

# Differentiated Instruction in Technology Education

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## **Abstract**

*Differentiated instruction is the concept of teaching to individual students acknowledging their individual strengths, weaknesses and learning styles. The call for differentiated instruction classrooms is echoed in both an appreciation of students as individuals as well as at the systems level through results of international exit surveys such as the PISA study. Differentiated learning calls for a move away from an industrialist model of the classroom, where the same programme (instructional activities and assessment structures) are applied to all students, to a model where we consider learning and assessment programmes to suit individual learners needs.*

*A move to differentiated instruction to allow differentiated learning to occur in the classroom has implications on school structures and vision, professional learning for teachers and teacher practice at the classroom and departmental levels. The role of assessment in teaching and learning is also critical in the functioning of a differentiated learning classroom.*

*This paper discusses the factors involved in setting up a differentiated learning classroom and is supported by a presentation of classroom examples.*

## **Introduction**

A differentiated learning classroom is one where all students have the same opportunity for success, and instruction occurs in a way that makes sense to them. A call for differentiated classrooms in technology education is not a call back to the individual learning programmes of the 1970's however, nor is it about "tailoring the same clothes to fit all students" (Tomlinson, 2005). Developing a differentiated instruction classroom is about finding some starting point that works for the teacher and by small increments beginning to offer learning opportunities that suit more than that illusive average student. It can start with just one activity in a unit of work, providing students with information in differing formats and allowing students to present their learning in a way that best suits them. Many teachers already have varied tools in their teaching kete; it is often just a matter of dusting off some of those that are less often used and adapting them for the topic, students and environment.

Tomlinson (2008) sets a realistic scene for considering differentiated instruction. She acknowledges that "education like all other professions has a literature of best practice – a collective wisdom born of research and experience – that points the way to success" whilst also acknowledging that despite this research, "there is no recipe that guarantees infallibility. Humans are varied, messy in their wants and needs. Young humans are certainly no less so" (Tomlinson C, 2008, p. xi).

With this in mind, differentiated instruction is about allowing every student the opportunity to reach their full potential, by operating in a learning environment that is safe, recognises differences, offers choice and allows students ownership of their

learning. It has implications for teachers and their classroom practice and the way they plan for, and structure student learning. A differentiated instruction classroom allows students to learn in a manner which is most suited to them.

Differentiated instruction is however more than just a classroom pedagogical approach and to be established effectively requires a whole school approach. Ideally it should be supported at the whole school level with a vision for differentiation led from the leadership team and supported practically to create a safe environment for pedagogical change. This whole school support is important to successfully develop and model the benefits that come from student centred learning. Teachers and Principals in many schools are recognising the need for developing classrooms that suit diverse learners.

Technology Education is a learning area within the New Zealand curriculum that is well suited for differentiated instruction as a model for classroom practice. Technology in the New Zealand curriculum gives direction for student learning but not directives, which allows teachers to consider student, environmental and community differences to be recognised and given consideration within their teaching programmes which can be different in different schools. It provides a perfect opportunity for students to take ownership of their learning, in both process and product.

This paper illustrates how differentiated instruction can be developed within Technology education.

### **Differentiated Instruction and Technological Literacy**

“Differentiated instruction is a teaching philosophy based on the premise that teachers should adapt instruction to student differences. Rather than marching students through the curriculum in lockstep, teachers should modify their instruction to meet students' varying readiness levels, learning preferences, and interests” (Willis & Mann, 2000, p. 1).

It is about maximising the opportunity for each individual in the classroom to learn. In the same way as Confucius called for a change to learning by doing “*I hear and I forget. I see and I remember. I do and I understand*” (Wright, 2002, p. 114), Differentiated Instruction is a call for learning and teaching that enables all students to learn in a way that makes sense to them.

The call for differentiated instruction is strong and easy to understand. At one level we only need to look at the faces of those students in the classroom in front of us every day to know that they are all different. Each student has a differing set of values and norms that is shaped by their home, environment and upbringing. Many will come from a different culture with different understanding and language. Some will come with learning difficulties and at different levels of readiness for the work that is expected of them in any given day. Even the events of the previous lesson will have an impact on their potential learning; some may have been at sport practice from early in the morning while others may have been out working till late the night before. At an educational systems level school exit surveys such as the PISA study also show that for many students schooling in the twenty-first century is mismatched to their needs.

One of the key components to achieving success in Technology is recognising the importance of Literacy. “The language of technology is indisputably a concrete one – of images, symbols and models. Without this language it is just not possible to conceive of technological solutions.” (Kimbell, Stables, & Green, 1996, p. 23) With the move towards Technology Standards being included as students' Literacy credits, it is

important that we open doors for those technology students who are possibly struggling in the traditional literacy subjects. We must ensure by every means that success for these individual students is possible.

Students move between five to seven subjects per day with the associated languages and lexicon that go with each subject. Each teacher expects students to have their mind focussed on the literacy of their subject within a very short time. We are short changing students if we do not give them the opportunity to learn the language of our subject. This is a good place to start with trialling some differentiated strategies, such as providing key vocabulary in various learning styles, from independent research, games, visual posters, electronic quizzes or conversations.

### **Setting the scene for differentiated instruction**

A differentiated learning classroom is an ideal that many teachers aspire to in the way they organise their classrooms but given the realities of the modern classroom many never achieve. We acknowledge that developing a differentiated classroom may require changing teaching practice and that this is a difficult process. It can be likened perhaps to setting a New Year's resolution of "eating healthy foods, cutting back on the alcohol and exercising regularly". We all know we should do it, but many of us are not so good at keeping to the plan until we have too.

To help teachers to successfully implement a differentiated learning programme in their classroom the following issues need to be addressed.

#### ***1. Knowledge of the curriculum***

Teachers require a thorough knowledge of the curriculum. For technology education this means a comprehensive knowledge of the nature of technology and the way this plays out through the strands and components of technology. Students may be working on different components of the curriculum within the one classroom so teachers need to be confident making decisions about where student learning fits within technology, and when it doesn't. Teachers may need to move from a focus on their area knowledge of technology in say food technology or materials technology building on that to develop an increasingly robust knowledge and understanding of technology as a learning area.

#### ***2. Knowledge of expected student learning and indicators of progression***

Teachers need to be very familiar with expected student learning in their area of technology as well as the expected progression of learning from one level to the next. In a differentiated learning classroom students may be working at different levels of the curriculum while working on the same project based learning activity and teachers need to appreciate these differences in their planning. In technology education this framework of expected learning is well supported by research and material provided to teachers on the techlink website.

#### ***3. Knowledge of learning in technology***

Teachers need to appreciate the range of ways that learning happens in technology. The traditional pedagogy of project based learning and learning by doing is very appropriate for many students that choose to study technology but there are a number of other pedagogies that are also appropriate and suit the learning styles of students in technology classrooms. A differentiated learning classroom may display a mixture of hands on and minds on practice for students. Teachers understandings of common misconceptions by students in different areas of technology as well as knowledge of

problematic issues for students in technological practice helps drive decisions of pedagogical approach in the classroom.

## **Developing a Differentiated Learning Programme**

### ***1. Teacher professional learning***

The goal of differentiation is to maximise the opportunity for each individual student. For this to occur, teachers need to scrutinise their own practices, what they are doing or not doing that helps or hinders student learning. This analysis of one's own practice can be a difficult and challenging task and fraught with uncertainty. It is much easier to accept the status quo. The leadership team of the school plays an important role here setting a professional environment that allows teachers to feel safe to not only examine their practice, but to acknowledge their lack of knowledge and skills in certain areas in order to develop professionally. Furthermore, the management team must also ensure that there is sufficient, continuing professional learning support for teachers to embed changes in their teaching practice over the long haul both in and out of the classroom.

The most effective model of staff professional learning support has been shown to be that which models the principles and practises of differentiation (Tomlinson C., 2008, p. 53). Here the professional support team have a shared vision and thorough knowledge and understanding of the principles of differentiation with the focus for professional development centred around the issue of student learning. Sykes (as cited in Tomlinson, 2008, p. 66) comments "student learning should be the engine that drives teacher learning."

### ***2. Understanding curriculum in terms of differentiation***

Tomlinson (as cited in Willis & Mann, 2000, p. 2) notes that teachers often differentiate three aspects of the curriculum; content, process, and products. Curriculum content can be defined as the core principles, concepts and skills that students are required to know. The term process refers to the activities which enable students to understand the content. The term product in this sense refers to how students choose to present the content they have learned to demonstrate their understanding of it.

In a differentiated learning classroom it is vital that teachers have a very clear understanding of the content that they wish students to understand. The key principles, concepts and skills they want students to learn need to be the same for all learners, not a more complicated version for the bright and a watered down version for the 'not so talented'. The way that the content is delivered however can be differentiated with the teaching and learning material and activities being of a level relevant to the learner.

### ***3. The classroom environment- What should it feel like?***

Just as it is essential for teachers to feel safe when embarking on change, a classroom should be a place where students feel safe and valued, both physically and emotionally. The environment must support students expressing unusual ideas, asking for help, and allowing undeveloped ideas to grow. Mutual respect and fairness are a must, as are feelings of value and trust. If teachers and students are working towards growth and success for all, this environment will encourage the values of excellence, equity, community and participation, integrity, and respect in all aspects of the students' life, all Values of the New Zealand curriculum. (Ministry of Education, 2007)

#### ***4. Knowledge of learners and preferred learning styles***

Before we can start planning lessons incorporating differentiated learning strategies, we must know our students. There are many ways for achieving this including; talking to them, finding out about their background, culture, and home environment. For example; Is English their first language? Do they have differing physical or cognitive abilities that may help or hinder their learning? Are they involved in sports, or work a job out of school? Not only will this understanding help with relevant instruction planning, students value a teacher that takes an interest in their life. Other strategies include talking to teachers from students previous year's classes and looking at their grades and test scores. Analysing students' assessment performance in relation to different assessment formats can for example show differences attributed to the type of activities that best suit individual students. Multiple Intelligence quizzes can also give information that can be invaluable to planning.

An understanding of what conceptual knowledge students' have prior to starting a unit of work is also vital to the planning of the content of that topic. To establish if the unit of work or topic being planned is going to be relevant, authentic and engaging, we need to assess the readiness of our students. "By considering in advance the assessment evidence needed to validate that the desired results have been achieved, teaching becomes more purposeful and focused." (Tomlinson C. A., 2006, p. 59)

Having an understanding of students' preferred learning styles is important. Not all students are the same, and the chances of having a group of students who learn in a manner similar to the teacher or as each other is very unlikely. There are many theories on learning styles and several types of analysis formats available that could be used to investigate student's preferred learning styles. A good suggestion is to investigate a few of them and choose a format that makes sense to you. Students, particularly at years nine and ten are often unaware of their preferred learning styles.

Another aspect of student preferred learning style is how students prefer to work together. Some students prefer to work with their friends and others like to work alone. Some students may benefit from taking part in individual or small group workshops or master-classes. There is nothing to be gained by whole class instruction if three quarters of the class already know what you are teaching. Another option is tiered activities, where the learning outcome remains the same but the varied activities offer students choice of how they wish to learn the content. Flexible groupings are certainly a valuable tool for differentiating process.

#### ***5. Pedagogical approach***

Technology Education provides a perfect vehicle for offering differentiated lessons. The typical pedagogical approach of project based learning is quite appropriate as a start point where students are able to see the relevance of their learning when they can use that knowledge to create something. This "creates opportunities for student involvement and interaction, incorporating practical activities, presenting information in different ways." (Hill, 1998, p. 4). In this way students have the opportunity to create something using the theoretical knowledge that they gain, putting this into practise, and thereby reinforcing that knowledge. Students get to apply that knowledge to create an outcome to a level which is achievable for them in an environment that is realistic. This intimate connection between learning and doing is fundamental in technology education and moreover, is part of the "enculturation into a domain, through participation in shared activities" (McCormick, 2004, p. 23).

Problem solving and design is another fundamental pedagogical approach to technology education that fits easily with differentiated learning. Where this is positioned as something real and tangible, where students can address a problem and can see in real time the affect their work has on the outcome, differentiated learning is easier to achieve. This approach fits well with Turnbull's thoughts on authentic activity where learning in technology is most successful when "... it is embedded in authentic and meaningful activity making use of the physical and social context." (Turnbull, 2002, p. 31).

## **6. Assessment**

Astin (as cited in Wickersham, 2006, p. 739) states "...quality educational programmes have a learning environment that includes students actively engaged, high expectations and continuous assessment and feedback." The main tension for assessment in a differentiated learning classroom is that between assessment **of** learning and the assessment **for** learning. Assessment of learning can be defined as that which occurs periodically (e.g., at the end of a unit) for summative purposes. Assessment for learning, is the process of seeking and interpreting evidence for use by learners and their teachers to decide at what point learners are up to in their progression of learning. From here teachers can make decisions about learning, where they need to go, and how best to get there. Assessment for learning should be formative and take place continuously in the classroom. (Pimental, 2008, p. 237). Furthermore "There should be no mystery for students about either intended learning outcomes or what success in achieving those learning outcomes will look like." (Tomlinson, 2006, p. 86).

"Assessment is the conduit between curriculum and instruction" (Tomlinson, 2008, p. 70). This close link between formative assessment and teacher action is a feature of a differentiated learning classroom. This becomes problematic when summative assessment structures are applied across the whole class as a standard. Should all students be assessed for the same assessment standards to a preconceived model of what the average student should achieve? Should summative assessment standards be pre-determined at the programme level at the beginning of the year or should standards be discussed and selected for each individual as the year progresses? The concept of making all students fit the same standards is perhaps ill-conceived in the twenty-first century. "Just as students differ in the preferred ways of taking in and processing information, so do they vary in the manner by which they best show what they have learned." (Tomlinson, 2006, p. 73). There is a considerable issue to be dealt with here in terms of how assessment might be structured to best allow students the opportunity to show what they have learned. As we are required to work within a predetermined framework, we should be offering students a wider range of standards, and then assessing them only against the standards that each student shows competence for. Technology is well suited for this approach as the range of standards is far greater than could be achieved by any individual in any year, giving room for considerable differentiation of assessment.

Assessment should not only be about measuring against the preset standard at the end of a unit of work. It should also be an important part of planning for re-teaching concepts that may have not been well understood by some, extending understanding for others and to provide opportunities for modification of design, production and evaluation for others. Only by staying close to individual students and using formative assessment strategies can teachers guide each student's success. Technology education offers amazing opportunities to create small group and individual master class type learning opportunities which enable students to have concentrated instruction in a format that

works for them. It also gives the teacher an opportunity to see capabilities and understanding grow in each individual student.

## **Conclusion**

Differentiated Instruction is not something that you can make happen overnight. It takes a commitment to the philosophy, for both the teacher and the school. It takes practise, time and plenty of support and practical tools provided through professional development.

Development of a school wide vision of a differentiated programme of learning which focuses on the optimum learning for all students takes a strong, professional leadership team who are able to create a community of learners who confidently support teacher development and change. Teachers involved in differentiated instruction are called upon to rethink the concept of teaching to the middle, the elusive average student and embrace a range of teaching and assessment styles and techniques to maximise the learning opportunities for all students.

There are many aspects which support student focused learning including creating safe environments, knowing your learners, and developing skills and tools to offer choice in student learning. It is important that teachers are also able to recognise the importance of assessment and how it can be used to constantly evaluate and adjust your instruction.

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