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Training Tools for Curriculum Development

Personalized Learning



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of Education

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Introduction

What is an education for?

This is the big question that we have tried to answer for thousands of years and answers have changed through time.

For the individual

The word “education” comes from the Latin word “educatus” which means “to bring up”. It is linked to the word “educere”, meaning “to bring out”.

To educate is bring out the potential a person has so that he/she can improve as a human being. The reason why children go to school, adults go on training courses and people seek to learn more is to become better at something, to gain new knowledge, competences and understanding. Education is a liberating, beautiful experience that allows us to progress in life and find happiness, security and opportunities through new experiences. At the core of education is the idea that through it you come to know more and understand yourself more.

For society

Of course, there are social aims to education: children are socialized through schooling, the workplace is strengthened by a competent workforce, the economy relies on educated people to make it run, societal renewal, peace and understanding, justice and nation-building are all deeply linked to education.

For the future

The future of humankind is unpredictable and we are living in a world that abounds with complexity, contradiction, ambiguity, and challenging problems. Education is one of the keys we have to a better world so we need to ensure that it addresses higher-order thinking, problem-solving strategies, mindful and sustainable behaviour and learning to live together.

Personalized Learning

For an education to be meaningful it needs to be personal: we cannot learn well if we do not see the relevance of what we are learning and how it applies to our personal situations. For an education to have use in the future it must be applied and for this to happen the individual needs to take full ownership of the learning process.

We cannot “make” an education happen to someone; we can only use strategies to allow the student to pick up the learning, want the education, make sense of it and then take ownership of it. In this way, the teacher walks alongside the child as the child discovers the world of education. This is what the Greek root of the word “pedagogy” means “to walk with the child”.

For learning to be personalized, the knowledge, competences, behaviours and approaches to be learnt should be presented to the learner in such a way that they make sense, can be understood, are relevant and make the learner want to find out more. It is not an easy thing and requires strategies, dedication, careful reflection, constant re-evaluation and an eye for detail. It can be done with few resources and with large numbers of students.

Aims of the Module

The training module Personalized Learning aims to:

- Give a clear definition of personalized learning;
- Discuss the theoretical framework around personalized learning;
- Suggest the enabling context and system alignment required for personalized learning;
- Outline core strategies that allow for a personalized learning;
- Provide examples of lessons that foster personalized learning;
- Provide resources for further reading and development around the theme of personalized learning;
- Provide examples of workshop sessions that can be used to help participants conceptualize personalized learning.

The intended audience of the training module includes:

- Classroom teachers;
- Curriculum developers;
- Teacher trainers;
- Quality assurance specialists.

What is personalized learning?

Personalized learning is teaching and learning that is focused on the background, needs, potential and perception of the learner. It is learner-centred education.

To put the learner at the centre is to recognize that the teacher's role is not so much to broadcast information but to work closely with the students to make sure that they have understood and are able to move their learning on to the next stage.

Personalized learning is a philosophy that implies certain strategies: it needs to be developed consciously and carefully. It is a much more difficult approach to teaching and learning than what we could call "teacher talk" (where lessons merely consist of long lectures with little interaction between the students and the teacher or among the students themselves) or the "textbook" approach where the teacher is merely there to replicate exercises from a textbook and/or to tell student to read it.

Personalized learning is a powerful statement that has as goal the student taking ownership of the learning process to become a lifelong learner.

A theoretical framework

The Past

The Franco-Swiss philosopher Jean-Jacques Rousseau (1712-1778), in his milestone work “The Emile” (1762) was one of the first educational philosophers to openly advocate an education where the child was at the centre. The teacher’s role, for Rousseau, was not to lecture the child but to engineer environments that would allow the student to make meaning for him or herself. For example, Emile (the name of the imaginary student Rousseau wrote to) is taught to read by making meaning of notes his master leaves on the table explaining where the sweets have been hidden. We have here the central idea of necessity: efficient learning takes place when there is a need to learn and when the student can understand that need.

Rousseau influenced most of the major educators of the early twentieth century, in particular Maria Montessori (1870-1952) and John Dewey (1859-1952). Montessori developed what is now famously known as the Montessori Method whereby children learn at different stations, at their own pace, with very little intervention from the instructor. Rather than a one-size-fits all lesson design, Montessori classrooms allow small groups of students to gather around problems to be solved, displays, reading stations and other such clusters and they move with relative freedom from one station to the next, one of the big idea being that they will not move until they feel that they have mastered the work at hand. Already in Montessori’s method we see some of the core principles of personalized learning: working in small groups, taking the time necessary to master material and not being rushed by the teacher and some degree of choice to make the learning relevant and interesting.

Dewey, on the other hand, developed a multi-faceted philosophy of education based on ideas of democracy, societal needs and socialisation. One of his main ideas was that of experiential education whereby students would learn by doing rather than through theory alone. As such, practical experiments would play a key role in making an education relevant and bringing it to life. This is another element of personalized learning to think about. For Dewey, prior knowledge (what a student already knows) was very important to take into account by the teacher before instruction to ensure that material was not being repeated and that the student could make sense of the new material by putting it alongside what he or she already knew.

A famous, radical initiative towards personalized learning was taken by the American educator Helen Parkhurst (1887-1973) who elaborated what is known as the Dalton plan (1914) using Montessori and Dewey’s ideas. The Dalton plan set out key principles for personalized learning: students would write their own timetables, only interact with the teacher when they needed help, help each other freely and would not follow any lessons. There are Dalton schools all over the world today, particularly in the Netherlands. The big idea is to design each student’s academic programme according to his or her needs.

There are other examples of personalized learning including Benjamin Bloom (1913-1999)’s concept of Mastery Learning (1968) whereby students only progress onto the next level of instruction once they have fully mastered the unit in question. This suggests a high degree of personalized learning as each student learns in a different way. Bloom’s 1968 paper “Learning for Mastery” outlined some of the essential principles for personalized learning:

- a good tutor for each student
- permitting students to go at their own pace
- guiding students with respect to courses they should or should not take
- providing different tracks or streams for different learners (Bloom 1968).

Bloom's main argument was that while it may be possible to draw a normal distribution curve on student capacity (in other words, there will be weak, middle and strong abilities in a group with the majority in the middle), there is no reason to accept that students should be distributed this way at the end of a unit of instruction since education has the ability to bring all students up to a high level through personalized instruction.

Keller's Personalized System of Instruction (1968) was a similar strategy with more emphasis on written materials with students "moving through these lessons at different rates" (Kulik, Kulik and Bangert-Drowns 1990, p. 265). Both systems are reported to have a positive effect on student learning (pp. 271–85) and both systems imply a shift in the concept of the classroom, homework and curriculum.

Personalized learning is related to differentiation: "a differentiated classroom provides different avenues to acquiring content, to processing or making sense of ideas, and to developing products so that each student can learn effectively" (Tomlinson 2001, p. 6). One could argue that differentiated instruction goes back to the nineteenth century so-called "one room schoolhouses" of rural America, Ireland and Australia where the teacher was faced with the daunting challenge of teaching a huge variety of learners and therefore taught at different speeds, levels and pitches.

A famous precursor of differentiation was the teacher Preston Search who in 1889 did not allow students to repeat a year and consciously adapted pedagogy to different learners in a single class (Washburne 1953, p. 139).

The Present and the Future

The question of individual learning needs is connected to cognitive science and theories of learning. We know that humans store information into their long-term memory (or "crystallized intelligence") by organising information into mental schemas. To do this they use working memory (or fluid memory). What is key is the way that the information is codified and stored in long-term memory, for this is what will determine how easily it can be retrieved and used by the mind. To give an example, short-term memory is used to make sense of a pattern or organize information into something that makes sense (like letters making a word or different steps organized into a chronological sequence) so that it can be called up again quickly.

Whilst there are standard ways of coding information to make it easier to retrieve (for example, coding information into acronyms, organising it into concepts that make sense, through association), it is also clear that different learners have different ways of making sense of information and therefore different mental schemas that they develop. We can call these organizational differences different learning styles.

Rita Dunn (1990) suggests that we have fairly fixed personality types and that we learn according to that personality type. The Myers-Briggs Type Indicator outlines a typology of different personality types, each with possible associated negative or positive traits. They are organized in dichotomies to suggest that individuals tend to lean more to one side or the other:

- Rational / Irrational
- Extroversion / Introversion
- Sensing / Intuition
- Thinking / Feeling
- Judgement / Perception

David Kolb, on the other hand, suggests that learning is "a differential preference for learning, which changes slightly from situation to situation. At the same time, there is some long-term stability in learning style" (Kolb 2000, p. 8). He located four main learning styles (diverging, assimilating, converging and

accommodating) in a Learning Style Inventory (LSI). An important feature of Kolb's theory on learning styles is that it is inquiry-based: we learn through experiential adaptation to the world.

Howard Gardner's Multiple Intelligence theory (Gardner 1983) suggests that there are at least nine different intelligences (Verbal-Linguistic, Mathematical-Logical, Musical, Visual-Spatial, Bodily-Kinaesthetic, Interpersonal, Intrapersonal, Naturalist, Existential). Art Costa's 16 habits of mind (Costa 2013) further categorize the various dispositions that characterize learning. Although these theories have limited scientific research behind them, they remind us that learning is not the same across the board and that different learners might prefer certain strategies to learn best (visual strategies such as mind maps, verbal techniques such as group discussion, recasting and/or so-called think-aloud protocols, logical organizers and so on). It also suggests that any learner can try a variety of strategies to learn better.

The field of neuroscience has developed dramatically in recent years with technology allowing for direct observation of neural activity through positron emission tomography scans (called PET scans) and functional magnetic resonance imaging. Brain research draws numerous parallels between mental and emotional experiences and specific brain activity. Thanks to brain research there is now strong evidence that dyslexia is caused not by phonological representation but by auditory temporal processing. In other words, dyslexics tend to have difficulty making the correct associations between sound and speech (see Pellegrino, Glaser and Chudowski 2001, p. 109). Another essential development in neuroscience has been around the role of emotion. We know now that the amygdala plays an important mediating role in the brain's information-processing functions: we learn better when we are stimulated in appropriate ways.

Another area that has changed perspectives and possibilities for accommodating different learners is information technology. Adaptive computerized learning, intelligent tutoring systems, free access to multiple learning platforms and the building up of knowledge through social networking has changed the face of knowledge acquisition radically, creating new relationships between teachers and students, students and students, knowledge and students and knowledge and teachers. Students with access to information technology can personalize their learning in many more independent and inventive ways. Teachers working in low-resource environments where there is little or no access to technology face supplementary challenges as they are preparing young people for a future where others have continuous online access.

UNESCO's position

UNESCO's position on education derives from the Universal Declaration of Human Rights which states that "everyone has the right to education" (Article 26).

In the concluding statements of the 48th Session of the UNESCO International Conference on Education (Geneva, 25-28 November 2008), the following conclusion was drawn: "governments as well as all the other social actors have an important role in providing a quality education for all and, in doing so, should recognize the importance of a broadened concept of inclusive education that addresses the diverse needs of all learners and that is relevant, equitable and effective" (UNESCO 2008, p.18). Therefore, the concept of inclusion goes beyond physical access to education but implies differentiated instruction of high quality.

The concluding statements recommend Member States to:

3. Promote school cultures and environments that are child-friendly, conducive to effective learning and inclusive of all children [...]. (p. 19).

7. Develop policies that provide educational support for different categories of learners in order to facilitate their development in regular schools (p. 19).
17. Train teachers by equipping them with the appropriate skills and materials to teach diverse student populations and meet the diverse learning needs of different categories of learners through methods such as professional development at the school level, pre-service training about inclusion, and instruction attentive to the development and strengths of the individual learner (p. 20).

Therefore, UNESCO recognizes the importance of different learning styles and the needs of the individual learner with the facets of personal relevance and inquiry that this implies.

The UNESCO Principles on Education for Development Beyond 2015, in discussing lifelong learning as a fundamental tenet for the educational landscape of the twenty-first century, state that there is “a need to focus on the learning needs of young people and their engagement in planning for relevant education systems” (UNESCO 2013, p. 4).

Summary

To summarize the conceptual framework of personalized learning, we should remember that:

1. Personalized learning involves key ideas of relevance, inquiry and differentiation;
2. Cognitive science and Neuroscience remind us that personalized learning implies different types of learner, different strategies for storing and making sense of information and the central role of the brain in learning;
3. New technologies have allowed for substantial personalized learning opportunities;
4. UNESCO’s position on personalized learning is that it is a vital goal for educational systems: access to quality education means access to personalized learning.

What enabling context and system alignment does it require?

For personalized learning to be successful, the following context and system alignment is required:

1. One where there is an agreed understanding of what personalized learning means. This should be understood by the whole learning community: teachers, administrators, leaders, parents and teachers. It has to be a critical part of the school's mission to recognize that student learning is improved dramatically when it is personalized.
2. A culture of continual dialogue about learning and about students' needs.
3. A context that is willing to listen to the learner's voice – and in many cases this will be a child's voice – to take his or her concerns seriously and to be prepared to act on them.
4. A context where continual re-evaluation and re-visiting of goals and strategies is valued and promoted.
5. A classroom and entire school environment where making mistakes is not seen as something bad or wrong but as a vital step towards learning. Students should be happy to say that they do not understand because they know that this means that they will be given a further opportunity to do so. This enabling context is vital for without that element of trust and confidence to share understanding and misunderstanding, students will be afraid to express where they are in the learning continuum.
6. Although personalized learning does not rely solely on new technologies, access to the internet and some computing devices can allow individual learners to take their learning further.
7. Access for teachers and students to a library or some learning materials that allow for the independent exploration of domain knowledge (textbooks, collated notes, past examples of good work).
8. A coherent approach that triangulates curriculum, assessment, teaching and learning with the principles of personalized learning.
9. A school culture that not only tolerates, but encourages outdoor education, fieldtrips, community and service activities.

Personalized learning in the classroom: some strategies and lessons

1. Flipping the Classroom

If the essential principle behind personalized learning is that the student should be in control of his or her learning, then it stands to reason that one of the first major steps towards personalized learning is to rethink classroom management.

To be clear, there is little that is personal in an environment where students are sitting in rows listening to a teacher read notes or lecture. In the teacher-centred model, the teacher broadcasts information and students copy that information down, the teacher controls the flow of the learning, usually according to the group's progress, as opposed to the individual learner's progress.

Since the teacher is the most important factor in learning and will play an essential role in shaping the learning of the student, (s)he is a valuable human resource that should be used to his/her full potential. As much of this module will show, we learn best through carefully designed questions, feedback, by collaborating in groups by teaching (learning through teaching). As such, the teacher's role is that of a psychologist, a sparring partner and coach, someone who can guide the students at an individual level to the next level of learning, understand where they are stumbling and need help and act accordingly. In a sense, it is a waste of a teacher to have him or her act as a type of walking textbook that merely outputs information.

The so-called "flipped classroom" (Pierce 2013) is an environment where "students watch teachers' lectures at home and do what we'd otherwise call 'homework' in class" (Rosenberg 2013). There are a number of examples of flipped classrooms, one of the first being Clintondale in the United States. This recent phenomenon has grown with the advent of new technologies and in particular access to free online courses such as those developed by the Khan Academy, Coursera and Udacity. So-called MOOCS (massive open online courses) are being run by universities and the idea of going to school to receive information is being challenged by the concepts of covering information at home and focussing on remediation in the classroom. The few studies that have been done on the effect of the flipped classroom argue for learning gains (Pierce 2013).

However, the concept of a flipped classroom does not rely uniquely on technology and is not necessarily an entirely new idea. The flipped classroom is fundamentally a question of attitude to instruction and more specifically how the teacher views him or herself in a personalized learning environment. Students are more capable of working and learning autonomously than we sometimes give them credit for: flipping the classroom is something that can be done if the mind-set is right and there are strategies in place, even in areas where there is little or no access to information technology.

a. Homework

In a flipped classroom, the homework that the teacher gives to students forms the core of their curriculum coverage. In low resource environments, this could include materials that have been prepared by the teacher (worksheets and notes) or textbooks that are shared if there are not enough to go round (student A has the textbook for a week while student B is working on a project and then A and B switch roles).

With some access to technology students can be directed to reliable sources to learn online. If circumstances permit, the school can take out subscriptions to adaptive online learning environments (meaning that items vary in challenge according to the user's previous answers, this way tailoring the learning experience even more) or develop their own online courses that students follow in their own time. All that is needed is an internet connection and some clear guidelines from the teacher on which sites to access.

Here are some examples of the type of homework learning that would be expected of students in a flipped classroom:

- Students read a chapter on subject/verb agreements in the English textbook, take notes and identify areas that are difficult to understand.
- In lower school geography, students find out from figures in the family or the local community what irrigation is, write up a one page report and identify areas that are difficult to understand.
- Students are given a list of questions and told to find the answers, write them down and bring their answers to class.
- Students are given an open-ended problem in maths, for example in the middle years the problem might be to calculate the time it would take for a bucket of 5 litres to be filled if a tap was dripping into it at one drop of 1 square millimetre every 13 seconds. They are told to come back to class with the answer and the strategy they used to solve the problem.
- Students are directed to a number of online resources and told to investigate a topic (for example, in the primary years, migration), take notes and identify areas that are difficult to understand.
- Students are given logins to enter an adaptive online learning website. They are told to complete a given number of units. Adaptive learning environments usually indicate when students have finished a unit so in theory there would be less need for the students to come back to class with the answers. It would be more important to discuss areas where they struggled.
- The teacher asks the students to read a book at home and follows up with a test.

b. In-class work

The work that is done in class is essentially the follow-through from the homework, this involves time given to individual students to explore difficulties that were encountered, scaffold according to what students learned and discovered and test the knowledge and competences gained during the homework. When the teacher is working with one student or small groups, the rest of the class can be engaged in the homework assignments so that they are not off-task while waiting for some face-to-face contact with the teacher. Therefore, planning flipped classroom learning experiences can mean bringing some homework into the classroom while tutoring takes place.

There are numerous strategies that can be used in the flipped classroom:

- Students are tested on the work that they engaged in out of class.
- Small discussion groups share what they learned and where they experienced difficulties, taking notes and auto-correcting.
- The teacher has 4 minutes sessions with each student or students in groups of two, addressing key questions such as "what did you not understand?" and checking for understanding with questions such as "explain how you would" or "what do you think is meant by ...".
- If students were meant to answer questions as homework, the lesson is spent asking students to put forward their responses and discussing them as a class.

- The teacher can go back over the material that was covered for homework but through an overview that synthesizes the main elements.
- The class can engage in a learning experience where they apply some of the knowledge gained outside of the classroom. The teacher facilitates, roams, observes and gives feedback. For example, if primary school students in mathematics were told to find out about two-dimensional geometric shapes at home, a classroom discussion could entail labelling them.
- In a highly differentiated environment where students are following different paths, they can teach the other students what they learnt (see the section on learning by teaching in the chapter on metacognition).

There are, of course, certain parameters that need to be thought out carefully before embarking on a flipped classroom, such as the age group that is right for this type of instruction (it is unlikely that it will be done successfully before the age of 7 since working independently at home requires discipline and maturity), a clear idea of all the techniques that will be used in class (in a flipped classroom the teacher can no longer hide behind the textbook or factual delivery), guidelines on the amount of time that should be spent, at home or in the school but outside the classroom, working. Flipping the classroom should still allow students the time to have a life outside of school.

If done correctly, flipping the classroom can allow a student's learning to be highly personalized, freeing up the time in the classroom to think carefully about the areas where there is need for remediation. A flipped classroom can be enhanced greatly with new technologies but can also be done without them. It is a strong step towards lifelong learning and learning to learn, expressions of an education in the twenty-first century that focus on the voyage and process of learning.

c. Workshop session

Workshop session aim	To stimulate higher-order abstractions on the purpose of flipping the classroom.
Resources	One picture (work of art or photograph) per group of four or five participants; scissors; a whiteboard/backboard or flipchart; marker or chalk.
Duration	1 hour or more, depending on the duration of discussion and depth of reflection.
Evaluation of outcome	The extent to which participants can describe the fundamental ideas behind flipping the classroom (student autonomy, classroom time spent on pedagogy rather than information transmission) and draw analogies between the workshop learning experience and the idea of flipping the classroom.
<p>After describing and discussing flipping the classroom, the workshop leader cuts 2 or 3 pictures puzzle style and hides the pieces around the room. The participants work in 2 or 3 groups. They must find and rebuild the pictures then describe and analyse the process of searching for the pieces and understanding where they should go to complete the picture.</p> <p>The workshop leader asks the whole group: "in what way were you like students in a flipped classroom?" "How would students feel about learning this way?" (positive and critical remarks welcome). Ideas are brainstormed and written on the flipchart or whiteboard by the workshop pleader to leave a trace of the group reflection.</p> <p>Additional multimedia resources can be provided, e.g.: http://youtu.be/y2QgtPyk_Gk</p>	

2. Projects

Projects are one of the most simple and effective ways of making sure that a student personalizes learning. For a student to design a project is to take ownership of the learning process: the student investigates an issue, works independently and develops his or her understanding of the subject matter but also learns something about him or herself, the way (s)he learns. However, making sure that projects are deep learning experiences requires certain key strategies. These are outlined below.

a. Getting the right start

The start of a project is very important because the teacher is going to set the tone of the work ahead, explain what will be assessed and set the student off. Projects are not like other learning experiences in that they involve independent work, much of which will usually be outside of the classroom. It is important for things to be clear from the start and it is also important to create a sense of excitement and student ownership.

Depending on the age of the students and what exactly it is the teacher wants them to investigate, the start will vary, but here are some essential points to think about:

- The most personalized learning experience a student can have is through a project that (s)he chooses. A personal project on a general theme such as “the things that I love” or “Who I am” are excellent ways of getting younger students to explore research methods in a natural, motivated setting. It is also important to give students a chance to say what they are interested in and what means a lot to them outside of school. Teachers should not be afraid to give this to students as their first piece of work, even if it moves away from the subject matter, it will allow the teacher to know the students better and give the students a chance to speak with their own voice, saying what motivates them and what they are good at.
- If the teacher is giving students a project that is directed towards an area of learning, (s)he should try to avoid dictating what the class will be investigating and let it come from the students. If, for example, the teacher wants the class to do a project on Ancient Egyptian Art, (s)he could write it on the board and ask the students to reflect on what that means to them and what they would like to find out about Ancient Egyptian Art. The students should tell the teacher what they are thinking of and the teacher should try to encourage the students to research their area of interest in more detail – so if a student says “I am interested in Hieroglyphics” then the teacher should encourage him or her to follow that up, if a student says “I want to do pyramids” then the teacher should tell him or her to go along with that idea. Each project will have a slightly different focus. The trick is getting the students to come up with the focus they will be following.
- If students cannot think of anything, then there are special ways of guiding them towards an area of investigation. For example, imagine the teacher is asking the class to do a project on the water cycle, and to brainstorm which part of the water cycle they are interested in and a student says “I don’t know”, then the teacher should check to see what he or she knows already by asking broader questions such as “what do you already know about water?” or “what interests you about water?”. If the student says “where it comes from” then the teacher might tell the student to investigate the question “where does water come from?”, if (s)he says “why the sea has salt in it” then the teacher might tell him or her to investigate that idea. The trick with a particular focus is to make sure that the students bring it back to the topic under investigation, so “where water comes from” or “why the sea has salt in it” would become “how water comes from the water cycle” or “why salty sea water is to do with the water cycle”. These strategies will allow for more personalized learning.
- If the teacher is in a situation where (s)he cannot give the students a choice and they all have to do the same project or a project on a topic that has been previously decided, there are still strategies to make the project as personal as possible: the teacher can get them to brainstorm what they already know about the subject, why they think it might be interesting to investigate, what it might teach them. It is important for students to understand the project as something that will help them grow and learn.

- It is always a good idea to frame the project in a question. The question gives more direction and purpose to the project (for example, instead of “mammals”, “what are the characteristics of a mammal”; instead of “The Cultural Revolution in China”, “Why was there a Cultural Revolution in China?” or “How did the Cultural Revolution in China bring about change in society?”).

b. Project design

Once students have been introduced to the project and can see the personal interest in it, it is important to give them an effective inquiry cycle that they can use as a framework. By establishing a certain number of structured steps, students will have the opportunity to step in and out of their learning, share ideas with others and reflect on what they are doing. Here is an example of how Kathy Short’s Inquiry model could be used for effective personal project learning. Examples of practice are given under each step:

Kathy Short’s Inquiry Model (developed from Short et al. [1996])

1. *Building from the Known (Browsing, Talking, Listening)*

When introducing the project to the students, the teacher should make sure that there is ample discussion around what students already know about the subject. A general class discussion would allow different students to share perspectives. The teacher should write big ideas and points that come out of the conversation on the board to give the class an idea of the themes or topics they could investigate. Teachers can also consider a short “browsing” lesson whereby students would be given the broad theme of the project (let’s say “volcanos”) and then, in small groups, asked to find out a bit more on volcanos by browsing through the textbook or looking through some websites to which the teacher would have directed them. After 20 to 30 minutes the teacher could ask the students to identify an aspect of volcanos they found interesting (for example, lava, famous examples, underwater volcanos) and choose one for the project. “Building from the Known” should be done at the beginning of the project and need not take more than one lesson.

2. *Taking the Time to Find Questions for Inquiry (Wondering and Wandering; Observing and Exploring)*

The question that students will use to give direction to their project is important. A good question will lead to a good project whereas a poorly phrased question will lead to an unclear project. There are also sub-questions that the student needs to develop in order to investigate different components of the project (for example, in a project on “How the Maya Civilization viewed the world” there would be sub-questions such as “What was the Maya calendar?”, “How did Maya writing work?”, “which gods did the Mayas worship?” and so on). More detail on the power of questions to scaffold personalized learning is given later in this guide. Teachers should not be in a rush to dictate the question that will drive the project, it should come from the students and then be corrected and/or shaped by the teacher. Formulating questions is a higher-order thinking experience and will allow the students to think conceptually about the constituents of the project before they develop it. The idea with step 2 is to make sure that the students are given the time to think about the questions they need to develop in order to carry out their project. A good homework task would be to develop the questions that would be necessary for the project. The teacher would not make this work but give advice on the pertinence and clarity of the questions.

3. Gaining New Perspectives (Inquiry Groups; In-depth Researching; Tools for Inquiry)

Now that the students have thought about what they will be investigating, which questions they will develop and the teacher has given feedback on the questions and sub-questions, they are ready to do their research. The teacher should encourage group work: students should not feel that they have to work in isolation. The class can be divided into “subject specialist” panels that spend some time sharing what they have found and giving advice to each other. The tools for inquiry will be the tools the student uses for the project. The teacher should help the students by giving them ideas on the kind of tools they could use. These could include books, magazines, newspapers, websites, oral accounts from authorities or members of the family, local archives, etc. A lesson should be put aside on research tools and, of course, ethical use (what plagiarism is, what appropriate and inappropriate sharing involve, what collusion is, the concept of intellectual property, how to reference sources). The school librarian can play an important role in this part of the process.

4. Attending to Difference (Revision on inquiry; Learning logs)

It is always a good idea to encourage students to use a learning log or diary as they compile their projects. This will allow them to manage their time better and reflect on the choices that they make. Some essential questions that they can use in their log would be:

“What did I want to find out and why?”

“How did I go about looking for the information, what obstacles did I meet and how did I go about them?”

“If I were to do this again what would I do differently?”

The learning log should be looked at by the teacher and there should be some meaningful conversation around it. Another term to describe this is a “process journal”.

5. Sharing What Was Learned (Inquiry Presentations)

A project involves hard work and much time spent on independent and group research. The culmination of the project should not simply be the product and the learning log (or process journal), but a presentation on the theme or subject that was investigated. Students should be given a chance to present their projects to their peers and – in a sense – teach a lesson. By recasting and verbalising their learning they will better master it and appreciate the experience all the more fully. The class should be encouraged to ask questions so that the presenter can be given a chance to show mastery of the subject and defend his or her work. The presentation should be assessed alongside the project as part of the larger learning experience. Although presentations can take quite a long time, possibly a few weeks of lessons, they are strong learning experiences and are worth the time investment. One key advantage with a project presentation is that it allows the student to show that he or she genuinely understands the topic, which is clearly one of the fundamental goals of a project.

6. Planning New Inquiries (Group Reflection; Reflection Portfolios)

Once the project has been submitted and the students have done their presentations, it is important for them to share some of the reflections they developed in their learning logs/process journals. This could be a class debate, small group discussions, whole class creative learning experiences such as collective mind-mapping. Teachers could also consider asking the students to write about the process individually in the learning log/process journal. Essentially, the idea here is for students to generalize the lessons that they learnt about themselves and about conducting research. Key reflection questions include:

“What did you learn about yourself in this project?”

“If you had to summarize your project in one headline, what would it be?”

“Why do you think it is important to know about X (the subject in question)?”

The reflection part of the project can be assessed but the focus should be on discussion and feedback more than a mark.

7. Taking Thoughtful New Action (Invitation for Action)

It is always a good idea to instigate some reflection on how the project can be used for some future practical purpose, inside or outside of the classroom. This could be part of the reflection process and should be the endpoint of the project. For most students the thoughtful new action will simply involve using the knowledge and experience gained through the project in a future learning experience – for example if a student did a project on Isaac Newton’s laws of thermodynamics, the new action might be applying the new knowledge to the student’s understanding of the way energy is used at home; if a student did a project on the French Revolution, the student might apply the general concept of revolution to the study of a different revolution in history (the American or Russian revolutions for instance). Students should also be called upon to reflect on how their project might influence some action they will take at home or in the local community (for example, a project on dams might lead the student to help build a dam in a rural community; a project on jazz might spark interest to take up an instrument and so on). The big idea with this final step is for the student to see how the learning experience gained through a project is part of a larger network of connections and possible actions that the student controls and can activate.

c. Implications for new technologies

When teachers set students off on a project they need to think ahead about internet access and how students might use that resource in the process. To be sure that the project is personal and involves genuine inquiry, it has to be framed in a question that is sufficiently specific for it to be impossible to merely Google the theme and copy what was found on the net. For example, a project called “Julius Nyerere” can be developed quite quickly by typing “Julius Nyerere” into Wikipedia and copying what is found. This is hardly a project and does not entail much personalized learning. If, on the other hand, you manage – with the student – to focus the project on something more dynamic such as “Julius Nyerere’s role in the independence of Tanzania” there is less likelihood of this happening. If you are running a project on algebra, look to a question such as “why is algebra so important for mathematics?” that requires thinking and a more in-depth approach. The big idea is to generate a research theme that is not too factual and implies creative and critical research.

Students need to be coached in the use of internet, to have some idea of quality sources and to understand that picking the first entries that come out of a search engine is not necessarily the best method. They should be encouraged to use a diverse range of sources and need to work with the school librarian to identify sources.

SOLES

Sugata Mitra’s SOLE technique (Self Organised Learning Environments) use what he calls “minimally invasive pedagogy”: students are given a question to solve, they work in groups of four with one computer and an internet connection. The teacher sets the problem or project framework for the students but then removes him/herself from the learning environment and is there to give assistance, encourage and observe but not to drive each and every step of the learning.

Students help each other and move between groups as they investigate the issue at hand and culminate with a presentation or some other form of exposé to show what they have learnt (Mitra 2013).

d. Workshop session

Workshop session aim	To discuss the constituents of a good project.
Resources	A whiteboard/backboard or flipchart; marker or chalk.
Duration	1 hour or more, depending on the duration of discussion and depth of reflection.
Evaluation of outcome	The extent to which participants, in groups, can outline what a good project would entail and therefore to conceptualize quality when thinking about a project for personalized learning.

Having discussed projects and different ways of using projects to personalize learning, the workshop leader gives interesting project titles to participants divided in groups of four or five. The titles must be broad and promising. Only one or two titles per group.

The participants discuss what the projects could look like, for what year level they would work, why they are good projects, how interdisciplinary learning comes into the picture. In this sharing session, each participant should find some inspiration for projects he/she might want to conduct with students. At the end of the small group discussions, each group feeds back, the workshop leader takes notes on a white/blackboard or flipchart.

Example of project titles for this exercise: An imaginary country/ The power of colour/ Language through a magnifying glass/ The end of the world/ Saving the bees/ seeing links, etc...

Additional resources can be provided, e.g.: <https://www.edmodo.com/publisher/biepb1>

3. Effective Group Work

The way that the teacher runs the classroom tells us a lot about how much scope there is for the development of personalized learning. If students are sitting in rows listening to the teacher then there is not much chance that this is happening. If they are more actively involved in their learning then there is every chance that they will be engaged in a personally meaningful experience. One key way of getting students to work together, listen to each other and take ownership of the learning process is through group work. However, there are certain strategies that can make group work particularly effective. Research has shown that group work is only effective if certain ground rules are respected, for example:

- All students must contribute;
- No one member say 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. (Mercer et al. 2004).

If students can be seated at small posts (at tables or in clusters) then the classroom environment will already start to feel different. This need not (and perhaps should not) be the case for every lesson but in a personalized learning environment should happen a lot.

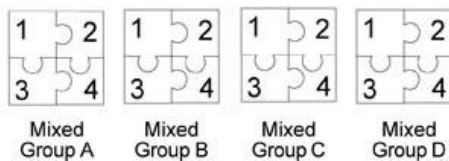
a. The jigsaw classroom

This famous strategy can be attributed to Aronson (1971). It takes a bit of time to get used to but once it has been understood it can be used for just about anything. The jigsaw classroom has shown to bring considerable gains to student achievement and affective dispositions such as listening skills and greater tolerance to others (Aronson 2000). Fundamentally, the jigsaw classroom allows for genuinely personalized learning as the responsibility is placed on the student who has to engage in independent inquiry, presentation, sharing and overall ownership of the learning process.

Jigsaw classroom lessons will usually take about one and a half hours as there are a number of separate elements to take into account. It will be important to explain to the students at the outset that they will be tested on the knowledge that they build up during the lesson, this way there is some guarantee that the students will engage in the group work seriously.

Step 1

The first step is to conceptualize the classroom as a series of different mixed groups that are made up of about 4 students each (one could have more -5 or 6 but if the class is big then it is better to keep it to 4 per group and have many different groups). Each student is given a number or letter, so in each group there will be student 1, student 2, student 3 or student A, student B, student C and so on.



Source: <http://marynabadenhorst.global2.vic.edu.au/icebreakers/>

Step 2

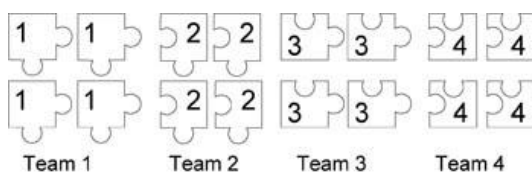
The next step is to allocate parts of the theme or topic that the class is studying to each student number or letter, for example, in a lesson on Shakespeare’s play “Macbeth”, if the teacher wanted students to investigate four important characters, (s)he could have student 1 look at Lady Macbeth, student 2 at Banquo, student 3 at Malcolm and student 4 at Duncan. There would therefore be many students (all the 1s for example) looking at the same character (Lady Macbeth in this instance).

Step 3

Once the areas for investigation have been allocated, the students are asked to start their investigation, so at any given table each student would be looking at something different. This would go on for about 20 minutes or so depending on the nature of the class.

Step 4

Step four would be to split up into new groups called “expert groups”, so all the 1s studying Lady Macbeth would be together, all the 2s studying Banquo would be at the same table and so on. If the class is extremely large then two expert groups for each number can be created and work simultaneously. Here the students would be given another 20 minutes or so to present their findings to each other, compare notes and build up together a stronger understanding of the area under investigation. For example, if all the 1s had been looking at Lady Macbeth, in the expert groups they would edit each other’s accounts, add and correct so that each account was richer and more detailed. This is an important part of the lesson and should be given the time it deserves. Each student would have to give a short presentation (perhaps three minutes each) and the other students in the expert group would give critical feedback. At the end of step four, students would have presented and listened and each would have a better grasp of their areas under investigation.



Source: <http://marynabadenhorst.global2.vic.edu.au/icebreakers/>

Step 5

Once the teams have built up a stronger understanding of their area, they are ready to go back into the original mixed group and present to their peers. So in each mixed group, student 1 would present to students 2,3,4; then student 2 would present to students 1,2,4; student 3 would present to students 1,2,4 and finally (if there are only four students in the mixed group), student 4 would present to students 1,2,3. Questions for deeper understanding should be encouraged during this part of the learning experience.

Step 6

The last step would be to test the whole class on all four (or five or six) elements, so in the example given above that would be on Lady Macbeth, Banquo, Malcolm and Duncan. The way that the teacher tests the students will depend on the context but it is important to make this final step a formal, serious part of the learning for this is what will ensure that the groups work hard, the students take notes and listen to each other carefully and respectfully.

The jigsaw classroom strategy allows for personalized learning not only because every student in the class investigates something, but also because every student presents back to their group, becomes a teacher, but also listens carefully to others and takes notes. The teacher's role is vital, especially in selecting the areas to be studied, the clarity of instructions and the testing at the end of the learning experience but in this case it is the students that will drive the learning.

b. Think, Pair, Share

The Think, Pair, Share strategy (Lyman 1981) involves working in groups of two. It is a structured way of stimulating summarisation strategies, information processing, communication and dialogic reasoning.

Think, Pair, Share is a good learning experience to use at the beginning or end of a unit, theme, concept or topic, to see what students already know and understand or what they have learnt. It can be used to structure brainstorming and it teaches students that ideas can be enriched by dialogue and different perspectives. Think, Pair, Share is an excellent way to develop personalized learning because it requires individual thought and introspection but then draws that thinking out into a dialogue so that a sense of construction is achieved and students are able to consider other points of view too.

The strategy works as follows:

Think – on your own

Pair – with a partner

Share – at your table

Here are some examples from different subject areas.

Primary School Mathematics: mathematical reasoning

- *Think – on your own*

Give the students a mathematical problem, for instance a weighing puzzle such as this one:

“You have 9 balls, equally big, equally heavy – except for one, which is a little heavier. How would you identify the heavier ball if you could use a pair of balance scales only twice?”

(<http://www.mathsisfun.com/puzzles/weighing-9-balls-solution.html>)

Ask the students to try and find the answer individually. If they find the answer tell them not to share it with anybody.

- *Pair* – with a partner
Put the students in groups of two – you can choose the pairs by making sure that they are of different or similar levels depending on what it is you are trying to achieve. Tell the students to share the strategies they are using to try and solve the problem by explaining them to each other one after the other (i.e. student 1 explains to student 2 how he or she solved – or tried to solve the problem, student 2 listens and then explains how he or she went about the problem).
- *Share* – at your table
Ask the students to share what they discussed with the rest of the table, group or whole class. This part is important because it is not just about finding the right answer but discussing the strategies that were used. It is also useful to discuss why the class did the exercise, what it is trying to achieve. In the case of the weighing puzzle the big idea is for students to engage in mathematical reasoning. Discussion on why it is important to have strategies to find unknown values can be held.

Secondary School History: the rise of Nazism in early twentieth century Germany

This could be a good learning experience to engage in towards the end of a unit on Nazism when the students have already covered a fair amount of material on the subject and need to think back and form their own opinion.

- *Think* – on your own
What were the reasons behind the rise of Nazism in Germany? Write down your ideas alone.
- *Pair* – with a partner
Exchange your notes with your partner, explaining your list and seeing whether you agree or disagree with your partners' list.
- *Share* – at your table
The table, group or class could now engage in a broader discussion of what the causes of the rise of Nazism might have been. The teacher can draw up a master list of the most commonly shared ideas and ask the students to copy down the list and take notes on the discussion around the different points.

c. Self-assessment and Peer assessment

Assessment is at the heart of teaching and learning. For a student to personalize the learning experience, he or she must not only fully understand the assessment criteria that will be used to judge his or her work, but take ownership of the assessment by integrating feedback, internalising goals and objectives and appropriating the necessary steps to improve in each step of the learning process. In order for this to happen, at some point in the learning experience the teacher should give the power to assess to the students themselves.

Self and peer assessment allow for deeper personal reflection on one's own learning, student-centred dialogue around learning and, quite simply, perspectives that come from sources other than the teacher. There are a number of simple principles to think about when activating self- and peer assessment. As Pellegrino, Chudowski and Glaser state: "Students learn more when they understand (and even participate in developing) the criteria by which their work will be evaluated, and when they engage in peer and self-assessment during which they apply those criteria. These practices develop students' metacognitive abilities, which, as emphasized above, are necessary for effective learning" (2001, p. 9).

Self-Assessment

Self-assessment refers to the involvement of learners in making judgements about their own learning, particularly about their achievements and the outcomes of their learning (Boud and Falchikov 1989). Research conducted by White and Frederiksen (2000) showed that self-assessment could be accurate and useful although in general stronger students tend to under-evaluate themselves and weaker students tend to over-evaluate themselves.

- *Self-assessment for diagnostic purposes*

In order to set the tone, a worthwhile learning experience is to simply ask students to draw up a list of the things they know and can do and say what they are best at. For example, in an art class, before embarking on some still life drawing, students could list different drawing techniques (outlining, hatching, cross-hatching, stippling, scumbling, shading, etching, drawing shadows, etc.). This diagnostic self-assessment will not only encourage the student to think about what he or she is good at and where there is space for growth but it will give the teacher an idea of the students' levels of self-confidence.

- *Self-assessment for summative purposes*

Another useful way of using self-assessment is by asking students to grade their own work, present the teacher with the score they have come up with and then receive the teacher's score. This can be done quite easily for assignments in subjects like creative writing, art, philosophy, literature or history where the concept of a right and wrong answer is not as clear as it is in mathematics, language learning and the pure sciences.

If the students have already graded their work they should be more interested in the comments and justifications the teacher gives to his or her grading as there is the gauge of comparison. Furthermore, asking students to self-assess makes them more aware of the assessment criteria and pushes them to understand and master them.

Peer Assessment

Peer assessment is another key opportunity to personalize the learning experience. This involves students rating, ranking, nominating and evaluating other students' work and can be done in a number of different settings.

Peer assessment is another strategy to break down the teacher-dominated world of assessment that can stop students from feeling a sense of ownership and it makes them think critically about standards of quality and what assessment criteria should entail.

- *Designing Criteria Together*

On a specific piece of work, it can be useful to ask students to design the assessment criteria themselves by brainstorming what they think would be important to look for in the assignment and then design scoring rubrics (for example, grade level descriptors).

Here is an example of what that might look like for a Primary School project after the students had discussed what was important in the project and how the points might be distributed for those facets:

The things you should try to do in this project are:

Be creative (do things in an original, beautiful and useful way)

1 point: little creativity

2 points: some creativity

3 points: a creative piece of work

4 points: very creative

Be precise (the detail and accuracy of the information)

- 1 point: little precision
- 2 points: some precision
- 3 points: a precise piece of work
- 4 points: very precise

Once students have helped design the criteria together they should feel more engaged and implicated in the task ahead. The teacher will have to help keep the assessment strands different from one another and simple enough to be graded.

- *Marking each other's work*

Another simple and extremely useful activity that should be done at least once in each unit of work is to explain to the students, in detail, what the assessment criteria for a piece of work are, to give them copies of the assessment criteria and then ask them to mark a piece of work using them.

This should be done for scoring systems that are simple to follow and not for subjective, highly analytical areas such as those involved in the marking of pieces of literary analysis or textual commentary. Multiple choice items and short response items for second language test items, for example can be marked this way.

d. Workshop session

Workshop aim	To conceptualize good team work for personalized learning by drawing analogies with examples of team work in the world outside the classroom.
Resources	Selected photographs/newspaper or magazine clippings, sticky notes.
Duration	1 to 2 hours, depending on the size of the group and the amount of time spent explaining why images were chosen.
Evaluation of outcome	Quality of discussion, sharing of ideas and establishing a conceptual framework for effective group work.

Having discussed the dynamics of group work and how it can be used for effective personalized learning, the workshop leader shows a number of photographs/newspaper or magazine clippings of team work. Usually the best examples come from sports (relays, hockey, football, cricket, basketball, yachting, tennis, etc.) but could include other types of team work (a theatrical troupe, band or orchestra, etc.). These images can be posted on the wall. The workshop leader hands out postits to each participant. Each workshop participant chooses an example of good team work from the images and writes key words to describe the qualities of team work on his or her postit, words like complementarity, synergy, cohesion, unity, etc.

The participants stick their postits under the images they have chosen. If there is time, each participant can explain why he or she has chosen the image in question.

Discussion points:

What are the notions of good team work for personalized learning that are visible on the pictures/? Is the opposite visible (let the participants define what they mean).
Transfer: How does this discussion apply to what we would like to see or not see in class group work?

Additional resources can be provided, e.g.: <http://www.cincinnatiastate.edu/online/faculty-resources/Effective%20Group%20Work%20Strategies%20for%20College%20Classroom.pdf>

4. How to Use Questions to Personalize Learning

The use of questions in the classroom, in task design, to follow up on student responses, to determine units of work and assignments is absolutely essential. In many ways, one could argue that the use of questions is one of the more important things that the teacher does with the student as the quality of the question has the potential to stimulate genuine critical and creative thinking.

Despite this, most teachers use questions for non-pedagogical, procedural instructions (see Myhill 2006, p. 25), do not dig deep enough into the context around a question (Edwards and Mercer 1987) and frequently do not wait long enough for students to answer (William 2011).

Here are a few critical questions that teachers can ask themselves about questioning:

1. Why do we ask a question? Is it to check prior knowledge, to extend thinking? To provoke discussion? Is it to see if something has been understood?
2. Based on the reason for the question, what exactly do we do with the answers and why? Do we follow up and dig deeper, do we make notes of the answers or not and why?
3. Do we ask all learners questions or are we often only letting those with their hands up answer, therefore leaving others out?
4. Do we answer our own questions before the students do?
5. Do we encourage students to ask questions?
6. If a student does not give the answer we were looking for, do we dismiss the answers or explore what they are saying to try and understand “what’s in their head”?

a. Question shells

Question shells are clauses that make questions more dynamic so as to stimulate higher-order thinking. Whether it is for written work or oral response, by phrasing questions in a certain way the teacher is sure to draw more thinking out of the student.

Question shells promote personalized learning as they ask students to justify their opinions, imagine scenarios, hypothesize and extend their thinking in original ways. These types of thinking ensure a more introspective, reflective response to learning.

Why?

One simple way of converting factual questions that do not check for understanding into deeper questions is by converting the “what” into a “why”, so instead of asking if As are Bs, the teacher asks why As are Bs. Here are some examples from Dylan Wiliam (2011):

Original Is 17 prime? Is a square a rectangle? Is a spider an arthropod?	Reframed Why is 17 prime? Why is a square a rectangle? Why is a spider an arthropod?
Original What is an insect? What is a prime number? Is this a prepositional phrase?	Reframed as a Contrast Why is an ant an insect and a spider not? Why is 13 prime and 12 not? Why is a prepositional phrase not a sentence?

When setting homework or project questions the teacher should consider the power questions have to engage students in far-reaching independent research. Open-ended questions (questions that cannot be answered with a single word but require the construction of a sentence or paragraph entailing deeper thinking) will take the learning further and ensure a more personal learning experience.

Here are some examples of what Sugata Mitra calls “big questions” for students in the fifth grade (about 11-12 years old):

What was ancient Egypt really like?
 How do my eyes know to cry when I'm sad?
 Why do people slip on wet surfaces?
 Did dinosaurs really exist?
 Why aren't there any mammals bigger than a blue whale?
 (Mitra 2013, p. 9)

b. Follow-up

When a teacher asks a question and the students answer there needs to be careful follow-up to make sure that ideas are fully expressed and justified. One of the simplest principles of personalized learning is making sure that there is genuine conversation in the classroom, what we could call “dialogic teaching” (Alexander 2006), meaning that talk is valorised and recognized as the main foundation of learning.

Personalized learning is when students are called upon to develop their thoughts in response to various stimuli. There are a number of questioning strategies that allow for this as shown below:

Ask pupils to repeat their explanation	Can you just say that again?
Invite pupils to elaborate	Can you just say a little more about that...
Challenge pupils to offer a reason	Can you explain why that works?
Cue alternative responses	Can you suggest another way of doing this?
Support with non-verbal interest	Nod head, rotate hand to indicate that you want more
Encourage pupils to speculate.	What would happen if...?
Make challenging statements	Someone in this group said... were they right?
Allow rehearsal of responses	Try out the answer on your partner first.
Encourage pupils to ask questions	Would anyone like to ask X a question about that?
Ask pupils to think aloud	Can you go through that step by step?
Encourage pupils to make connections	Can you remember something else we did like this...?
Thinking aloud with pupils	Let's think this through together...

Source: Swan and Pead (2008).

Triadic dialogues

Lemke describes two classroom scenarios called “triadic dialogues”:

1. IRE
 - Teacher initiation (I)
 - Student response (R)
 - Teacher evaluation (E)
2. IRF
 - Teacher initiation (I)
 - Student response (R)
 - Teacher follow-up (F) (Lemke, 1990)

Often teachers “evaluate” responses rather than following up on what the student might have been thinking, meaning that student answers are not examined for what they might be saying about genuine understanding but instead are regarded as factually valid or invalid. This leaves little space for any discussion about what the learning experience “looks like” in each student’s mind and will not necessarily tell the teacher if the student has achieved the right answer the right way or, on the other hand, by chance or rote memory. It is important to spend some time unpacking student responses to try and understand their personal perspectives.

Here is an example of a classroom dialogue built around “evaluative” responses (IRE) to student responses that do not allow for any real dialogue around personal understanding:

Teacher initiation (I): “Yusuf, could you tell me why this stick looks like it’s bending when we put it underwater?”

Student response (R): “It’s because things under water look different”

Teacher evaluation (E): “That’s not what I was looking for, anyone else? Mary?”

Student response (R): “It’s because things under water are not straight”

Teacher evaluation (E): “No, they are the same, they just appear different. Pablo?”

Student response (R): “It’s because light refracts under water”

Teacher evaluation (E): “Yes, well done, that’s the right answer”

Here is an example of how the teacher might have given the students a chance to elaborate on their thinking and share their personal conceptions of the problem so as to draw them to the right answer using follow up (IRF):

Teacher initiation (I): “Yusuf, could you tell me why this stick looks like it’s bending when we put it underwater?”

Student response (R): “It’s because things under water look different”

Teacher follow-up (F): “Mmm, interesting. Can you say a little bit more about what you mean?”

Student response (R): “Well, if I put my hand under the water it does not look the way it does out of water”

Teacher follow-up (F): “How does your hand look under water Yusuf?”

Student response (R): “It looks bigger”

Teacher follow-up (F): “Why do you think it looks bigger?”

Student response (R): “I don’t know”

Teacher follow-up (F): “Would anyone like to help us? Mary?”

Student response (R): “Maybe it’s because water is different to air, it makes things look different”

Teacher follow-up (F): “What is different about water? Yusuf?”

Student response (R): “Water is thick and heavy when air is light”

Teacher follow-up (F): “And why would this make things look different? Mary?”

Student response (R): “I’m not sure”

Teacher follow-up (F): “What do we need to see something? Yusuf?”

Student response (R): "We need our eyes"

Teacher follow-up (F): "What else do we need? Can you see in a dark room?"

Student response (R): "No because it's dark, so you need light to see"

Teacher follow-up (F): "Light! And what do we know about the way light behaves?"

Student response (R): "Ah yes, it bends when we shine it through a prism"

Etc.

c. Random selection

Another important part of questioning techniques in the classroom is making sure that all the students get a chance to respond and show what they are thinking. This is a challenge when teachers are working with large classes but there are some simple strategies to make sure that over a few lessons every student answers.

It is a good idea for the teacher to have a list of the students' names in front of him or her and to make a note (tick, mark or short comment) next to the name of a student when he or she is questioned. It is also important to make sure that the students are drawn out of silence so that they give some sort of answer: asking a question but receiving no answer does not count. If a student cannot answer then the teacher should tell the student that he or she will be coming back with another question.

If the aim is to personalize the learning experience for every student then every student needs to feel engaged at all moments, this means that students should know that he or she can be asked a question at any moment. In order to keep the students engaged this way, the teacher has to be unpredictable in the choice of students when questions are posed.

No hands up

If the classroom strategy for choosing those that should answer questions is to respond to "hands up" then the quieter students who do not wish to participate will not be engaged. Therefore, the first thing to do is for the teacher to explain to the students that they need not put their hands up to answer questions as they will be chosen at random.

A random selection system

Teachers should avoid asking students questions one by one in a predictable system (such as "going round" the entire class, asking in the order of the register (which will probably be in alphabetic order) but should make the selection as unpredictable as possible.

One way of doing this is to choose of a list in a seemingly random manner by skipping some names and asking students successive questions (although the teacher should attempt to get at every student in a questioning session). Other techniques involve creating cards with the students' names on them and drawing the cards at random or using ICT algorithms to draw names randomly.

d. Thumbs up thumbs down

If one of the fundamental purposes of a personalized learning experience is to ensure that different learners are allowed to master material at different paces and according to different styles, then the teacher needs to develop strategies to check where students are in their understanding at different parts of their learning voyage.

Too often the teacher only finds out whether students understand through tests and graded assignments when, in many ways, it is too late and the class is meant to be grappling with new content. Indeed, one of the reasons why students become disengaged with a subject is because they "fall behind" the pace of the class or the teacher.

A simple technique that teachers can use to check the level of student understanding is to ask for a sign from the students. Instead of asking rhetorical questions such as “does everybody understand?” or creating potentially embarrassing situations by asking those who have not understood to raise their hands, once a concept has been taught to the students the teacher can give the following instructions:

“If you think you have understood this well, give a thumbs up”;

“If you think you have understood this but you are not sure then put your thumb sideways”;

“If you do not understand then give a thumbs down”.

There are variations of this using coloured cards (green = understand, orange = not sure, red = do not understand).

The teacher then has an idea of the spread of perceived understanding in the classroom and can modify instruction accordingly. Students who understand can be grouped with those that are not sure and those that do not understand and the teacher can give them some time in small groups to talk through the problem, share their degrees of understanding together and help each other.

Here is an example of what this might look like in a Middle Years mathematics class:

Teacher: “Right, we have looked at how to add fractions. If you think you have a very clear understanding then put your thumbs up, if you are not sure or do not understand then put your thumbs down.”

The students react accordingly.

Teacher: “Okay, all the thumbs up over here (designates a space). Please spread out. If your thumb is down could you please meet up with a thumbs up. (If there are many more thumbs up or thumbs down then the teacher organizes the groups accordingly so there is a mix of both in each).

Teacher: “Now, could the thumbs up please explain to the thumbs down how they would go about adding fractions” (gives the groups a few minutes for this). If you are still not clear on how to add fractions, please show us a thumbs down. Now those with their thumbs down, please join another group (a few more minutes are given for a different “thumbs up” to explain how one adds fractions to the “thumbs down” that did not understand).

As one can imagine, strategies like this depend on a certain classroom environment where the students feel safe to say that they do not understand. It is important for the teacher not to use student signs of misunderstanding as a reason to grade even if there is an ongoing process of informal assessment that involves gauging student understanding between formally assessed checkpoints.

Ultimately, using questioning to personalize learning means creating a dialogue of trust, enthusiasm, sharing and confidence.

e. Workshop session

Workshop aim	To understand the importance of questions in creating understanding.
Resources	Hand-out of a drawing of a triangle with a square over it and an irregular circle in one corner (it could be another drawing, it should be fairly difficult to describe), enough copies of this image for the number of groups in the session – four to five participants per group), paper and pencils or pens for each participant, hand-outs (one per participant) of a piece of text – newspaper clipping, poem, short piece of descriptive writing that the workshop leader has chosen, blackboard/whiteboard or flipchart, pens or chalk.
Duration	2 hours or longer depending on the depth of discussion.
Evaluation of outcome	Quality of discussion, the ability of the participants to articulate how questions can be used to personalize learning.
Step 1: The importance of students being allowed to ask questions	

The workshop leader splits the group into smaller groups of four or five and makes sure that there is one volunteer per group. The volunteer of each group is given the image of the triangle with a square over it and an irregular circle in one corner (or whichever image has been chosen by the workshop leader). The other participants must not be able to see this image. (s)he is told to describe it to the group and for them to draw it from the verbal description alone. No-one is allowed to talk. After five minutes, the participants are allowed to ask closed questions (questions that can only yield a “yes” or “no” answer). After another five minutes the participants are allowed to ask any question they like.

The small groups then discuss which learning environment was the most suitable for personalized learning, the workshop leader roams and adds to the different discussion points. The conclusion the groups will be moving towards is that learning is more personalized and of higher effectiveness when full questions can be asked and answered as this allows for more clarity and understanding. The workshop participants should keep their drawings to remember the process.

Step 2: the importance of generating useful and creative questions

The workshop leader gives out the text that was chosen and starts a question competition. The participants must imagine the best possible questions that would allow for the deepest exploration of the poem. The group agrees on the best questions, the workshop leader writes them on the board and starts a discussion on what effective questions look like. The conclusion to move towards is that if teachers want to encourage spirit of enquiry and reflection, then they must be reflective enquirers themselves.

Additional resources can be provided, e.g.:

<http://www.fromgoodtooutstanding.com/2012/05/ofsted-2012-questioning-to-promote-learning>

5. Giving Powerful Feedback

“Feedback is information with which a learner can confirm, add to, overwrite, tune, or restructure information in memory, whether that information is domain knowledge, meta-cognitive knowledge, beliefs about self and tasks, or cognitive tactics and strategies” (Winne and Butler 1994, p. 5740). Feedback to students is what the teacher or other students say, write or do to help them understand how they performed on a piece of work and what they need to do to improve.

Feedback can take place at many levels – it can be given to the student about performance on a task, the process behind the tasks (in other words, how they went about doing the work), the emotional and mental engagement they put into it and what this says about their character and the metacognitive processes behind the work, in other words how well they used learning strategies to accomplish the task.¹

Feedback, if done well, can produce significant gains in a student’s learning. In a large scale meta-analysis (a study of studies), John Hattie listed feedback in the top 5 to 10 strategies for student achievement (Hattie and Timperley 2007, p. 83). “Those studies showing the highest effect sizes involved students receiving information feedback about a task and how to do it more effectively. Lower effect sizes were related to praise, rewards, and punishment” (p. 84). In other words, one of the best ways of making sure that a student is progressing in his or her learning is simply to give precise feedback on the work at hand. Too many opportunities are lost when work is graded with no comments and students receive work back with no clear idea on what they need to do to improve but are instead told things like “well done” or “can do better”.

¹ Metacognition means being aware of how we learn.

Feedback is critical for personalized learning because it allows students to internalize the steps that they need to take to direct their learning towards goals. Personalized learning is an education where the teacher is there to scaffold the student's learning so as to guide him or her along the way, it is not an education without a teacher: no powerful learning can come from solitary action.

If feedback is not given the right way it can have negative effects. A study by Day and Cordon (1993) showed that students would improve in their learning if they were given just enough information to know how to take their learning to the next step. If too much feedback is given (for example, giving the whole answer or so much of the answer that there is little left to do for the student to get there alone), there will be little learning.

a. Oral feedback

Oral feedback is an on- going process, it is more than merely acknowledging a student's efforts by saying things like "yes, thank you for that contribution", "I can see that you put a lot of effort into this" or "that was an interesting point": these comments will do nothing to improve the student's learning. The teacher should consider whichever point a student makes very carefully, try to understand what the student means and respond in such a way that the student can get closer to a correct understanding of the knowledge issue at hand.

Oral feedback is often misunderstood by teachers as a manner of giving praise ("Yes, good boy!") or sending a punitive message to the student (" I don't appreciate that", "what do you think you are doing?") when it should be used as an opportunity to scaffold the learning process ("next time use more examples to back up your main points so that your arguments are more believable", "you need to conclude by answering the essay question so that you end in a clear way").

When the teacher hands back written work, it is always a good idea to go through the comments orally with each student. It is true that this can take a lot of time but if the teacher is well prepared, has made written notes of what will be said to each student and can limit the oral feedback to one or two clear points for improvement, it should take well under one minute per student. Here are some examples of quick, to the point oral feedback messages that can be shared with a student when handing back graded creative writing exercises to 15 year olds:

- "The way you develop your characters is convincing because of the situations you put them in. Keep this up. Some of your sentences are too long and make it difficult to understand what your point is. For example this one on page three. Next time, aim for shorter sentences and read over each one to make sure that it is as clear as you can make it. To sum up: good character development but shorter sentences."
- "Your story starts well because it is descriptive and creates a sense of suspense, for example not knowing what the name or identity of the main character are keeps the reader guessing. However, the section in the train is not convincing because the dialogue feels artificial, for example the exchange on page 9. Next time try to keep the conversations more realistic and make sure that they are there for a good reason: to advance the plot or our understanding of character. To sum up, good opening but more care with dialogues."

The main thing to retain about oral feedback is that students tend to forget it unless it is clear and well put. The teacher should make sure when interacting with the student that the advice they give can be clearly understood and is not so detailed or multi-faceted that it will be forgotten or misconstrued by the student. For all feedback but for oral feedback in particular, the message should be simple. Summing everything up in a single sentence or a few words can be helpful.

Teachers can consider asking the student to recast the feedback to show that he or she has understood it and can internalise it by using his or her own language. This is an important step to take towards the personalising of the feedback.

b. Written feedback

The written comments that teachers give students are important as they explain what the students are doing well and where they need to improve but unlike oral comments, they can be read by the student carefully, slowly and more than once. If the teacher's written comments are read and re-read by the student, there is a greater chance of personalized learning in that the student will have the time to absorb and make sense of the comments. Although written comments tend to be longer than oral comments, they should still be succinct so as to communicate essential information. All this means that written comments should be composed carefully. Teachers would do better to write short, pertinent comments than long, vague and irrelevant comments.

There is considerable evidence that providing written comments [with a focus on the task] is more effective than providing grades (Black and William 1998; Crooks 1988). In one of the early and influential studies, Page (1958) found that feedback in the form of short written comments rather than grades alone significantly improved the test performance of students in 74 classrooms [...]. R. Butler (1987) demonstrated that grades can increase involvement, but they do not affect performance [...]. She also showed (R. Butler 1988) that feedback through comments alone led to learning gains, whereas marks alone or comments accompanied by marks or giving praise did not. She claimed that such results called in question the whole classroom culture of marks, grades, gold stars, merit awards, competition rather than personal improvement. (Hattie and Timperley 2007, p. 92)

As Hattie and Timperley point out, Ruth Butler's study to compare students' gains in learning in response to different types of feedback (grades alone, comments alone, grades and comments) showed that the highest gains were amongst those students who received comments alone. Interestingly, when comments and grades were given together, the study showed that the grades would wash out the potential effect of the comments. In other words, contrary to the practice we see in most schools, teacher written feedback should be made up of comments alone.

Here are some strategies that teachers can consider to make the most use of opportunities offered by written feedback:

- Once an assignment has been marked, the students are not given the mark but only the comments indicating strengths and areas for improvement;
- The teacher marks assignments but only releases the marks after students approach him or her and show that they have read and understood the comments;
- Students submit assignments, the teacher marks them but keeps the marks and the comments in a separate place. The students are then asked to mark their own work or to peer-mark. They approach the teacher with their grades and justify their choices. The teacher shares the comments first and has a short discussion with the student about them and then releases the official mark.

Although these strategies will slow things down, teachers should not underestimate the power of feedback and the potential to turn a situation where the student does not feel in any real ownership of the learning process into one where there is a rich dialogue and deeper understanding of the steps needed for improvement. All in all, more time taken over rich feedback will go further than more time put into marking but less time put into feedback.

c. The three big questions

Hattie and Timperley suggest three vital questions that should be answered when giving feedback to students, whether it be immediate or delayed, spoken or written:

Where Am I Going?

The response to this question is a learning goal: students must know where they are headed and what the goal of the learning experience is. Setting the goal is a complex issue as the goal needs to be challenging, clear and attainable.

Too often, the feedback given is unrelated to achieving success on critical dimensions of the goal. For example, students are given feedback on presentation, spelling, and quantity in writing when the criteria for success require, say, "creating mood in a story." Such feedback is not effective in reducing the gap relating to the intention of creating mood. (Hattie and Timperley 2007, p. 89)

For a student to be engaged in a learning experience (assignment, test, project or presentation) that is truly personal, there must be a clear goal that answers the question "where am I going?" This can include examples of excellent work to give a student a model to work towards, student-friendly assessment criteria that are broken down for easy understanding, clear instructions and so on.

How Am I Going?

This question is the one that most students want answered as it will mean an evaluation of some performance. Test scores are only one small part of the picture, there needs to be qualitative feedback and more especially some sort of dialogue around this question. How Am I Going? Should be answered with much more than "well" or "not well", the student needs to know why (s)he is doing well or not. Some examples of good answers to the question would be:

Grade 10 Mathematics: "you are showing your working clearly, keep doing this. You need to look over switching notation from radical notation to fractional exponents as you are still making some mistakes here."

Grade 1 Language: "you are reading clearly and taking breaths, that is good. Remember the rule about short vowels. Sometimes you are saying 'aa' when you mean 'a', for example with the word 'apple'."

Grade 12 History: "your argument in this essay is set out clearly in the introduction and that makes things clear from the start. In the main body you need to substantiate your points with stronger example, such as when you say that the treaty of Trianon was unfair to Hungary you do not explain why you think this."

Where to Next?

The answer to this question should be clear and at an appropriate scale: the teacher needs to indicate the precise step/steps that should be taken to move the learning along. Hattie and Timperley point out: "enhanced challenges, more self-regulation over the learning process, greater fluency and automaticity, more strategies and processes to work on the tasks, deeper understanding, and more information about what is and what is not understood" (2007, p. 90).

Where to next? Can be answered with very succinct instructions such as:

Grade 4 Art: “Practice drawing symmetrical shapes.”

Grade 4 Science: “Review the life cycle of the butterfly. Remember which comes when.”

d. Workshop session

Workshop session aim	To demonstrate the power of effective feedback for personalized learning and to instigate meaningful reflection on the relative effectiveness of different types of feedback.
Resources	Felt pen, large pieces of paper (for example, flip chart sheets).
Duration	Between 1 and 2 hours.
Evaluation of outcome	The extent to which participants can articulate the effects of different types of feedback on learning.

Having discussed feedback and looked at the examples explained in this section, the group is split into three groups of about six each. If the group is 30 participants or more then there would be two sets of three groups working simultaneously.

Each group is told to draw a map of the place where they are (it could be the school, building, district or area or even the country). They should show on the map how a participant would get from one place to another. The workshop leader would have to think about this in advance depending on the context: it could be from the school to the airport or from one city to another or from one district to another. The groups work in separate spaces so they cannot see each other's maps but they are all drawing the same basic map. After 20 minutes or so, group 1 views group 2's map and gives nothing but positive feedback (everything that is good about the map), then group 2 views group 3's map and gives nothing but negative feedback (everything that is bad about the map) and finally group 3 views group 1's map and gives corrective feedback (what is not clear and needs to be done for improvement).

The whole group comes together and the workshop leader facilitates a discussion on which type of feedback was the most and least useful and why. The conclusion should be that corrective feedback is the most effective, then negative and finally positive but that rounded feedback would need some of all three combined but with emphasis on correctives.

6. Metacognition

In 1976, the developmental psychologist John H. Flavell coined the word metacognition to mean “one's knowledge concerning one's own cognitive processes” (p. 232). The term therefore describes what someone knows about the way he or she thinks. It has become a popular word since it is now widely recognized that learning to learn and knowing how you know something are important steps towards more effective learning. This is based on the premise that learning is not something that happens in a mysterious way that escapes us – as a type of divine inspiration, but that there are strategies that we use to learn. Understanding those strategies and knowing when to use them makes someone a more effective learner.

A term that we can associate with metacognition is “self-regulation”. This describes the ability a learner has to control his or her own learning by mastering elements of concentration, attention, memory, perception and other behaviours, attitudes and skills that we use to learn.

Learning to learn is not a straightforward issue as it involves many variables, it is “a complex mix of dispositions, lived experiences, social relations, values, attitudes and beliefs that coalesce to shape the nature of an individual's engagement with any particular learning opportunity of individual students” (Deakin Crick, Broadfoot and Claxton 2006).

Studies like those conducted by Hatano (1990) show that experts use metacognitive skills to solve problems whereas novices will not know what to do, which strategies to use, which rules to follow or how to step back and strategize: “strong learners can explain which strategies they use to solve a problem and why, while less competent students monitor their own thinking sporadically and ineffectively” (Pellegrino, Chudowski and Glaser 2001, p. 78).

Planning tasks is an example of metacognition: instead of simply diving into a long answer, the metacognitive approach will be to lay out a roadmap and then to apply it. Self-correction is another example of metacognition: good learners will look back over their work and correct it before (and after!) the teacher gets there. At a more sophisticated level, metacognition involves coding information into schemas that make it easily retrievable: for example methods of memorising all the verbs that take “être” as an auxiliary or important dates as part of a sequence in history.

As metacognition is an important part of learning, it should be scaffolded by the teacher. It has been shown that metacognition is closely linked to the domain (or subject) where the learning is taking place – the teacher is more likely to build up a student’s metacognitive skill in a specific subject than in general for all subjects.

a. Examples of how teachers can enhance student metacognition

A learning journal

Teachers can ask that students keep a learning journal that records the way they learn best, the lessons that they learned about their learning and which strategies they will take into their next learning experience. Entries can be on-going, like diary entries, or more punctual, after tests, assignments or projects. For example, a student in grade 12 might have this to say about their learning: “When I studied for my philosophy mid-term examination I practiced some of the strategies that I had used in biology to remember Plato’s main ideas, namely by making index cards that my friends or brother would test me on every evening, using acronyms to remember them (ToFAoC: Theory of the Forms, Allegory of the Cave). The strategy worked well to help me remember things but was less effective in philosophy than biology because in the examination I had to argue points and justify my position and that goes beyond memorising”.

The learning journal is a personal track of learning and will encourage reflection on self and process. The teacher can look at the journal to learn more about the student and make comments/suggestions if they will advance learning strategies but will probably not want to mark a learning journal as the content should be free of constraints to allow full expression and is meant to stimulate thought rather than teacher evaluation.

A portfolio representing progress in a subject

Whilst portfolios can be used for a number of purposes as we shall see in the next section of this module, one particularly useful application of the portfolio method for metacognitive strategies is to map progress in a subject with comments on why and how this happened.

The student would have to start by including work with room for improvement, so that would be work with a low score or many errors, misunderstandings or misconceptions. This would be followed by successively better pieces of work to show the progress. The idea is only to include work when it is better than the previous entry so that there is evidence of improvement. These could be accompanied by short explicative commentaries such as “on this test I scored better because I spent more time on each of the long answer questions that are worth more marks, a strategy I learned after the first test”.

Class Discussion

It is always a good idea to break from subject specific learning for a short period and to share practice: students should talk about how they prepare for lessons, how they take notes, retain information and apply knowledge. Conversations of this type with very young students (for example 5 year olds) could involve diagrams and analogies to indicate levels of confidence (stars, smileys and so on to represent comfort with a skill such as reading or basic arithmetic, a puzzled face or cloud to indicate difficulties). Questions for this age-range would focus on issues such as how students feel when they read a difficult text and what they do to remediate the situation. Typical answers will range from intuitive strategies such as asking for help from someone else to slightly more trained techniques that entail breaking the word down into chunks for reading or using learned strategies for arithmetic such as knowing that the sum of two odd numbers is always even.

The essential purpose of classroom discussion around metacognition is to make students aware of the way that they learn and what they can do to learn better. Conversations will give students ideas of how others learn for them to apply to their own situations.

Here are some examples of the types of questions that the teacher could ask to scaffold the dialogue around learning to learn:

- “How do you know that you’ve learnt something?”
- “What do you do to prepare for a lesson? What materials should you have ready to start the lesson?”
- “How do you study for tests?”
- “What do you do with the feedback that you get in teacher comments?”
- “When you get stuck with a maths problem, what do you do?”
- “How do you plan your essays?”

Think-aloud Protocols

Think-aloud protocols are common with younger students - but can be used successfully with older students too - and simply meant that when the learner is engaged in a task (s)he verbalizes the different steps that are being taken so that the teacher or peer who is listening gets an idea of the thought processes behind the actions that are taken. For example, a student using a think-aloud protocol when engaged in a simple chemistry experiment would tell the teacher what (s)he was doing as (s)he went along, saying things like “Now I’m rinsing each cup with distilled water to make sure there is no distortion of the pH value due to what was in there before. I’m labelling each cup and now I’m pouring $\frac{1}{2}$ a cup of distilled water into each cup. Next I take $\frac{1}{2}$ a teaspoon of ammonia in this cup, $\frac{1}{2}$ a teaspoon of vinegar in this one and I leave the third one with the distilled water. The reason why I do this is because I want to test the comparative pH values of each of these liquids. Oh yes and I make sure that the spoon is clean etc.”

The teacher’s role in think-aloud protocols is to intervene when the student does something unusual or incorrect with questions such as:

- “Why would you do that?”
- “What would you want to show by doing that?”
- “What if you did it another way?”

The think-aloud protocol can be managed in different ways: it may be too time-consuming for the teacher to go through the steps with each individual student, in which case students could be organized in small groups and, one by one, be asked to explain to the rest of the group what they were doing. The students in the group would ask questions and give feedback to the student doing the think-aloud’s thought processes, the teacher would roam and observe the groups, adding questions where appropriate. The student doing the think aloud would change each time the teacher would make a signal (clap hands, say something or ring a bell).

Example: all students are involved in an experiment, when the teacher makes a signal (after 5 minutes for example), student A stops verbalising his or her actions (“think-aloud protocol”) and student B carries on. The other students ask questions and comment as they go along

Student A	Student B	Student C
Student D	Student E	Student F

A vital step towards personalized learning is knowing how we learn and therefore think-aloud protocols should be used to make thinking visible to the learner.

Different ways of learning

Since metacognition involves thinking about thinking and learning about learning, students need to be made aware of the fact that there are different ways that we can learn, different strategies that can be adopted to solve problems and different approaches to the same questions. Learning in the twenty-first century, particularly personalized learning, is not about there being one “correct” answer, it’s about exploring different ways of getting there.

In general, whenever the teacher explains something to the students, (s)he should always suggest more than one way to solve a problem: students have different ways of going about things and they need to feel comfortable with the strategy they choose. These can involve mind-maps, acronyms, rhymes, images as analogies, flow-charts, etc.

There are numerous ways that teachers can go about exposing students to different ways of knowing. One is to build time into lessons to talk about the ways that we learn. To give an example, Howard Gardner’s multiple intelligences (1983) could be explained to the students for them to understand that there are multiple pathways to learning. Here is an example of how that could be done:

Example: Grade 12 chemistry

The teacher wishes to demonstrate different learning styles that can be used to understand a concept such as valence. Students work in small groups and spend about five minutes on each of these steps.

Verbal-linguistic intelligence: students explain the concept to one another and refine their understanding with questions and answers.

Mathematical-logical intelligence: students communicate the properties of valence through mathematical representations by looking at items such as covalent bonds and divalent molecular entities.

Visual-spatial intelligence: students explain valence through diagrams. They should try to avoid talking or using mathematical notation – the idea is to explain the concept diagrammatically.

Bodily-kinaesthetic intelligence: students express valence, possibly by acting out the Lewis dot diagram to show by their physical positions where electrons can situate themselves in an atom.

At the end of these short learning experiences the teacher engages the class in a discussion on what it was like considering valence from those different perspectives, which worked better than others and why. It is a chance to allow students to reflect on the type of learning that they feel more comfortable with and to explore other ways of knowing. As the point is for students to reflect on their learning, the discussion part should be detailed enough for students to draw conclusions and make reflections on their own learning.

The student as teacher

The Roman philosopher Seneca the younger famously stated in one of his letters that we learn by teaching. Any teacher knows that something cannot be taught if it is not fully understood and in order to teach well we need to prepare well by mastering the subject matter in question. Furthermore, the act of teaching sharpens a person's understanding of the subject because one needs to demonstrate clear mastery in order to synthesize information convincingly, generalize the main principles and explain them to someone else. The questions that students ask teachers further sharpen the teacher's knowledge and understanding of the material being taught.

Certain studies have shown that there can be significant increases in learning if the students take ownership of the teaching process (for example Gartner et al. 1971; Fiorella and Mayer 2013). Learning by teaching also allows the class atmosphere to develop in a collegial environment of mutual respect and sharing:

Kids love to learn from other kids. First of all, it's often easier. The child teacher is closer than the adult to the students' difficulties, having gone through them somewhat more recently. The explanations are usually simpler, better. There's less pressure, less judgment. And there's a huge incentive to learn fast and well, to catch up with the mentor. Kids also love to teach. It gives them a sense of value, of accomplishment. More important, it helps them get a better handle on the material as they teach; they have to sort it out, get it straight. So they struggle with the material until it's crystal clear in their own heads, until it's clear enough for their pupils to understand. (Greenberg 1987, p. 75)

Therefore, an excellent way of personalising the learning experience and enhancing metacognitive awareness is by creating environments where the students are the teachers. This has to be done carefully to avoid any state of confusion that might arise if the right steps are not respected. The table below is an example of the learning through teaching (called, in this example, "LdL" from the German) approach developed by the German educator Jean-Pol Martin:

Phases	Students' behavior	Teacher's behavior	Additional comments
Preparation at home	The students work intensively at home, because the quality of the classroom discussion (collective intelligence, emergence) depends closely on the students' ("the neurons") preparation. Students who are not prepared or who are often absent are not able to react to impulses or to "fire off" impulses themselves.	The teacher [...] has to perfectly master the content because he or she must be able to intervene at any time, completing or giving incentives in order to enhance the quality of classroom discussion	Using LdL means that lesson time will not be used in order to communicate new content but instead for interaction either in little groups or with the entire class (collective knowledge constructing). The homework should prepare the students to interact on a high level during the lesson
Interactions during the lesson	The students sit in a circle. Each student listens with concentration to the other students and asks questions if something in the explanations is not clear	The teacher looks for absolute quietness and concentration during the explanations by students, so that each student may explain their thoughts without being interrupted and so that other students may ask	Using LdL means that during the presentations and interactions the students have to be absolutely quiet so that everybody is able to listen to the students' utterances. During the students' interactions, the teacher has to back off

		questions of the student giving the lesson	
Introduction: information gathering two by two: example “Dom Juan by Molière”	The students in charge of the course briefly present the new topic and let the other students discuss what is new about this topic (for example about Dom Juan by Molière)	The teacher looks to see if the students really exchange their knowledge	Using LdL means that the students’ already existing knowledge about the new topic will be “inventoried” in little groups
1st deepening: Gathering information in class	The leading students inspire their classmates to interact (they are sitting in circle) as long as all the questions are asked and answered. The students interact like neurons in neural networks and thoughts “emerge”.	The teacher makes sure that each student has the opportunity to participate, and asks questions if something is not clear and needs to be clarified by the class (until the “emergence” has reach the desired quality)	The previous knowledge from each student is interchanged within the full-classroom discussion and aligned, since the new content will be fed in.
Introducing the new content in the classroom (example: “Molière’s humor in <i>Dom Juan</i> ”)	The teaching students introduce the new content in small portions to their peers (for example, relevant scenes from Dom Juan) and they repeatedly ask questions in order to check if everything is clear	The teacher observes the communication and intervenes if something is not clear. The teacher continues to let the students clarify what they have said if meaning or content are not completely clear	By LdL the new content is shared in small portions and communicated step-by-step in the classroom.
The 2nd deepening: Playing scenes	Led by the teaching students, the relevant scenes will be played and memorized (for example the seduction of the peasant-maid by Don Juan)	The teacher gives input of new ideas, and makes sure that there is adequate and successful scene-playing by the students	In LdL the teacher is a director and is not afraid of interrupting if presentations in front of the other students are not expressive enough (workshop ambiance).
The 3rd deepening: written homework (text task, interpretation of a place, for instance, Don Juan’s discussion with his father)	All pupils work hard at home	The teacher collects all homework and carefully corrects it	In teaching younger grades the LdL tasks are prepared during the lessons themselves. For older grades, the preparation shifts more and more towards homework so that a bigger proportion of the teaching time is available for interactions (collective reflection).

Source: Wikipedia, 2013

Learning how to learn (metacognition) is a vital life-skill that ensures the type of autonomy that we are seeking in our students for they are entering a relatively unstable world where being adaptable, reflective and self-knowing is crucial. There are numerous aspects to metacognition and it can be approached in different ways, the most essential ongoing feature is that students are brought to recognize the way they learn and consider various strategies for learning better.

b. Activating prior knowledge

Metacognition is a voyage into the architecture of cognition, how the mind and brain work in storing and retrieving information, how we process information and how we are most effective in understanding new material. "One major tenet of cognitive theory is that learners actively construct their understanding by trying to connect new information with their prior knowledge" (Pellegrino, Chudowski and Glaser 2001, p. 62). These questions can only be addressed once the teacher has some idea of what the student already knows.

Although screening for baseline knowledge is common for pre-entry protocols in streamed learning environments (for example, testing students' levels of language proficiency before allocating them to a group or having them do some form of maths assessment before deciding on the group that they should enter), it is not always done across the curriculum and in many areas teaching takes place before there is a clear idea of what the students have already covered. This can mean that the learning objectives are too ambitious or redundant: a lack of diagnostic assessment can lead to frustration and poor learning.

Knowing what students already know is important since "long before they enter school, children [...] develop theories to organize what they see around them. Some of these theories are on the right track, some are only partially correct, while still others contain serious misconceptions" (p. 83). The mind tries to assimilate new material with the conceptual understanding (or misconceptions) that are already in place and, therefore, the teacher's job is to find out what the students are thinking and then help them accommodate new understanding according to the mental representations that the students hold on to so that they can make sense of the world.

Lev Vygotsky gave this analogy to outline the importance of identifying prior knowledge in learning:

Like a gardener who in appraising species for yield would proceed incorrectly if he considered only the ripe fruit in the orchard and did not know how to evaluate the condition of the trees that had not yet produced mature fruit, the psychologist who is limited to ascertaining what has matured, leaving what is maturing aside, will never be able to obtain any kind of true and complete representation of the internal state of the whole development (1934/1987, p. 200).

So diagnosing prior knowledge is important for two reasons: it can allow the teacher to build on what the student already understands or correct what the student thinks he or she understands but in fact does not. This is particularly important for foundation concepts that are necessary for deeper understanding that will develop later on, for example, understanding arithmetic to access higher levels of mathematics such as algebra; knowing how to conjugate verbs in language learning in order to access more sophisticated levels of linguistic expressions and having a clear conceptual understanding of numerous scientific concepts (force, gravity, photosynthesis, hibernation, migration, chemical compounds) to be able to apply them in contexts that are increasingly cognitively demanding.

Here are some concrete examples of the types of strategies that can be used to identify and build on prior knowledge and understanding:

Mind Maps

Example: Primary School science.

Context: the teacher wishes to see what students already understand and know about the solar system.

Learning Experience: The teacher asks the students to draw a picture of the solar system, labelling the planets. The students have to work independently so as not to see each other's work. Once this has been done, the teacher asks the students to show him/her their pictures. This can be done by the students raising the pictures above their heads so that the teacher can grasp the situation with a broad glance across the classroom or each student can approach the teacher and show their work, or it could be handed in for the teacher to take home and look at in more detail.

Follow-through: The teacher will group the responses into three broad groups: those who have identified the planets correctly and placed them in the right order orbiting the sun; those that have the right pictorial representation (planets orbiting the sun) but do not remember all of the planets and/or do not have them in the right order from the sun; and those that do not understand the main principles of the solar system: the notion of orbit and ellipsis. The next work will be differentiated accordingly, either by students working in carefully selected groups or through differentiated homework. After this has been done, the teacher will check again to see where students are in their understanding.

Example: Middle School history.

Context: the teacher wishes to ascertain the degree of knowledge students have of the political boundaries of Africa before teaching a unit on the Scramble for Africa and the drawing up of political boundaries in Africa.

Learning Experience: Students are asked to draw a map of Africa including political boundaries. They should work independently so as not to see each other's' work. The students do not write their names next to their maps but at the end of the drawing session the teacher takes the maps in and posts them on a wall in the classroom. Students are then asked to observe the maps and discuss which one they think is the most accurate. Based on these discussions and a larger, whole class discussion, the teacher draws a master map on the board with the boundaries and the students copy it.

Note that the aim with this example is not so much for the teacher to differentiate instruction according to baseline knowledge but for students to share their relative knowledge frameworks and to self-correct by viewing and discussing other models.

Assessment Conversations

Whole class, group or individual conversations on what students already know, do not know or perhaps know incorrectly, can be done quite easily at the outset of a new unit or topic. Some simple strategies include the following:

- The teacher asks students to raise their hands if they have already heard about the topic in question (for example "hands up if you have heard of Isaac Newton"). From this information, subsequent questions and/or differentiation strategies can be developed.
- The teacher identifies a student who knows a fair amount about a topic, asks the student in question to do a short presentation to the rest of the class, takes notes on the board and facilitates questions and answers after this.
- The class discuss what they know and do not know about a topic before starting it, the teacher takes notes by drawing two columns, one for "what we already know" and another for "what we would like to learn".
- The teacher sets off a class discussion with an open ended question such as "how would we find out the relationship between a person's heart rate and the amount of exercise they do?" The answers would be mapped on the board and some subsequent discussion would be used to identify the best response.

- In an environment where students will be doing something practical, for example in Physical Education, the students are asked to describe a technique before they attempt it. If students are going to do a class on long jump for instance, the teacher would ask them to describe the technique of long jump before he or she explained it and then asked them to practice it.

Tests

Tests are the most common way of checking what students already know, can do and do not know, cannot do, or know (or do) incorrectly. A test at the beginning of a unit of work (diagnostic assessment) should be carefully designed so that students are given the opportunity to show the extent of their knowledge, competence and understanding.

Multiple choice test items can be particularly effective for diagnostic assessment because carefully chosen distractors can help the teacher identify not only what students know, but the types of misconceptions they might hold in their minds. For example, in logic as part of a course in philosophy or critical thinking in the senior years, the following question could be set:

Example: Senior Years Logic

If I study hard for the test then I will do well in the test is the rule. Which of the following statements is therefore valid?

- A. I did not study hard for the test, therefore I did not do well on it
- B. I did well on the test so I must have studied hard for it.
- C. I studied hard for the test but I did not do well on it
- D. None of the above

Option A will show the teacher that the student believes that the opposite of a cause will lead to the opposite of its corresponding effect: a certain type of misconception. Option B, on the other hand, is the error of reversibility, showing the teacher that the student believes that the causal pathway goes in both directions, which is not necessarily the case. Option C cannot cohere with the rule because the conclusion of the premise is other than the only one suggested.

In other words, a test like this will not be about the right answer so much as the wrong answer and more particularly what type of wrong answer. The teacher will be able to modify instruction according to the misconceptions that these responses suggest.

Example: Middle School Physics

Minstrell (2000) devised tests in physics to identify what are known as “facets” (intuitive knowledge claims that students have developed to explain a domain). The extract below describes it.

Problem: In the following situation, two identical steel marbles M1 and M2 are to be launched horizontally off their respective tracks. They each leave the ends of their respective tracks at the same time, but M2 will leave its track travelling twice as fast as M1. The track for M1 can be set at any height in relation to M2.

(a) If we want the two marbles to collide, how will we need to arrange the horizontal launch tracks?

- A. The track for M1 should be much higher than the track for M2.
- B. The tracks for M1 and M2 should be at the same elevation.
- C. The track for M1 should be much lower than the track for M2.

Now, suppose we have set the track for M1 at an appropriate height so that the marbles will collide in the space between and below the two tracks.

(b) The picture below is just before the two marbles collide. Diagram (arrows with appropriate relative lengths) and label the forces on each marble.

[A for horizontal component in the forward direction]

[B for no horizontal component in the forward direction]

(c) When they collide, which marble will exert the greater force on the other?

- A. M2 will exert the greater force on M1.
- B. M1 will exert the greater force on M2.
- C. M2 and M1 will exert equal forces on each other.

Briefly justify your answer.

(d) After the marbles collide, they fall the rest of the way to the floor. Which would reach the floor the soonest?

- A. They will reach the floor at the same time.
- B. M1 will reach the floor before M2.
- C. M2 will reach the floor before M1.

Briefly justify your answer. (Pellegrino, Chudowski and Glaser 2001, p. 204)

The answers to these problems would allow teachers to situate student's understanding on a "novice" to "Newtonian" continuum, showing whether their answers were indicative of an incorrect, intuitive facet or a contra-intuitive, scientific concept. For example, the answers a)B, b)B, c)C, d)A would indicate a clear understanding of the Newtonian principles to be applied in the problems whether a)A, b)A, c)A, d)C would demonstrate "novice" understanding.

Conclusions on the importance of prior knowledge in personalized learning.

The two big ideas behind the examples of activating prior knowledge are:

1. That the teacher should take into account what the student already knows as this is a key part of what makes learning personal. By knowing this the teacher will be in a position to build on prior knowledge or, in more difficult cases, to correct misconceptions so that the subsequent building is not done on faulty foundations.
2. That for students to personalize their learning they should reflect on the starting point of any new learning experience and analyse, critically, the "knowledge map" they carry in their minds (in other words, the mental representations they have already built up).

c. Workshop session

Workshop session aim	To stimulate reflection on how we learn best.
Resources	None.
Duration	About 1 hour.
Evaluation of outcome	Quality of discussion.

Can be done before, in the middle or at the end of the unit on metacognition.

The participants sit in a broad circle. If this is not possible because of numbers, two or three smaller circles can be formed and work simultaneously with elected facilitators for each circle. The workshop leader asks the question: “describe an ‘a-ha’ moment that you had – a moment when you realized that you has understood something. Describe that in detail and say what it tells you about learning to learn.

Each participant shares his or her “a-ha” moment and once everyone has spoken the workshop leader brings closure to the session by outlining some of the main take-aways from the sharing.

7. Student Portfolios

The student portfolio is one of the strongest ways of ensuring that a student’s learning is personalized. “The overarching purpose of portfolios is to create a sense of personal ownership over one’s accomplishments, because ownership engenders feelings of pride, responsibility, and dedication.” (Paris and Ayres 1994, p.10). The big idea behind a portfolio for personalized learning is that the student has a say in what goes in it and how it is organized. As Jane Jones points out:

A portfolio best suited to young language learners is essentially formative in nature as it can include work in progress, even imperfect work, yet of some pride to the learner. It is therefore dynamic. This portfolio is also inclusive, in that it allows all children possibilities to show what they know, however modest that knowledge might be, and what they can do, however limited. The scope for able pupils, indeed all children, is considerable. (Jones 2012, p. 402)

Portfolios can focus on process or product or both, depending on the age group that is targeted and the purpose of the portfolio. It is a useful piece of evidence for assessment decisions (whether formative or summative) as many different types of work can go into it and, therefore, a more holistic, multi-faceted picture of the learner can be drawn up. A helpful definition of the portfolio from Kolb points to many of its advantages. The portfolio is described as:

A collection of pupils’ work that is personal, dynamic and suitably structured, with ‘footprints of learning’ and the learning process, with evidence of feedback to the learner as well as learning results. It presents a story of a pupil’s learning based on pupil choices, elements of reflection, comments, explanations and self evaluation. (Kolb 2007, 21)

By using the words “footprint” and “story” to describe the learning process, one can see how personalized the portfolio can be as an expression of education. To keep the portfolio as authentic as possible, there are a number of principles that should be considered:

1. The portfolio should be chosen as one of the main ways that students will learn and reflect on the subject that is chosen, it should not be seen as an add-on or extra. By giving it this centrality the portfolio will be taken seriously by the students.

2. Portfolios should be assessed regularly. The purpose of portfolio assessment should be mainly formative (assessment for learning) so that the information in it is used to further guide the student towards learning goals. Self-assessment works particularly well with the portfolio. Portfolio assessments with a summative purpose (assessment of learning) should gather relevant evidence of learning within the portfolio on agreed areas (standards, outcomes or goals) and evaluate the progress made.
3. Students should have a large amount of choice on what goes in to the portfolio but should nonetheless be given clear guidelines on how to establish learning goals and how to reflect on their learning.
4. For portfolios to be truly personal, students should be encouraged to add items that say something about what they do outside of school, what they like and who they are.
5. Portfolios should be displayed or open to a broader readership (peers, other classes, parents).

a. Setting up a portfolio for personalized learning in five steps

1. *Purpose and Audience*

Teachers and students need to be clear on the purpose of the portfolio. Is it a footprint of the student's learning that is there to encourage assessment for a formative purpose (assessment discussions, formative feedback, goal-setting), is it going to be used for assessment with a summative purpose (the portfolio will be graded against criteria at established intervals) or are there elements of both? Another important question at the outset is who is the portfolio for? Whether it is intended for parents, the whole class, only the teacher, certain groups of teachers, organizations and people outside of the schools, the decisions that will be taken about its format and layout will vary accordingly. Portfolios have the potential to give extremely holistic and authentic pictures of students' learning and therefore could be considered for academic reports or parent-teacher-student meetings, they are also useful towards the end of a student's school education as evidence of achievement and action in the light of post-secondary options and applications.

2. *Platform and classification*

Will this be a digital portfolio or a manual one? If it is the former, the teacher will need to think through questions of access and protection (what will the password protection specifications be? What type of virtual learning environment will you use?). The latter (manual portfolios) will limit the types of work that can be included and the links and/or communications platforms that could be embedded in a digital portfolio. The classification question is, essentially, what goes in the portfolio. A typical structure to a portfolio is:

- About me (information on the student, what (s)he likes, goals and aspirations).
- Areas of Learning (areas of study divided by subject and then subdivided into units).
- Reflection on Learning (this can be a single entry on learning in different areas or separate entries reflecting on learning in each subject area).
- Examples of work (good work, two pieces of work that show progress, pieces of work that the student is proud of).
- Links to other sources of interest (galleries, booklists, events attended).
- Hobbies/passions (these can be outside of the curriculum).
- Diary (miscellaneous or more structured comments that are written periodically).
- Areas for communication (blogs, copies of letters, etc.).

3. Clear guidelines

Students need to be clear on what the criteria for the selection of work are, whether they are expected to collate the best work, examples of work where they struggle, do reasonably well and excel, work they are proud of, examples of a draft and then improved final version, etc. A recommendation is to have as many different types of work in the portfolio as possible in order to represent as detailed a story of learning as possible. When it comes to reflecting on learning, students need to know which questions typically generate worthwhile reflection so that they can work within clear guidelines. Good reflection questions that could be built into the framework of the portfolio include:

Looking Back:

- *How much did you know about the subject before we started?*
- *What process did you go through to produce this piece?*
- *Have you done a similar kind of work in the past (earlier in the year or in a previous grade; in school or out of school)?*
- *In what ways have you gotten better at this kind of work?*
- *In what ways do you think you need to improve?*
- *What problems did you encounter while you were working on this piece? How did you solve them?*
- *What resources did you use while working on this piece? Which ones were especially helpful? Which ones would you use again?*
- *Does this work tell a story?*

Looking Inward:

- *How do you feel about this piece of work? What parts of it do you particularly like? Dislike? Why? What did/do you enjoy about this piece or work?*
- *What was especially satisfying to you about either the process or the finished product?*
- *What did/do you find frustrating about it?*
- *What were your standards for this piece of work?*
- *Did you meet your standards?*
- *What were your goals for meeting this piece of work? Did your goals change as you worked on it? Did you meet your goals?*
- *What does this piece reveal about you as a learner?*
- *What did you learn about yourself as you worked on this piece?*
- *Have you changed any ideas you used to have on this subject?*
- *Find another piece of work that you did at the beginning of the year to compare and contrast with this what changes can you see?*
- *How did those changes come about?*
- *What does that tell you about yourself and how you learn?*

Looking Outward:

- *Did you do your work the way other people did theirs?*
- *In what ways did you do it differently?*
- *In what ways was your work or process similar?*
- *If you were the teacher, what comments would you make about this piece?*
- *What grade would you give it? Why?*
- *What the one thing you particularly want people to notice when they look at your work?*
- *What do your classmates particularly notice about your piece when they look at it?*
- *In what ways did your work meet the standards for this assignment?*
- *In what ways did it not meet those standards?*
- *If someone else were looking at the piece, what might they learn about who you are?*

Looking Forward:

- *One thing I would like to improve upon is...*
- *What would you change if you had a chance to do this piece over again?*
- *What will you change in the next revision of this piece?*
- *What's the one thing that you have seen in your classmates' work or process that you would like to try in your next piece?*
- *As you look at this piece, what's one thing that you would like to try to improve upon?*
- *What's one goal you would like to set for yourself for next time?*
- *What would you like to spend more time on in school?*
- *What might you want next year's teacher to know about you (what things you're good at)?*
- *What things you might want more help with?*
- *What work would you show her to help her understand those things?*

(Edutopia 2011)

4. Time and Space

Students need to be given the space and time to select pieces of work, enter reflective statements and, of course, to step back from the portfolio, look at it carefully and draw conclusions about their learning from it. There are many ways that this can be done: in a designated portfolio or reflection class, within lessons or as homework. The main principle is that the work should be ongoing. The teacher should check on the progress of the portfolio weekly if (s)he is to be sure that it is being complied regularly. If checks are infrequent then there is a chance that the student will rush to enter material just before observation or assessment points, making the learning experience superficial.

5. Culmination

It is useful for the students and the teachers to bring a clear culminating note to the portfolio, although this does not necessarily mean that the work will stop. If the portfolio can be carried into the next year than it is better as it shows the continuum of learning. Nonetheless, teachers should create environments where others can access the portfolio, ask questions about it and share their own work. Students learn a tremendous amount from observing others and seeking inspiration in the work of others. Teachers should be sure that students present their portfolios and are given ample opportunity to talk about it. A learning portfolio gives the students a chance to look back over a lengthy period of study (a year for example) and verbalize how they have grown over time.

b. Digital portfolios

Digital portfolios or e-portfolios allow for practically endless amounts of information to be stored onto a platform by the student and include numerous advantages such as:

- Multimedia artefacts (digital audio, images and video);
- Two-way web 2.0 information flow through blogs and wikis;
- Transfer (students can take their digital portfolios from one year to the next);
- Easy exports for use in different contexts (reports, motivation letters, profiles, CVs, social networking);
- Hyperlinks;
- Dematerialized: is not physically cumbersome;
- Students use ICT-related competences when developing digital portfolios.

There are, however, some disadvantages that one should consider with digital portfolios, such as:

- Difficult decisions over degree of access to the portfolio (which parts should be made public, semi-private or private?);

- As evidence for assessment purposes it might not be fair due to varying degrees of access to technology within the student body;
- Increases screen time;
- Using commercial platforms can reduce autonomy;
- Certain types of work, such as the visual arts, will lose their poignancy if filtered by computer screens.

How to set up a digital portfolio

The following steps need to be taken to develop a digital portfolio:

1. An audit of the capacity in the school and student body to use such a platform. This will entail whether the school has the technical support to ensure that digital portfolios are done well, the means to choose and purchase a suitable VLE (virtual learning environment) and whether all students will have equal access to technology to work on their portfolios;
2. Clear information sessions to staff, parents and students about the opportunities and pitfalls of digital citizenship, explaining clearly what the student's virtual learning environment (platform) is, what sort of screen time at home is recommended, what to do if not sure about a posting and where to draw the line with social networking media
3. Time in class with the students helping them set up their digital portfolios.
4. Regular interactive sessions with students to discuss their entries, assess the portfolio (for formal and/or summative purposes as decided) and look through reflections.
5. Sharing sessions at the end of an academic cycle so that students can project their digital portfolios and present them to a wider audience. This implies supplementary technological facilities such as projectors.

To find out more about how to set up a digital portfolio using Google Apps look at the work of Helen C. Barrett (<https://sites.google.com/site/eportfolioapps/Home>)

c. Workshop session

Workshop session aim	To stimulate creative thinking around the purpose of the portfolio.
Resources	Pen and paper for each participant, flipchart sheets and flipchart markers.
Duration	1 to 2 hours depending on group size and the extent of the reflective discussions.
Evaluation of outcome	The degree of pertinence and reflection in the group presentations and drawings.

This is a good learning experience to do at the outset of the unit on student portfolios as it allows for some preliminary blue-sky thinking.

Learning Experience 1: Imagine a storing machine for precious personal information: what would you store?

The workshop leader asks the participants, working in groups of four or five, to design a storing machine that would be used to store the most precious information about a person (any person, not necessarily someone in particular). The big question is: what is precious about someone's identity and why? Each group draws their storing machine with words and/or symbols to denote what would be stored from that person's life. When the drawings are ready, each group presents their storing machine to the rest of the participants and a broad discussion is facilitated. At the end of the learning experience the pictures can be placed on the wall for on-going viewing and reflection. The discussion should be transposed to personalized learning: what should we keep a trace of? Why? How? For how long?

Learning Experience 2: The time capsule.

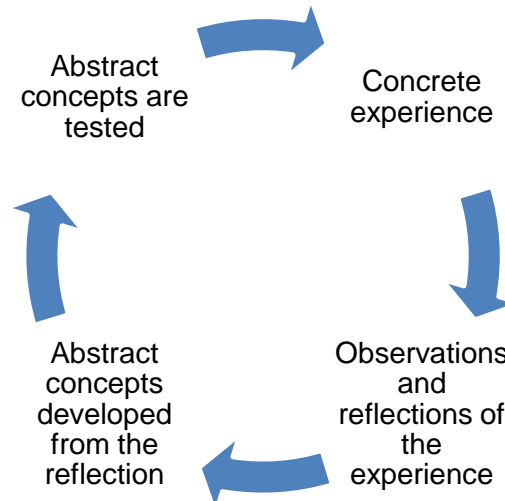
This is a variation on Learning Experience 1 and can be done much in the same way. The imaginary scenario is:

You are burying a testimony of your time for the future generations. What do you place in the time capsule and why? Transpose to students' work. Is there a point in keeping anything? In what way should a student portfolio be like or unlike the time capsule?

8. Experiential Learning

Experiential learning is learning by doing, it involves students moving away from pure theory to practice. Experiential learning is connected to, although not necessarily the same thing as, outdoor learning, service learning, physical activity, field trips and applied, real-world context learning. The main idea behind this vision of education is that we learn best through direct experience.

There are elements of experiential learning in the educational theories of Rousseau, Piaget and Dewey but the figure who has popularized it the most is David Kolb (1939). His experiential learning model is made up of four steps that form a cycle:



Source: Kolb, Rubin and McIntyre, 1974

Experiential learning is based on the premise that we learn best when we are actively engaged in our learning, reflect upon it critically and develop conceptual understanding from real-life experience. In many ways, experiential learning is the purest form of personalized learning because there is necessary ownership through action and experience. To give an example, if a child sees an anthill and observes the behaviour of ants, (s)he is likely to have a far more personal understanding of ant behaviour than the student who is shown pictures in class and takes notes that are dictated by a teacher on what happens around an anthill.

Indeed experiential learning implies moving out of the classroom into new, real-life settings, be they natural, social or professional. It is an opportunity for the teacher to make the learning of the child come alive so that (s)he can make connections and internalize authentic examples.

a. Moving beyond the classroom

Moving out of the classroom is not only a question of physical displacement, it means bringing real-life examples into student's learning. This can be done in numerous ways:

- Inviting a guest speaker to the class to share some experience of life (a war or natural disaster survivor, witness of some important event, professional or public figure with a story to tell). Often parents are underused human resources;
- Bringing real-life artifacts into the classroom and allowing students opportunities to interact with those materials (books, pamphlets, stones, plants, fossils, instruments, pieces of technology);
- Giving students a chance to share their experiences with others in the class when and where they resonate with the curriculum;
- Allowing students to experience real-life materials such as newspaper and magazine articles, websites, wikis and blogs, audiovisual materials (music and films for example) in class;
- Skyping with other classes or individuals for in-class exposure to real-world stories;
- Setting up a pen-pal scheme with another school or group.

If the essential idea behind experiential learning is that students are to experience real-world examples and draw conclusions from those to develop their conceptual understanding, then at some point the teacher must be able to take the students out of the classroom too. There are numerous ways this can be done and not all of them can be listed here, but they include:

- Field trips, typically but not exclusively for subjects such as science, history and geography;
- Arts visits to museums, concerts or theatrical productions;
- Placements in businesses, either as part of a formal professionalising school course or as a unit of work in subjects like business and management or economics in the senior years;
- Competitive sports trips or tournaments;
- Outdoor education trips with a co-curricular focus (team building, multi-terrain sports, endurance, camping);
- Service Learning activities that involve community and service work in the local community (working in schools, hospitals, old age homes, orphanages, for other public services and so on);
- Simple outings from school to gain new perspectives (for example, outdoor drawing or poetry reading, measurement and mapping exercises around the school's external premises);
- Visits to factories and other highly developed production sites;
- Participation in local public events such as fairs or community walks;
- Attending public readings, colloquia, debates;
- Exchanges with other schools.

Ultimately, the quality of the real-world contact that students have will depend on what the school is able to provide, how carefully the outings are prepared and scaffolded by the teacher and what sort of reflection students are asked to engage in during and after these moments beyond the classroom. It is key to ask students to log their observations during this type of contact with the world outside the classroom, this can be done with a journal or log book for older students and by using key guiding questions for younger students such as:

1. What did you see/hear/experience?
2. What did you learn?

b. Action

At the core of experiential learning is the idea of active learning, meaning that students need to play an active participatory role in their learning. Action should be a way for students to acquire new skills in such a way that they are exercising multiple ways of knowing such as kinaesthetic and/or interpersonal skilfulness. There are numerous ways that this can be done:

- The teacher should allow students to take the initiative when it comes to finding opportunities to apply classroom knowledge through an experiential project.

Example: In a unit on water in the primary years, students might learn about the scarcity of water and decide to create a “poemathon” – poems on water read continuously in the community – that would be sponsored to give relief aid to a community without access to water. The students would choose the target organization and community through a class discussion while the teacher would scaffold with subtle questions (“why would you do that?”, “what would happen if?”, “what if on the other hand ...?”) and chairing techniques (“You have decided on the community, what more do you think you need to know about it before you proceed?”).
- Students should work collaboratively and build on each other’s strengths, skills and knowledge. This will allow for a sense of responsibility that leads to genuine engagement with what is being taught.

Example: in a Secondary School second language course (French for example), students learn about Francophone culture and decide to put together a concert of famous French songs by artists all over the French speaking world. If the students work together this way there is a strong chance that they will retain what they have learnt more actively and meaningfully than in a theoretical lecture controlled by the teacher. Working together creates a sense of group responsibility and fun for the students.
- The strength of experiential learning will be compounded if the knowledge acquired is relevant to the course of study.

Example: In the Middle Years, students studying food and nutrition in biology could apply their knowledge by in an activity at a local soup kitchen by preparing balanced meals for the homeless. This could be part of a Service Learning programme but by making it relevant to the student’s academic course of study there is a higher degree of curriculum coherence, making it easier for the students to make connections. Furthermore, it conveys an inspirational dimension to learning as students will recognize that they have the power with their knowledge to be agents of change.

Example 2: If in the Middle School, students study the French Revolution the teacher could allow them to establish links with organizations that support Human Rights, such as Amnesty International, to find out about the human impact of other contemporary revolutions such as those of the “Arab Spring”. Students could engage in letter writing around a Human Rights cause that resonates with their history lessons.
- The most accessible action that covers all subject areas is tutoring led by older students for younger students within a school. This is beneficial for the older students’ learning, as we have already discussed the value of learning through teaching, and it presents the younger students with role models who are closer to younger student’s social sphere. In this example knowledge acquires a special status in the eyes of the student community as it no longer belongs to the teacher only but is integrated into the youth culture of the school.
- Reflection on action is something that must not be overlooked. Neither should it be made too heavy or procedural: a balance is to be struck.

Example: A school field trip without prior thinking and post-activity reflection is a half-lost opportunity for learning. On the other hand, if tension is created by allowing students to look for answers to questions during the trip and/or to confirm prior beliefs, a dynamic is created that feeds the will to learn.

The big ideas behind action in experiential learning are: tapping into the natural excitement and curiosity that drives students to make their education more vivid.

c. Reflection

All teachers are reflection teachers. In other words, reflection should not be seen as an add-on but should be naturally embedded into the curriculum as part of action.

It is important to recognize that reflection does not necessarily come naturally to students. It is a skill that must be taught. Without reflection, students will not ask the fundamental questions “why am I learning this?” and “where is it taking me?”

Reflection should be embedded into the curriculum gradually: in the primary years its purpose is mainly to create some stimulus response, for example simple questions such as “did you enjoy this?” and “How did it feel?” will help students form an opinion of how their learning impacts them. In the senior years, however, reflection becomes more nuanced including ethical and philosophical dimensions. For example, students could be asked to discuss the consequences of actions and to substantiate the choices that they make.

For reflection to be authentic and genuinely personalized, it is important not to restrict it to one format: reflection can be much more than written narrative or discussion and can involve artistic production (films, commented photographs, theatrical reproductions, painting), interviews, group, blogging, making a speech, posters, making a statement through posters or T-shirts.

One should not assume that reflection only takes place at the end of an activity: it has a role to play in goal-setting before action, *in-situ* during the action and, of course, as retrospection after the activity. Teachers should scaffold the reflection process so that students are drawn out of their comfort zones to reflect to the highest of their intellectual capabilities.

Reflection cannot be properly assessed if the student has not set out learning objectives for action. Goal setting (what the student aims to do) and learning objectives (the broader, more abstract principles behind the goals) should be co-developed by the student and the teacher through conversation, understanding of needs and areas for growth. In large classes where it is difficult for the teacher to access each student individually on a regular basis, group learning experiences can be used for goal-setting and the teacher can give feedback on written statements that are handed in at the end of the lesson. What is important is that the activity goals and learning objectives are differentiated enough to be meaningful and to offer sufficient challenge to each student.

There are essentially four layers to the assessment of reflection quality:

1. *The descriptive level:* This is a reflection that merely states what happens without referring to objectives or making further conclusions
2. *The emotional level:* This expresses engagement and personal involvement, goes beyond description but does not show critical thinking
3. *The critical level:* This is when a student can describe an action, reflect on the emotional impact it has had on him and critically evaluate the action for its impact in the light of the set learning objectives and activity goals.
4. *The level of transfer:* In this final level, students are not only able to reflect on the elements discussed in the earlier levels but can make inferences, generalisations and draw abstractions from the experience that are transferrable to new situations.

These levels are indicative and often reflections will fall somewhere between them. The main idea is that students are being pushed to the next level of reflection by moving from mere declarative knowledge, through understanding to synthesis and application.

Another way of considering how to move students along a progression of increasingly critical reflection is by asking them to address questions that steadily move into more complex areas of reflective thinking such as the one below from the Community Service Learning Centre:

What?

- What happened?
- What did you observe?
- What issue is being addressed or population is being served?

So What?

- Did you learn a new skill or clarify an interest?
- Did you hear, smell, or feel anything that surprised you?
- How is your experience different from what you expected?
- What impacts the way you view the situation/experience? (What lens are you viewing from?)
- What did you like/dislike about the experience?
- What did you learn about the people/community?
- What are some of the pressing needs/issues in the community?
- How does this project address those needs?

Now What?

- What seem to be the root causes of the issue addressed?
- What other work is currently happening to address the issue?
- What learning occurred for you in this experience?
- How can you apply this learning?
- What would you like to learn more about, related to this project or issue?
- What follow-up is needed to address any challenges or difficulties?
- What information can you share with your peers or the community?
- If you could do the project again, what would you do differently?
(CSL 2013)

d. Workshop session

Workshop session aim	To experience experiential learning and reflect on the role it has to play in personalized learning.
Resources	Space and, depending on the chosen area for development, appropriate materials (musical scores, instruments, the words of a song, a stage, a CD player).
Duration	2 hours, depending on the group size and the depth of discussion that ensues.
Evaluation of outcome	Enjoyment of participants, quality of reflection.
<p>This learning experience can be done at the beginning, middle or end of the unit on experiential learning, depending on the context.</p> <p>The workshop leader becomes a choir master and teaches a song to the participants out of the blue (similar learning experiences can be achieved with other active areas of learning such as dance or theatre). The workshop leader observes the participants' reaction, looking for surprise, shyness or enthusiasm.</p> <p>A reflective discussion ensues on experiential learning based on the following guiding questions: how did you feel doing something new, unexpected, collaborative and emotionally connoted? Is this valuable in a child's education? What can we learn this way? Is this a teacher's role? What does this type of experience tell you about personalized learning?</p>	

Conclusions (Creativity, Inquiry and Challenge)

This module on personalized learning has developed numerous examples from different domains to illustrate how learning and teaching can be brought to the student and how the action of learning can become something that the student owns.

If a student is exposed to these different strategies, he or she will be put in a situation of responsibility to act, personal interest to consolidate and engagement to be a lifelong learner.

Three simple but fundamental ideas can be elicited to communicate the substance of personalized learning:

Creativity

As the module has shown, the teacher has to be creative so that the student is able to explore ideas with sufficient autonomy, multiple perspectives and, by doing this, develop his or her own creativity. For a student to take full ownership of the learning process, there must be an ongoing undercurrent of creative thinking around the learning process.

Inquiry

Lifelong learning is an attitude of curiosity that transcends school and drives individuals and groups on to contribute to knowledge. Without inquiry there will be little guarantee of successful learning for whilst schools transmit a large amount of previously established knowledge to students, for the students to apply that knowledge and go on to seek new knowledge, they will have to embody the spirit of inquiry. The teacher must show genuine interest in the student's ideas and never close down thinking that is curious but might stray from the learning objectives. Inquiry, like creativity, requires a certain amount of risk-taking and for a personalized learning experience to be profound, both the student and the teacher need to be inquirers.

Challenge

Personalized learning should not be mistaken for an unchallenging comfort zone where the teacher merely allows the student to confirm what he or she knows or decides what (s)he would like to know without moving into uncomfortable areas. The teacher needs to let the student drive the learning process but at the same time the teacher has a vital role in setting challenging goals and always remaining a few steps ahead of the learner. The fundamental aim of education is the betterment of the individual, which leads to the betterment of society, and without challenge this will not happen.

Note on workshop sessions

This module's examples of workshop learning experiences are based on a few guiding principles that can be extended to other learning experiences that the workshop leader might design:

- Ice-breakers at the beginning of the workshop should be used to allow participants to get to know one another and feel more confident to engage with the work.
- Participants should be led to engage in rich discussion on each of the areas outlined in personal education; it is through dialogue, sharing, recasting and debating that each participant will establish the clearest understanding and personal relevance of the module's content. These discussions should happen, for the most part, at the end of a task so that there is some meaningful reflection to give closure to the session.
- The workshop leader should facilitate these discussions by taking note of key words, agreed statements and ideas. This can be done quite simply by posting or writing ideas and concepts down on flipcharts or whiteboards/blackboards or websites, wikis or blogs (web-based platforms can allow for further discussion and a communication network that can continue after the workshop). An advantage with flipcharts is that diagrams, ideas, statements and references can be left on the wall throughout the workshop and will allow participants time to look at them and internalize their content whereas the medium of the blackboard/whiteboard requires note-taking for recall and is less convenient for the workshop leader as the workshop progresses because he or she cannot point to previous work for reference and consolidation.
- During the course of the workshop participants should be encouraged to participate and share but the workshop leader needs to move conversation along in a timely, efficient manner and bring closure to discussions by capturing the main take-aways.
- Workshop learning experiences should draw participants into different ways of knowing and learning (drawing, discussing, presenting, group work, imagining, playing games, drawing analogies and so on) so as to stimulate a broad spectrum of appreciation. The workshop should not consist of too much workshop leader-centred talk with silent participants taking notes, especially for a module on personalized learning.
- Workshop learning experiences are primarily designed to allow abstraction and generalisation so that participants can stand back from the examples given and master a conceptual understanding of the themes in question.
- Workshop sessions and the entire workshop should end with recapping, summaries and conclusions.

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Training Tools for Curriculum Development

Personalized Learning

"Personalized learning is teaching and learning that is focused on the background, needs, potential and perception of the learner. It is learner-centred education."

The IBE series of *Training Tools for Curriculum Development* is designed to support Member States with regard to strengthening leadership for education and curriculum reforms and development processes. Specifically, "Training Tools for Curriculum Development: Personalized Learning" acknowledges that for education to be meaningful it needs to be applied and for this to happen the individual needs to take full ownership and regulation of the learning process.

This *Thematic Module* provides comprehensive guidance to teachers, curriculum developers, teacher trainers, and quality assurance specialists. It consists of:

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