United Nations
Educational, Scientific and
Cultural Organization

International Bureau
of Education

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Education

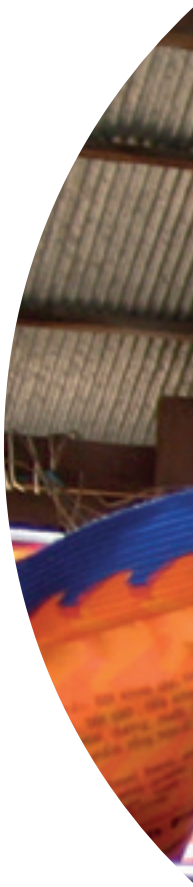
Guiding Principles for Learning in the Twenty-first Century

Today's students are growing up in an age characterized by breathtaking technological and scientific advance, ethical and social challenge and unprecedented longevity. In partnership with their parents, schools seek to form young people who, on their path to adulthood, will learn how to learn, learn how to be, learn how to do and learn how to love. We want them to be independent, sociable, self-aware, principled and employable young people who can make a responsible contribution to the communities they join and participate in tackling some of the world's challenges.

To provide a relevant and worthwhile education for them requires conviction, passion, judgement and expertise. It also requires deep thinking and clarity about what our priorities should be, what our students need to learn and how to do our work well. This remarkable set of principles is the fruit of two year's collaboration between the International School of Geneva and the International Bureau of Education. Staff have worked with experts in many fields to fashion a reference document that we hope will be of value to schools around the world united in the exciting challenge of education in the twenty-first century.

Vicky Tuck
Director General
International School of Geneva

The *Guiding Principles for Learning in the Twenty-first Century* is an impressive synthesis of the educational principles and practices that will prepare students effectively for the future, a future in which they will not only thrive personally but will be able and eager to contribute to creating a better world. The ten sets of principles chime strongly with the principles that underpin all four International Baccalaureate (IB) programmes and with the development work that the IB is currently engaged in. All ten are areas of focus for us, in all the programmes. For example, we are currently developing new materials to support schools in strengthening academic honesty at all age levels, and additional guidance to support teachers in developing more inclusive education. Concept-based teaching and learning and mindfulness are at the heart of the revised MYP [Middle Years' Programme] and are being strengthened in the PYP [Primary Years' Programme], Diploma Programme and IBCC [International Baccalaureate Career-related Certificate]. We know we also need to better articulate and promote creativity and creative thinking as fundamental to an IB education.



I congratulate Ecolint for developing these guidelines to ensure a consistent approach within and across all the schools.

Judith Fabian
Chief Academic Officer
International Baccalaureate/
Bachillerato Internacional/
Baccalauréat International

I like very much the emphasis on values. In particular, I applaud the priotizing of academic honesty, a principle which is quickly declining among both students and faculty. Its disappearance mocks the seminal principles of scholarship—giving credit when it is due and putting forth one's own ideas.

Howard Gardner
Hobbs Professor of Cognition and Education
Harvard Graduate School of Education

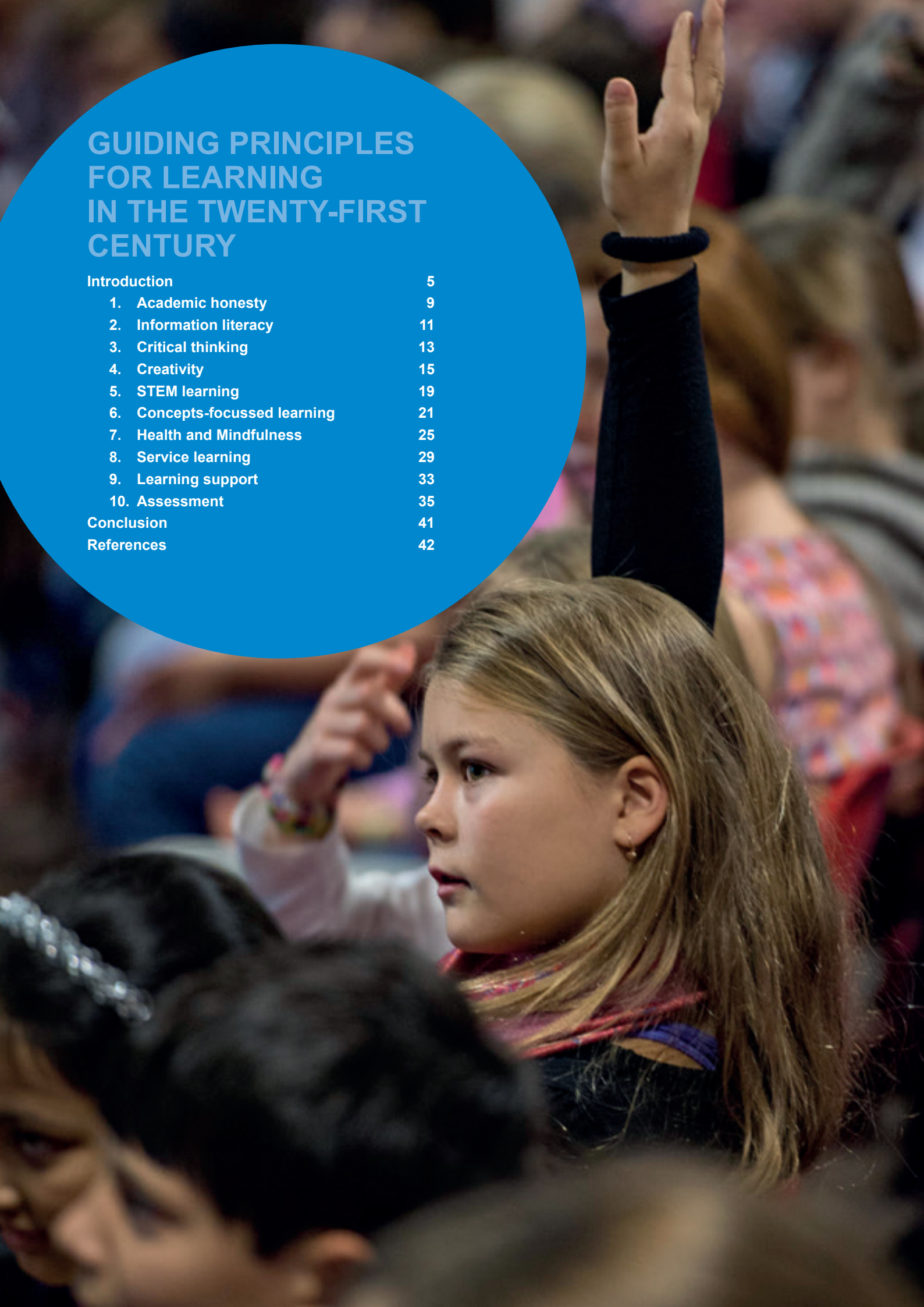
The *Guiding Principles for Learning in the Twenty-first Century* provide a thoughtful framework for educationalists engaging with what it means to be educated in a world of uncertainty and change. It demonstrates that curriculum must be more than a set of qualifications, concerned with inter-disciplinary as well as disciplinary understanding and the development of character and resilience.

Tristian Stobie
Director, Education
Cambridge International Examinations

I am convinced that this tool will be useful for those involved in primary and secondary education who have set out to develop or adapt the curriculum to best meet the needs of society in the 21st century. In particular, the student who can engage in constructive critical thinking and creativity will reap the benefits in tertiary education. In fact, critical thinking and creativity form the basis of all scientific work in higher education.

Margareta Baddeley
Vice-rector
University of Geneva

GUIDING PRINCIPLES FOR LEARNING IN THE TWENTY-FIRST CENTURY



Introduction

The purpose of this booklet is to offer guiding principles about what students should be learning in the twenty-first century. It is intended for teachers, curriculum designers, school leaders and others involved in all levels of school education. The guide offers a bridge between classroom practice, educational theory and academic research. It draws on theories developed by researchers and teachers, along with the expertise of educational organizations. The main contributors are the International School of Geneva and UNESCO's International Bureau of Education (IBE).

Historically, theories of learning, ideas about what we should teach, examples of practice and suggested models have been developed separately by different organizations. The result has been a lack of unity, with little cumulative knowledge and an absence of cooperation on research. This guide attempts to address this lack of unity by responding to the question: What is it that students should be learning in the twenty-first century?

This challenge takes us back to a fundamental question about the purposes of education: What is education for? The subject areas traditionally taught in school (languages, humanities, natural sciences, mathematics, technology, the arts, religious and physical education) are still required by universities and are still relevant. However, there is increasing understanding that new areas of knowledge, competences and behaviour need to be integrated into curricula if young people are going to function well in an increasingly complex global society. In the future, they may be faced with enormous challenges associated with poverty, overpopulation and declining bio-capacity.

For example:

- The International Education Advisory Board suggests that twenty-first century learning is and will continue to be linked to information technology;
- the Centre for Curriculum Redesign points to the need for a thorough review of the knowledge, skills and character necessary for deep and relevant learning;
- the Organisation for Economic Cooperation and Development's Programme for International Student Assessment has identified the "need to assess problem-solving abilities as governments around the world seek to equip young people with the skills they need for life and employment" (Schleicher, 2011);
- and UNESCO has stated that "concern for peace and sustainable development should be at the centre of our efforts to promote inclusive and equitable societal development" (UNESCO, 2013, p. 1).

What is clear is that learning in the twenty-first century involves numerous areas of human development. They go beyond skills and technology to cover all aspects of the social, psychological and moral development of learners. Education is expected to include sustainable development, learning to live together, intercultural understanding, communication skills and the respectful attitudes towards others needed for genuinely inclusive and peaceful development. If this is the case, education needs to go beyond traditional academic content. This guide offers ten areas for learning that are particularly significant in the present world's educational climate. It is a place where stability, predictability and continuity are no longer guaranteed. On the contrary, young people are entering a volatile, unpredictable, complex and ambiguous world.

These ten areas can be divided into:

- core areas of knowledge (such as STEM [science, technology, engineering and mathematics] learning, information literacy and concepts-focused learning);
- competences (such as creativity and critical thinking);
- attitudes (associated with academic honesty, service learning, health and mindfulness);
- and broad approaches to learning (in areas such as learning support and assessment).

This guide is the result of two years of brainstorming among school-teachers from the International School of Geneva and academics from various institutions, such as the IBE, Durham University, King's College, London, and the Centre for Curriculum Redesign. Students and parents of the International School of Geneva have also played a role in producing this work.

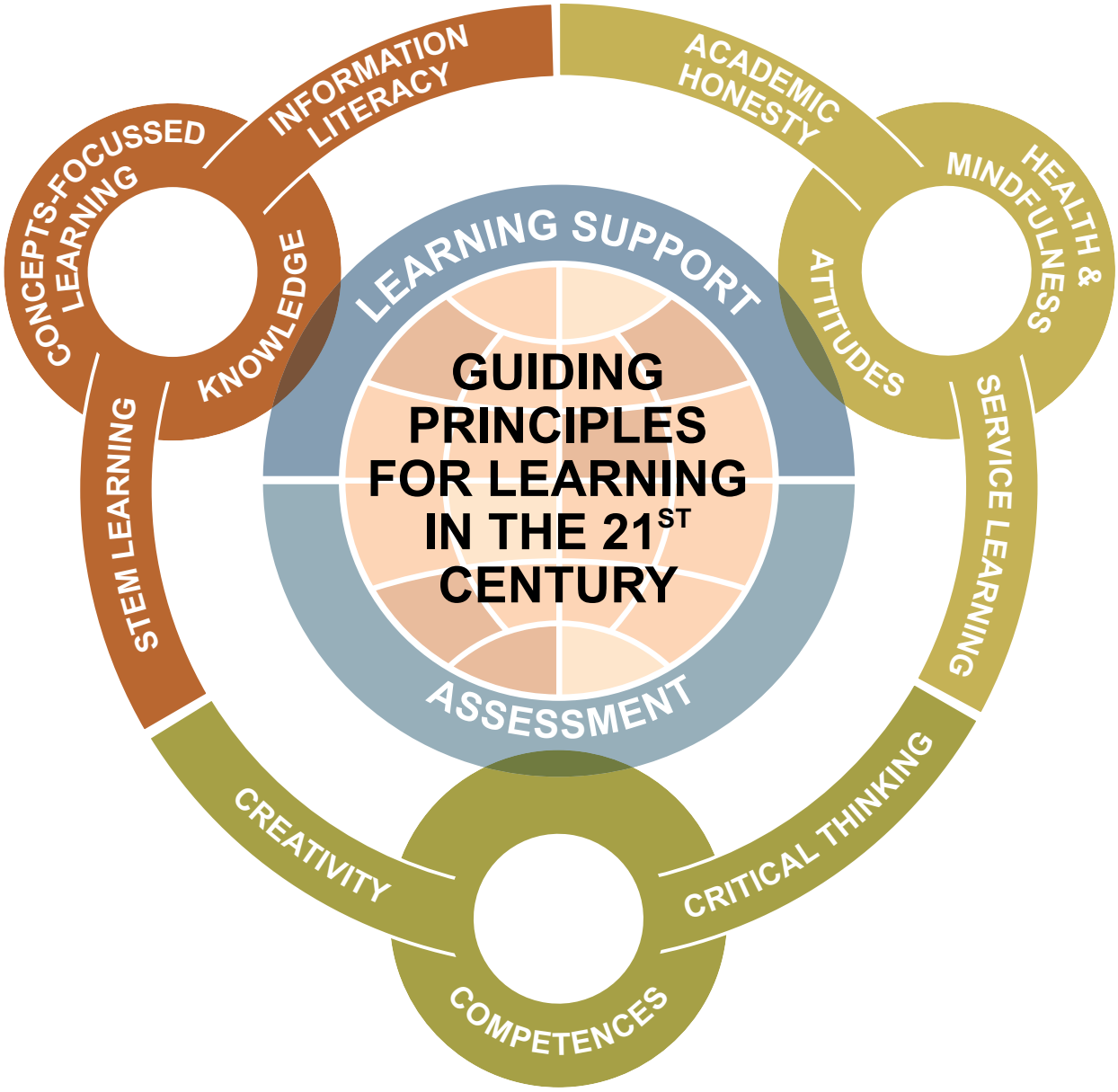
The guide can be used for any age group, as the principles it contains are general enough to be applied in different contexts.

It is intended to stimulate meaningful reflection on education so that those who read it feel inspired to take up some of the suggestions and adapt them to the realities of their own classrooms. Although the use of these ideas will vary depending on the context, the underlying message will be the same: these guiding principles are essential for quality learning in the twenty-first century.

CONRAD HUGHES,
Director of Education,
International School of Geneva

CLEMENTINA ACEDO,
Director,
UNESCO International Bureau of Education

Suggested readings:
Coffield et al., 2004; Fadel, 2011; IEAB, 2013; Schleicher, 2011; UNESCO, 2013.


GUIDING PRINCIPLES FOR LEARNING IN THE 21ST CENTURY
LEARNING SUPPORT
ASSESSMENT
KNOWLEDGE
INFORMATION LITERACY
CONCEPTS-FOCUSSED LEARNING
STEM LEARNING
ATTITUDES
ACADEMIC HONESTY
HEALTH & MINDFULNESS
SERVICE LEARNING
COMPETENCES
CREATIVITY
CRITICAL THINKING

1. Academic honesty

Students should be encouraged to carry out independent and original research with a clear understanding of academic honesty.

As the basic aim of education is for students to learn and since carrying out independent research is a core element of learning, schools should give students the technical means, an understanding of the concepts and the ethical foundation to conduct research with confidence.

1. **Good academic practice entails deep understanding of academic honesty**

All students, teachers and parents should understand the concepts of "plagiarism", "collusion", "malpractice" and "intellectual property". These concepts need to be repeated from the first years of schooling up until the final examinations in an appropriate manner according to the age of the students. Schools will communicate these concepts to students in suitable ways, ensuring that there is a constant, open dialogue on academic honesty. Formative assessment, making learning visible and reflection on the learning process reinforce academic honesty.

2. **Creative task design enhances academic honesty**

The best way of avoiding academic dishonesty is to design tasks that require original and not reproductive thinking. Open-ended creative tasks and learning experiences based on authentic individual contexts will put students in situations where malpractice, collusion or plagiarism are less likely to occur.

3. **Academic honesty requires clear referencing**

Each school should have clear guidelines on the way it requires students to display the references they have used for their research. Each school's curriculum coordinators will be responsible for the choices that students make about their research and the degree of consistency and clarity students receive on the matter.

4. **Academic honesty requires team work at the school level**

The librarian in each school should work with teachers and coordinators to ensure that students' use of electronic and manual resources is ethical, informed, up-to-date and productive.

In the school

- Each school will use plagiarism-detecting software to screen students' work, as appropriate.
- Each school is responsible for equipping each student with a study guide that gives clear guidelines about acceptable research practice and the conventions of academic writing, as well as examples of academic dishonesty.
- In cases where students are found guilty of academic dishonesty, the teacher involved in the incident and the relevant academic programme coordinator will convene the student and the student's parents to issue an official warning. This opportunity should be used judiciously to discuss the issue at hand and to ensure clear understanding of all aspects of the case.

2. Information literacy

All students should be able to use information creatively, ethically and critically.

1. **Students should be able to achieve their personal goals through the efficient, effective and ethical use of information**

Learning experiences at all year levels should allow individuals and groups to search for and use information for the creation of original materials, decision-making and problem-solving. Students should be encouraged to seek out information constantly from many different sources, disciplines and cultures. This will contribute to good scholarship, a comparative understanding of different subjects in the curriculum, global awareness and the very best possible work.

2. **Schools should give their students opportunities to develop the skills and attitudes necessary to be skilful in the use of new technologies**

Information literacy should allow students to increase their use of technology and to develop the skills of analysis, discernment, synthesis, creativity, investigation, collaboration, communication, organization, critical evaluation of sources and reflection. Schools should make sure that students are familiar with recent and new technologies, and students should be shown how to use them intelligently. A key part of this process is about educating students in rigorous, creative and critical use of source material.

3. **Schools should show students that information literacy is a skill that is appreciated in society and be careful to teach it taking into consideration related ethics, legality and safety**

Students should learn about the concept of digital citizenship at each year level. Digital citizenship defines the way that a person "participates in society online" (Mossberger, 2009, p. 173). Schools should ensure that the guiding principles of academic honesty are an important part of information literacy.

4. **All students should be given the opportunity to engage in meaningful, independent, inquiry-based learning**

Schools should make sure that project-based learning is a regular feature of the curriculum during each year level. Each school should refer to design and/or inquiry cycles, and should be clear when they refer to them in order to support students' information literacy consistently and coherently.

5. **The best way of achieving a strong information literacy programme is through carefully-planned collaboration between all stakeholders**

This involves appropriate interaction between students, librarians, technology-for-learning coordinators, teachers, administrators and parents.

In the school

In order to achieve these goals, schools must develop the following common procedures:

- A clearly defined information literacy programme with a set of criteria showing what would be understood as success when judging the effectiveness of the programme during assessment that will take place every second year.
- Clearly established lines of responsibility for introducing and evaluating the programme. It is recommended that the person in charge is the one responsible for coordinating technology for learning in the school. This person is expected to work closely with the chief librarian and relevant

department heads or year leads, depending on the school's organization.
- Making available long-term workshops/courses for parents and teachers on subjects such as information literacy and digital citizenship.
- An integrated approach to using information and communication technologies (ICTs), based on joint planning and teaching with librarians, teachers, technicians and technology-for-learning co-ordinators.
- Long-term digital/multimedia creation courses.
- Standard language and research frameworks for use with teachers, parents and students.
- Curriculum opportunities for age-appropriate, vertically coordinated learning of programming and coding incorporated into the programme.
- Yearly reviews of the most successful practices that have stimulated information literacy learning.

Suggested readings:
Mossberger, 2009.

3. Critical thinking

Students need to learn how to become critical thinkers.

1. Critical thinking is simply "good thinking"

Critical thinking is a popular, sometimes overused, term that in reality describes, quite simply, the principles of "good" or "clear" thinking. "Good thinking" is the ability to judge arguments or points of view with intelligence and not to be influenced by ideology, fundamentalism, indoctrination, prejudice and unverified beliefs. Critical thinking allows students to think for themselves. "The critical thinker must be autonomous-that is, free to act and judge independently of external constraint, on the basis of her own reasoned appraisal of the matter at hand" (Siegel, 1985, p. 70). This approach can be recognized in the following actions and attitudes, which are by no means exhaustive:

- Examining sweeping generalizations in detail and avoiding over-simplifications;
- Clarifying issues, conclusions or beliefs;
- Clarifying and analysing the actual meaning of words or phrases;
- Developing criteria for evaluation: clarifying values and standards;
- Evaluating the credibility of sources of information;
- Listening critically to what the speaker is actually saying;
- Thinking precisely about thinking: using critical vocabulary (Paul & Elder, 2006).

2. Critical thinking happens in all domains through knowledge, skills and attitudes

Critical thinking is not merely rational thinking, it involves propositional knowledge ("knowing that"), procedural knowledge ("knowing how") and dispositional knowledge ("knowing to") (Ryle, 1971). This involves a respectful, open-minded approach, "intellectual humility and suspending judgment [...], good faith [and] integrity" (Paul, 1990, p. 56). To stimulate critical thinking in its fullest forms, teachers should be aware of these different abilities and attempt to develop them in students. Critical thinking should be developed in all domains and considered in a whole context (mathematics, literature, social life, creative thinking). Children can be taught to think critically from a young age, but in an age-appropriate manner.

3. Critical thinking is essential for inquiry-based learning

The way students ask questions is essential for them to become critical thinkers. On the one hand, teachers need to use questions as tools to stimulate critical thinking, notably open-ended questions that make students justify and provide evidence for their positions ("Can you go through that step by step?", "Can you explain why that works?", "What would happen if ...?", "Why do you say that?" (Swan & Pead, 2008)). On the other hand, students should also be shown how to appreciate what makes a good question (challenging deeper thought, seeking justification, eliciting abstractions and generalizations from particulars and examples) and different types of question (clarification, probing assumptions, probing reason and evidence, viewpoints or perspectives, probing implications and consequences, questions about questions (Paul, 1990)). This will help students learn to develop good questions of their own. Questioning for critical thinking goes further than asking questions; it implies rigorous follow-through

using, amongst other appropriate strategies, the Socratic method—based on discussion between individuals asking and answering questions to clarify ideas.

4. Critical thinking requires a high-gain/low-risk learning environment

Students should feel free to take risks, to be corrected without feeling that they are being criticized, to challenge, to be challenged and to discuss different opinions. The teacher needs to promote wide-ranging discussion between students so that arguments in favour and against ideas can be examined in great detail, even if, on occasion, this moves away from curriculum coverage. In this regard, critical thinking, like creative thinking, requires an open-minded approach from the teacher. It is the quality of the critical thinking itself that is the learning objective.

5. Knowledge is a prerequisite for achieving critical thought

The quality of critical thinking depends upon the level of relevant knowledge that will be used to support it. There can be little meaningful critical thinking if it is not related explicitly to an understanding of different types of reason in different bodies of knowledge. "A person learns the proper assessment of reasons by being initiated into the traditions in which reasons play a role. Education, on this view, amounts to the initiation of the student into the central human traditions [of] science, literature, history, the arts, mathematics, and so on" (Siegel, 1985, p. 72). The observations young people make of the world and their natural capacity for critical thought should be appreciated and developed when and where possible: students should be brought to reflect critically on different types of knowledge, not only in academic domains but in terms of broader personal and shared experiences.

6. Critical thinking can lead to international-mindedness

Since critical thinking involves open-mindedness, good listening skills and the ability to look at different points of view, it can lead to a rich appreciation of cultural, national and historical diversity in human thought. Students should therefore be encouraged to explore and appreciate diverse scholarly traditions, including major differences and similarities between "Western and non-Western intellectual cultures" (Singh & Qi, 2013, p. xii).

7. Teachers should model sceptical thought

Teachers should demonstrate healthy scepticism when dealing with unproven information. This does not mean dismissing claims of unconfirmed knowledge on principle or expressing melodramatic disbelief, but being prepared to investigate claims thoughtfully and methodically. This is especially important in today's world where the media plays a crucial role in forming public opinion. Young people need to learn how to be sceptical when approaching knowledge that is supposed to be true.

In the school

- Each school should have a logical sequence of learning objectives that students should discover related to critical thinking within the curriculum.
- Opportunities for professional development for teachers on critical thinking should be ongoing.
- Schools should ensure that the elements of critical thinking are also evident when student are taught about service learning, self- and peer-assessments, and portfolios.
- When evaluating the work of teachers, there should be evidence of critical thinking taking place in the classroom.

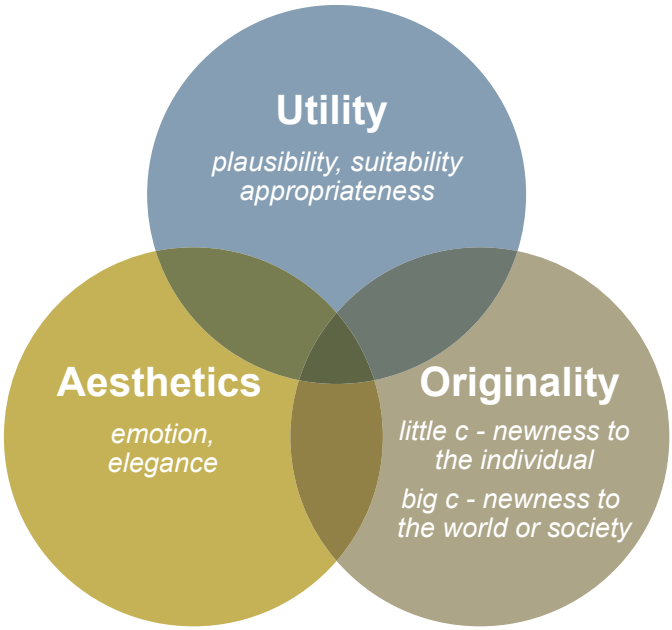
Suggested readings:

Paul, 1990; Paul & Elder, 2006; Ryle, 1971; Siegel, 1985; Singh & Qi, 2013; Swan & Pead, 2008.

4. Creativity

Students should be taught the skills of creative thinking.

There are many definitions of creativity, but they all have these essential elements in common:



1. Creativity is not limited to the arts

We are living in a world that requires creative thinking to solve increasingly complex problems. The process of using creative thinking skills leading to a new solution may arise in many different areas. Creativity is a life skill and approach that does not belong exclusively to the arts. It should be fostered in all disciplines, and across all physical, intellectual, social and emotional areas.

2. Being a creative teacher is only part of the process

There is a distinction between creative teaching where there is a focus on planning and teaching procedures, and teaching for creative thinking where the emphasis is on developing the learner's creative thinking skills. While both are important and the latter may be developed by the former, the teacher's basic goal is to stimulate creative thinking in the student's mind.

3. Certain command terms drive creative thinking

Mental behaviours suggest that creative thinking is at work when we use skills-based command terms such as: add to, adapt, alter, amend, analogize, analyse, combine, create, design, generate ideas, hypothesize, modify, re-arrange, re-design, re-state, reverse, substitute and supplement. It is also useful to remember that problem-solving is an important component of creativity and includes the following processes: ask a question; notice; identify a need or opportunity; come up with alternatives; select from options; collect data; test options; verify solutions; apply ideas; and evaluate outcomes.

4. Play is an important part of creativity

Play and joy in the flow of creative thinking are essential and we should not be afraid to let our students play with ideas. Imagination plays an essential role in developing abstract thought. One of the essential "dialectical tensions" involved in creativity is that the creative individual "shows a playful attitude while remaining disciplined" (Csikszentmihalyi, 1996, p. 58). Whenever possible, play should be used to extend the range of opportunities to think.

5. Teachers need to demonstrate creative thinking

Both teachers and students should be encouraged to demonstrate their creative thinking to help others recognize and appreciate what is involved. Teachers should attempt to recreate the class atmosphere that is likely to stimulate creativity. They should also be aware of the types of resources, and teaching strategies/tasks that demand rigorous creative thinking on the part of the students.

6. Creativity can be recognized

The assessment of creativity is challenging and controversial. However, large-scale research (QCA, 2004) has identified some core behaviours that are typical of creative thinking:

- questioning and challenging;
- making connections and seeing relationships;
- envisaging what might be;
- exploring ideas and keeping options open;
- and reflecting critically on ideas, actions and outcomes.

These are best evaluated formatively, particularly through self-evaluation, peer-evaluation and portfolio assessments. Due to the characteristics of creative thinking, assessments should be multi-dimensional (Lindström, 2006).

7. Certain questions stimulate creative thinking

Questions that stimulate responses requiring higher order cognitive functions can encourage creativity, such as the evaluation and/or synthesis of information, application of ideas in new circumstances or the creation of alternative outcomes. What if...? and Why…? questions tend to stimulate creative and critical thinking, especially if followed by more questions that probe and encourage the learner to go further (Fredericks, 1991; Kazemi, 1998; Newton, 1996).

8. Deep creative thinking can only be fostered if the preparatory knowledge, skills and knowledge have been understood

The teacher has to ensure that prior understanding has taken place to ensure that creative thinking is meaningful. Subject knowledge should be at an adequate level to ensure that creativity is a powerful extension of learning and not a superficial event.

9. Creative ideas should be actualized

Creativity is not just about thinking but what you do with your creative thoughts. Students should carefully select the ideas they decide to pursue further and use analytical skills to judge the value and impact of their proposed actions. All citizens, especially students, need to plan for a future that is likely to develop at an accelerating rate and where creativity will be as important as sustainability for the survival of the human species.

10. Creativity involves a process

The creative process is seen as both controlled and automatic (Zabelina & Robinson, 2010), conscious (Fillis & McAuley, 2000) and unconscious (Koestler, 1964). It can be viewed through the following steps:

- preparation (detecting a problem and gathering data);
- incubation (stepping away from the problem for a period of time);
- illumination (a new idea or solution emerges, often unexpectedly);
- and verification (the new idea or solution is examined or tested) (Wallace, 1926, quoted in Spencer, Lucas & Claxton, 2012).

Another account sees it as "a process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses, or formulating hypotheses about the deficiencies; testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results" (Torrance, 1970, quoted in Spencer, Lucas & Claxton, 2012) .

In all cases, the creative process should be respected as one that relies on perseverance, rigour, lengthy periods of hard work and purpose. For creativity to have an impact, the process must be carried through to the end.

In the school

All schools should actively identify the best ways of developing creative thinking in and out of the classroom. Creativity should be taken into consideration in the decisions made concerning:

- Staff recruitment;
- Setting aside time in the curriculum for students and teachers to develop creative thinking;
- Allowing students to play a leading role in their own learning;
- Making sure that students take time to review their learning from multiple perspectives;
- The creation of spaces in schools that allow for creative activity;
- Codes of behaviour and classroom procedures that value and promote creativity.

Suggested readings:

Csikszentmihalyi, 1996; Fillis & McAuley, 2000; Fredericks, 1991; Kazemi, 1998; Koestler, 1964; Lindström, 2006; Newton, 1996; QCA, 2004; Spencer, Lucas & Claxton, 2012; Sternberg, 1996; Torrance, 1970; Treffinger et al., 2002; Zabelina & Robinson, 2010.

5. STEM learning

The learning of science, technology and mathematics should be integrated using the principles of engineering.

STEM stands for "science, technology, engineering and mathematics": it suggests an integrated approach to these domains whereby science and mathematics are learnt through interdisciplinary projects that use technology and the principles of engineering. Although interdisciplinary learning should not be restricted to these areas, STEM provides particularly useful opportunities for meaningful, innovative practice that reflects the increasingly integrated nature of real-world scientific research.

1. **An interdisciplinary approach to STEM learning should be prioritized**

Sufficient time should be set aside for teachers to collaborate on planning, timetabling, professional development and partnerships, which would allow STEM learning to be carried out through interdisciplinary projects. These projects are aimed at learning objectives and prepare students for formal assessments through the most exciting and concrete methods available and possible. For effective transfer of knowledge across disciplines, learning should be based on concepts rather than topics.

2. **Science, technology and mathematics learning should be innovative, highly creative and authentic**

All students should have the opportunity to work on real-world problems and to communicate with experts outside the school. Schools are encouraged to use expertise found among parents to enhance the understanding of mathematical, technological and scientific real-world dynamics. The study of science and mathematics should be associated, where appropriate, with technology. In our educational provision we should consider new branches of mathematics that are more relevant to today's world. Schools should be careful to maintain a gender balance in STEM learning by actively encouraging girls to participate in these subjects as much as boys.

3. **The essentials of STEM history should be taught to all students**

The socio-economic, historical and cultural background of STEM subjects should be explored by students. They should have an opportunity to see science, mathematics and technology not just as a series of "thats" and "hows", but as constructs that have developed over time with specific values and assumptions that occurred at the same time. Analysis of case studies across various domains and in different historical periods could be one approach. Similarly, students should be encouraged to question the usefulness of their STEM learning and to probe its relevance.

4. **STEM projects should be displayed both inside and outside the school**

Interdisciplinary projects should take students and their learning out of the classroom into the community and connect them with industries, where they can benefit from external contact, feedback and real-world situations. Teachers should ensure that STEM projects are displayed within the school as often as possible. They should also take advantage of opportunities to publicize projects through official partnerships with universities and other external organizations.

5. **STEM learning should strengthen students' ability to transfer knowledge and skills to new situations**

The core STEM skills are magnitude estimation, conjecture, hypothesizing, prediction and generalization before experimentation, and creative problem-setting and -solving. These skills should be used to give students confidence to approach the world with curiosity, sound thinking and the ability to approach unknown circumstances with an array of critical-thinking strategies, including a thorough understanding of scientific processes. Students should be required to ask critical questions to clarify the problem and to make responsible decisions when it is known that sufficient information is available.

In the school

In order to meet these goals all schools should:

- Where necessary, consider condensing the timetable into a shorter period of time at the appropriate year level so that a place can be found for interdisciplinary projects.
- Ensure that adequate planning time and study space is made available to the relevant staff and students.
- Take advantage as much as possible of the skills and resources available from parents, local industries and officially endorsed partnerships.
- Allocate clear responsibility for the coordination and evaluation of STEM projects, as well as allowing for the necessary training of staff.
- Ensure that STEM learning projects are driven by significant questions that should be agreed by relevant staff and students.

6. Concepts-focussed learning

Concepts are fundamental in learning.

One of the most important aspects of learning is the way that we organize information so that it can be understood and retrieved. The mental categories that we use to order information are called "concepts" (Bruner, Goodnow & Austin, 1967). Concepts are the mental categories that help us identify, develop and classify objects, events or ideas, building on the understanding that each object, event or idea has a set of common relevant features. Thus, concept learning is a strategy which requires a learner to compare and contrast groups or categories that contain concept-relevant features with groups or categories that do not contain concept-relevant features.

Learning for understanding takes place when it is carried out through concepts: this means that the learner identifies the basic characteristics of something that allow it to be generalized to a higher, more abstract level. It is by identifying the basic characteristics of a piece of information that the learner will be able to master an understanding of what defines it and, therefore, what its purpose and meaning is. "With the exponential growth of information we need to rise to a higher level of abstraction –

1. to create brain schemata for organizing, and patterning the information base;
2. to facilitate transfer of learning through time, across cultures, and across situations" (Erickson, 2013).

If knowledge is not taken to a higher level of abstraction, then it is not possible to recognize and appreciate its significance and basic characteristics. Learners will be faced with disparate elements that are not unified by any obvious principles or laws. One of the essential aims of education is to make clear the elements of knowledge through a structure that will allow for deep understanding, transfer and application.

1. Teaching through concepts is teaching for understanding

Students need to be taken through the process going from:

- factual knowledge (separate pieces of information);
- to topics (which are groupings of pieces of information);
- to concepts (ideas within and across topics that identify the common characteristics linking pieces of information to one another);
- to principle generalizations (laws);
- and, eventually, to theory, where broad statements can be made about the body of knowledge in question.

It is through this rigorous process that students will be able to master understanding of individual elements and how they fit into an overall system.

2. Concepts are mental categories

Students should be made to place the knowledge to which they are exposed into categories of conceptual frameworks or "lenses". A conceptual framework is an analytical tool with several variations and contexts. It is used to make conceptual distinctions and organize ideas. Strong conceptual frameworks capture something real and do this in a way that is easy to remember and apply. These organizational structures make learning more efficient, relevant and meaningful. Some examples of the broad concepts that can be used to organize knowledge include: conflict, complexity, beliefs/values, paradox, interdependence, interactions, freedom, transformations, force, identity, patterns, relationships, origins, change, perspective, reform, heroes, power, influence,

system, balance, structure/function, innovation, design, genius, aesthetics and creativity (Erickson, 2013).

3. **"Synergistic thinking is the interplay between factual and conceptual levels of thinking and is key to intellectual development and motivation for learning" (Erickson, 2007)**

By inviting students to bring their own intellect to the topic of study through concepts they are more engaged with the learning process than they would be through a purely factual approach.

4. **Concepts are powerful tools for the transfer of knowledge**

Conceptual frameworks are necessary for students to be able to transfer knowledge to different contexts; it is through a broad concept that students will transfer lessons learnt in one area to another. For example, the concept of a cycle can be applied from the natural sciences to history. This will take place once the student is able to understand the idea of the cycle clearly as a general concept rather than something that only operates at one level or within one subject (for example, the water cycle is only one manifestation of the concept; the vicious cycle of poverty is a completely different one, but they both share the underlying principles of a cycle). It is by understanding the key abstract features of a concept that students will be able to recognize them in different circumstances and therefore transfer them to their learning.

5. **Interdisciplinary learning depends upon concepts-focussed learning**

This means that different disciplines can only be compared meaningfully through a principal concept that draws out the main features in the relevant areas of knowledge in a new context. Superficial interdisciplinary learning involves briefly learning about separate subject areas without any clear conceptual goal (for example, believing that, in a humanities/art project, students making a poster are therefore "doing" art). In fact, deeper, concepts-focussed interdisciplinary learning involves investigating a single concept through the disciplinary lenses of two or more areas of knowledge for deeper understanding (for example, a project on the representation of time in history and visual art).

6. **"Threshold" concepts should be identified in the curriculum and within a student's learning progression**

"A threshold concept represents a transformed way of understanding, or interpreting, or viewing something without which the learner cannot progress. As a consequence of comprehending a threshold concept there may thus be a transformed internal view of subject matter, subject landscape, or even world view, and the student can move on" (Land et al., 2005, p. 53). Threshold concepts, such as fractions, buoyancy, photosynthesis, gravity, analysis and numerous examples from economics (such as opportunity cost, price and value, equilibrium), should be recognized as important moments in a learning progression. Teaching and learning, as well as curriculum design, should take threshold concepts into account and examine ways of basing instruction around these significant, troublesome areas of knowledge acquisition.

7. Learning objectives and assessments should allow students to show conceptual understanding

Conceptual understanding means actively building new knowledge from experience and prior knowledge. Assessments with diagnostic, formative or summative purposes should, when and where possible, give students opportunities to show their conceptual understanding of the domain in question. This can be done in numerous ways and has implications for task design. Learning objectives within the curriculum should not communicate specific elements of knowledge and skills development alone, but should incorporate these facets of learning into broad concepts so that teaching and learning is directed at such understanding.

In the school

- Schools should ensure that the curriculum structure is structured around concepts-focussed learning objectives.
- Interdisciplinary projects should have a clear conceptual focus.
- There should be continuous appropriate professional development in concepts-focussed learning.
- The school administration should ensure that time is set aside for teachers to collaborate and plan together in order to teach interdisciplinary projects.

Suggested readings:

Bruner, Goodnow & Austin, 1967; Erickson, 2007; Erickson, 2013; Land et al., 2005.


ESPAÇO
CRIANÇA
ESPERANÇA

7. Health and mindfulness

Students should be encouraged to be physically, mentally, emotionally and socially alert, and ready to adopt new solutions for new experiences.

The aim is to increase the mental, emotional and physical well-being of students in preparation for the long lives they can expect to lead. The education provided should include a range of opportunities to learn, to grow, to succeed and "to develop to their fullest the powers of each individual to understand, to modify and to enjoy his or her environment, both inner and outer, in its physical, social, moral, aesthetic and spiritual aspects" (Peterson, 1987).

Mindfulness can be defined as "the awareness that emerges through paying attention, on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment" (Kabat-Zinn, 2003, p. 145), it is "openness to novelty, alertness to distinction, sensitivity to different contexts, awareness of multiple perspectives, and orientation in the present, paying attention to the immediate situation" (Sternberg, 2000). Our educational offering should take our students away from mindlessness, which entails an "overreliance on categories and distinctions drawn in the past and in which the individual is context-dependent and, as such, is oblivious to novel (or simply alternative) aspects of the situation" (Langer, 1992, p. 289).
"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1946). It goes beyond physical well-being and entails a holistic state whereby thoughts, actions and impressions are interrelated. Health and mindfulness are inextricably linked.

1. **Mindfulness is an important way to maintain health and well-being**

Members of the school community should work together to create environments that allow learners to reflect meaningfully on their interaction with the outside world and their inner sense of being. In this way students will be able to appreciate what is going on around them and their own sense of purpose. By enhancing intrapersonal, interpersonal and environmental awareness, students will be enabled to take more thoughtful decisions about their lives. This reflective process is necessary for a rich, serene existence.

2. **School should aim to empower students to learn more effectively and to think more clearly**

Students, like staff, should be made to clarify their thoughts and learning strategies through "reflective and metacognitive thinking, self-regulation, decision-making, and problem solving, as well as disciplinary forms of thinking" (Ritchhart & Perkins, 2005, p. 777).This is a broad ongoing goal depending on the quality of teaching and learning, assessment and curriculum design. A mindful approach will encourage students and teachers to identify items of thought with a sense of presence, so that learning is not an unidentified, automatic process, but a recognized pathway that pursues clear objectives and requires a mentally alert state.

3. **The education provided in each school should encourage all students to be aware of self, others and context**

The daily life of the school should be based on a holistic approach to teaching and learning. Students should be made aware of the significance of participating in the life of their community and what it means to be part of multiple communities (school, home, local, global). Without understanding

ourselves, our relations and actions within our community are not as effective. Schools should aim to help all learners to be aware of values and beliefs and to care about them, but also at times to question and challenge them. Students should be brought to recognize the fundamental role of place, not as a meaningless, blank stage for presence, but as the very vehicle of actions and decisions. A simple message to all learners is: “be brave, be aware and be respectful”.

4. **Schools should aim to provide space and time for reflection in order that individual students and teachers are able to realise, develop and understand their potential**

Students should be given time during their education to examine themselves in their environment and to reflect deeply on their choices. The route to mindfulness is an individual one and the time necessary should be found to create the conditions allowing this to happen. Physical space should also be a consideration so that students are provided with opportunities to find silence, peace and calm to enhance their presence of mind.

5. **All members of the school community should be aware of intercultural diversity, at all levels of communication**

An internationally-minded school is a place where a multitude of different approaches come together. Members of such a community need to make a serious, conscious and on-going effort to put their own worldviews into perspective and to remain sensitive to other people’s needs, beliefs, positions and cultural frameworks.

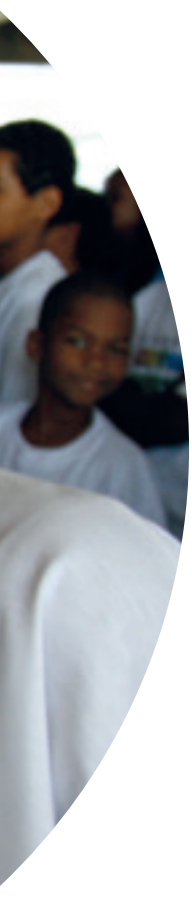
6. **Schools should aim to develop and sustain a Health Promotion Project**

All schools should aim to improve the quality of teaching and learning in the school through the broad concept of a healthy school—one that values the growth of social and human capital, and the active promotion of a healthy life for all those living and working in the school. This broad concept of health is defined in the Ottawa Charter for Health Promotion (WHO, 1986) as building healthy public policy, creating supportive environments, strengthening community actions, developing personal skills and reorienting health services. Suitable steps should be taken to ensure that the promotion of health happens at all levels of the school community (structural organization, teaching and learning, academic programmes, teamwork, and partnerships with the local community).

In the school

In order to best support the needs of students through structural arrangements that inspire effective practice, schools will:

- Encourage each individual in the school community to adopt mindful behaviour at the levels of reflection, leadership, partnership, teaching and learning, and communication.
- Ensure that there is regular time put aside for staff and students so that they have an opportunity to reflect deeply. The concept of mindfulness can be the theme of assemblies, group discussions, projects, theme days or weeks, and school outings leading to more meaningful experiences.
- Ensure that there are clearly identified times during a student's year at school, and included in the written curriculum, that encourage the student to reflect about self, others and context.
- Use the mentor/homeroom or reflection programmes, as appropriate to the relevant school, to build a coherent approach to health and mindfulness.
- Designate a space in the building that allows for silent meditation: each school should have a space where students can think in silence.
- Encourage teachers to use silence as a powerful medium for mindfulness through set procedures, such as one-minute silence at the beginning, middle or end of a lesson, periods where there is no talking and clear moments where there is in-depth reflection on a single thought for an extended period.
- Communicate the principles of health and mindfulness to parents so that the effect is carried beyond the classroom.
- Designate a specific person or group to monitor the place and meaning of health and mindfulness at each level of the school community.
- Consider professional development in health and mindfulness through programmes, pedagogical days and workshops put aside for the sharing of best practice in this area.
- Develop, sustain and monitor a Health Promotion Project in each school.



Suggested readings:

ISG, 2012; Kabat-Zinn, 2003; Langer, 1992; Peterson, 1987; Ritchhart & Perkins, 2005; Sternberg, 2000; WHO, 1946; WHO, 1986.

8. Service learning

Students should participate in service learning for their personal growth and as a contribution to society.

Service learning is education taking place through voluntary work and in community projects. Students need to be given a deeper understanding why they should become involved in service learning and how they can do so as effectively as possible. This is a vital part of experiential learning in that concept-formation follows from concrete experience (Kolb, Rubin & McIntyre, 1974). Service learning is also a cornerstone of citizenship education in that it explores "the duties and rights of citizens at local, national and global levels [and] an exploration of the nature of personal and civic identity" (ISG, 2009).

Service learning leads to the development of the whole child: it takes him or her beyond academic learning into applied knowledge and personal conduct. This enrichment of the educational experience can lead to wisdom*.

Therefore, service learning must be recognized as an essential part of education. It is necessary for students to become directly involved in service projects so as to internalize the values of the school and to carry them out in real-life situations.

In the twenty-first century, it is vital that schools recognize the place that service learning has to play in the sustainability and regeneration of society. It is a way to develop notions of reciprocity, meaningful action and purposeful engagement within the individual and the local community so as to make the world a better place. Service learning is at the heart of what it means to be human. The fundamental goal of service learning is to empower students to take an active part in an education that develops a profound sense of humanity. This implies values such as humility, empathy and open-mindedness, and personal conduct such as commitment and initiative that are mediated by critical, creative, alert and reflective thinking.

1. Service learning must meet a genuine need

Before engaging in voluntary work, students should be encouraged to find out about and understand the needs for voluntary work at different levels in the community. It is through research, communication with the person or group served and direct experience that students will learn what it means to participate in a community. Developing an understanding of the community and all its different needs will make subsequent service work more valuable.

2. Service learning has consequences

Actions and interactions in the context of a voluntary service activity have consequences for which students need to be aware. Students must find out about the repercussions and effects of service actions before, throughout and after they have been involved in these activities. The activities

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* *wisdom is defined as the application of intelligence, creativity, and knowledge as mediated by positive ethical values toward the achievement of a common good through a balance among [...] intrapersonal, [...] interpersonal, and [...] extrapersonal interests, over the [...] short- and [...] long-terms. Wisdom is not just about maximizing one's own or someone else's self-interest, but about balancing various self-interests (intrapersonal) with the interests of others (interpersonal) and of other aspects of the context in which one lives (extrapersonal), such as one's city or country or environment (Sternberg, 2009, pp. 20-21).*

need to be planned critically and respectfully, in conjunction with the person or group served.

3. Service learning should involve long-term commitment

Whenever possible, projects developed by and/or with students need to take place over a lengthy period of time. Even though students may be involved in short-term support during emergencies, such as natural disasters or accidents, it is preferable that they should plan their service projects with long-term involvement and impact in mind. Commitment to a project is more likely to develop if students are asked to have carried out careful planning, SWOT analyses and face-to-face discussions with the person or group served. SWOT analyses are defined as: "Strengths: characteristics of the business or project that give it an advantage over others; Weaknesses: characteristics that place the business or project at a disadvantage relative to others; Opportunities: elements that the project could exploit to its advantage; Threats: elements in the environment that could cause trouble for the business or project" (Wikipedia, 2014).

4. A respectful attitude is required for service learning

Students need to show empathy and respect for the person or group served. It is crucial to avoid patronizing or "messianic" approaches in service, i.e. that the student has come to the rescue. The student should see himself/herself as a learner first and foremost. In this perspective, it is important for the students to understand that people from different cultural and socio-economic backgrounds may also have something to teach them.

5. Service learning should lead to personal growth

Students have different levels of understanding and involvement in service. This situation should be taken into account when proposing a service-learning programme. Students should be evaluated individually as far as possible in order to find out what their personal goals are. Giving students constructive and precise feedback during and after these activities is an essential way of developing the quality of service learning.

6. Service learning follows a cycle of inquiry

Service learning involves connecting, discovering tensions, investigating, sharing, acting and reflecting (Short et al., 1996). Whilst there are different inquiry models that can be used to contribute to students' service learning, the essential steps in all of these models follow a sequence of investigation, preparation and planning, action, reflection and demonstration (Berger Kaye, 2010). Reflection, a fundamental part of service learning, can take many forms (text, art, diverse media and materials). Authentic, meaningful and critical reflection will allow the student to better plan and investigate future service learning experiences. Considering the importance of reflection in service, students should be shown how to clarify their expectations and to develop their reflective skills.

7. Service should be celebrated

All schools need to send the message to the entire school community that service learning is an important part of the students' education. Students' achievements in this domain should be recognized and staff involvement acknowledged. Students should be exposed to as many service opportunities as possible, as it is an opportunity for them to become active and enlightened community members.

In the school

- Schools will develop opportunities for students to think about their service actions meaningfully.
- Schools need to provide the physical space and time within the curriculum to ensure that students have an opportunity to investigate, act and reflect on their service projects meaningfully.
- Teachers should find opportunities to bring aspects of service learning and personal reflection into other subject areas and other aspects of school life.
- A culture should be developed in each school that acknowledges those who have carried out service learning: exceptional cases should be shared with the whole school community.
- Service learning can provide opportunities to bring all members of the school community together and should be used to explore partnerships with parents and alumni.
- Schools should ensure that those responsible for the coordination of service learning support the principles of this activity with rigour.

Suggested readings:

Berger Kaye, 2010; ISG, 2009; Kolb, Rubin & McIntyre, 1974; Short et al., 1996; Sternberg, 2009.

9. Learning support

Students should be taught to understand how learning happens and how they themselves can learn.

1. Teachers must respect the learning styles and capabilities of all students

By valuing diversity and students' rights to access the curriculum, all educators are responsible for differentiating their instruction to correspond to the needs of their students. Schools must constantly seek to understand better the way students learn and to provide them with suitable support and new approaches.

2. Every teacher has a responsibility to extend students' learning

Teachers should create safe, respectful and challenging learning environments for students to achieve their individual potential both inside and outside the classroom.

3. Students should be given strategies to help them become autonomous and confident

By encouraging students to be independent learners who understand their strengths and weaknesses and who can self-regulate, schools aim to educate and prepare them to be adaptable, and to function in the world around them.

4. Teachers should reward effort and progress, and provide feedback as necessary

The principal purpose of learning support and enrichment is student progress — and this is not always expressed in terms of test scores. Teachers should design realistic, attainable, individualized objectives for students, identify barriers to learning and show students how to overcome them. Assessment should be used to drive teaching and learning.

5. Schools must work in partnership with parents, students and colleagues

Collaboration is essential in providing the most effective support for students. Working in multi- and interdisciplinary teams, teachers can create a collaborative environment that allows for an exchange of expertise and ideas among all professionals. Schools should attempt to cultivate strong, trusting partnerships with parents, students, teachers, administrators and educational specialists.

In the school

In order to best support the needs of students using the structural arrangements that best allow for effective practice, schools will:

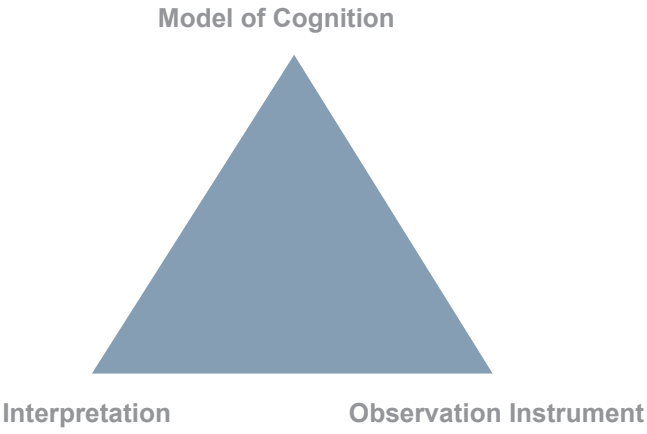
- Hold frequent student support group meetings.
- Outline clear and effective referral processes.
- Conduct, when needed, psycho-educational reports.
- Conduct efficient, timely screenings.
- Prepare Individual Education Plans (IEPs) where appropriate and monitor the way that the IEP is applied in the classroom. During the year, reference should be made to the IEPs so as to share information that is useful for all stakeholders.
- Devise clear procedures for removing students from particular lessons or introducing them in other lessons, with careful attention paid to the role of teaching assistants.
- Constantly reassess the integration of withdrawn students into the mainstream.
- Constantly reassess the structure of learning support and new approaches in view of different populations of students each year, as well as for the professional development of teachers.

- Design creative opportunities for students to reach their potential through the use of many different opportunities, such as clubs, on-line learning environments, projects and other extension activities.
- Celebrate outstanding student achievement in different areas of learning.
- Communicate clearly and effectively the school's provision for student learning and new approaches to all stakeholders.
- Establish effective and appropriate working relationships between all those concerned so that there are clear procedures for achieving the best possible programme at each year level.
- Ensure ongoing, effective professional development opportunities to stimulate learning support and new approaches for all teachers.
- Create models for collaboration that actually work in practice and on-going professional dialogue between specialists and classroom teachers (co-teaching, coaching, workshops, presentations, classroom drop-ins, discussion groups, reports, etc.) so that learning support and new approaches have an impact.

10. Assessment

What students know and can do should be assessed through a range of techniques.

Educational assessment is a system that involves three interconnected parts: a model of cognition, an observation instrument and a model for interpreting student performances. These elements can be represented as a triangle:



(Developed from Pellegrino, Glaser & Chudowski, 2001.)

For assessment to be of high quality, there should be symmetry between the three vertices of the triangle.

Cognition refers to thinking and learning. Any assessment system must begin with a clear understanding of the cognition that is desired. Typically, this will be stated as a learning objective within the curriculum. This model of cognition can include:

- knowledge types (propositional, procedural, dispositional, applied);
- skills and competences (such as critical thinking, creativity, collaboration);
- attitudes (perseverance, open-mindedness, etc.);
- and metacognition (thinking about thinking and learning about learning).

Teachers will design learning experiences (such as classroom tasks, projects or tests) according to the targeted model of cognition expressed in the relevant learning objective. For example, if the

learning objective is for students to be able to write clear instructions, then the learning experience task might be for them to write the instructions on "how to change the tyre of a bicycle".

Observation instrument refers to the instrument that is developed to stimulate a student response and then to record that response. An observation instrument should allow students to represent their knowledge and/or skills, competences, attitudes and metacognition according to the model of cognition that the teacher or peer wishes to observe. These instruments are extremely diverse and range from observation of student behaviours and general approaches to learning, conversations, responses to questions, formulation of questions by the students, performances on various designed tasks (item response tools such as tests, or broader learning experiences such as projects). Teachers need to choose the right observation instrument for the corresponding model of cognition (this is called "assessment fitness for purpose").

All learning experiences should provide evidence of learning and are, therefore, to be considered as observation instruments. Not only must the observation instrument correlate closely with the model of cognition being observed, it should also allow for learning to be shown in different ways. For example, a well-designed test will allow for a range of basic-to-strong responses, so that all learners are given a chance to show what they know and/or can do. The key measure of the quality of an observation instrument is its "validity". There are over twenty types of validity, but the most essential ones to consider include:

- *face validity*, in other words, whether the observation instrument really captures or tests the learning that it is supposed to. For example, if we wanted to observe a student performance on the task of writing instructions on how to change the tyre on a bicycle, for the task to have *face validity*, it should not ask the students to describe what it feels like to ride a bicycle as this has nothing to do with writing instructions;
- and *ecological validity*, whether an observation instrument is appropriate to the context. For example, if we wanted to observe a student performance on the task of writing instructions on how to change the tyre on a bicycle, for it to have *ecological validity*, the task should not be presented to students in highly complex language that can only be understood by a small number of specialists, but in clear and unambiguous language that make it understandable to as wide a range of students as possible.

Interpretation refers to what can be assumed about what a student knows and can do based on the responses to the observation instrument. Methods of interpretation include marking written responses to items, estimating the value of drawings and evaluating oral responses. In order to interpret student performance, the evaluator needs assessment criteria or "rubrics". The key concept to consider when interpreting student performances is reliability; in other words, how sure can we be that the conclusions we reach about student performances on observation instruments are accurate, fair and stable. There are many types of reliability but some of the main ones to consider are "rater reliability" (how consistent the scorer is) and "grade-cut reliability" (how accurate and fair the ways of categorizing student responses are). Care needs to be taken so that the conclusions about student learning correspond with the observation instrument and the model of cognition being assessed. For example, if a student is being assessed on his/her capacity to write instructions that are clear and straightforward on how to change the tyre on a bicycle, it would not be fair or appropriate to compare the performance or to make conclusions about the ability of the whole cohort or the entire school to do this. On the other hand, this is not an exercise about the student's abilities in creative writing, since the task is asking for clarity, not creativity.

Purposes of assessment. It is vital to have a clear sense of the purpose of an assessment

procedure before it is designed. Assessment purposes include:

- *diagnostic*, meaning that we design an assessment in order to establish what a student already knows and can do, usually at the beginning of a unit or course of study;
- *formative*, meaning that the purpose of the assessment is to help students in their learning (assessment for learning);
- and *summative*, meaning that the purpose of the assessment is to evaluate how much a student knows or can do once they have completed a learning experience; this usually happens at the end of a unit or course (assessment *of* learning).

The purpose of an assessment will influence task design, assessment criteria and interpretation. While assessments can have more than one purpose, in general the larger the number of purposes for a single assessment, the lower the quality and precision of the alignment of the assessment triangle vertices.

1. Assessment should use a large variety of sources of evidence to help students with different learning styles achieve mastery of learner outcomes and lifelong learning

Teachers need to be aware of the variety of assessment types they use, including peer and self-assessment so that student learning is observed from a large number of different perspectives covering different learning styles.

2. Everyone involved with assessment should have a clear understanding of the purpose of the assessment

The purpose of the assessment needs to be communicated to the relevant participants in language that is clear and relevant to the intended audience. Assessment needs to be based on agreed criteria that are communicated to the students before they engage in a task. Expectations and learning objectives should be clear to students and other relevant participants throughout the learning experience. Feedback should correspond clearly with assessment goals and criteria. Assessment should take into account the language ability of individual students.

3. Assessment *for* learning (assessment with a formative purpose) is integral to all teaching and learning

Assessment for learning should enable students to progress in their learning. It should be ongoing and involve detailed, process and task-specific feedback to learners that allows them to understand how they are doing, where they are going and what they need to do next on the learning voyage. Assessment for learning keeps the learning moving forward (Hattie & Timperly, 2007). As such, discussion in the classroom should be carefully designed to build understanding. Feedback should be timely, highly specific, corrective and not focused on personality traits, but rather on learning progression. Furthermore, student responses to assessment feedback should form the basis for subsequent learning.

4. Assessment *of* learning (assessment with a summative purpose) should allow students to generalize their knowledge, competency and/or skilfulness

The end of a learning cycle (unit, topic, term and year) should contain assessments with a summative purpose that involve the basic principles of quality test design (assessment items should address different areas of the domain being tested and allow for multiple levels of performance; scoring headings should reflect the relative importance of the concepts being tested). The purpose is to make performances accurate descriptions of domain-specific or general summative knowledge, competency and/or skilfulness. Assessment with a summative purpose should be carefully designed so as to minimize the unreliability of interpretations made about student performance. Teachers should therefore observe each other's grading frequently. They should agree on what particular levels of achievement look like at particular ages and domain-specific levels.

5. Appropriate diagnostic assessments should be carried out at the beginning of units of work

Teachers need to make sure that students' prior knowledge and misconceptions are identified and discussed before the teaching and learning of a new unit begins. Results on diagnostic assessments should inform subsequent differentiated teaching strategies. Where possible, appropriate observation instruments should be designed or agreed upon among teachers of a year group or cohort. The results of diagnostic assessments should be discussed among the teachers responsible for particular groups of students.

6. Assessment should largely be derived from authentic materials that allow students to come into contact with real-life situations

Learners should be able to connect their learning with a real-world context that is relevant to them. As such, analogies, models, concrete examples and applications should be used as these can make concepts clearer, whereas pure theory alone is often difficult to grasp. Good task design will take this into account. When explaining learning objectives or giving feedback on assessment performances to students, teachers should make sure that students have understood that information and can relate to it.

7. Students should be allowed to reflect on their learning

Students need to be given ample opportunity to look over the work they are doing and have done, understand the processes that are or were involved, and think about the strategies they used to reach their new level of learning. This can be done in a number of ways, but must be an ongoing feature of the learning process and should involve open dialogue and feedback.

8. Assessment should allow students from a variety of backgrounds to show what they can do and what they know in conditions that are fair and equitable

Well-designed assessment tasks should attempt to minimize external, material or culturally-specific influences that can affect student performance because they are suitable to some learners but not all of them. Homework assignments should not rely on the availability of equipment, home-learning environments and parent dispositions, but should focus on minimal resources and student-centred factors that have been established and monitored correctly in the classroom. Assessments should be culturally sensitive and not ask some students to put themselves in situations that they find embarrassing.

9. Portfolio assessments should be developed to allow students to be responsible for their own learning

Each school should agree upon a format for student portfolios with an identified and agreed audience and purpose. Students should be allowed to use the portfolio to show pieces of work that correspond to the learning process, the areas where they are strong, and what they know or can do outside of the school's learning parameters.

10. All assessment procedures should involve strict alignment of the three vertices of the assessment triangle

No matter what the purpose and style of the assessment in question, some standard quality assurance can be achieved by ensuring that the model of cognition as specified in the unit learning objectives is reflected in an observation instrument that is valid and fit-for-purpose. It should be ensured that the interpretations made about student performances on the observation instrument are aligned with the limitations and style of the instrument in question, as well as the intended learning outcomes. In other words, all assessment should triangulate *cognition*, *observation* and *interpretation*.

In the school

- Summative assessments should be designed at the start of a unit of study.
- The following issues should be triangulated when designing assessments:
  - Task design (validity);
  - Classroom dialogue;
  - Dialogue with written work;
  - Group work (self- and peer assessment);
  - Review (informal summative assessment - how to conduct it and how to involve students);
  - Formal summative assessment (how best to manage summative assessment structures and procedures)(Black, 2013).
- Where collaborative skills are being assessed, students should be given clear guidelines on how best to work in groups:
  - All students should be engaged;
  - No one member says too much or too little;
  - Every contribution treated with respect: everyone is to listen thoughtfully;
  - The group must achieve consensus: work at resolving differences;
  - Every suggestion/assertion has to be justified: arguments must include reasons (adapted from Mercer et al., 2004).
- The staff of schools should share best practice in matters of assessment design and discuss assessment as a group regularly.
- Teacher portfolios of moderated work need to be kept as a "history", not only for the benefit of students but also for programme improvements.
- Teachers should conduct peer evaluations, outside the formal evaluation process, so as to keep open discussions about the principles of embedded formative assessment.
- School curriculum leaders are to ensure that clear school-level guidelines on feedback, reporting and grading are made available to the teaching community.

Suggested readings:

Black, 2013; Hattie & Timperly, 2007; Mercer et al., 2004; Pellegrino, Chudowski & Glaser, 2001.

Conclusion

These principles bring together core elements for learning in the twenty-first century. They encompass a notion of learning that involves knowledge, competences, attitudes and not just narrow technical skills. Furthermore, the principles incorporate school processes and the involvement of the learning community. They require deep reflection and action to make education meaningful and the world a better place.

As such, this is a holistic account of learning, a vision that spans some of the essential questions that we must ask of ourselves if we want students to be empowered for lifelong learning in today's complex world.

The development of these principles was a collaboration among teachers, students, parents, school leadership, academics and researchers. Its implementation and success will depend on similar commitment to genuine collaboration.

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