluation of informal learning** anywhere and at any time. The **learning and evaluation** approach is based on information that enables monitoring of the learning process data as a basis for evaluating the learning and making decisions about the learning mode. In the context of this approach, **quantified learning** is being developed to monitor the learner's physiology and mental activity in real time, using smart sensors and wearable technology.
Learning practices	Personalization in the future world of education is starting to appear with the implementation of **personalized learning** that includes individual customization of the learning features to suit the learner's preferences. Collaboration motivates **collaborative learning which** develops the learners' ability to think together and examine a variety of points of view as an aid to creative thinking.

	Future innovative learning practices can be identified, such as **informal learning** anywhere at any time throughout all areas of life (lifelong learning) which thus become potential learning environments; **learning through creating** in which the learners create content and products of their own - the first signs can already be seen in the Makers Movement; **learning through play**, which is a powerful tool for developing high-level thinking and initiative The pedagogy of the future will include hybrid learning designs incorporating different learning practices, such as the **reverse classroom**, in which learners acquire knowledge at home and do exercises using the knowledge in class under the direction of the teacher; or **skills-based learning and evaluation** which focuses on the learner and incorporates skills-oriented techniques for personal, informal, and virtual learning.
Teaching practices	Teaching practices are expected to support advanced learning practices. Teachers are required to encourage **experimenting with a variety of ways of thinking**, to provide solutions for **a variety of learning styles and types of intelligence** among the students, based on their **abilities, potential, and preferences** with an emphasis on **development of soft skills.** Teaching practices include: **personal mentoring** to promote individualized learning, **teaching fields of meaning** for learning that goes beyond material needs, and **teaching for focused understanding** which employs acquired or new knowledge and defies thinking "schemes". Collaborative learning practices require the implementation of guided **Internet-based teaching** which includes connection of the learners to each other and to external parties, while the **teacher** becomes a **learning peer** as she/he is both a contributor and a receiver. Informal learning practices require **teaching that directs learning in areas of life**, with the goal of identifying and exploiting opportunities at any time and in any situation. Teachers will be required to be **pedagogical mentors** who are experts in practices, tools, technologies, and relevant processes. Emphasis will be placed on **creating opportunities for authentic learning** of the reality

15	outside of the classroom and **students will participate in designing the learning** to increase their involvement. In addition, **complex thinking and communication** will be taught through graphic and visual information.
Organization	Change of paradigms, adoption of different conduct, and training of new players and educational models are part of the required adjustments in the world of learning. A leading alternative paradigm is the **ecology of learning flows** based on learning flows in the environment and on a variety of sources that create learning opportunities. This is done independently anywhere and at any time. This ecology encourages the creation of **new jobs** such as personal learning counselor and learning ability coach, and makes way for **new players** in the field, such as vendors of tools and open courses on the Internet, online institutions of higher learning, creators of open learning platforms, collaborative learning communities, etc. In addition, the implementation of concepts and tools involving **crowdsourcing and crowd wisdom** enable creation and knowledge sharing among learners throughout the world. **New and competing models** are being developed in the field of education, and offer a variety of quality learning opportunities at low cost. MOOC courses represent an inexpensive alternative to formal learning. Online personalized and skill-based academic programs enable learners to get a degree at their own pace. Some offer training instead of credits, and there are models that incorporate learning and employment simultaneously. Other online learning models make fields of global interest available to learners, such as world health or global warming. Minerva University offers a learning model that enables active participation in virtual seminars and "dormitories" that move to a different city throughout the world each semester. A more effective structure is also needed at the organizational level. A flexible **fractal organization** enables changes in the environment to be identified and responded to quickly and optimally. When each individual is a subsystem, and each principle that applies to the system generally

	applies to the individual, dynamic self-organization becomes possible, as well as access to resources and achievement of the learning goals. **The network paradigm** champions the creation of global networks of educators who create a learning community. It enables the education system and school to be a living, dynamic, flexible, and open structure that quickly implements innovation in response to the changing reality. Collaboration with parents and students and collaboration between organizations and schools will create networks of students, teachers, and principals who together create a "city of education" that is in a symbiotic relationship with the education system.
	At school, **the student will be a major unit of measurement**, and the student's skills and preferences will dictate a personal, independent style of learning with regard to content and evaluation. Emphasis will be placed on authentic, personal, and collaborative learning and **removal of the boundaries between the school and the external world**; multidisciplinary learning that exposes the students to interconnected ideas from various fields; and **flexible school guidelines** adapted to learning practices. Online, virtual, and collaborative technologies will be used, relevant learning outputs will be evaluated, and emphasis will be placed on strengthening the quality of learning and not on the quantity of knowledge. **Schools will receive pedagogical, administrative, and budgetary autonomy**, **brand and differentiate themselves, and compete for students**. This reality will encourage the **development of a range of different teaching specialties**, such as curriculum advisor, learning skills coach, teaching guide, expert in teaching for understanding, mentor in areas of meaning, etc.
	Incorporation of external parties in teaching tasks, such as experts, parents, and community leaders, will become more common. **Training and professional development programs for teachers** will contribute to their professional and personal skills.
Leadership and values	Determined leadership will promote pedagogy that is suited to the trends and challenges of the future through **a comprehensive, system-wide**

17	**pedagogical approach** that will take into account all of the components and the links between them. Education institutions and systems will become **future-thinking organizations** that will adjust themselves on a continual basis to the changing reality. This will start with a survey of general and pedagogical trends, continue with the building of potential future scenarios and the definition of goals, and end with designing the desirable future and building a strategic plan to actualize it. Future-oriented educational leadership will promote **models of continual improvement** at the levels of the individual and the system. **The model of the pedagogical matriculation exam** will enable self-diagnosis, identification of gaps and the design of programs to close the gaps. **Innovation and entrepreneurship** will become possible through specific frameworks and the nurturing of a culture that values the taking of calculated risks. Additionally, **autonomy** for entities such as local authorities, schools, teaching faculties, and students will encourage those involved to maximize abilities and make decisions by themselves and for themselves. Future-oriented pedagogical leadership will also include the values of social justice and equality in shaping a desirable future with appropriate human and environmental sustainability through the implementation of a **policy of social responsibility** and the adoption of the concept of **broad sustainability**. For this purpose, the system will encourage **"Tikkun Olam" ("Improving the World") missions**; the **school's responsibility will be expanded to the overall welfare, safety, health, and happiness of the student** along with **protection of the student from risks associated with data security, privacy, bullying, attacks, and fraud on the Internet.**
Connectivity	Connectivity with the environment and with the range of parties active within it becomes vital for effective conduct. It creates opportunities for students, teachers, and institutions **to collaborate with many players** to open **alternative learning channels**, acquire knowledge and skills, and **achieve openness to cultural diversity.**

	Techniques for **active collaborative learning** will connect between the students and teachers as learning peers and mentors. **Heterogeneous learning groups** composed of students with diverse cognitive and other abilities will be empowered by their mutually-shared contribution. Teachers will create learning and doing communities in order to plan out directions for action, develop new teaching practices, and provide solutions for shared challenges. The concept of the **"flat classroom"**, which promotes the removal of barriers between the school and the external environment, from the local to the global level, will be reflected in all aspects. **Parent involvement** will increase in light of their growing awareness and improving education. **Collaboration with the community** will increase since learning takes place in communal spaces - community stakeholders will be involved in teaching activities and the school will become a communal learning center. Collaboration will be expanded with **elements in academia, companies, and organizations in the business and industrial sector** and with **parties in the third and fourth sectors**. These will take part in shaping curricula and applying it in the school environment, in workplaces, and in academia. Online learning technologies and open education will enable learning groups and connection with **learning vendors in Israel and globally.** Social networks and social learning platforms will enable **virtual collaborative learning** in the context of **global virtual learning projects and events. Authentic collaborative and experienced-based learning**, in Israel and globally, will connect **students from different cultures.**
Physical and technological infrastructures	Innovative designs of the physical environment use space more effectively, serve as a basis for formal and informal learning, and promote creativity and innovation. Dynamic spaces, special seating arrangements, and convenient and available personal infrastructure create **flexible learning spaces that support diverse learning practices** such as active learning, personal learning, collaborative learning and informal learning. Attention is also given to comfortable and inviting designs for the

	recreational spaces, such as schoolyards, hallways, and auditoriums, both as leisure spaces and as informal personal or group learning spaces.
	The education institution's learning spaces become **maker spaces** and invention labs in which learners can actualize their ideas. Academic and municipal libraries become functional spaces for independent and collaborative learning based on creation using 3D printers, laser cutting machines, and new visualization tools and software.
	Efficient planning and use of school building, reduced maintenance and operating costs, and tailoring the learning environment conditions to the needs of the students will materialize as the **smart school**, by using smart sensors that will collect and analyze data, and activate various functions in the building accordingly, such as the adjustment of lighting, masking of noise, and adjustment of temperature and air quality in the classroom to suit the conditions of the learning environment, number of students, time of day, and disturbances from the external environment. In addition, the system will provide information about the quality of student work with computing devices/surrounding systems in order to learn from the data and make the necessary conclusions.
	Advanced technologies such as the Internet of Things and augmented reality will promote **learning in the town and community space.** This space will be networked with sensors to provide ongoing information in real time about the properties of the space, as a basis for learning. Augmented reality will enable learning through the projection of digital information on objects in space.

Challenges

Future trends will create new challenges and intensify existing challenges relating to the characteristics of the education system in Israel. This section presents the challenges for the education system in light of the future trends as they are expressed in the inventory of the literature, interviews with experts, and collective discussion. The challenges are divided into **external challenges, pedagogical challenges, and organizational challenges**.

External challenges involve the provision of solutions to direct requirements presented by the external environment to the education system, such as those derived from the knowledge economy and the future employment market.

Readying students for the knowledge economy and future employment market	The global knowledge economy and future employment market challenge the Israeli education system. Effective integration into the global knowledge economy requires a capacity for independent learning and development of personal and social skills. Education must impart skills in areas such as collaboration, technological literacy, ethical literary, innovation and entrepreneurship, collaborative economy, and online commerce. Learners must be readied for an employment market in which professions are disappearing and new ones are constantly being created and in which career, employer, job, and employee turnover takes place at a high rate.
	In order to deal with these challenges, the education system must implement, over the long term, a periodic and multi-phase process of continual adjustment of education to the ever-changing reality of the global knowledge economy.
The opportunities and risks of technology	Humankind relies on the ecological systems that sustain it and the social systems that have developed throughout history.[1] As the power of technology increases, its influence on the ecological systems expands and engenders improvements as well as risks that are difficult for the legislative, judicial, and law enforcement systems to address. Such risks may cause severe damage at the individual and societal levels and to life-supporting systems on the planet.
	At the level of the education system, a leading challenge is the **preparation of students for effective exploitation of technological opportunities in order to improve both their personal statuses and the condition of society.** The affluence upon which our lives are based stems largely from the public domain that belongs to no one and at the same

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[1] From: *Hinukh Le-Kayamut Rehava: Mitveh Le-Bet Sefer Shel Ha-Me'ah Ha-21*, Carmon Ettinger, Harel, Donitz.

	time everyone. Wealth and happiness are public products that can be achieved by relying on society and nature. The purpose of education is to develop human creativity and teach how to expand public wealth so that it will enable individual happiness. The second challenge is that of **bolstering the students' awareness of the risks of technology** by developing and imparting abilities and tools for identifying and coping with technological risks, as well as educating them in the area of proper digital civics in order to reduce these risks. A third challenge is the **enlistment of technological developments to create groundbreaking pedagogical innovation that changes the face of education** by increasing digital literacy among students and teachers. This ability directly correlates with the outcomes of student learning.[2] It also includes integrating technology into pedagogy through budgets, equipment, and models of capability and pedagogy. This entails clear objectives for the use of ICT,[3] professional, structured training and guidance for teaching faculty,[4] and an understanding of the educational value of technology.[5]
The glocalization dilemma	The phenomenon of "glocalization"[6] reflects a constant conflict and tension between globalism and localism. The globalization steamroller includes a capitalistic global economy, information and communications technologies, and intensive activity by international organizations. It must cope with pushback from local, nationalistic, ethnic, and cultural communities that are trying to preserve and strengthen their own characteristics and identities in the face of the external threat. The challenge faced by the education system is the **creation of harmonious glocal identity and abilities among the students in order to create a balance between global and local** and to benefit from both worlds. Education must impart consciousness and identity to the students

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[2] The Norwegian SMILE report.
[3] From: Survey of Schools: ICT in Education.
[4] In the nationwide Digedu survey of over 600 teachers in the US, 50% of whom noted a lack of assistance when using technology in the classroom, and 46% of whom reported that they lack the required training.
[5] From the Institute for Policy Research at Northwestern University.
[6] A combination of "globalization" and "localization".

	as both world citizens and citizens of the State of Israel. Glocal mindsets and abilities will enable learners to shape the country's, and humanity's, image in desirable ways in the future. An important component in this challenge is **striking the appropriate glocal balance for each of the streams in the Israeli education system: state schools, religious state schools, Haredi schools, and Arab schools.**
Narrowing economic and social gaps	Global economic activity and technological developments contribute to the growth of local as well as global GDP. The worldwide growth in wealth is usually accompanied by significant changes in income and wealth distribution within society and increases the inequality of the average income per capita. It is estimated that by the end of the second decade of the 21st century Israel will be among the top 20 developed nations in the world. The rise in per capita GDP will be expressed as a rise in available income per capita and the forecast gap between the top ten percent and bottom ten percent with regard to available income (after food expenditures) is estimated to be 25 times greater. Education plays a significant role in coping with the causes of inequality and narrowing gaps **by imparting skills and experience that enable all students to enter the employment market of the 21st century, including those from a disadvantaged socioeconomic background.** Studies show that the parents' influence is critical for the success of their children. It is thus important to enlist parents from a strong socioeconomic background to help their children in their studies while the system focuses on the disadvantaged populations (students and parents), beginning in early childhood.
Broad sustainability consciousness and skills	There are two approaches that support sustainability, both of which recognize the severity of the global environmental crisis and need for action to change the situation. However, each has different starting assumptions and theories of change. **The narrow sustainability approach** focuses on human ability for environmental and physical survival and assumes that the change will be essentially technological. **Broad**

	sustainability looks beyond physical survival and assumes that the cultural and ethical crisis derives from the separation between humans and nature and between people. According to this approach, "suitable human and environmental sustainability" relates to public happiness, meaningful life, community interaction, democratization, and fair distribution of resources. Broad sustainability presents a **challenge in terms of content and pedagogy**. The content challenge sees **broad sustainability as enabling the building of a global identity and consciousness, and forming a concept of social responsibility and a desirable future.** To this end, the education system must become a green system, promoting activities and real experiences in the fields of environmental science, sustainability, and green economics as mandatory studies at all ages, along with the training and guidance of teaching staff and promotion of collaboration with relevant parties. The pedagogical challenge relates to the use of **broad sustainability as a suitable platform for implementing a variety of learning practices** such as innovation, entrepreneurship, futures thinking, etc.

Pedagogical challenges – Dealing with changes means enabling learners to comprehensively cope with a complex and changing world, through self-realization and fulfillment of the learner's ambitions.

Self-realization and fulfillment of the learner's potential and ambitions	Individualism and empowerment of the individual are growing trends that are reflected in many different areas of life. The individual striving for self-realization and fulfillment of personal potential rejects blind loyalty to systems and expects the systems to adjust themselves to his or her needs so that he or she can pursue his or her ambitions. Technological development that enables the personalized customization of services and products supports this expectation. With this mindset, **the challenge facing the education system is to provide learning services that are personally customized for each student in order to enable him or her to**

	fully realize abilities and preferences as the student understands them. In this situation, **students and parents will become more involved in shaping the learning**, and the education system is expected to cooperate as failure to do so will be to the advantage of competing learning providers in the network. The learners themselves expect to be able to independently choose learning providers and schools and design content, curricula, and learning tools, and even methods of evaluation.
Coping with a complex, changing, and unfamiliar world	Reality in the 21st century intensifies feelings such as anxiety, tension, and difficulty in coping with errors, and harms the individual's sense of confidence that makes coping with the changing world possible. **The education system's challenge is to stimulate the capacity for constant personal change** and enable the learner to act with a sense of self-confidence, flexibility, and ability to deal with errors. The skills that enable students to deal with learning under conditions of ambiguity are independent learning and investigation, creativity and entrepreneurship, flexibility, curiosity, and motivation. In addition, optimal functioning under conditions of uncertainty requires the development of mental resilience, and this is fostered by legitimizing error, evaluating the learning methods and process beyond the results, encouraging trial and error, maintaining patience in the face of uncertainty, managing prolonged frustration and developing the ability to move on to a clearer situation. The power of the processes of global and local change may cause the learner to feel incapable of influencing and changing the course of his or her development. As a result, he or she may avoid dealing with critical questions relating to the public domain and social contribution and focus exclusively on building personal meaning.[7] **The resulting challenge for the education system is to promote education for change that will enable learners to become active and involved citizens who contribute to the development of society, from the community to the global level.**
The learner's	The current complex reality makes it difficult for the individual to

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[7] From: Hinukh Le-Kayamut Rehava: Mitveh Le-Bet Sefer Shel Ha-Me'ah Ha-21, Carmon Ettinger, Harel, Donitz.

personal meaning and identity in a changing world	construct his or her own personal meaning and identity. **The challenge facing the education system is to help learners develop a strong ethical foundation and rich inner world so they can navigate the ups and downs of a changing reality**, through greater awareness of the consciousness and of self, reconsideration of personal and collective presumptions, and questioning basic assumptions and identity-shaping mentalities. The identity of the self[8] is the image that a person builds for him or herself and includes the self and the manner in which the self is perceived by others. Identity creation[9] involves the understanding the individual's unique perspective, its relation to the perspectives of others, and the interactivity on the continuum between processes of globalization and personal tendencies. **The education system's challenge in this respect is to help learners construct a deep self-understanding in relation to local and global-environmental elements.** This is to be accomplished through reflective investigation, practical experiences, creative activities, social activities, and communal initiatives. At the level of the school, modes of action and methods of teaching and learning will be adjusted, and there will be greater democratic exchange of ideas at local and global levels. At the level of the education system, it is important to create opportunities for authentic experiences that enable the building of a "personal narrative" and "self-realization", thus **assisting the learner in developing personal meaning in the sense of a personal purpose and "raison d'être" (reason for being) within a changing reality.**
Creation of pedagogical and technological innovation on broad scale	Developing technology enables the education system to create pedagogical innovation in line with the requirements of the changing reality. This is a demanding task that requires great resources as well as the need to manage and resolve countless objections to new ideas and the adoption of innovation.[10] Besides the difficulty of translating the

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[8] From: *Zehut Ishit – Zehut Kevutztit*, Dr. Yaffa Sekali – Education Mentor Northern Region (2006).
[9] Personal identity includes values, principles, and roles that the person adopts for himself, choice of profession, religious and moral beliefs, political ideologies, and adoption of social roles in connection with sexuality, marriage, and parenthood.
[10] Rodgers' model proposes five phases of adoption of innovation/technology.

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	effectiveness of technological innovations into learning and teaching practices, it has been found that many educators are reluctant to create new and more efficient practices because the system does not compensate them for developing new approaches and improvements, and does not replicate breakthroughs for the benefit of the overall system. **The education system's challenge is to create an ecosystem that encourages thriving pedagogical creativity by a range of parties within the system and among its stakeholders.** This should be accomplished by defining a system-wide policy and planning future pedagogical innovation, granting schools and innovators the autonomy to implement changes with minimal regulation, supplying infrastructure, methods and training that support innovation and processes of constant improvement,[11] creating distribution mechanisms for pedagogical innovation, allotting funds to successful innovators, and awarding appropriate compensation to outstanding creators of innovation.
Evaluation as a support for meaningful learning	Along with the development and implementation of advanced learning practices and increasing focus on skills, comes a need for fundamental change in the concept of evaluation and its methods. Evaluating practices such as investigative learning, learning through play, collaborative learning, etc. involves many components that cannot be measured by exam-based evaluation methods. Digital platforms that document the learning processes enable the evaluation of the actual learning processes and not just the final outcomes. **The challenge of the education system is to implement, on a broad scale, a variety of practices for evaluating the outcomes, processes, and skills of advanced meaningful learning practices.** To this end, a range of aspects must be evaluated: soft skills, process performance skills, peers, experts, accreditation, results of competitions, community adoption of results, etc. To this end, new measures (like the "Educational Picture" project) must be defined, e.g.: collaboration, social contribution, personal learning, etc.

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[11] In the 1980s and 1990s.

Organizational challenges – Dealing with required changes in the way the education system organizes itself in order to provide a suitable solution for future trends requires, for example, the ability to maintain the relevance of the formal education system against competing models.

Identification of future trends and their consequences for education	Like any organization, the education system is interested in surviving and prospering in a complex and changing reality as well as in preserving its position as a functional and relevant system. To do so, it must develop an understanding of future reality and its consequences. **The challenge facing the education system lies in the development of an ongoing process for identifying future trends and their consequences for Israeli education, as a basis for planning and implementing a desirable future that addresses the needs of the future reality.**[12] The accelerated pace of change requires a comprehensive cyclic process that begins with identifying new trends and changes to familiar trends; the next step is analyzing the consequences for the education system and identifying gaps; and, finally, there must be measurement and evaluation processes that create input for a new cycle of the process. Special meta-entities that specialize in futures studies[13] and investigative methodologies will define the desired overall pedagogical vision for the education system, relying on collective insight and collaborating with a range of stakeholders (principals, teachers, students, parents, experts, academics, the business sector, the third sector, etc. Then, local authorities and schools can formulate for themselves a unique and suitable pedagogy for the future. **The challenge of the education system is to support and assist the futures thinking processes carried out by educational parties at various levels**; therefore, it must train professionals

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[12] Based on: *Taxonomia Shel Meyumanuyot Ve-Kishurim Atidiim* (200). Pasig, Bar Ilan University School of Education.

[13] For example CHAMP: Relevant *Comparisons* as a starting point; *Historical trends* while examining the chances and reasons for change; *Average opinions* – identification of the meaning of a variety of opinions; *Mathematical models* that should be taken into account when there are model-based forecasts; and *Predictable biases* without clinging relentlessly to old forecasts versus new ones.

	such as futurologists and analysts and integrate them into the system.
Maintaining the relevance of the formal education system versus competing models	The education system must re-create itself **in order to deal with the challenge it is facing – the transition from a controlling "monopoly" with a captive audience to simply one of many players on a competitive market.** A tremendous number of learning providers accessible through the Internet offer a variety of online virtual learning services with countless methods, on a global level and not just a local one. These providers compete with the classic, rigid, classroom-based model. This extensive offer allows learners to leave the formal content provider – the education system - and freely choose where, what and how to learn. Nevertheless, implementing this kind of learning models requires the learner to be able to assess and choose suitable providers, organize and manage his or her time, learn independently, be diligent, and, in most cases, adequately master a foreign language. Therefore, the strategy should focus on improving and developing the learner's ability to make optimal choices and on providing advanced learning services, including turning the school into a center for counseling and guidance with respect to a variety of services that may have already been offered by other learning providers.
Broad distribution of pedagogical innovation to all streams	Technological development creates opportunities for innovation in many pedagogical fields.[14] Although there are numerous local applications of pedagogical innovation, these are not distributed and implemented on a broad scale due to a shortage of suitable mechanisms and the innovative schools' reluctance to invest in this area. **The challenge facing the education system is to design an infrastructure and processes that will enable the distribution and implementation of significant pedagogical innovations on a broad, system-wide scale within reasonable time frames. These distribution mechanisms will have to be defined and built and the pedagogical innovations will have to be created in accordance with system-wide targets and principles.** In order to ensure that the

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[14] Open education, MOOCs, reverse classrooms, flat classrooms, embedded learning, lifelong learning, and learning through play.

	school faculty absorbs and implements the innovations, any organizational and bureaucratic barriers and constraints should be lifted and resources allocated in order to promote a supportive organizational culture. Solutions should be provided in advance for questions such as the distribution mode (pushing or pulling in line with the school's decision) or the parties who will assist with selecting the mode of implementing the innovation, (standard or unique to each school), etc. Moreover, successful implementation of innovative pedagogy among each of the subcultures in Israel requires a process of **customized distribution for each of the educational streams in Israel**: state schools, religious state schools, Haredi schools, and Arab schools.
Adjustment of the purpose, structure, and functioning of the school to a changing reality	**One of the fundamental challenges of the education systems today is redesigning the foundation of the school's traditional characteristics which are not adapted to the needs of the modern age.**[15] Competing with online and global models requires the school to justify its existence and purpose. This raises questions such as: Can the school also be repurposed for the larger community? Is it responsible for the welfare and happiness of the student as well as for informal learning? The school's structure raises other issues for discussion such as the connection between school registration and area of residence; the transition to a fractal or network organizational structure; the level of pedagogical, administrative, and budgetary autonomy that the school should be allowed to exercise; the choice of organizing classes by age group, subject, or knowledge; the design of physical learning spaces that provide a connection between the building and the subject matter. Moreover, the learning experience in the future school requires reconsideration, revision and redesign. For example, the time allotted to class work and recess, the adjustment of learning practices[16] in order to

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[15] For example, Pres. Obama's ED Connect initiative, whose purpose is to train teachers in skills for integrating new technologies in a classroom that supports personal and flexible learning.

[16] Director of the Center for Applied Research and Educational Improvement at the University of Minnesota.

	improve student performance,[17] the involvement of external parties in the teaching process, and so on.
Adjusting the role of the teacher, teacher training, and professional development for a changing reality	Technology-supported learning activities[18] change the nature of teaching. In order to create value in the innovative learning processes, the teacher's role needs to be redefined along with the training and professional development. The teacher must master diverse learning practices and demonstrate high-level technological literacy as well as technology-based skills[19] including the ability to guide the creative and innovative use of technology. Teachers must also encourage creativity, innovation, and personal learning autonomy among the learners, allow the students to express themselves in their school activities, and promote a spirit of collaboration and flexibility among teachers and students.
	Due to the complexity of the teacher's job, there are those who propose to split it into a number of specialties. The New Teacher Project (TNTP)[20] identifies three main teaching roles: investigator and developer, adapter, and guide. In their definitions, the teacher's areas of responsibility will include: designing pedagogical approaches, guidance and provision of materials in accordance with the student's need; innovation and sharing of ideas with colleagues; and use of data in line with the learning paths. For this purpose, training courses are recommended in core skills, such as: data analysis, risk taking, and collaborative learning. It appears that the **main challenge is redefining the teacher's roles in relation to the various types of teaching specialties.** An associated challenge is **updating teacher training courses in accordance with the specialization paths** in order to incorporate experience in the required practices, skills and technologies. Finally, **teachers should be allowed to construct a personal development plan adapted for and in relation to the needs of the reality** developing in the area in which they operate.

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[17] An up-to-date article of the American Academy of Pediatrics recommends that youth start class only after 8:30 in the morning, as it defines sleep deprivation as a major factor in school performance.
[18] Study recently conducted by the Academy of Finland.
[19] Based on: The NMC Horizon Report: 2015 K-12th Edition
[20] The New Teacher Project.

Future-Oriented Pedagogical Model

The future-oriented pedagogical model addresses requirements arising from the world of education which stem from general future trends (STEEP) and trends identified in the field of education.

The systemic model of future-oriented pedagogy provides a compass and practical setting for adapting the school system of the present to a changing future reality.

The future-oriented pedagogical model
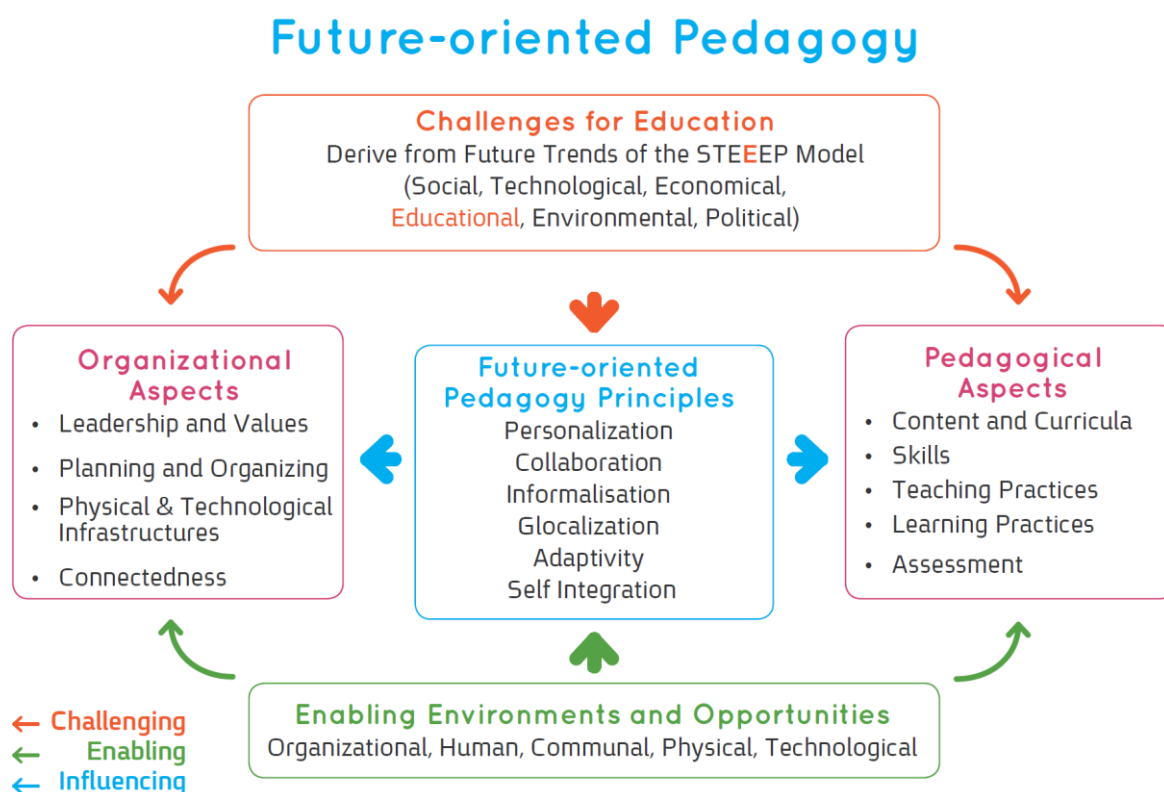
Education in the present must take the unknown future into account, a future that will undoubtedly differ in many significant ways. Future-oriented pedagogy aims to help the school system make today's education relevant to an unknown tomorrow. Educational relevance consists of two elements. The first is the learners' relevance to the world, i.e. to what extent the education provided now prepares learners to succeed, flourish, and contribute to their environment in the future academic, employment, cultural, civic, global, virtual, and other fields. The second is the education's relevance to the learners, i.e. to what

extent the education provided is appropriate to the specific nature of the learners so as to enable them to achieve a level of self-fulfillment that is suited to their abilities and desires. These elements of relevance are dynamic and require constant updating due to reality's rapidly-changing pace.

The future-oriented pedagogical model proposes to meet the relevance challenge by adopting basic general principles of conduct in an uncertain, changing future and applying them to the field of education. The application of these principles in education is made possible by the availability and accessibility of new environments and technologies. The application of the basic principles has implications and consequences for every pedagogical field, in terms of both teaching and organization. The model contains several major interrelated components:

Future trends and the resulting demands on schools: Local and global future trends in society, technology, the economy, the environment, and politics create new challenges and demands for schools. The educational system must invest in monitoring, identifying and understanding these trends and offer a suitable response to the resulting challenges and requirements in order to continue to provide relevant education in a changing reality. It is important to note that monitoring trends and identifying these challenges and demands must be an ongoing process as reality outside the schools is in a constant state of flux.

Opportunities arising from enabling technologies and environments: This evolving reality is constantly creating new opportunities for schools in the form of new technologies and environments which enable the model's principles to be applied in ways that were impossible in the past. It is therefore necessary to maintain an ongoing process of monitoring and identifying new technologies and environments that will allow the application of the model's principles in innovative and effective ways in order to provide relevant education.

Basic future-oriented principles: The core of the model consists of six basic future-oriented principles on which schools must focus to provide an appropriate response to the demands of future trends, with the aim of preserving the relevance of education in a changing world. These six principles – personalization, cooperation, informality, glocality, alternativeness, and integration – are general principles currently applied in a range of fields other than

education. Some of these principles have been applied to education in the past, in different forms, but all can now be applied in new, revolutionary ways, based on new technologies and environments.

Pedagogical aspects: The application of the basic principles determines the way in which the pedagogical aspects of contents and curricula, skills, learning methods, teaching methods, and assessments are applied in practice. These aspects may also be applied in novel and innovative ways through new technologies and environments to provide solutions to challenges derived from general trends.

Organizational aspects: The application of the basic principles determines the way in which the organizational aspects supporting the application of the pedagogic aspects – such as leadership and values, planning and organization, connectivity, physical and technological infrastructures – are applied in practice. These aspects can also be applied in new and revolutionary ways thanks to new technologies and environments in order to provide solutions to challenges derived from general trends.

The model proposes six principles that the education system must focus on: personalization, collaboration, informality, glocalism, change, and integration. These principles were processed as a result of an inventory of the literature, surveys of expert opinions, and recommendations of the collective discussion. Application of the basic principles will be expressed through new learning methods and the related transmission of required skills. Furthermore, there will be a need for change in the way education institutions are run and suitable technological infrastructures will be required (Figure 13). Focusing on the proposed principles will enable the education system to adopt the methods and acquire the skills required for optimal functioning in complex, dynamic, ambiguous, and unfamiliar future environments. The six future-oriented principles combine to create a unified, cohesive influence on the pedagogical and organizational aspects of pedagogy and do not contradict one another. As an example, the principle of personalization, cooperation and glocality come together to define learning methods that are personalized, shared, and glocalized. The principles of cooperation and glocality are expressed when learners participate in an international study event discussing how the topic of the environment is applied in different cultures and the principle of personalization is expressed through the use of a real-time

speech translation program enabling the participants to communicate in their native languages.

Principles

Personalization	Learners choose and promote their own learning characteristics in accordance with their interests, ambitions, abilities, and personal traits. The adapted personal learning practices will enable the learners to prepare for the desired future they have defined for themselves, through the choice of school and/or learning providers, including required content, technologies, and resources; and the design of a personal curriculum in a path adjusted to level, pace, methods, and learning environments. Learners will be able to choose between personal independent learning ~~or~~ and collaborative learning. In addition, they will be required to independently manage their learning, including the assessment of the process and the materials studied. To enact the principle learners will need skills such as emotional literacy, responsibility and self-discipline, internal motivation and self-management, resilience and the ability to recover. Teachers will be required to act as personal mentors, be highly familiar with the learners, and provide a supportive environment. In terms of infrastructure, the learners will be supported in learning contents and styles by open and online educational technologies; quantifiable and adaptive learning technologies will enable compatibility between the characteristics of the learning and learners; brain-computer interfaces will provide solutions for motor-disabled individuals; and cognitive augmentation technologies will increase the learners' abilities.
Collaboration	To create better learning and greater compatibility between learning and the objectives and needs of society, individuals and education institutions must join together to cooperate with various shareholders in the world of education and the surrounding society. Collaboration will promote the individual's learning, awareness, understanding, and empathy for the environment, and impart to the learner vital skills for success in a future

	reality within a multicultural and global world. Implementing the principle of collaboration requires social learning methods (peer learning, learning and action communities, dialogue and discussion, learning through multiplayer games), and social skills (social literacy and intelligence, teamwork in physical and virtual environments, empathy for others, and social responsibility).
	In practice the education system must collaborate with the students and the relevant actors in the external environment, by adopting a flat classroom practice that enables the lifting of barriers between the classroom and the surrounding reality. For this purpose, a new job should be defined – **community organizer and networker** – to carry out internal networking within the school, and external networking between the school and the surrounding environment. Internal networking should focus on connecting between learners and mentors, implementing technological platforms for social learning and creating learning communities, and shared activities students and teachers. External networking should nurture collaborations between the school, teachers, learners and outside parties.
	The advanced technologies will support the principle of collaboration, and bridge gaps of space, time, and culture.
	School networks will enable the development of effective learning communities; collaborative learning projects will be supported by real-time translation technologies enabling communication between distant sites around the world and systems for managing collective discussions between many participants.
Informality	An ecosystem of learning streams available anytime and anywhere, facilitates connecting and learning independently without being dependent on the formal education system. The education system must adopt and promote what is now the dominant form of learning, i.e. informal independent learning that takes place anywhere and at any time (life wide learning), and throughout one's entire life (lifelong learning).

	Such learning is also supported and accelerated by competing models. Implementation will be based on a variety of open and inexpensive learning services be means of a variety of independent learning technologies and physical spaces, virtual spaces, and augmented spaces. These services will be provided by public and private parties at a national and international level and will be available anywhere and at any time. The learner will be required to acquire technological and digital literacy skills, independent ability to manage and organize learning, and meta-cognitive ability for thinking and analysis. Implementing life wide learning practices will require the formal education system to assist learners in the identification, selection, and evaluation of suitable learning opportunities and services and in coping with difficulties. The school will function as a center for learning services and offer guidance and support. This will require a new position of **pedagogical mentor and expert learning counselor**; evaluation methods that focus more on skills and less on the acquisition of specific knowledge; and certification and accreditation mechanisms such as learning and evaluation based on micro-credentials earned by the student and evaluation assignments for which the student receives assessment and official recognition and accreditation. The enabling technologies include a variety of high-quality, inexpensive cloud learning services that can be accessed using a personal computer (BYOD). This will also require, among other things, automatic algorithms for locating and suggesting learning opportunities in accordance with the learner's location and situation, tools for evaluating and selecting learning services; and accessible virtual environments such as social networks, virtual worlds, and virtual assistants.
Glocalism	Countries are facing conflicting pressures simultaneously: on the one hand there is the trend of globalization, while on the other hand there are local ethnic pressures. Glocalism - the blend of globalism and localism - encourages contrasting and conflicting identities, values, and interests

	that generate social tension and division. The principle of glocalism in learning is to support the development of systemic understanding, moving from local to global, and create consciousness and identity, thus forming a harmonious mix of global and local components and values. Glocal learning practices exposes the learner to fields of knowledge relating to culture, language, broad sustainability, and global citizenship. They create experiences that highlight intercultural learning projects and collaboration based on the open classroom concept. Skills such as systemic thinking, critical thinking, ethical literacy, multicultural literacy, and ecological and global literacy help cope with the complexity of glocal awareness and identity. Supporting technologies such as social networks, real-time translation, and virtual reality and presence enable unmediated exposure to a variety of sources of forming a balanced glocal consciousness and identity.
Change	The learner's ability to adapt, thrive, and function in a complex, changing, and highly uncertain reality in an optimal manner requires personal change as well. The learner must implement the learning practices of futures thinking and acquire suitable skills for functioning in a rapidly changing world. Future thinking practices imply a systemic understanding of contemporary structures and processes, assessment of trends and potential futures, and the design and implementation of a desirable future for the learners and/or community in which they operate. The required skills include systemic thinking, trend surveys, forecasting techniques, techniques for forming a vision, and methods for planning and leading change. On a personal level, the learner needs to show initiative and entrepreneurship, the ability to make decisions and manage risks in an environment of uncertainty, project management and creation skills, along with personal resilience, adaptability, ethical literacy, and use of critical thinking. Schools must implement futures thinking-such as broad sustainability, sciences, history, civics, and geography, along with framework for

	proactive, creative, and collaborative activity within the community within the fields of knowledge, and this throughout the system. For this purpose, a **teacher to facilitate understanding** is required to impart the ability to employ new knowledge with the required quality and flexibility, stimulate intelligent discussion on the basis of new knowledge, guide and develop personal and group investigative processes, provide personalized feedback, communicate with experts in the field, etc. The learner will acquire knowledge either independently from experts or through research on the Internet and in literature. The success of teaching as an enhancement of understanding will be measured by learning outcomes such as a presentation to the learners and experts, exhibition projects, research-based documents, videos, etc.
	To summarize, learners will receive feedback that stimulates understanding with respect to their performances in order to ensure improved performance in the future. Technologies which support the implementation of futures thinking in learning practices include social networks to connect with experts, virtual and augmented reality and games to help acquire realistic wisdom and create potential future scenarios. In addition, the Internet of Things and big data for identification and investigation of patterns and forecast of derivative trends, in association with 3-D printing for management of entrepreneurial projects, will further enhance these practices.
Integration (meaning)	In learning, integration is the learners' ability of the learner to formulate personal meaning in a world of change, to build their own narratives, and to achieve self-realization in the changing reality.
	The school must offer each learner a space for experiencing, learning, and formulating personal meaning that will serve as a source for the individual concept of purpose and reason beyond material needs. Such learning will focus on seeking and developing the common good together with the release of the individual's creative forces. It will be based on reflective investigation of practical experiences in fields of meaning, such as arts and

	crafts, sports, travel, community activity, and social activism. Learning through the experience of creating something that is personal to the learner requires dealing with basic ethical, identity, analytical, and practical questions that are discussed together with the mentoring teacher. Learning to formulate meaning requires emotional intelligence, reflective literacy, conversational skills, investigative skills, creativity, and persistence.
	Learning to formulate meaning also requires a **teacher-mentor of meaning** whose role is mainly to coach, direct, and guide the learners through the creation process, by way of questions, suggestions for change, and exemplification of improved performance. However, the teacher/mentor must be active in the field and have undergone suitable professional training in order to have a deep familiarity with the complex emotional dimensions involved in the process.
	Supporting technologies include multimedia technologies, virtual and augmented reality and 3-D printing. These enable creation, creativity, and entrepreneurship in a virtual and physical space. They accompany collaborative infrastructure for multiplayer games and group creation and thinking which promote social projects.

Recommendations

Future-oriented pedagogy offers an innovative approach for the initiation of pedagogical experiments and developments. Past developments mostly stemmed from local needs and were highlighted by principals of education institutions and then approved by the education system on the basis of criteria such as how well it addressed the challenge, innovation, feasibility for distribution and practical implementation. The principles of future-oriented pedagogy propose a systemic approach to the initiation of developments, both through laboratories and research and through school development departments. The principles serve as a system-wide compass for definition and preparation in accordance with future trends that have been identified. The role of the R&D, Initiatives, and Experiments Division is to examine the suitability of the principles of future-oriented pedagogy, and to propose

optimal directions in this regard for the education system. This can be done in more than one way; for example, through a centralized formulation of incubators that actualize the principles, by calling on entrepreneurs to take part and implement the incubators, or by informing entrepreneurs through a public announcement presenting the principles and requesting them to propose ideas for incubators actualizing the principles.

To create a support system for the model, the following is a series of recommendations in accordance with the eight areas of pedagogy as defined by the OECD in 2012: content and curriculum, evaluation, learning practices, teaching practices, organization, leadership and values, connectivity, and physical and technological infrastructures. For each of these fields, there are direct recommendations at the system-wide level and/or the school level, which rely on an inventory of trends, interviews with experts, and the results of the collective discussion. Specifics and broader discussion of the recommendations are included in the position paper.

Content and curriculum	It is recommended to consider providing autonomy for school principals to in determining curricula and to encourage collaborative examination of the core curriculum and subject matter. Focus should be placed on acquiring skills required to operate in the professions of the 21st century, beyond the transmission of knowledge to the learners, especially in relation to skills derived from the principles of futures-oriented pedagogy.
Evaluation	The effectiveness of standard evaluation examinations should be reconsidered and methods of evaluating meaningful learning and micro-credential evaluation should be implemented
Learning practices	Implementing diverse innovative learning practices while using different learning styles, within the learning spaces, should be considered. Examples of this are personal learning, quantifiable adaptive learning, productive learning, learning through play, collaborative learning, life-wide learning, and learning in virtual spaces.
Teaching practices	It is recommended to examine the addition of options in specialized teaching fields, to develop integrative teaching faculties that support learning and to encourage broad implementation of the reverse classroom

	when appropriate.
Organization	It is recommended to promote the school's autonomy and encourage schools to become centralized fractal organizations that provide guidance, learning and development services for students and the community.
Leadership and values	Collaboration should be encouraged at all levels, through building and implementing a model for the school improvement processes while relating to the principles of futures thinking.
Connectivity	It is important to encourage openness to the real world through inter-school collaboration, participation in online learning projects and events, development of learning communities and teacher projects, and collaboration with the local community, academia, the world of employment and the third and fourth sectors.
Physical and technological infrastructures	Such infrastructure is required to implement advanced learning spaces, including the definition of a basic standard for technological infrastructure and support. Integrating smart home technologies in the schools, a school social learning network, and the use of an LMS should be considered.
Policy in support of future-oriented pedagogy	The system should ensure a continual and cyclical process of organizational futures thinking, including immediate implementation of laboratories and incubators that implement future-oriented pedagogy. It is important to encourage controlled and supported autonomy, and to implement transparency at all levels of the education system. It is desirable to encourage online collaborative learning of students from different streams as a means of reducing economic and social gaps. In addition, policies should be formulated regarding the use of cognitive augmentation technologies and the legalization of recreational drug use.
Organization supporting future-oriented pedagogy	This requires the implementation of mechanisms for broad and rapid distribution of pedagogical innovation, while adjusting teacher training and professional development to future-oriented pedagogy. In addition, it is worth considering the use of external parties with a relative advantage for specific teaching needs.

List of laboratories proposed for 2016-17 - the proposed list is ranked, as mentioned, in

accordance with the principles for future-oriented pedagogy. Each laboratory is assigned a percentage representing the percentage of participants that ranked it as high priority. Following approval of the proposed list, the R&D, Initiatives, and Experiments Division, guided by the Unit for Future Pedagogical Planning, will prepare the development specifications for the laboratories that have been approved in accordance with the principles of future-oriented pedagogy.

Principle of personalization	**Personal learning** - learning in which the student chooses the curriculum, manner of learning, and methods of evaluation. The student independently manages the learning, monitors progress, and responds and improves learning. **(67%)**
	Personal mentoring – the teacher as a personal mentor will provide continual personal mentorship to each learner, supporting his or her progress on the basis of a deep and extensive knowledge of the learning. **(58%)**
Principle of collaboration	**The flat classroom** - the classroom is connected to and collaborates with many actors in the scholastic, municipal, national, and global environments. Collaborative projects are set up in physical and online environments involving schools from different educational streams, Israel's center and periphery, and schools in Israel and abroad. **(64%)**
	Learning in workplaces – students carry out an entrepreneurial project in which they learn and work in workplaces that sponsor the project. **(44%)**
Principle of informality	**Life-wide learning** – Learning in life spaces anywhere and anytime, while taking advantage of learning opportunities that exist in the learning stream ecology surrounding the learner. **(58%).**
	Integrative learning-supporting teaching faculty – teaching faculty with various specialties, providing a holistic support framework for the learner and groups of learners. **(56%)**
Principle of glocalism	**Broad sustainability –** development sustainable concept and worthy human and environmental existence that also deals with concepts such as public happiness, meaningful life, community, democratization, and fair distribution of resources. **(82%)**

	The world-improving school - a school that defines and implements a conception of social responsibility and from it generates world-improvement missions at the level of school and individual student. **(59%)**
Principle of change	**Ethical literacy** –acquiring skills to function in an ethical manner in life routines through conscious and purposeful decision-making, taking into consideration the obligation to society and the person himself. **(52%)**
	Risk management literacy and conditions of uncertainty – skills and personal traits that support the ability to make decisions and function under conditions of uncertainty and risk. **(49%)**
Principle of integration	**Reflective literacy** – development of skills for creating meaningful and sustainable interpersonal relationships, while maintaining a coherent self-identity and personal moral credo.
	Learning that creates meaning and personal purpose –formulating a complete self with an ethical consciousness, living in a world of rapid change and multiple arenas of association.

Einstein defined insanity as "doing the same thing over and over again, but expecting different results". This definition is more apt than ever in today's reality, which is undergoing exponential speeds of change that present the individual and the system with countless new and unfamiliar challenges.

In 2015-16, the R&D, Initiatives, and Experiments Division took up the gauntlet and developed the Unit for Future Pedagogical Planning, in order to lay the appropriate groundwork for "different" thinking in line with the trends and challenges of the approaching future. This document presents in brief the in-depth work and processes undertaken this year in the division. Its particular value is in how it translates theory to practice and proposes the means, principles, and development for immediate implementation.