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Guiding Principles for Learning in the Twenty- first Century

*by Conrad Hughes
and Clementina Acedo*



United Nations
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International Bureau
of Education

EDUCATIONAL PRACTICES SERIES-28

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Series Preface

The present booklet, entitled *Guiding Principles for Learning in the Twenty-first Century*, has been prepared for inclusion in the Educational Practices Series, a publication series developed by the International Academy of Education (IAE). As part of its mission, the International Academy of Education provides timely syntheses of research on educational topics of international importance. The booklets are published and distributed by UNESCO's International Bureau of Education (IBE). This is the twenty-eighth in this series of booklets on educational practices positively related to learning.

The International Academy of Education is grateful to Conrad Hughes and Clementina Acedo for writing the present booklet. Conrad Hughes is the Director of Education at the International School of Geneva, where he also teaches Theory of Knowledge. He was educated in France, Swaziland, and South Africa, holds a PhD in English literature from the University of the Witwatersrand, and has worked in schools in France, the Netherlands, and India. He has published articles in academic and educational journals, as well as an English textbook for students pursuing the International Baccalaureate Diploma. Clementina Acedo is Director of Webster University Geneva. Between 2007 and 2014, she was Director of the International Bureau of Education (IBE). She holds a PhD in international and comparative education and Master's degrees in philosophy and international development education from Stanford University. She was Director of the Institute for International Studies in Education (IISE) and a professor in comparative education at the University of Pittsburgh. Prior to that, she worked for the World Bank. She has published extensively on international educational policy, teacher education, education reforms, and curriculum development.

The officers of the International Academy of Education are aware that this booklet is based on research carried out primarily in economically advanced countries and that the recommendations of this booklet need to be assessed with reference to local conditions and adapted accordingly. In any educational setting, guidelines for practice require sensitive and sensible applications and continuing evaluation of their effectiveness.

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This publication was produced in 2015 by the International Academy of Education (IAE), Palais des Académies, 1, rue Ducale, 1000 Brussels, Belgium, and the International Bureau of Education (IBE), P.O. Box 199, 1211 Geneva 20, Switzerland. It is available free of charge and may be freely reproduced and translated into other languages. Please send a copy of any publication that reproduces this text in whole or in part to the IAE and the IBE. This publication is also available on the Internet. See the 'Publications' section, 'Educational Practices Series' page at:

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Printed in 2016 by Gonnet Imprimeur, 01300 Belley, France.

Introduction

The purpose of this booklet is to offer guiding principles about learning in the twenty-first century. It is intended for teachers, curriculum designers, school leaders, and others involved in all levels of school education and can be used for any age group, as the principles it contains are general enough to be applied in different contexts. The guide offers a bridge between classroom practice, educational theory, and academic research. It draws on theories developed by researchers and teachers, and on an article of the same title published in *Prospects* (2014), along with the expertise of educational organizations.

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 required by universities and are still relevant. However, there is increasing understanding that new areas of knowledge, competences, and behaviours 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 OECD's Programme for International Student Assessment (PISA) 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);
- 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. Educational programmes are often 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. Due to this evolution, education may benefit from understanding how to go beyond traditional academic content.

This guide offers ten areas for learning that are particularly significant in the present world's educational climate, in which 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 information literacy, concepts-focus learning, and STEM [science, technology, engineering and mathematics] learning) [sections 2, 5, and 6];
- Competences (such as critical thinking and creativity) [sections 3 and 4];
- Attitudes (associated with academic honesty, health and mindfulness, and service learning) [sections 1, 7 and 8];
- Broad approaches to learning (in areas such as learning support and assessment) [sections 9 and 10].

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.

Authors' notes and acknowledgements: This guide is the result of two years of brainstorming among the leaders of the International Bureau of Education and the International School of Geneva, as well as school teachers and academics from various institutions, such as 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.

Suggested Readings: Acedo & Hughes, 2014; Coffield et al., 2004; Fadel, 2011; IAEB, 2013; Schleicher, 2011; UNESCO, 2013.

1. Academic honesty

Understanding and promoting values of academic honesty enables students to conduct independent research with confidence and integrity.

Research Findings

A quality education in the twenty-first century needs to address the affective disposition and ethical decision-making capacity of learners. This includes their attitudes towards themselves, the community, and learning itself. The survival of the planet depends as much on ethics as it does on competences. A value-based education is particularly necessary in an age when ethical dilemmas are often either reduced to legal, technical questions in a secularised model — which runs the risk of sterilizing them — or radicalized through religious fundamentalist models where dogmatic moral absolutism is often cast over rational and empirical thought. The challenge facing schools in the modern era is to teach ethics without straying too far on either side of this spectrum.

Carrying out independent research is a core element of learning. When considering academic integrity in the twenty-first century world, it is important to take into account the opportunities and dangers that new technologies represent. Students are being taught to conduct research more efficiently by using databases and software functions rather than mere commercial search engines, while schools are revisiting the concepts of collusion and malpractice in the light of social media and the worldwide web. This is particularly salient in a digitised world, given that the concepts of plagiarism and intellectual property have been blurred by easy access to open source material, and few people really understand copyright infringement.

These concerns regarding academic integrity are relevant not only in schools that use technology in the classroom but also those where hardware or Internet access is scarce: students need to know how to deal with information ethically and safely, as these are issues they will face throughout their lives. It is important that students are given the technical means, understanding of the concepts, and the ethical foundations with which to conduct research with confidence and academic honesty.

Implications for Educators

- 1. Foster a deep understanding of academic honesty.** It is recommended that all students, teachers, and parents understand

the concepts of “plagiarism”, “collusion”, “malpractice”, and “intellectual property”. These concepts can be repeated from the first years of schooling up until the final examinations in an appropriate manner according to the age of the students. It is important that schools 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. Design creative tasks to enhance 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, and plagiarism are less likely to occur.
- 3. Require clear referencing.** It is recommended that every school have clear guidelines on the way it requires students to cite the references they have used for their research. It is often the case that schools appoint curriculum coordinators who are responsible for the choices that students make about their research and the degree of consistency and clarity students receive on the matter.
- 4. Promote team work at the school level.** The librarian in each school can work with teachers and coordinators to ensure that students’ use of electronic and manual resources is ethical, informed, up-to-date, and productive. Schools can also use plagiarism-detecting software to screen students’ work as appropriate. In cases where students are found guilty of academic dishonesty, it is important for the teacher involved in the incident and the relevant academic programme coordinator to meet with the student and the student’s parents to discuss the issue and to ensure clear understanding of all aspects of the case.

Suggested Readings: Bertram Gallant, 2011.

2. Information literacy

Effective inquiry-based learning requires students who can utilize today's constant flow of information both confidently and fluently.

Research Findings

Effective inquiry-based learning is a key twenty-first century competence, as it means detecting signals (important, salient information) from the surrounding noise in an age where the amount of data generated online is several quadrillions of bytes per day. One of the earliest theories of learning stated that learning should be relevant and situated within a meaningful, real-world context. This is based on the idea that we learn best when we can see the usefulness of what we learn and can connect it to the real world.

Today we know that the human mind thrives in highly complex polyvalent environments, implying that learners can cope with more than we previously thought they could. We also know now from extensive meta-analyses that teachers have the most important impact on learning and that pedagogical quality is a vital part of educational quality. In particular, research indicates that students can develop synthesising minds through well-designed courses in which they learn information literacy as a regular feature of each year's curriculum. It is therefore important for curricula to emphasize and assess rigorous, creative, and critical use of source material, starting at an early age, with and through increased collaboration between classroom teachers, librarians, and coordinators of technology for learning.

Another important element of information literacy is digital citizenship, which involves students being aware of the implications of activity on social media (the repercussions of the digital footprint they leave behind, and appropriate and ethical use of the internet) and open-minded about the opportunities information technology offers for problem solving and creative thinking (connected social networks, sharing of ideas, synchronous and asynchronous communication). Across curricula, students can be stimulated to consider issues related to the media at age-appropriate levels. They can then develop a critical view on the role it plays in group perceptions of reality, the global economic market, and social norms. This is vital for critical thinking in the twenty-first century, as the media plays such a large role in forming public opinion.

We must remember that, even if classrooms and schools have little or no Internet access, they are still preparing students for an interconnected world where social media plays an important role. Therefore, learning experiences can make students aware of these issues whether or not technology is used in school.

Implications for Educators

1. Support the ethical, effective, and efficient use of information.

Learning experiences at all year levels allow individuals and groups to search for and use information for the creation of original materials, decision-making, and problem-solving. It is important to encourage students to seek information 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 best possible work.

2. Give students opportunities to develop the skills and attitudes necessary in the use of new technologies.

Information literacy will 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 can enable information literacy by introducing students to recent and new technologies and by demonstrating how to use them intelligently. A key part of this process is educating students in rigorous, creative, and critical use of source material.

3. Consider ethics, legality, and safety when teaching information literacy.

It is likely that students will learn about the concept of digital citizenship at each year level. Digital citizenship defines the way a person “participates in society online”. (Mossberger, 2009, p. 173). It is important to ensure that the guiding principles of academic honesty are an important part of information literacy. This also requires standard language and research frameworks for use with teachers, parents, and students. Finally, making available long-term workshops/courses for parents and teachers on subjects such as information literacy and digital citizenship can ensure consistency for students both inside and out of the classroom.

4. Foster meaningful, independent, inquiry-based learning.

Incorporating project-based learning as a regular feature of the curriculum at each year level allows students to learn through experiential adaptation to the world. Schools 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. Ensure carefully planned collaboration among all stakeholders.

A clearly defined information literacy programme requires a set of criteria showing what would be understood as success when judging the effectiveness of the programme and the roles of all stakeholders involved. This involves appropriate interaction and joint planning and teachings among librarians, technology-for-learning coordinators, teachers, and administrators.

Suggested Readings: Gardner, 2007; Halpern, 1999; Hattie, 1999; Herman & Chomsky, 1988; Kolb, 2000; Mossberger, 2009; Ohler, 2011; Silver, 2012; Wiliam, 2011.

3. Critical thinking

Critical thinking is essential for students to become autonomous, independents and open-minded individuals.

Research Findings

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 to not be influenced by ideology, fundamentalism, indoctrination, prejudice, or unverified beliefs. Critical thinking allows students to think for themselves. This approach can be recognized in the following actions and attitudes, which are by no means exhaustive:

- Examining sweeping generalizations in detail and avoiding oversimplifications;
- Clarifying issues, conclusions, and 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).

Critical thinking is not merely rational thinking; it involves propositional (or declarative) knowledge (“knowing that”), procedural knowledge (“knowing how”) and dispositional knowledge (“knowing to”). 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 attitudes and attempt to foster them in students.

The way students ask questions is important in their becoming critical thinkers. Questions, notably open-ended ones that require students to justify and provide evidence for their positions, can be a useful tool to stimulate critical thinking (“Can you go through that step by step?”, “Can you explain why that works?”). Critical thinking is also stimulated when students are encouraged to formulate and develop good questions of their own. Finally, questioning for critical thinking goes further than simply asking questions: it implies rigorous follow-through using, among other appropriate strategies, the Socratic

method-based on discussion between individuals asking and answering questions to clarify ideas.

It is the quality of the critical thinking itself that is the learning objective. This quality depends in part on 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. Critical thinking should be developed in all domains and considered in a whole range of contexts (mathematics, literature, social life, creative thinking).

Finally, critical thinking, like creative thinking, requires an open-minded approach from the teacher. Students are more likely to develop critical thinking skills when they feel free to take risks, are corrected without feeling criticized, and when they challenge, are challenged, and discuss different opinions. Classrooms that promote wide-ranging discussion among students so that arguments both in favour of and against ideas can be examined in detail create supportive environments for students to express themselves without fear of judgement.

Implications for Educators

Children can be taught to think critically from a young age, but in an age-appropriate manner. It is recommended that each school have a unique, logical sequence of learning objectives that students can discover related to critical thinking within the curriculum.

- 1. Nurture inquisitiveness.** It is important to appreciate and develop the observations young people make of the world and their natural capacity for critical thought when and where possible. Students should be encouraged to reflect critically on different types of knowledge, not only in academic domains but in terms of broader personal and shared experiences. In addition, students can be shown how to appreciate what makes a good question (challenging deeper thought, seeking justification, eliciting abstractions and generalizations from particulars and examples) and how different types of questions can be used to elicit different responses (clarification, probing assumptions, probing reason and evidence, viewpoints or perspectives, probing implications and consequences, questions about questions).
- 2. Model sceptical thought.** Teachers can demonstrate healthy scepticism when dealing with unproven information. This does not mean dismissing claims of unconfirmed knowledge on principle, 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 purports to be true.

3. Encourage 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. Therefore, it is important for students to be encouraged to explore and appreciate diverse scholarly traditions, including major differences and similarities between “Western and non-Western intellectual cultures”. Schools can ensure that the elements of critical thinking are also evident when students are taught about service learning, self- and peer-assessments, and portfolios.

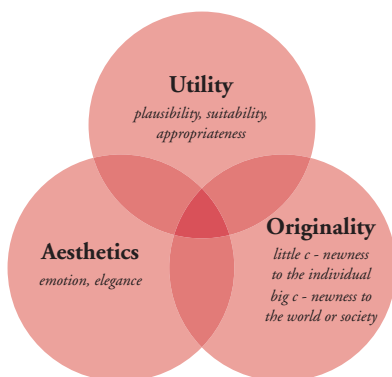
Suggested Readings: Paul, 1990; Paul & Elder, 2006; Ryle, 1971; Siegel, 1985; Singh & Qi, 2013; Swan & Pead, 2008.

4. Creativity

Students use creativity to rethink situations from new perspectives, to see approaches that are not apparent at first, and to respond to situations with elegance, utility, and novelty.

Research Findings

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



The creative thinker will see hidden patterns, reconceptualise the fundamentals of a state of affairs, step back and see the big picture, and entertain ideas that have not been thought of before. The creative process is seen as controlled and automatic, conscious and unconscious. 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);
- Verification (the new idea or solution is examined or tested).

Imagination plays an essential role in developing abstract thought. Play and joy in the flow of creative thinking are essential; teachers should not be afraid to let students play with ideas. However, it is necessary to note that 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.

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. 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 questions that probe and encourage the learner to go further.

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

Assessment of creativity is challenging and controversial. However, large-scale research 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;
- Reflecting critically on ideas, actions, and outcomes.

These are best evaluated formatively, particularly through self-evaluation, peer-evaluation, and portfolio assessments. Given the characteristics of creative thinking, it is important for assessments to be multi-dimensional.

For more information on critical thinking, please refer to the Educational Practices Series Issue #25, *Nurturing creative thinking*.

Implications for Educators

- 1. Encourage creativity in all disciplines.** Creativity is a life skill and approach that does not belong exclusively to the arts. It can be fostered in all disciplines, and across all physical, intellectual, social and emotional areas. Whenever possible, play can be used to extend the range of opportunities to think. This also means having students take time to review their learning from multiple perspectives.
- 2. Demonstrate creative thinking.** It is recommended that both teachers and students be encouraged to demonstrate their creative

thinking to help others recognize and appreciate what is involved. Teachers can attempt to create a class atmosphere or other spaces within school that are likely to stimulate creativity. It is also helpful for teachers to remain aware of the types of resources and teaching strategies/tasks that demand rigorous creative thinking on the part of the students.

3. **Foster preparatory knowledge and skills.** Deep creative thinking can be fostered only if preparatory knowledge and skills have been developed. It is important for educators to make certain that prior understanding has taken place to ensure that creative thinking is meaningful. Subject knowledge should be at an adequate level so that creativity is a genuine extension of learning and not a superficial event.
4. **Ensure ideas are actualized.** Creativity is not just about thinking, but what you do with your creative thoughts. Teachers can encourage students to carefully select the ideas they decide to pursue further and use analytical skills to judge the value and impact of their proposed actions. This will allow students to play a leading role in their own learning. 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.

Suggested Readings: Csikszentmihalyi, 1996; Fillis & McAuley, 2000; Fredericks, 1991; Kampylis & Berki, 2014; 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 teaching and learning of science, technology, engineering and mathematics benefit from an integrated approach.

Research Findings

STEM learning is learning in 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. Many of the world's most pressing problems are so complex that they cannot be solved from one epistemological framework: they require an interdisciplinary approach that draws from different fields. Although interdisciplinary learning should not be restricted to these areas, STEM provides particularly useful opportunities for meaningful, innovative practices that reflect the increasingly integrated nature of real-world scientific research.

Integrated humanities and sciences courses tend to be offered in primary and middle schools, though some argue that they would be better positioned at the latter stages of formal schooling when students have enough subject-specific knowledge and can think rigorously enough to engage in authentic interdisciplinary work. This work involves complex problem-solving with an emphasis on ethical issues in the sciences (bioethics, scientific rigour in the name of 'good science' despite economic and social pressure, genuine group work and peer review).

Reasoning and problem solving, which lie at the heart of mathematics, have a core role to play in learning science and technology. The twenty-first century approach can benefit from taking problems embedded in real-life scenarios, notably in engineering, and placing them at the centre of the learning of science, mathematics and technology. Furthermore, students participating in STEM learning may work best in groups where they can co-construct knowledge through dialogue, discussion and sharing, provided that these groups are given clear instructions on how to work together.

Implications for Educators

- 1. Prioritize an interdisciplinary approach to STEM learning.** It is important to set aside sufficient time for teachers to collaborate on

planning, timetabling, professional development and partnerships that would allow STEM learning to be carried out through interdisciplinary projects. These projects can be aimed at learning objectives and should prepare students for formal assessments through the most exciting and concrete methods available and possible. For effective transfer of knowledge across disciplines, learning needs to be based on concepts rather than topics. Where necessary, consider condensing the timetable into a shorter period of time at the appropriate year level so that space can be found for interdisciplinary projects.

- 2. Enable innovative, creative and authentic STEM learning.** Students can benefit from 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. This also means ensuring that STEM learning projects are inspired by good questions. The study of science and mathematics should be associated, where appropriate, with technology. In addition, it is important for educators to be careful to maintain a gender balance in STEM learning by actively encouraging girls to participate in these subjects as much as boys.
- 3. Emphasize the essentials of STEM history.** The socio-economic, historical and cultural background of STEM subjects should be explored by students. It is important for students to have an opportunity to understand science, mathematics and technology as constructs that have developed over time with specific values and assumptions. Analysis of case studies across various domains and in different historical periods could be one approach. Similarly, teachers can encourage students to question the usefulness of their STEM learning and to probe its relevance.
- 4. Display STEM projects both inside and outside of school.** Interdisciplinary projects allow for taking learning out of the classroom and into the community to connect students with industry and the world of work, where they can benefit from external contact, feedback and real-world situations. Teachers can ensure that STEM projects are displayed around the school, as well as take advantage of opportunities to publicize projects through partnerships with universities and other external organizations.
- 5. Strengthen students' abilities to transfer knowledge and skills to new situations.** Core STEM skills include magnitude estimation, conjecture, hypothesizing, prediction and generalization before experimentation, and creative problem-setting and -solving. STEM skills can 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. Teachers may also encourage students to ask critical questions to clarify problems and to make responsible decisions.

Suggested Readings: Buchanan, 1992; Mercer, Dawes, Wegerif & Sams, 2004.

6. Concept-focused learning

Organizing information in conceptual structures is fundamental for learning.

Research Findings

One of the most important aspects of learning is the way that we organize information so that it can be understood and retrieved. Learning is most effective when it is articulated around concepts rather than topics. Concepts are mental categories that allow us to identify and classify objects, events or ideas, building on the notion that they are similar in significant ways and/or have certain common, relevant features. Studies indicate that concepts-focused learning creates deeper understanding because it is based on cognitive structures.

Learning for understanding takes place when it is categorized in higher-order conceptual structures: 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 are. Research indicates that given the exponential growth of information today, we need to rise to a higher level of abstraction to create schema for organizing and patterning information and to facilitate the transfer of learning through time, across cultures, and across situations.

An essential question for all teachers and students is why they learn what they do. A question like this will force the learner to reflect beyond the immediate surface of the learning experience. 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. However, when the teacher and student look at learning experiences conceptually, their perspectives shift, from disassociated pieces of knowledge to a group of broad categories that share common features.

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.

Finally, 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. 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. Reflecting on concepts rather than topics allows for an interdisciplinary transfer of learning; we can apply the principles of literary analysis to the appreciation of art, or the tenets of scientific experimentation to the social sciences, and so on.

Implications for Educators

- 1. Encourage conceptual understanding.** Conceptual understanding means actively building new knowledge from knowledge previously acquired through experience or instruction. Teachers can encourage conceptual understanding by taking their students through the process of ordering information. This includes going from (1) factual knowledge (separate pieces of information) to (2) topics (groupings of pieces of information); to (3) conceptual structures (ideas within and across topics that identify the common characteristics linking pieces of information to one another); to (4) principle generalizations (laws); and, finally, (5) 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. Enable efficient learning.** It is recommended that students learn to place the knowledge to which they are exposed into categories of conceptual frameworks that will serve as “lenses”, in order to make learning more efficient. In addition, by encouraging students to bring their 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.
- 3. Create collaborative curriculum to ensure progress.** Equally important, is for teachers to recognize “Threshold” concepts 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). Teaching and learning, as well as collaborative curriculum design, can take threshold concepts into account and examine ways of basing instruction around these significant, troublesome areas of knowledge acquisition. Collaborative curriculum also allows for deeper, concepts-focused interdisciplinary learning, which involves investigating a single concept through the disciplinary lens of two or more areas of knowledge for deeper understanding.

4. Align concepts with learning objectives and assessments.

Finally, it is important for educators to create assessments with diagnostic, formative or summative purposes to 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 rather incorporate these facets of learning into broad concepts so that teaching and learning is directed at such understanding.

Suggested Readings: Erickson, 2007; Erickson, 2013; Land et al., 2005; Smith & Medin, 1981.

7. Health and mindfulness

Encouraging students to be physically, mentally and socially alert enables them to be ready to adopt new solutions for new experiences.

Research Findings

One of the results of high-stakes assessments in schools is the pressure it places on students and teachers, often leading to too much stress, and, in extreme cases, mental breakdown. Integrating health and mindfulness into education is therefore essential, and goes beyond the classroom to involve the ethos of the entire educational system. The aim is to increase the mental 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). Educational offerings ideally take 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).

Integrating health and mindfulness goes beyond physical well-being and entails a holistic state whereby thoughts, actions and impressions are interrelated. In a world with an enormous amount of information noise, hyperactivity, competition, and in many regards, a coarsening of society, a twenty-first century curriculum must allow students opportunities to distil their thoughts. In doing so, students will develop ways to bring their mind and body together in an attitude of oneness in which they can focus their thoughts on the environment, self and others.

Implications for Educators

- 1. Encourage mindfulness as a way to maintain health and well-being.** Members of the school community can work together to create environments that allow learners to reflect meaningfully on their interactions 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.
- 2. Empower students to learn more effectively and to think more clearly.** Students, like staff, can be encouraged 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 that is dependent 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 rather a recognized pathway that pursues clear objectives and requires a mentally alert state.
- 3. Encourage awareness of self, others and context.** It is important for the daily life of the school to 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). Schools can 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. A simple message to all learners is: “be brave, be aware and be respectful”.
- 4. Provide space and time for reflection for individuals to realise, develop and understand their potential.** When given time to examine themselves in their environment, students are able to reflect on their choices. The route to mindfulness is an individual one and the time necessary should be found to create the conditions for this to happen. Physical space may be a consideration so that students are provided with opportunities to find silence, peace and calm to enhance their presence of mind. This can also be done by encouraging teachers to use silence as a medium for mindfulness through set procedures, such as occasional one-minute silences, periods where there is no talking, and moments where there is in-depth reflection on a single thought for an extended period.

- 5. Foster 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. It may also be useful to designate a specific person or group to monitor the place and meaning of health and mindfulness at each level of the school community.
- 6. Develop and sustain a Health Promotion Project.** It is recommended that all schools 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. Steps can 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). Finally, schools may consider professional development in health and mindfulness through programmes, pedagogical days and workshops.

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

8. Service learning

Participating in service learning enables students' personal growth and allows them to contribute to society.

Research Findings

Service learning is education taking place through voluntary work and community projects. It highlights the rights and responsibilities needed to live together in a better world. This is a vital part of experiential learning in that concept-formation follows from concrete experience.

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 between 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.

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 “the nature of personal and civic identity” (ISG, 2009). Schools have a crucial role to play as community leaders through the cultural activities they organise, the partnerships they establish with local authorities and the way they work with their parent bodies to make an impact around them.

Studies indicate that 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. 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, country or environment.

Implications for Educators

It is recommended that service learning be recognized as an essential part of education. It is important for students to become directly

involved in service projects so as to internalize the values of the school and carry them out in real-life situations.

- 1. Ensure service learning meets a genuine need.** Before engaging in voluntary work, students can be encouraged to find out about the needs for voluntary work at different levels within 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 its different needs will make subsequent service work more valuable.
- 2. Plan critically and respectfully.** Actions and interactions in the context of voluntary service activity have consequences of which students need to be aware. It is important for service activities to be planned critically and respectfully, in conjunction with the person or group served. Showing empathy and respect for the person or group served is also imperative. It is important to avoid patronizing or “messianic” approaches in service. When students see themselves as learners first, they are better able to understand that people from different cultural and socio-economic backgrounds will also have something to teach them.
- 3. Make long-term commitments.** 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 plan their service projects with long-term involvement and impact in mind. Commitment to a project is more likely to develop if students have carried out careful planning, SWOT (Strengths, Weaknesses, Opportunities, and Threats) analyses and face-to-face discussions with the person or group served.
- 4. Enable personal growth.** Students have different levels of understanding and involvement in service. It is important for this to be taken into account when proposing a service-learning programme. Giving students constructive and precise feedback during and after these activities is an essential way of developing the quality of service learning.
- 5. Follow a cycle of inquiry.** While there are different inquiry models that can be used to contribute to students’ service learning, the key steps in these models follow a sequence of investigation, preparation and planning, action, reflection and demonstration. Reflection can take many forms (text, art, diverse media and materials). Authentic, meaningful and critical reflection will allow students to better plan and investigate future service

learning experiences. Students can be encouraged to clarify their expectations and to develop their reflective skills.

- 6. Celebrate service learning.** It is important for schools to send the message to the whole school community that service learning is a key part of students' education. Students' achievements in this domain may be recognized or staff involvement acknowledged. Service learning can also provide opportunities to bring all members of the school community together and can be used to explore partnerships with parents and alumni.

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

9. Learning support

Teaching students how learning happens and how they themselves can become better learners is imperative for student progress.

Research Findings

An area that is particularly interesting to investigate is learning support (also called special educational needs), mainly because the strategies that have been developed in this area of education, such as accommodations (adjusting teaching practice to meet learner's needs) or modifications (adapting the content of what is being taught) apply to the needs of all students in a modern educational paradigm. We see such strategies as necessary elements of differentiated instruction for all learners, especially with the advent of new technologies that allow for adapted online learning environments.

Learning support remediation involves metacognition (learning about learning), scaffolding, mastery learning, high levels of feedback and multiple strategies for learning. In many ways, this type of pedagogy is a distillation of the quality and excellence that is prevalent in any high-performing classroom. In this regard, teachers consider themselves specialists in cognitive psychology rather than merely subject specialists. It is important for the psychology of learning to be promoted if we are to rise to the challenge of providing students with an education in which they can succeed.

A typical process in learning support is the development of an individual education plan (IEP) focused on the specific learning goals of the student. This highly individualised approach to learning should not be reserved just for those experiencing difficulties, but could form the basis of general teaching and learning.

A differentiated instructional programme is one where every learner's needs are met. Recent neurobiological progress has directed educational philosophy to the idea that each individual learns differently and that differentiated instruction is vital if what we want to achieve is not just getting the curriculum covered but seeing students truly master their learning. Therefore, differentiation should not be considered a strategy to be used only in exceptional circumstances; that implies that the norm is a one-size-fits-all approach, in which little attention is paid to the student's specific needs.

Implications for Educators

- 1. Respect learning styles and capabilities of all students.** By valuing diversity, educators are responsible for differentiating their instruction to correspond to the needs of their students. To respect the diverse needs of students, schools can constantly seek to better understand the way students learn and to provide them with suitable support and innovative approaches. Teachers are also encouraged to create safe, respectful and challenging learning environments for students to achieve their individual potential both inside and outside the classroom. It may also be necessary for schools to devise procedures for removing students from particular lessons or introducing them into other lessons, with careful attention paid to the role of teaching assistants, in order to provide them with the support they need based on their learning style. This strategy should be coupled with a constant reassessment to determine re-integration of withdrawn students into the mainstream.
- 2. Provide strategies to encourage confidence.** 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. Teachers can achieve this by being aware of and promoting strategies that support self-regulated learning, such as goal setting, planning, attention control, self-monitoring, help-seeking and self-evaluation.
- 3. Reward progress and provide feedback.** To support student progress, teachers can reward effort and provide feedback as necessary to students. This includes designing realistic, attainable, individualized objectives for students, identifying barriers to learning and showing students how to overcome them. Celebrating outstanding student achievement in different areas of learning allows for recognition of diverse skillsets. Assessment can be used to drive teaching and learning, encouraging students to view learning as something that can incrementally evolve and improve, rather than as a process that is out of their control.
- 4. Collaborate with parents, students and colleagues.** Finally, collaboration is important in providing effective support for students. Working in interdisciplinary teams, teachers can create a collaborative environment that allows for an exchange of expertise and ideas among all professionals. It is recommended that schools attempt to cultivate strong, trusting partnerships with parents, students, teachers, administrators and educational specialists. This can be done by holding frequent student support group meetings and preparing Individual Education Plans (IEPs)

where appropriate. Ensuring ongoing, effective professional development opportunities may also stimulate learning support and new approaches for all teachers.

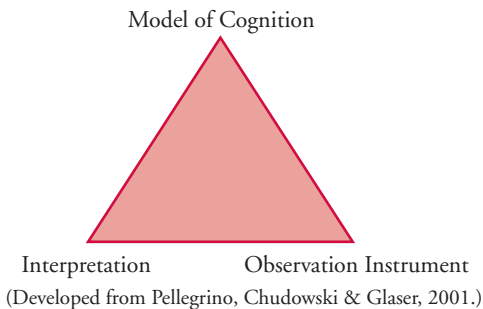
Suggested Readings: Dweck, 1999; Zumbrunn, Tadlock & Roberts, 2011.

10. Assessment

Assessment, through a range of techniques, is important to evaluate progress and follow students on their learning progression.

Research Findings

Educational assessment 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. For assessment to be of high-quality there should be symmetry among the three vertices of the triangle.



Cognition refers to thinking and learning. Assessment begins with a clear understanding of the cognition that is desired. This model of cognition can include knowledge types (propositional/declarative, procedural, dispositional, applied); skills (discursive writing, arithmetical calculation) and competences (critical thinking, creativity, collaboration); attitudes (perseverance, open-mindedness); and metacognition (thinking about thinking and learning about learning).

An observation instrument refers to the instrument that is developed to stimulate a student response and to record that response. An observation instrument allows students to represent their knowledge, skills and competences, attitudes and/or metacognition through conversations, responses to questions, or performances on various tasks. To ensure that assessment is fit for its purpose, teachers need to choose an observation instrument that is appropriate for the corresponding model of cognition. A key measure of the quality of an observation instrument is its validity. There are numerous types of validity, but the most essential ones to consider include:

- Face validity – whether the observation instrument really captures or tests the learning that it is supposed to
- Ecological validity – whether an observation instrument is appropriate to the context

Interpretation refers to what can be assumed about what a student knows and can do based on responses to the observation instrument. In order to interpret student performance, the evaluator needs assessment criteria or “rubrics”. A 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).

Clarifying the purpose of an assessment before it is designed is essential. Purposes include:

- *Diagnostic*, meaning that the purpose of the assessment is 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)
- *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, which 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.

Implications for Educators

1. **Use a variety of sources of evidence.** Sources of evidence, including peer- and self-assessment, help students with different learning styles realize learning outcomes. Teachers can also conduct peer evaluations outside the formal evaluation process to keep open discussions about the principles of assessment.
2. **Have a clear understanding of the purpose, expectations and learning objectives.** Assessment needs to be based on agreed criteria that are communicated to students before they engage in a task. Where collaborative skills are being assessed, it is important to give students clear guidelines on how best to work in groups, so that all students are engaged and every contribution is treated

with respect. Feedback should correspond clearly with assessment goals and criteria. It is also important for assessment to take into account the language ability of individual students.

- 3. Emphasize assessment for the purposes of learning.** This involves detailed, process- and task-specific feedback, allowing learners to understand how they are doing, where they are going and what they need to do next, in order to keep learning moving forward. Feedback should be timely, specific, and focused on learning progression. Student responses to assessment feedback then form the basis for subsequent learning.
- 4. Allow students to generalize their knowledge, skilfulness and/or competency.** The end of a learning cycle (unit, topic, term, year) can contain assessments with a summative purpose that involve the basic principles of quality test design. It is important that assessment be designed to maximize the reliability of interpretations made about student performance. To ensure this, teachers can observe each other's grading frequently and agree on what particular levels of achievement look like at particular ages and domain-specific levels.
- 5. Ensure authenticity and relevance of assessments.** Assessments derived from authentic materials (analogies, models, concrete examples, applications) allow students to come into contact with real-life situations. This encourages learners to connect their learning with a real-world context that is relevant to them.
- 6. Enable fair and equitable conditions.** Allow students from a variety of backgrounds to show what they can do and what they know. Well-designed assessment tasks will 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. Carrying out diagnostic assessments at the beginning of work can also make sure that students' prior knowledge and misconceptions are identified and discussed before the teaching and learning of a new unit begins. It is important to design assignments regardless of the availability of equipment, home-learning environments and parent dispositions; rather, focus on minimal resources and student-centred factors that have been established and monitored appropriately in the classroom.
- 7. Encourage students to take responsibility for their own learning.** Portfolio assessments allow students 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. Encouraging students to reflect on learning also allows them to take ownership of the process by giving them 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.

- 8. Achieve a strong alignment of the three vertices of the assessment triangle.** This can be done by ensuring that the model of cognition is reflected in an observation instrument that is valid and fit for its purpose. Interpretations made about student performances on the observation instrument can then be aligned with the limitations and nature of the instrument in question, as well as the intended learning outcomes. Finally, it is recommended that curriculum leaders provide clear school-level guidelines on feedback, reporting and grading to the teaching community.

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

Conclusions

These principles bring together core elements for learning in the twenty-first century. They encompass a notion of learning that involves knowledge, competences, values and attitudes, rather than 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 more meaningful. As such, this is a holistic account of learning, a vision that spans some of the essential questions that we must ask ourselves if we want students to be empowered for lifelong learning in today's complex world.

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

References

- Acedo, C. & Hughes, C. (2014). Principles for learning and competences in the 21st-century curriculum. *Prospects*, 40(1), 503-525.
- Berger Kaye, K. (2010). *The complete guide to service learning*. Minneapolis, MN: Free Spirit Publishing.
- Bertram Gallant, T. (2011). *Creating the ethical academy: A systems approach to understanding misconduct and empowering change in higher education*. New York: Routledge.
- Black, P. (2013). Formative and summative aspects of assessment: Theoretical and research foundations in the context of pedagogy. In McMillan, J.H. (Ed.), *Sage handbook of research on classroom assessment*, p. 167-178. Los Angeles, CA: Sage.
- Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues*, 8(2), 5–21.
- Coffield, F., et al. (2004). *Learning styles and pedagogy in post-16 learning: A systematic and critical review*. Trowbridge, UK: Cromwell Press Ltd.
- Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention*. New York, NY: HarperCollins.
- Dweck, C.S. (1999) *Self Theories: Their Role in Motivation, Personality, and Development*. Hove: Psychology Press, Taylor and Francis Group.
- Erickson, L. (2007). *Concept-based curriculum & instruction for the thinking classroom*. Thousand Oaks, CA: Corwin Press Pub.
- Erickson, L. (2013). *Concept-based curriculum and instruction: Engaging the child's mind*. [Presentation at the ninth Annual Education Conference at the International School of Geneva, 2014.]
- Fadel. (2011). Redesigning the curriculum. <curriculumredesign.org/wp-content/uploads/CCR-Foundational-Whitepaper-Charles-Fadel2.pdf>
- Fillis, I. & McAuley, A. (2000). Modelling and measuring creativity at the interface. *Journal of Marketing Theory and Practice*, 8(2), 8-17.
- Fredericks, A.D. (1991). Using “What if...?” questions across the curriculum, *Learning*, 19, 50-53.
- Gardner, H. (2007). *Five minds for the future*. Boston: Harvard Business School Press.
- Halpern, D. F. (1999). Teaching for critical thinking: Helping college students develop the skills and dispositions of a critical thinker. *Journal Directions for Teaching and Learning*, 80, 69–74.

- Hattie, J. (1999). Influences on student learning. Inaugural lecture. University of Auckland, August 2, 1999. <<https://cdn.auckland.ac.nz/assets/education/hattie/docs/influences-on-student-learning.pdf>>
- Hattie, J. & Timperly, H. (2007). The power of feedback. *Review of Educational Research*, 77(1): 81–112.
- Herman, E. S., & Chomsky, N. (1988). *Manufacturing consent*. New York: Pantheon.
- IAEB International Education Advisory Board. (2013). *Learning in the 21st century: Teaching today's students on their terms*. <www.certiport.com/Portal/Common/DocumentLibrary/IEAB_Whitepaper040808.pdf>
- ISG International School of Geneva. (2009). *Foundation Policy on the promotion of the values of the International School of Geneva and for the citizenship education of students*. <www.ecolint.ch/sites/default/files/document_files/Promotion_of_Values_2009_E.pdf>
- ISG International School of Geneva. (2012). *Focus for the future*, Geneva, Switzerland: Ecolint.
- Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice*, 10, 144–156. [doi:10.1093/clipsy/bpg016.]
- Kampylis, P. & Berki, E. (2014). Nurturing creative thinking. *Educational Practice Series* (25).
- Kazemi, E. (1998). Discourse that promotes conceptual understanding. *Teaching Children Mathematics*, 4, 410–414.
- Koestler, A. (1964). *The act of creation*. New York: Penguin Books.
- Kolb, D.A., Rubin, I.M., & McIntyre, J.M. (1974). *Organizational psychology: A book of readings* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Kolb, D. A. (2000). *Facilitator's guide to learning*. Boston: Hay/McBer.
- Land, R. et al. (2005). Threshold concepts and troublesome knowledge (3)*: Implications for course design and evaluation. In C. Rust (Ed.), *Improving student learning diversity and inclusivity*. Oxford, UK: Oxford Centre for Staff and Learning Development.
- Langer, E.J. (1992). Matters of mind: Mindfulness/mindlessness in perspective. *Consciousness and Cognition*, 1, 289–305.
- Lindström, L. (2006). Creativity: What is it? Can you assess it? Can it be taught? *International Journal of Art and Design Education*, 25(1), 53–66.
- Mercer, N., et al. (2004). Reasoning as a scientist: Ways of helping children to use language to learn science. *British Educational Research Journal*, 30(3), 359–377.

- Mossberger, K. (2009). Towards digital citizenship: addressing inequality in the digital age. In A. Chadwick & P.N. Howard (Eds.), *Routledge handbook of internet politics*. New York, NY: Routledge.
- Newton, D.P. (1996). Causal situations in science: A model for supporting understanding, *Learning and Instruction*, 6(3), 201–217.
- Ohler, J. (2011). Digital citizenship means character education for the Digital Age. Kappa Delta Pi, Centennial issue. <<http://www.jasonohler.com/publications/articles.cfm>>
- Paul, R. (1990). *Critical thinking: What every person needs to survive in a rapidly changing world*. Santa Rosa, CA: Foundation for Critical Thinking.
- Paul, R., & Elder, L. (2006). *A guide for educators to critical thinking competency standards*. Dillon Beach, CA: Foundation for Critical Thinking.
- Pellegrino, J.W., Chudowsky, N., & Glaser, R. (2001). *Knowing what students know: The science and design of educational assessment*. Washington, DC: National Academy Press.
- Peterson, A.D.C. (1987). *Schools across frontiers: The story of the International Baccalaureate and the United World Colleges*. Chicago, IL: Open Court.
- QCA – Qualifications and Curriculum Authority. (2004). *Creativity: Find it, promote it*. Sudbury, UK: QCA Publications.
- Ritchhart, R. & Perkins, D. (2005). Learning to Think: The Challenges of Teaching Thinking. In K.J. Holyoak and R.G. Morrison (Eds.) *The Cambridge Handbook of Thinking and Reasoning*. New York: Cambridge University Press.
- Ryle, G. (1971). Knowing how and knowing that. In G. Ryle (Ed.) *Collected papers* (Vol. 2, pp. 212–25). New York: Barnes & Noble.
- Schleicher, A. (2011). Pearson to develop frameworks for OECD's PISA student assessment for 2015. <uk.pearson.com/home/news/2011/september/pearson-to-develop-frameworks-for-oecd-pisa-student-assessment-for-2015.html>
- Short, K.G., et al. (1996). *Learning together through inquiry: From Columbus to integrated curriculum*. Portland, ME: Stenhouse.
- Siegel, H. (1985). Educating reason: Critical thinking, informal logic, and the philosophy of education. Part Two: Philosophical questions underlying education for critical thinking. *Informal Logic*, 7, 2–3.
- Silver, N. (2012). *The signal and the noise: Why so many predictions fail—But some don't*. New York: Penguin.
- Singh M. & Qi J. (2013). *21st century international mindedness: An exploratory study of its conceptualisation and assessment*. Sydney, Australia: Centre for Educational Research School of

- Education, University of Western Sydney. <ibo.org/research/programme/development/programme/devstudies/literature/documents/SinghQiIBreport27JulyFINALVERSION.pdf>
- Smith, E. & Medin, D. (1981). *Categories and Concepts*. Cambridge and London: Harvard University Press.
- Spencer, E., Lucas, B., & Claxton, G. (2012). *Progression in creativity: Developing new forms of assessment: A literature review*. Newcastle, UK: CCE.
- Sternberg, R. (1996). *Successful intelligence: How practical and creative intelligence determine success in life*. New York, NY: Simon & Schuster.
- Sternberg, R.J. (2000). Images of mindfulness. *Journal of Social Issues*, 56(1), 11–26.
- Torrance, E. (1970). *Encouraging creativity in the classroom*. Dubuque, IA: William C. Brown.
- Sternberg, R.J. (2009). *Academic intelligence is not enough. WICS: an expanded model for effective practice in school and later in life*. Worcester, MA: Mosakowski Institute for Public Enterprise. <www.clarku.edu/aboutclark/pdfs/Sternberg_wics.pdf>
- Swan, M. & Pead, D (2008). *Bowland Maths Key Stage 3: Professional development resources*. Blackburn, UK: Bowland Charitable Trust. <www.bowlandmaths.org.uk>
- Torrance, E. (1970). *Encouraging creativity in the classroom*. Dubuque, IA: William C. Brown.
- Treffinger, D., et al. (2002). *Assessing creativity: A guide for educators*. Storrs, CT: The National Research Center on the Gifted and Talented.
- UNESCO–United Nations, Educational, Scientific and Cultural Organization. (2013). *UNESCO principles on education for development beyond 2015*. [Adapted from UNESCO Education Sector contribution to the Quadrennial Programme Priorities for 2014 2017 (37 C/5) – unpublished.]
- WHO – World Health Organization. (1946). *WHO definition of health*. <www.who.int/about/definition/en/print.html>
- WHO – World Health Organization. (1986). *The Ottawa Charter for Health Promotion*. <www.who.int/healthpromotion/conferences/previous/ottawa/en/index4.html>
- Wiliam, D. (2011). *Embedded formative assessment*. Bloomington, IN: Solution Tree.
- Zabelina, D. & Robinson, M. (2010). Creativity as flexible cognitive control. *Psychology of Aesthetics: Creativity, and the Arts*. 4(3), 136–143.
- Zumbrunn, S., Tadlock, J. & Roberts, E.D. (2011) *Encouraging Self-Regulated Learning in the Classroom: A Review of the Literature*. Metropolitan Educational Research Consortium (MERC). Virginia Commonwealth University.



Notes

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The International Bureau of Education–IBE

Mandate

To strengthen the capacities of Member States to design, develop, and implement curricula that ensure the equity, quality, development-relevance, and resource-efficiency of education and learning systems.

The IBE's mandate strategically positions it to support Member States' efforts to implement SDG4 and indeed other SDGs that depend for their success on effective education and learning systems.

Vision

A world where each and every person is assured quality and relevant education and lifelong learning.

Mission

To provide support and promote innovative solutions to challenges ministries of education and governments face in the complex task of improving equity, quality, relevance, and efficiency of their curriculum, teaching, learning, and assessment processes and outcomes.